48th Annual Meeting Syllabus

Care Coordination in Obstetric Anesthesia

May 18-22, 2016

Seaport Boston Hotel and World Trade Center
Boston, Massachusetts

"Boston's Back Bay," Robbie Shade

JOINTLY PROVIDED BY THE AMERICAN SOCIETY OF ANESTHESIOLOGISTS AND THE SOCIETY FOR OBSTETRIC ANESTHESIA AND PERINATOLOGY

American Society of Anesthesiologists

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Society for Obstetric Anesthesia and Perinatology

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Welcome Letter

Join us at the 2016 Annual Meeting at The Seaport Boston Hotel and World Trade Center in Boston, Massachusetts

On behalf of myself and Meeting Host, Phil Hess, I would like to enthusiastically welcome you to the 48th Annual Meeting of SOAP this spring in Boston. The theme of this year's meeting is care coordination and we have created a forum for discussing the management of obstetric problems from the perspective of multiple disciplines. The goal as always is to deliver the highest quality educational and scientific forum for anesthesiologists who practice obstetrics. Specifically we made an effort to highlight our society's best speakers and incorporate more experts from other specialties and partners in the international obstetric anesthesiology community into the SOAP 2016 Annual Meeting program. Naturally, Boston provided a rich environment to recruit local speaking talent.

Several innovations are being employed this year in the program. This will be the first SOAP meeting using electronic versus paper posters. In addition, we would like to extend the discussion around abstracts beyond the meeting itself. SOAP members will be able to review and discuss abstracts in a blog format in the weeks preceding and following the annual meeting. We are once again providing Spanish language venues for some of international attendees including translation of the main program.

The SOAP Annual Meeting is the highlight of my professional year and I am proud to present what I'm sure will be a wonderful program. On a personal note, this year's meeting is particularly meaningful to me, as Boston is the city where I trained and where I was lucky enough to be introduced to obstetric anesthesia. I'm looking forward to seeing all of you in Boston.

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Program Information

Mission Statement
The Society for Obstetric Anesthesia and Perinatology (SOAP) was founded in 1968 to provide a forum for discussion of problems unique to the peripartum period. SOAP is comprised of anesthesiologists, obstetricians, pediatricians, and basic scientists who share an interest in the care of the pregnant patient and the newborn.

The mission of this Society is to improve the pregnancy-related outcomes of women and neonates through the support of obstetric anesthesiology research, the provision of education to its members, other providers, and pregnant women, and the promotion of excellence in clinical anesthetic care.

A membership in SOAP is an opportunity to meet people who share your interests, and to stimulate improvements in health care for pregnant patients.

ACCME Accreditation and Designation Statements
This activity has been planned and implemented in accordance with the accreditation requirements and policies of the Accreditation Council for Continuing Medical Education (ACCME) through the joint providership of the American Society of Anesthesiologists and the Society for Obstetric Anesthesia and Perinatology. The American Society of Anesthesiologists is accredited by the ACCME to provide continuing medical education for physicians.

The American Society of Anesthesiologists designates this live activity for a maximum of 31.75 *AMA PRA Category 1 Credit ™**. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

*This amount includes the optional workshops.

Target Audience
The SOAP 48th Annual Meeting is intended for anesthesiologists, obstetricians, neonatologists, obstetric medicine specialists, maternal-fetal medicine specialists, residents, fellows and medical students. The Society supports the attendance by associate members in the educational sessions of the annual meeting. The program is generated from member requests and an assessment of need by the Program Committee. Attendance at this meeting does not guarantee competency or proficiency in the performance of any procedures which may be discussed or taught during the course.

Mission of SOAP Program Committee
The mission of the Society's Program Committee is to provide anesthesiologists, obstetricians, and other physicians and members of related allied health specialties with the knowledge that will reinforce past learning as well as disseminate new concepts, practices, and skills involving anesthesia and analgesia for the pregnant woman.

Participation in the SOAP 48th Annual Meeting
Attendance shall be open to all health practitioners, provided that they have registered for the meeting. CME credit will only be offered to M.D.s, D.O.s or equivalent.

Educational Format
CME activities may include the following formats: plenary sessions, debates, lectures, poster discussions, oral abstracts, problem-based learning, and skill-set workshops.

Annual Meeting Objectives
At the completion of this conference the participants should be able to:

1. Identify and critically evaluate current research related to obstetric anesthesia, obstetrics, perinatology, and related medical disciplines;
2. Design and implement research investigations related to obstetric anesthesia that are built upon the foundations of current research;
3. Compare recent findings related to obstetric anesthesia to the prevailing standard of care, and adjust patient care plans accordingly;
4. Learn the details of new obstetric guidelines for thromboembolic prophylaxis and their impact on administering neuraxial anesthesia;
5. Review the applications of the discipline of blood management to obstetric practice and the use of point of care coagulation testing;
6. Identify the benefits and consequences of utilizing various obstetric anesthesia quality measures;
7. Formulate appropriate anesthetic care plans for parturients with sepsis with the goal of reducing related mortality;
8. Recognize the applications of focused cardiac ultrasound in the management of obstetric patients;
9. Determine if investigations in the human biome has a role in improving obstetric outcomes;
10. Review changes in the health care policy and their impact on practice and outcomes in obstetrics.

Special Needs Statement
The American Society of Anesthesiologists and the Society for Obstetric Anesthesia and Perinatology are committed to making its activities accessible to all individuals and fully comply with the legal requirements of the Americans with Disabilities Act and the rules and regulations thereof. If you are in need of an accommodation, please do not hesitate to call the SOAP office at (414) 389-8611 and/or submit a description of your needs in writing to info@soap.org.

Commercial Support Acknowledgement
This CME activity is supported by in-kind donations.
SonoSite: Ultrasound Systems
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Disclosure Policy
The American Society of Anesthesiologists remains strongly committed to providing the best available evidence-based clinical information to participants of this educational activity and requires an open disclosure of any potential conflict of interest identified by our faculty members. It is not the intent of the American Society of Anesthesiologists to eliminate all situations of potential conflict of interest, but rather to enable those who are working with the American Society of Anesthesiologists to recognize situations that may be subject to question by others. All disclosed conflicts of interest are reviewed by the educational activity course director/chair to ensure that such situations are properly evaluated and, if necessary, resolved. The American Society of Anesthesiologists educational standards pertaining to conflict of interest are intended to maintain the professional autonomy of the clinical experts inherent in promoting a balanced presentation of science. Through our review process, all American Society of Anesthesiologists CME activities are ensured of independent, objective, scientifically balanced presentations of information. Disclosure of any or no relationships will be made available for all educational activities.

Program Schedule

Wednesday, May 18, 2016

7:00 a.m. - 6:00 p.m.
Registration Hours
World Trade Center Commonwealth Lobby

8:00 a.m. - 12:00 p.m.
Focused Cardiac Ultrasound in the Management of the High Risk Parturient Workshop
World Trade Center Waterfront Ballroom 2
***Course Director:** Laurie A. Chalifoux, M.D.*

1:00 p.m. - 5:00 p.m.
The Use of Ultrasound in Obstetric Anesthesia: Vascular Access, Neuraxial Anesthesia, TAP Block and Gastric Assessment Workshop
World Trade Center Waterfront Ballroom 2
***Course Director:** Jose C.A. Carvalho, M.D., Ph.D., FANZCA, FRCPC*

6:00 p.m. - 8:00 p.m.
Welcome Reception
Seaport Hotel Lighthouse Ballroom

Thursday, May 19, 2016

6:00 a.m. - 5:00 p.m.
Registration Hours
World Trade Center Commonwealth Lobby

6:00 a.m. - 7:30 a.m.
Continental Breakfast & Exhibits Open
World Trade Center Commonwealth Complex E

View Posters
World Trade Center Commonwealth Complex D

7:30 a.m. - 7:45 a.m.
Welcome to the 48th Annual Meeting
World Trade Center Commonwealth Complex A-C
John T. Sullivan, M.D., M.B.A.; Philip E. Hess, M.D.; Manuel C. Vallejo, Jr., M.D., D.M.D.

7:45 a.m. - 9:15 a.m.
Gertie Marx Research Competition
World Trade Center Commonwealth Complex A-C
***Moderator:** Richard M. Smiley, M.D., Ph.D.*

9:15 a.m. - 9:30 a.m.
Distinguished Service Award
World Trade Center Commonwealth Complex A-C
***Recipient:** Joy L. Hawkins, M.D.*
***Presenter:** William R. Camann, M.D.*

9:30 a.m. - 10:15 a.m.
Coffee Break & Exhibits
World Trade Center Commonwealth Complex E

Poster Viewing
World Trade Center Commonwealth Complex D

10:15 a.m. - 11:15 a.m.
What's New in Obstetric Medicine?*
World Trade Center Commonwealth Complex A-C
***Introduction:** Philip E. Hess, M.D.*
***Speaker:** Neel T. Shah, M.D., M.P.P.*

11:15 a.m. - 12:15 p.m.
Poster Session 1
World Trade Center Commonwealth Complex D
***Moderators:** Brian T. Bateman, M.D., M.Sc.; Yaakov Beilin, M.D.;. William R. Camann, M.D.; Michael A. Froelich, M.D., M.S.; Lisa R. Leffert, M.D.; Chawla LaToya Mason, M.D.; Jill M. Mhyre, M.D; John A. Thomas, M.D.; Paloma Toledo, M.D., M.P.H.; Mark I. Zakowski, M.D.*

12:15 p.m. - 1:45 p.m.
SOAP Business Meeting & Elections
World Trade Center Commonwealth Complex A-C
Boxed lunch will be provided.

1:45 p.m. - 3:15 p.m.
Oral Presentations 1
World Trade Center Commonwealth Complex A-C
***Moderator:** Rebecca D. Minehart, M.D., M.S.H.P.Ed.*

3:15 p.m. - 4:00 p.m.
Coffee Break & Exhibits
World Trade Center Commonwealth Complex E

Poster Viewing
World Trade Center Commonwealth Complex D

4:00 p.m. - 5:00 p.m.
New ACOG Thromboprophylaxis Guidelines*
World Trade Center Commonwealth Complex A-C
***Speaker:** Errol Norwitz, M.D., Ph.D.*

Neuraxial Anesthesia & Anticoagulation*
World Trade Center Commonwealth Complex A-C
***Speaker:** Richard M. Smiley, M.D., Ph.D.*

6:00 p.m. - 8:00 p.m.
Fellows' Reception *(By Invitation)*
Seaport Hotel Lighthouse Ballroom

Friday, May 20, 2016

6:00 a.m. - 1:15 p.m.
Registration Hours
World Trade Center Commonwealth Lobby

7:00 a.m. - 8:00 a.m.
5K Fun Run/Walk
Meet at Seaport Hotel Plaza Lobby

6:00 a.m. - 8:00 a.m.
Continental Breakfast & Exhibits Open
World Trade Center Commonwealth Complex E

View Posters
World Trade Center Commonwealth Complex D

7:55 a.m. - 8:00 a.m.
Opening Remarks
World Trade Center Commonwealth Complex A-C
John T. Sullivan, M.D., M.B.A.; Philip E. Hess, M.D.; Manuel C. Vallejo, Jr., M.D., D.M.D.

8:00 a.m. - 9:30 a.m.
Best Paper Session
World Trade Center Commonwealth Complex A-C
***Moderator:** David H. Chestnut, M.D.*

9:30 a.m. - 10:30 a.m.
Gertie Marx/FAER Education Lecture*
World Trade Center Commonwealth Complex A-C
***Introduction:** Richard M. Smiley, M.D., Ph.D.*
***Speaker:** Mary E. D'Alton, M.D.*

10:30 a.m. - 11:15 a.m.
Coffee Break & Exhibits
World Trade Center Commonwealth Complex E

Poster Viewing
World Trade Center Commonwealth Complex D

11:15 a.m. - 12:00 p.m.
What's New in Neonatology?*
World Trade Center Commonwealth Complex A-C
***Introduction:** William R. Camann, M.D.*
***Speaker:** Terrie E. Inder, M.D., Ph.D., M.B.Ch.B.*

12:00 p.m. - 1:00 p.m.
Poster Session 2
World Trade Center Commonwealth Complex D
***Moderators:** Katherine W. Arendt, M.D.; Arthur L. Calimaran, M.D.; Yehuda Ginosar, B.Sc., M.B., B.S.; Klaus Kjaer, M.D., M.B.A.; Kenneth E. Nelson, M.D.; Cathleen Peterson-Layne, M.D., Ph.D.; Stephen Pratt, M.D.; Barbara M. Scavone, M.D.; Grace H. Shih, M.D.; Mohamed Tiouririne, M.D.*

Program Schedule *continued on next page*

Program Schedule *continued*

Friday, May 20, 2016 *continued*

1:00 p.m.
Open Afternoon & Poster Viewing
World Trade Center Commonwealth Complex D

2:00 p.m. - 4:30 p.m.
Debriefing Workshop at the Center for Medical Simulation: Identifying and Addressing Performance Gaps
Center for Medical Simulation
***Course Director:** Toni Beth Walzer, M.D.*

Saturday, May 21, 2016

6:00 a.m. - 5:00 p.m.
Registration Hours
World Trade Center Commonwealth Lobby

6:00 a.m. - 8:00 a.m.
Continental Breakfast
World Trade Center Commonwealth Complex E

View Posters
World Trade Center Commonwealth Complex D

7:55 a.m. - 8:00 a.m.
Opening Remarks
World Trade Center Commonwealth Complex A-C
John T. Sullivan, M.D., M.B.A.; Philip E. Hess, M.D.; Manuel C. Vallejo, Jr., M.D., D.M.D.

8:00 a.m. - 9:00 a.m.
Oral Presentations 2
World Trade Center Commonwealth Complex A-C
***Moderator:** Erica N. Grant, M.D., M.Sc.*

9:00 a.m. - 9:30 a.m.
Coffee Break
World Trade Center Commonwealth Complex E

Poster Viewing
World Trade Center Commonwealth Complex D

9:30 a.m. - 10:30 a.m.
Obstetric Applications of Echocardiography*
World Trade Center Commonwealth Complex A-C
***Speaker:** Alicia Dennis, Ph.D., M.B.B.S, PGDipEcho, FANZCA*

Echocardiography Education*
World Trade Center Commonwealth Complex A-C
***Speaker:** Feroze-Ud-Din Mahmood, M.D.*

10:30 a.m. - 11:30 a.m.
Gerard W. Ostheimer Lecture
What's New in OB Anesthesia?*
World Trade Center Commonwealth Complex A-C
***Introduction:** Katherine W. Arendt, M.D.*
***Speaker:** Philip E. Hess, M.D.*

11:30 a.m. - 1:00 p.m.
Lunch On Your Own & Poster Viewing
World Trade Center Commonwealth Complex D

1:00 p.m. - 2:00 p.m.
Fred Hehre Lecture*
World Trade Center Commonwealth Complex A-C
***Introduction:** Michaela K. Farber, M.D., M.S.*
***Speaker:** Lawrence C. Tsen, M.D.*

2:00 p.m. - 3:00 p.m.
Poster Session 3
World Trade Center Commonwealth Complex D
***Moderators:** Jeanette R. Bauchat, M.D.; Alexander Butwick, M.B.B.S., M.S., F.R.C.A.; Brendan Carvalho, M.B.B.Ch., F.R.C.A., M.D.C.H.; Michaela K. Farber, M.D., M.S.; Ronald B. George, M.D., FRCPC; Ashraf S. Habib, M.B., B.Ch., M.H.Sc., F.R.C.A.; Ruth Landau, M.D.; Ellen M. Lockhart, M.D.; Mark D. Rollins, M.D., Ph.D.; Vernon H. Ross, M.D.*

3:00 p.m. - 4:00 p.m.
Blood Management in Obstetrics*
World Trade Center Commonwealth Complex A-C
***Speaker:** Walter H. Dzik, M.D.*

Point of Care Coagulation Testing*
World Trade Center Commonwealth Complex A-C
***Speaker:** Roshan Fernando, M.B., Ch.B.*

4:00 p.m. - 5:00 p.m.
Research Hour - Of Bacteria and Babies: Determinants and Impact of Infant Gut Microbiota
World Trade Center Commonwealth Complex A-C
***Moderator:** Richard M. Smiley, M.D., Ph.D.*
***Speaker:** Caroline Mitchell, M.D., M.P.H.*

6:00 p.m. - 10:00 p.m.
SOAP Awards Banquet
World Trade Center Harborview Ballroom

Sunday, May 22, 2016

6:30 a.m. - 12:00 p.m.
Registration Hours
World Trade Center Commonwealth Lobby

6:30 a.m. - 8:00 a.m.
Continental Breakfast
World Trade Center Commonwealth Complex E

View Posters
World Trade Center Commonwealth Complex D

7:55 a.m. - 8:00 a.m.
Opening Remarks
World Trade Center Commonwealth Complex A-C
John T. Sullivan, M.D., M.B.A.; Philip E. Hess, M.D.; Manuel C. Vallejo, Jr., M.D., D.M.D.

8:00 a.m. - 9:00 a.m.
Panel: Obstetric Anesthesia Quality Measures
World Trade Center Commonwealth Complex A-C
***Moderator:** Jill M. Mhyre, M.D.*
***Panelists:** Jill M. Mhyre, M.D.; Barbara M. Scavone, M.D.; B. Scott Segal, M.D., M.S.*

9:00 a.m. - 10:00 a.m.
Sepsis in the Parturient *
World Trade Center Commonwealth Complex A-C
***Speaker:** Nuala Lucas, M.D.*

Advances in Sepsis Treatment*
World Trade Center Commonwealth Complex A-C
***Speaker:** Andrea L. Ciaranello, M.D.*

10:00 a.m. - 11:00 a.m.
Best Practice Panel - Case Report Review with the Experts*
World Trade Center Commonwealth Complex A-C
***Moderator:** Katherine W. Arendt, M.D.*
***Panelists:** Katherine W. Arendt, M.D.; Brendan Carvalho, M.B.B.Ch., F.R.C.A., M.D.C.H.; Robert D'Angelo, M.D.; Roshan Fernando, M.B., Ch.B.*

11:00 a.m. - 12:00 p.m.
Poster Session 4
World Trade Center Commonwealth Complex D
***Moderators:** Gillian Abir, M.B., Ch.B., F.R.C.A.; Nicole Higgins, M.D.; Jennifer E. Hofer, M.D.; Rachel M. Kacmar, M.D.; Ihab R. Kamel, M.D.; Thomas T. Klumpner, M.D.; Katherine G. Lim, M.D.; Jessica N. Rock, M.D.; Philip A. Rubin, M.D.; Anasuya Vasudevan, M.B., B.S., M.D., F.R.C.A.*

12:00 p.m.
Adjournment

**** Translated into Spanish***

Thursday, May 19, 2016

Gertie Marx Research Competition
Moderator: *Richard M. Smiley, M.D., Ph.D.*

What's New in Obstetric Medicine?
Speaker: *Neel T. Shah, M.D.*

Oral Presentations 1
Moderator: *Rebecca D. Minehart, M.D., M.S.H.P.Ed.*

New ACOG Thromboprophylaxis Guidelines
Speaker: *Errol Norwitz, M.D., Ph.D.*

Neuraxial Anesthesia and Anticoagulation
Speaker: *Richard M. Smiley, M.D., Ph.D.*

Abstract #:GM-01

Programmed intermittent epidural bolus for labor analgesia during first stage of labor: A sequential trial to determine the optimum interval time between boluses of a fixed volume of 10 ml of bupivacaine 0.0625% plus fentanyl 2 mcg/ml

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Jose Carvalho M.D., Ph.D. - Department of Anesthesia and Pain Management, Mount Sinai Hospital, University of Toronto - Toronto, Ontario

Introduction: Most studies comparing Programmed Intermittent Epidural Bolus (PIEB) with Continuous Epidural Infusion regimens have included patient controlled epidural analgesia (PCEA) and/or manual bolus as rescue analgesia for breakthrough pain (1,2). Consequently, the optimal time interval between programmed intermittent boluses is yet to be determined. We designed a study to establish the optimal time interval between programmed intermittent boluses of 10 ml of bupivacaine 0.0625% with fentanyl 2 mcg/mL to produce effective analgesia in 90% of women during first stage of labor without the need of rescue boluses.

Methods: We conducted a double-blind sequential trial with a biased coin up-down design to obtain the effective interval 90% (EI90) for the PIEB regimen. We included ASA 2-3 nulliparous women at term undergoing spontaneous or induced labor requesting epidural analgesia. An ultrasound-assisted epidural was inserted at L2/3 or L3/4. A test dose of 3 ml of bupivacaine 0.125% plus fentanyl 3.3 mcg/ml was followed by a loading dose of 12 ml of the same solution. PIEB was then started in women whose pain scores achieved VNRS ≤ 1/10 within 20 min after the loading dose. In all subjects the programmed bolus dose was fixed at 10 mL, and the first bolus was delivered 1 hour after the loading dose. The PIEB interval was set at 60 min for the first patient and at varying time intervals (60, 50, 40 and 30 minutes) for the subsequent patients, according to a biased coin design. The primary outcome was effective analgesia, defined as no requirement for a PCEA or a manual bolus for 6 hours after the initiation of the epidural or until the patient was fully dilated, whichever event occurred first. Pain scores, sensory block levels to ice, degree of motor block and blood pressure were assessed hourly.

Results: We studied 40 women. The calculated EI90 was 42.6 min (95% CI: 38.9 - 46.4) using the Dixon and Mood method and 36.8 min (95% CI: 31.0 - 49.0) using the Isotonic Regression analysis. Peak sensory levels, degree of motor block and incidence of hypotension in each subgroup is presented in table 1.

Discussion: The optimal time interval between programmed intermittent boluses of 10 mL of bupivacaine 0.0625% with fentanyl 2 mcg/mL is approximately 40 minutes. Further studies to determine the efficacy of this regimen throughout the entire duration of labor are warranted.

Table 1. Sensory block levels, motor block and hypotension

		PIEB interval			
		30 min (n=13)	40 min (n=9)	50 min (n=9)	60 min (n=9)
Highest sensory block over study period (n, %)					
	T2	3 (23.1)	1 (11.1)	0 (0.0)	0 (0.0)
	T3	1 (7.7)	0 (0.0)	1 (11.1)	0 (0.0)
	T4	1 (7.7)	0 (0.0)	0 (0.0)	0 (0.0)
	T5	4 (30.8)	3 (33.3)	1 (11.1)	1 (11.1)
	T6	0 (0.0)	2 (22.2)	5 (55.6)	3 (33.3)
	T7	2 (15.4)	2 (22.2)	1 (11.1)	2 (22.2)
	T8	2 (15.4)	1 (11.1)	0 (0.0)	3 (33.3)
	T9	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
	T10	0 (0.0)	0 (0.0)	1 (11.1)	0 (0.0)
Degree of motor block (n, %)					
Bromage score	0	8 (61.5)	0 (0.0)	0 (0.0)	0 (0.0)
	1	3 (23.1)	0 (0.0)	0 (0.0)	0 (0.0)
	2	1 (7.7)	0 (0.0)	0 (0.0)	0 (0.0)
	3	1 (7.7)	0 (0.0)	0 (0.0)	0 (0.0)
Hypotension (n, %)		1 (7.7)	1 (11.1)	2 (22.2)	0 (0)
Pts requiring treatment (n,%)		0	0	0	0

References:

1. Can J Anesth 2004; 51: 581-585; 2) Int J Obstet Anesth 2005; 14: 305-309

Abstract #:GM-02

Intraperitoneal instillation of lidocaine improves postoperative analgesia at cesarean delivery. A randomized, double-blind, placebo-controlled trial

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Introduction: The incidence of persistent pain after cesarean delivery is high.1,2 Acute severe pain following surgery is a strong predictor of chronic pain. Multimodal analgesia, including intraperitoneal instillation of local anesthetics has been shown to be effective in reducing postoperative pain.3,4 We sought to investigate the effect of intraperitoneal instillation of lidocaine at cesarean delivery on post-operative pain scores and maternal satisfaction, as part of a multimodal pain management strategy inclusive of intrathecal morphine.

Methods: Following local ethics approval and informed consent, 204 healthy women scheduled for elective cesarean delivery under spinal anesthesia were recruited. After administration of standard spinal anesthetic (bupivacaine, fentanyl and morphine) patients were randomized into either a treatment (20 mL 2% lidocaine with epinephrine 1 in 200,00) or placebo (20 mL normal saline) group. The study solution was instilled into the peritoneum by the surgeon following uterine closure. The parietal peritoneum was left open or sutured depending on the preference of the obstetrician. Postoperative analgesia including standing orders of acetaminophen and diclofenac PO and PRN morphine/hydormorphone IV/SC was prescribed for both groups. The primary outcome was pain on movement at 24 hours measured on a visual analogue scale (VAS 0-100 mm). The secondary outcomes included pain scores at rest and on movement; maternal satisfaction; opioid consumption and side effects measured at 2, 24 and 48 hours post-op.

Results: Patient characteristics were similar in both groups (Table 1). Pain on movement at 24 hours was not significantly different between the two groups. There was a significantly higher pain score at rest and on movement at 2 hours in the placebo group. A sub-group analysis of patients with peritoneal closure showed significantly higher pain scores in the placebo group at 2 hours (at rest and on movement) and at 24 hours (on movement) and lower maternal satisfaction at 2 hours. Patients with self-reported high anxiety scores (NRS ≥ 7/10) showed significantly higher pain scores at 2 hours (at rest and on movement) and lower maternal satisfaction in the placebo group. A higher opiate use was seen in the placebo group, however the number of opiate related side effects was similar in both the groups.

Discussion: Intraperitoneal instillation of lidocaine during elective cesarean delivery reduces pain scores in the early postoperative period. This analgesic benefit is demonstrated at 24 hours in a sub-set of patients with peritoneal closure. Further studies controlling for peritoneal closure, and using long acting local anesthetics or continuous infusion catheters are warranted.

Table 1

	Placebo (N=94) Median (IQR)	Lidocaine (N=99) Median (IQR)	p-value
VAS rest at 2 hour	8.5 (0, 21)	0 (0, 10)	0.0020
VAS movement at 2 hour	25 (4, 44)	13 (0, 29)	0.0073
VAS rest at 24 hour	10.5 (1, 27)	11 (2, 24)	0.9514
VAS movement at 24 hour	39.5 (25, 61)	39 (23, 61)	0.7590
VAS rest at 48 hour	8 (1, 19)	7 (1, 17)	0.7708
VAS movement at 48 hour	31 (17, 53.5)	30 (11, 49)	0.2499
Opiates requested postpartum –N (%)	61 (65)	40 (40)	0.0007
Peritoneal closure sub-group:			
VAS rest at 2 hour	17 (4, 33)	0.5 (0, 12)	0.0006
VAS movement at 2 hour	33 (15, 50)	14 (0, 29)	0.0002
VAS movement at 24 hour	59 (25, 78)	31.5 (20, 56)	0.0313
Satisfaction at 2 hour	91 (74, 99)	99.5 (87, 100)	0.0227
Anxiety NRS ≥ 7/10 sub-group:			
VAS rest at 2 hour	10 (0, 37)	0 (0, 5)	0.0051
VAS movement at 2 hour	30.5 (7, 66)	3 (0, 20)	0.0020
Satisfaction at 2 hour	84 (62, 99)	100 (93, 100)	0.0021

VAS = Visual Analogue scale for pain and satisfaction (0-100mm)
NRS = Numeric Rating scale for anxiety (0-10)

References:

1. Acta Anaesthesiol Scand 2004; 48: 111-6
2. Pain 2008; 140: 87-94
3. Clin J Pain 2010; 26: 121-27
4. J Family Reprod Health 2015; 9: 19-21

Abstract #:GM-03

A Prospective, Randomized Trial of Standard Epidural, Dural-Puncture Epidural, and Combined-Spinal Epidural Labor Analgesia Techniques on Maternal and Fetal Outcomes

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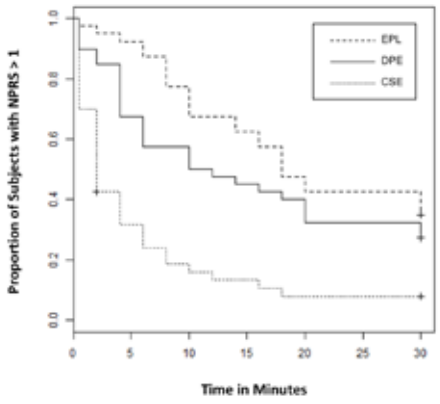
Introduction: The dural puncture epidural technique (DPE) is a modification of the combined spinal epidural technique (CSE), where a dural hole is created but intrathecal medication administration is withheld. DPE has labor analgesia advantages compared with a standard epidural technique (EPL).[1] To date, all three techniques have not been compared; we hypothesized that DPE would result in faster onset of pain relief compared to EPL, with fewer maternal and fetal side effects compared to CSE.

Methods: Upon patient consent, we prospectively randomized 120 parturients in early labor (≤ 5cm cervical dilation) to EPL, DPE or CSE. Attending and fellow anesthesiologists performed all placements. Initial dosing for EPL and DPE consisted of 20 mL of 0.125% bupivacaine + fentanyl 2 mcg/mL over 5 min, and for CSE, 1 of 1.5 mL premixed solution of 0.25% bupivacaine 2.5 mg and fentanyl 25 mcg. Upon block completion, an independent blinded co-investigator assessed the outcomes. Two blinded obstetricians independently interpreted uterine contractions and fetal heart rate tracings one hour before and after neuraxial placement. The primary outcome was time to achieving numeric pain rating scale (NPRS) ≤1. Secondary outcomes included maternal and fetal side effects. Cox proportional hazard regression was used to analyze timed outcomes. Fisher's exact test was used to analyze secondary outcomes.

Results: The time to achieving NPRS ≤1 was similar between EPL and DPE. However, the incidence of T10 and S2 sensory blockade at 10 min with DPE was greater than EPL (p=0.03; <0.001) and comparable to CSE (p=0.49; 0.09). DPE had fewer requests for top-ups (p=0.02) compared to CSE and EPL. DPE and CSE had less asymmetric (2 dermatome difference) blockade after 30 min (p<0.001) and less motor block (p=0.04;0.003) compared to EPL. CSE had significantly higher incidence of pruritus (p<0.001) and uterine hypertonus (p=0.001) compared to DPE and EPL.

Discussion: DPE, when compared to EPL, has greater incidence of T10 and sacral coverage at 10 min, and lower incidence of asymmetric and motor blockade. DPE, when compared to CSE, has fewer requests for epidural top-ups and a lower incidence of pruritus and uterine hypertonus. For parturients requesting early labor analgesia, the DPE technique offers greater maternal and fetal advantages when compared with EPL and CSE techniques.

Primary Outcome:



Selected Secondary Outcomes:

	Groups			*P*-values		
	EPL (n=40)	DPE (n=40)	CSE (n=40)	E vs D	D vs C	C vs E
Bilateral T10 at 10 min	30	38	40	**0.03**	0.49	**0.001**
Bilateral S2 at 10 min	15	32	38	**<0.001**	0.09	**<0.001**
Nausea	4	1	1	0.36	1	0.36
Pruritus	4	4	27	1	**<0.001**	**<0.001**
Hypotension	5	5	13	1	0.06	0.06
Post-dural puncture headache	0	0	0	-	-	-
Top-ups	20	9	20	**0.02**	**0.02**	1
Asymmetric block after 30 min	21	4	4	**<0.001**	1	**<0.001**
Uterine hypertonus	5	4	18	1	**0.001**	**0.003**

References:

1. Cappiello E, et al. Anesth Analg, 2008

Abstract #:GM-04

Gestational and Postpartum Sleep Apnea: Exhaled Nitric Oxide as a Biomarker in a Predictive Model

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Objective: To determine prevalence of obstructive sleep apnea (OSA) in the third trimester and postpartum. To evaluate the utility of exhaled nitric oxide (exNO) when added to screening tools (Mallampati score, pregnancy specific score described by Facco et al) in predicting OSA during pregnancy.

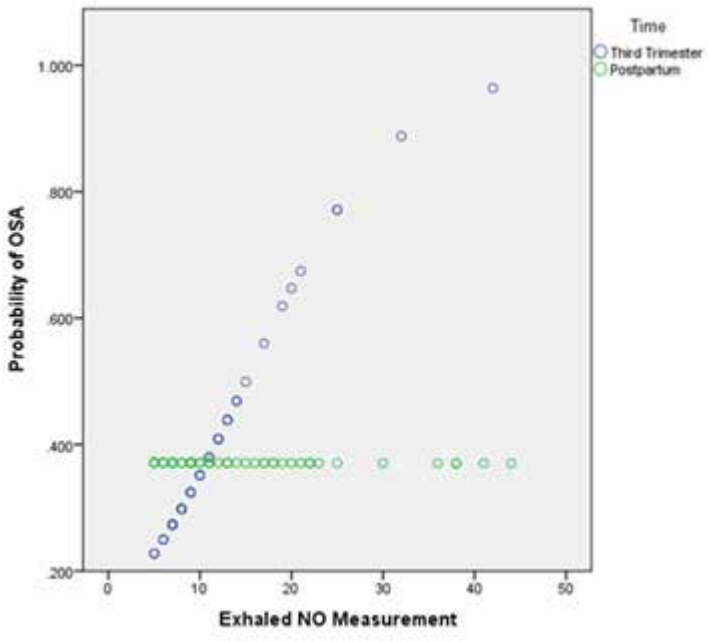
Study Design: Prospective cohort using overnight Watch-PAT200® to diagnose OSA and morning, single breath NIOX-MINO® to evaluate exNO at 32-35 6/7 weeks gestation and again at 6-15 weeks postpartum in women delivering at Forsyth Medical Center. OSA was defined as an apnea-hypopnea index (AHI) of ≥5 . We also measured Facco score, Mallampati score, neck circumference, responses to a Berlin Questionnaire and medical and obstetric data.

We tested the hypothesis that prevalence of OSA does not change postpartum using an exact McNemar's test. A generalized estimating equation (GEE) was used to examine the difference in exNO in pregnancy in women with and without OSA. A multivariable logistic regression was used to determine the utility of exNO, Facco score, and Mallampati score as risk factors for OSA in pregnancy.

Results: Of 63 participants with valid data for both time points, the proportion testing positive for OSA in the third trimester (38%) did not differ from that postpartum (36%; p > .99).

GEE showed a significant effect of time (p=0.039) and a time x exNO interaction (p=0.024) for presence of OSA and utility as a biomarker only during pregnancy (Fig 1). Of the 72 participants with valid data during pregnancy, ExNO (odds ratio (95% CI): 1.139 (1.021, 1.270), p=.019 and Facco score (odds ratio (95% CI): 1.041 (1.006, 1.077), p=.020 were significant independent risk factors for OSA . After controlling for confounding effects, the odds of testing positive for OSA increases by 14% for each part per million increase in exNO and 4.1% for each 1 unit increase in Facco score. Mallampati score did not add to the utility of the model (p=.607). The model had modest discrimination with an area under the ROC curve (95% CI) of .751 (.632, .870), sensitivity of .654 and specificity of .659.

Conclusion: OSA is as common in the postpartum period as late in pregnancy. ExNO shows promise as a biomarker for OSA in pregnancy, particularly when combined with simple historical and observational data.



Abstract #:GM-05

Elevated Angiogenic Factors Across Gestation In Women With Postpartum Hemorrhage

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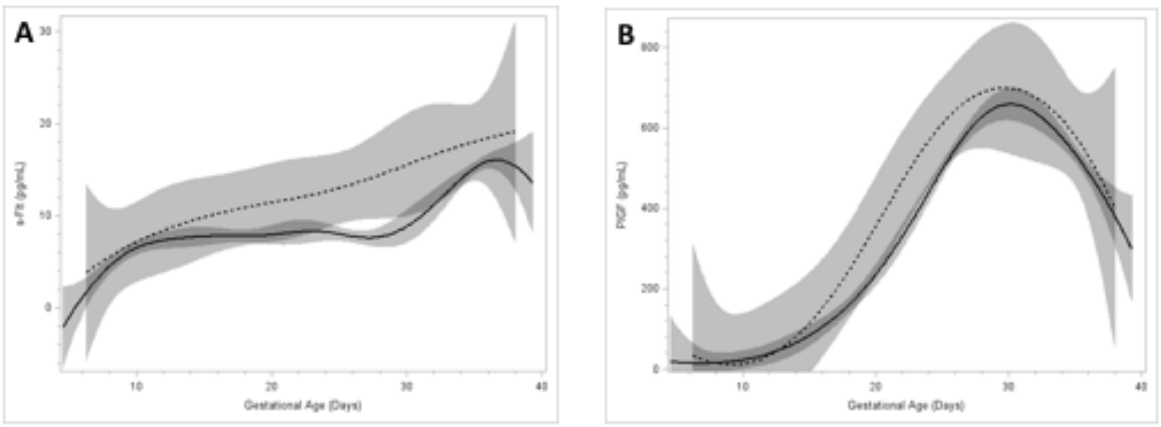
Introduction: Postpartum hemorrhage (PPH) is the leading cause of maternal death worldwide. While clinical risk factors are known, the molecular basis for PPH is not understood. Biomarkers to predict PPH could greatly improve care by triaging high-risk women to tertiary care centers for delivery. Given that PPH is closely linked to placental delivery, we hypothesized that levels of angiogenic factors (i.e., sFlt-1, PlGF) involved in placental implantation and development would be altered in women with PPH.

Methods: This is a secondary analysis of data from an IRB-approved prospective longitudinal cohort study designed to evaluate sFlt-1 and PlGF as biomarkers for preeclampsia. Women were recruited during routine prenatal care at Brigham & Women's Hospital in Boston, MA and serum samples were collected at 4 visits (< 15 (T1), 16-20 (T2), 24-28 (T3), and 34-38 (T4) weeks' gestation). Levels of sFlt-1 and PlGF were assayed. PPH cases were identified by ICD-9 code (666. xx) and verified by two physician review. PPH was defined as ≥ 500 or 1000 mL following vaginal delivery or cesarean section, respectively. PPH cases not due to atony or retained placenta were excluded. The geometric mean sFlt-1 and PlGF concentrations were calculated at each time point and compared using the Wilcoxon rank sum test.

Results: In this cohort of 1233 women, we identified 43 cases of PPH (3.5%). Women with PPH were more likely to be non-White, self-pay or Medicaid, and pregnant with a multifetal gestation ($p < 0.05$). Levels of sFlt-1 were significantly increased in cases at T2 ($p < 0.05$), T3 ($p < 0.1$), and T4 ($p < 0.1$), while PlGF levels were significantly increased only at T2 ($p < 0.05$) (Figure 1). The ratio of sFlt-1/PlGF was not different between cases and controls. The differences in sFlt-1 levels remained after adjusting for maternal age, BMI, race, multifetal gestation, and preeclampsia.

Conclusions: Angiogenic factors are increased during gestation, particularly in the second trimester, in women who ultimately have PPH. This suggests that altered placental development and invasion may be a risk factor for PPH, even in women with PPH due to atony. Future work aims to identify biomarkers that can predict PPH at delivery. Ultimately, improved understanding of PPH pathophysiology could significantly reduce maternal deaths due to hemorrhage.

Figure 1. Change in sFlt-1 (A) and PlGF (B) levels across gestation.



**Dashed line = PPH cases; solid line = entire cohort.

Abstract #:GM-06

Maternal blood: a window into the neonatal immune system

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Introduction: Peripartum infection is a leading cause of morbidity and mortality for mothers and their newborns. Determining maternal immune signatures that predict neonatal susceptibility to infection will facilitate risk stratification and earlier treatment. This study used high dimensional mass cytometry to comprehensively interrogate the immune systems of neonates and their mothers to identify functional immune responses in maternal blood uniquely associated with their neonate.

Methods: Umbilical cord-blood (n=10) and maternal peripheral blood (n=10) samples were stained with 21 cell-surface and 15 intracellular functional markers at basal state and after stimulation with exogenous ligands (LPS; IL-2, IL-6, GM-CSF, and INFa). An unsupervised hierarchical clustering algorithm (SCAFFOLD) was used to group immune cells by similarity of

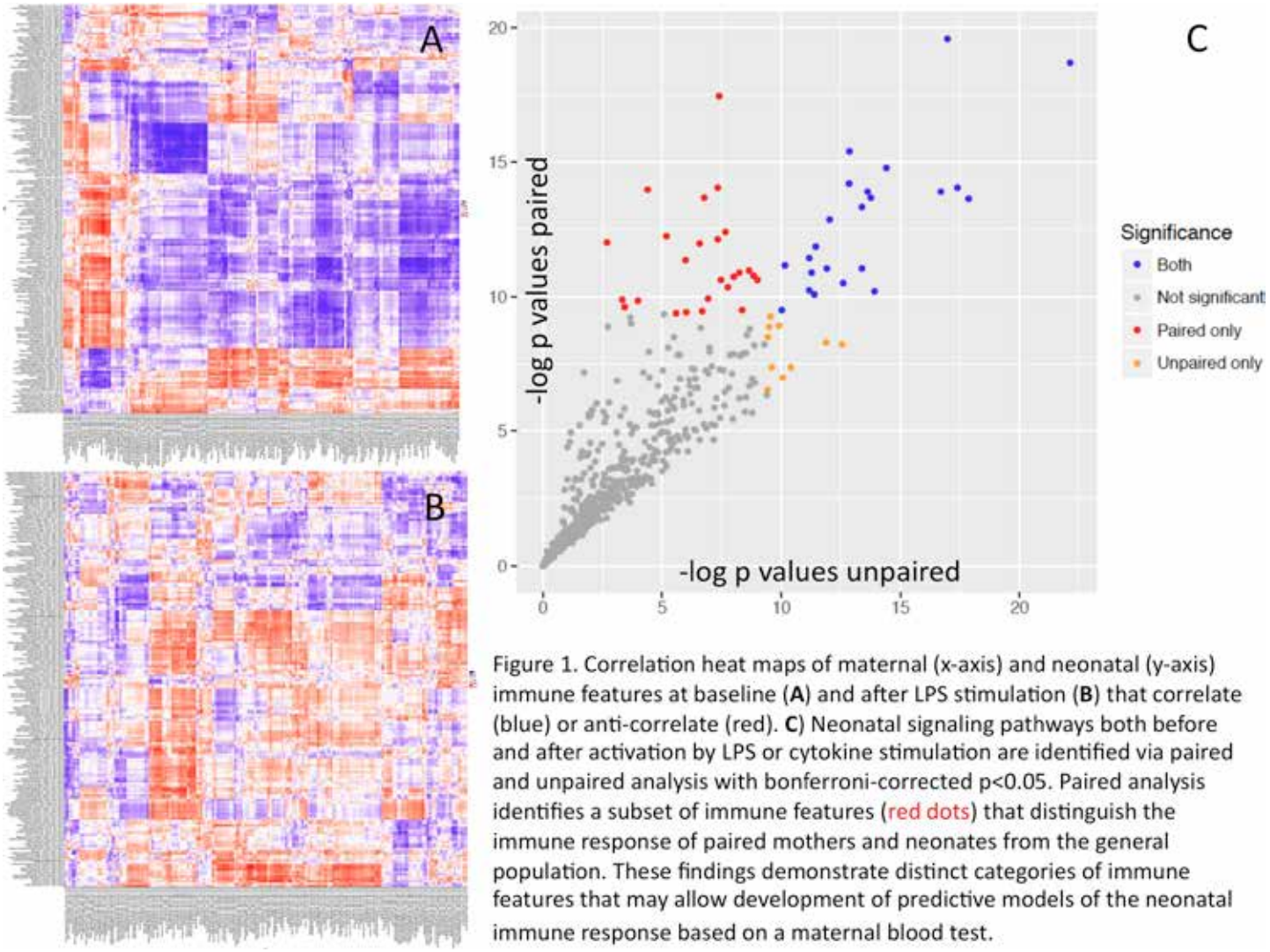

Figure 1. Correlation heat maps of maternal (x-axis) and neonatal (y-axis) immune features at baseline (**A**) and after LPS stimulation (**B**) that correlate (blue) or anti-correlate (red). **C**) Neonatal signaling pathways both before and after activation by LPS or cytokine stimulation are identified via paired and unpaired analysis with bonferroni-corrected p<0.05. Paired analysis identifies a subset of immune features (red dots) that distinguish the immune response of paired mothers and neonates from the general population. These findings demonstrate distinct categories of immune features that may allow development of predictive models of the neonatal immune response based on a maternal blood test.

cell-surface markers, and visually present their characteristics via force-directed layout. Correlation of paired and unpaired neonatal and maternal immune responses followed by principal component analysis was performed and significant features (Bonferroni-corrected $p < 0.05$) were identified.

Results: Superimposable maps of maternal and neonatal immune systems highlighted phenotypic differences across adaptive and innate cell subsets reflecting the tolerogenic bias of the neonatal compared to maternal immune system. Functional interrogation of single-cell intracellular signaling responses identified 81 immune features that distinguish neonatal and maternal immune response. These include dampened neonatal P38 MAPK signaling response in innate immune cells, and exacerbated STAT3 and STAT5 signaling responses in adaptive cell subsets. Analysis of paired and unpaired comparisons of functional responses revealed a subset of 27 unique immune features that significantly distinguish maternal and neonatal pairs but not the average population (Fig 1).

Conclusions: This study presents a comprehensive map of the neonatal and maternal immune systems, and highlights functional immune features tightly associated between mother and neonate. The findings provide mechanistic data for the development of predictive models of the neonatal immune response based on a maternal blood test. Tests that predict neonatal susceptibility to infection have the potential to facilitate risk stratification and aid clinical decisions for peripartum neonatal inflammatory states in preterm labor, premature rupture of membranes and chorioamnionitis.

What's New in Obstetric Medicine?

Speaker: Neel T. Shah, M.D.

NOTES

Abstract #:O1-01

Agreement of Nexfin® non-invasive cardiac output monitor with non-invasive blood pressure measurement in patients undergoing Cesarean delivery under spinal anesthesia: a pilot observational study

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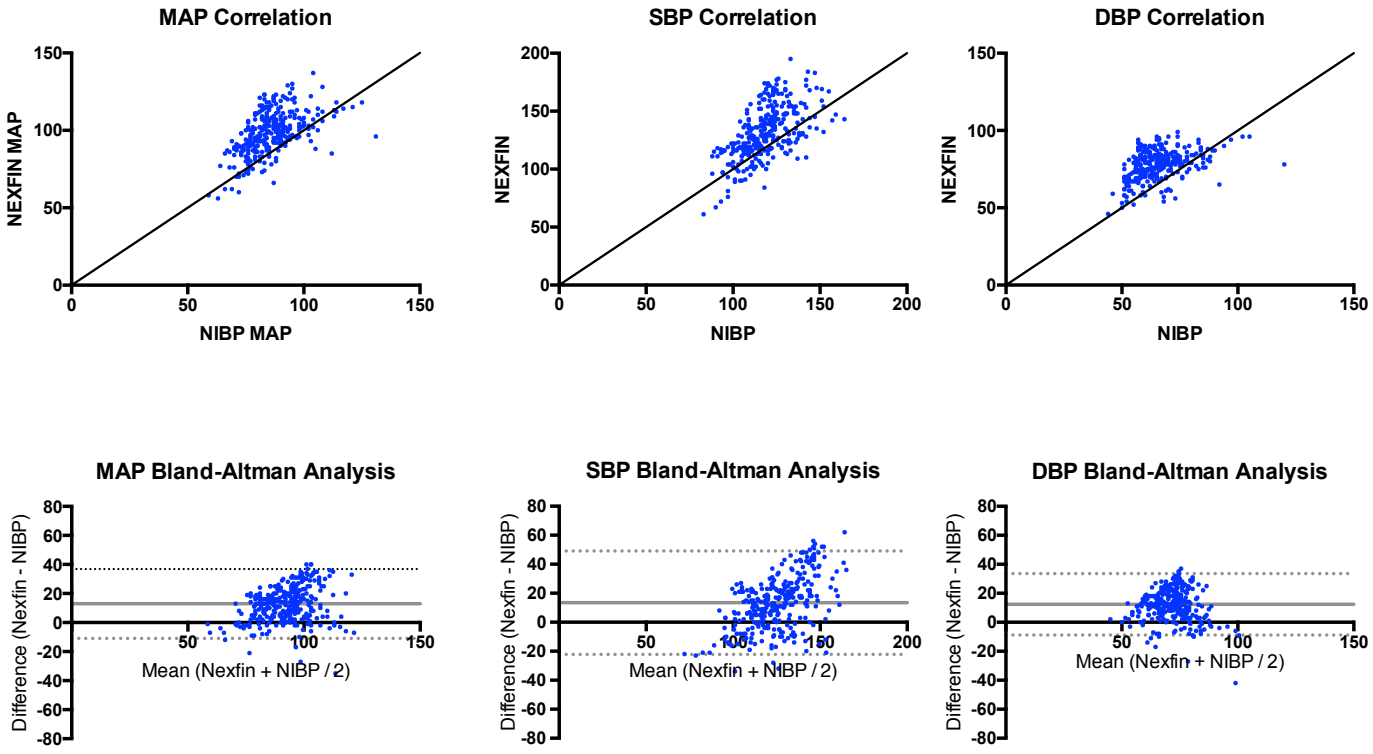
Introduction: Hypotension occurs under spinal anesthesia in 55-90% of Cesarean deliveries (CD), causes feto-maternal morbidity, and can be managed with vasopressor infusions necessitating frequent blood pressure (BP) measurement(1). Non-invasive blood pressure (NIBP) measurement devices record BP once per minute at most, and measurement may fail due to patient movement or shivering(2). Frequent NIBP measurement is uncomfortable and may be associated with permanent injury(3).

The Nexfin® non-invasive cardiac output monitoring system uses a finger cuff to display continuous cardiac output data including BP. It is validated in the pregnant population(4) and has been studied in elective CD under spinal anesthesia(5).

We aimed to assess agreement between Nexfin® and NIBP, hypothesising acceptable agreement with lower measurement failure rates and higher patient comfort scores in the Nexfin® group.

Method: Healthy term pregnant patients undergoing CD under spinal anesthesia gave written consent. In the operating room, standard monitors were applied. An appropriately-sized Nexfin® finger cuff was applied on the contralateral side to the NIBP cuff. Baseline NIBP data comprising systolic (SBP), diastolic (DBP) and mean arterial pressures (MAP) were



calculated from the mean of three readings taken 1 minute apart. Nexfin blood pressures (also SBP, DBP and MAP) were recorded simultaneously with each NIBP. Failure of either device (including re-cycling of the NIBP) to display a measurement was recorded.

After the anesthesiologist administered spinal or CSE anesthesia, NIBP was recorded every minute until 5 minutes after delivery. NIBP frequency was then reduced to once per 2 or 2.5 minutes at the anesthesiologist's discretion. Data collection terminated at the end of surgery. The patient was asked to rate each device's comfort by marking a 100 mm visual analog scale (VAS) from 0 mm = extremely uncomfortable to 100 mm = extremely comfortable.

Results: 307 measurement pairs were obtained. Correlation coefficients for Nexfin vs NIBP were 0.51, 0.59 and 0.42 for MAP, SBP and DBP respectively. Bland-Altman plots are shown. The mean bias (95% limits of agreement) of Nexfin® over NIBP was 12.93 (-11.0 to 36.8) mmHg for MAP, 13.43 (-22.2 to 49.1) mmHg for SBP and 12.34 (-8.86 to 33.5) mmHg for DBP.

Measurement failure occurred in 14 NIBP and 2 Nexfin® measurements. Patient-reported comfort scores on the 100mm VAS were 80.7 mm (Nexfin®) vs 60.9 mm (NIBP), $p<0.05$.

Discussion: We compared agreement between Nexfin® and NIBP and found it to be clinically unacceptable. Correlation between Nexfin® and NIBP was better for SBP than for MAP or DBP. However measurement failure rates and patient comfort scores were better in the Nexfin® group.

References:

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2. SOAP 2013 Abstract S1
3. Indian J Anaesth 2012;56(4):428–430
4. Hypertens Pregnancy 2009;28(2):230-42
5. Anaesthesia 2015 Jun;70(6):691-8

Abstract #:O1-02

Trial of labor versus primary cesarean delivery in women with superobesity

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Objective: Delivery of superobese women (BMI≥50) presents specific challenges regardless of whether a trial of labor (TOL) or plan a primary cesarean delivery (CD) is undertaken. It is unclear whether either choice alters maternal or neonatal outcomes. This study examines maternal and neonatal outcomes among women with superobesity who undergo a TOL versus a primary CD.

Methods: This is a retrospective cohort study of all singleton deliveries ≥36 weeks' gestation in the State of California between 2007-2011. Data were extracted from maternal discharge data linked to infant birth certificate records. Included were all women with a body mass index (BMI) ≥50. Excluded were women undergoing a trial of labor after cesarean (TOLAC) or a repeat CD. The primary outcome was severe maternal mortality or death (SMMD). Secondary outcomes included composite neonatal morbidity or death and the individual components of the composites.

Results: There were 3990 (0.3%) women with superobesity who delivered a single fetus at ≥36 weeks. The total CD rate for this group was 59%.1279 (32%) women underwent a repeat CD and 18 (0.9%) underwent a TOLAC leaving 2683 in the final cohort. 71% underwent a TOL and 29% a primary CD. Women undergoing a TOL were less likely to be nulliparous or have HTN or diabetes. Compared to primary CD, women undergoing a TOL had a reduced risk of SMMD (Table 1) however this was not significant after adjusting for parity and HTN (aOR 0.45, 95% CI 0.26-0.87). There were no differences in composite neonatal morbidity. Women who required a CD after a TOL were at increased risk of SMMD compared to women undergoing vaginal delivery (1.7% vs 0.4%, RR 4.7, 95% CI 1.5-15.4), however there was no difference in SMMD compared to women with primary CD (1.7% vs 1.4%, RR 1.22, 95% CI 0.43-3.50). A successful TOL was associated positively with parity and negatively with maternal age and hypertensive disorders.

Conclusion: Among women with superobesity, a TOL and primary CD have similar associated morbidities. Primary CD does not appear to reduce these morbidities.

Table 1: Maternal and neonatal outcomes

	Trial of Labor N=1918	Primary Cesarean Delivery N=775	RR (95%CI)	P value
Maternal death	0	0	n/a	n/a
Severe maternal morbidity*	11 (0.57)	11 (1.42)	0.40 (0.18-0.93)	0.02
Blood transfusion	15 (0.78)	10 (1.29)	0.61 (0.27-1.34)	0.21
Pulmonary embolism	0 (0.00)	2 (0.26)	0.14 (0.01-1.30)	0.08
Mechanical ventilation	1 (0.05)	2 (0.66)	0.20 (0.02-2.22)	0.20
Sepsis	3 (0.16)	0 (0.00)	1.62 (0.18-14.5)	0.56
Neonatal death	1 (0.05)	2 (0.26)	0.02 (0.02-2.22)	0.21
Neonatal morbidity	17 (0.89)	12 (1.55)	0.57 (0.28-1.19)	0.13
NICU admission	13 (0.68)	12 (1.55)	0.44 (0.20-0.96)	0.03
Birth Injury	1 (0.05)	0 (0.00)	0.81 (0.07-8.91)	0.53
Ventilation	5 (0.26)	0 (0.00)	2.42 (0.29-10.1)	0.33
Seizure	0 (0.00)	1 (0.13)	0.20 (0.01-2.22)	0.28

All numbers are N (%) or mean ± standard deviation

*Severe Maternal Morbidity was examined using the methods described by Kuklina[1] et al and Callaghan[2] and defined by ICD-9 or birth certificate codes if the length of stay for the delivery hospitalization was >90th percentile for the route of delivery and if any of the following occurred: postpartum hemorrhage, maternal sepsis, deep vein thrombosis, pulmonary embolism, uterine rupture, respiratory failure, heart failure, puerperal cerebral vascular accident, severe anesthetic complication, maternal shock, disseminated intravascular coagulation, or renal failure. SMM also was de signated as occurring regardless of length of stay if ICD-9 or birth certificate codes indicated any of the following: hysterectomy, ventilation, unplanned return to operating room, transfer to the intensive care unit, or maternal death.

1. Kuklina EV, Meikle SF, Jamieson DJ, Whiteman MK, Barfield WD, Hillis SD, et al. Severe obstetric morbidity in the United States: 1998-2005. Obstetrics and Gynecology 2009;113:293-9.
2. Callaghan WM, MacKay AP, Berg CJ. Identification of severe maternal morbidity during delivery hospitalizations, United States, 1991-2003. American J of Obstetrics and Gynecology 2008;199:133.e1-.e8.

Abstract #:O1-03

Risk Factors and Systemic Inflammatory Response Syndrome (SIRS) Criteria for Severe Sepsis in Pregnant Women: A Multicenter Case-control Study

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Background: Sepsis is an increasingly important source of maternal morbidity and mortality. The most recent estimates suggest that sepsis accounts for approximately 25% of all maternal deaths in the United Kingdom and 13.6% in the United States.(1,2) Early identification and prompt treatment of patients with sepsis have been shown to improve outcomes. However, diagnosing sepsis during pregnancy can be challenging as many parturients meet SIRS criteria due to physiologic changes of pregnancy alone.(3) This multicenter case-control study aims to define revised SIRS criteria for use in pregnancy and to evaluate risk factors for severe sepsis.

Methods: Validated severe maternal sepsis cases from 1995 to 2012 were retrospectively identified at seven academic medical centers in the US and Israel. Control patients were identified and matched by date of delivery with date of severe sepsis diagnosis cases in a 1:4 ratio. Data including potential risk factors, vital signs, and white blood cell (WBC) values were collected for cases and controls. Univariate analysis estimated the association between potential risk factors and severe sepsis. Additionally, the diagnostic sensitivity and specificity for identifying cases of severe sepsis using different thresholds of abnormal vital signs and laboratory values were evaluated.

Results: Eighty-two cases of severe sepsis and 328 controls were identified. Risk factors identified in the study included PROM>24 hours to labor (OR 8.9, 95% CI 2.5 to 39.4), retained products of conception (OR 12.9, 95% CI 2.4 to 128.1), preterm delivery (OR 6.1, 95% CI 2.4 to 16.8), multiple gestation (OR 5.7, 95% CI 1.8 to 19.5), BMI≥40 (OR 3.7, 95% CI 1.4 to 9.6), cesarean delivery during labor (OR 20.9, 95% CI 5.1 to 128.3), cesarean delivery not in labor (OR 15.6, 95% CI 4.2 to 87.2), nulliparity (OR 1.8, 95% CI 1.1 to 3.1), and recent smoking history (OR 2.7, 95% CI 1.2 to 5.8).

Current SIRS criteria have the following (sensitivity, specificity): heart rate (HR)>90 (0.96, 0.45), respiratory rate (RR)>20 (0.62, 0.90), WBC<4 x10^9/L or WBC>12 x10^9/L (0.75, 0.59), temperature (T) <36°C or T >38°C (0.69, 0.71). Using more extreme thresholds for defining aberrant vital signs improved specificity but decreased sensitivity: HR≥110 (0.82, 0.82), RR≥25 (0.42, 0.99), WBC<4 x10^9/L or WBC≥20 x10^9/L (0.37, 0.97), T ≤35.5°C or T ≥38.5°C (0.44, 0.91).

Conclusions: Clinicians need to be alert to the potential for severe sepsis in parturients, particularly in those having risk factors for this complication. While the specificity is improved when higher thresholds for aberrant vital signs are used, the sensitivity is decreased. The use of criteria with higher screening thresholds is therefore not recommended due to increased false negatives in parturients with sepsis.

References

1. Knight et al, University of Oxford 2014
2. Creanga et al, Obstet Gynecol 2015
3. Bauer et al, Obstet Gynecol 2014

Abstract #:O1-04

Effect of maternal supine horizontal position versus 15° left lateral table tilt during cesarean delivery under spinal anesthesia on neonatal acid-base status

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Introduction: Left lateral uterine displacement during cesarean delivery (CD) is ingrained in obstetric anesthesia practice. Studies from the 1970's reported improved neonatal status with maternal tilt during CD, although many women were tilted right, anesthetic techniques varied, and hypotension was poorly controlled.1 Traditionally, 15° tilt is attempted, based on the "Crawford wedge", but is almost never achieved.2 MRI imaging indicates that at term, the inferior vena cava (IVC) is almost completely compressed in both the supine position and with 15° left lateral tilt but that IVC volume increases with 30° tilt. The aorta is not compressed in any position.3 This suggests that left tilt may not accomplish what the literature and textbooks have assumed it does. We hypothesized that with contemporary obstetric anesthesia care, 15° left lateral tilt may not be indicated and conducted a randomized clinical trial comparing neonatal acid-base status in women who were completely supine vs. tilted left by 15°.

Methods: Healthy women, with a singleton term fetus, undergoing elective CD with a spinal anesthetic (bupivacaine 12mg, fentanyl 15mcg, morphine 150mcg) were randomized to supine horizontal (SUPINE, N=50)) or to 15° left lateral tilt of the surgical table (TILT, N=47)) following spinal injection. A lactated Ringer's 10ml/kg coload and a phenylephrine (PE) infusion titrated to achieve 100% baseline systolic BP (SBP) were initiated at the time of the spinal dose.4 The primary outcome was umbilical artery (UA) base excess (BE). The study was powered as a non-inferiority study with > 90% power to determine that UA BE was not more than 1.0 mmol/L worse in the supine versus tilted group.

Results: There were no differences in umbilical artery or vein BE or pH between groups (Table). One neonate in each group required bag-mask ventilation, and one in the TILT group had an Apgar of 5 at 1 min; the 5 min Apgar score was 9 in all cases.

Conclusion: Not tilting the surgical table by 15° during CS with spinal anesthesia does not impair neonatal acid-base status compared to the tilt position, when baseline SBP is maintained with a PE infusion. Our data suggests that current recommendations on maternal positioning during CD under spinal anesthesia may no longer be necessary and are not evidence-based.

Table. Neonatal outcome according to maternal position during cesarean delivery

Variable	Supine group (n = 50)	Tilt group (n = 47)	p value
Apgar scores at 1 min <7	0	1	ns
Apgar scores at 5 min <7	0	0	ns
Umbilical arterial blood gases			
pH	7.29 (7.26, 7.31)	7.28 (7.25, 7.30)	0.19
PCO_2 (mmHg)	55 (51, 59)	56 (52, 60)	0.47
PO_2 (mmHg)*	17 (17, 18)	17 (17, 20)	0.40
HCO_3 (mmol/L)	25 (24.3, 26.0)	25 (24.0, 26.0)	0.88
Base excess (mmol/L)	-0.35 (-1.5, 0.5)	-0.5 (-1.5, 0.2)	0.46
Umbilical venous blood gases			
pH	7.34 (7.32, 7.36)	7.33 (7.30, 7.35)	0.21
PCO_2 (mmHg)	45 (42, 48)	47 (43, 49)	0.16
PO_2 (mmHg)	26 (22, 30)	26 (23, 30)	0.40
HCO_3 (mmol/L)	23.2 (22.6, 24.4)	23.5 (22.8, 24.7)	0.31
Base excess (mmol/L)	-1.4 (-2.7, -0.8)	-1.6 (-2.2, -0.9)	0.87

Values are median, IQR
*pO_2 values less than 17 mm Hg are reported by the laboratory as "<17 mm Hg" and were treated as 17 mm Hg for this analysis.

References:

1. Crawford, BJA 1972;44:477-84.
2. Jones, BJA 2003; 90; 86-7.
3. Higuchi, Anesthesiology 2015;122:286-93.
4. Odekon, Anesth Analg 2015; 120: 1309-16.

Abstract #:O1-05

Effect of maternal position during cesarean delivery on cardiac output and vasopressor requirements

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Introduction: Up to 10% of women at term suffer severe hemodynamic effects when supine ("supine hypotensive syndrome"),1 although most women are asymptomatic, presumably due to venoconstriction in the lower limbs, which raises venous pressure and promotes collateral flow through paraspinal and azygous veins. After 20 weeks' gestation the gravid uterus begins to obstruct the inferior vena cava (IVC) and displace the subrenal aorta in the supine position, which may impede venous return and decrease cardiac output (CO); the traditional dogma is that 15° left lateral tilt will relieve IVC compression. However, MRI imaging shows the IVC is almost completely compressed in both supine and 15° left tilt position at term, and IVC volume only increases with 30° left tilt.2 We designed a study to compare the effect of the supine vs. 15° left lateral tilt position on neonatal outcomes; this is a secondary analysis of maternal CO and vasopressor requirements.

Methods: Healthy women undergoing elective term cesarean delivery (CD) with spinal anesthesia were randomized to be supine horizontal (SUPINE, N=45) or with 15° left lateral tilt of the surgical table (TILT, N=44). At spinal injection (bupivacaine 12mg, fentanyl 15mcg, morphine 150mcg), a lactated Ringer's 10ml/kg coload and phenylephrine (PE) infusion were started, with the goal of maintenance of systolic BP (SBP). Cheetah NICOM provided continuous non-invasive CO. All women had baseline measures (CO, BP and HR) before spinal anesthesia in both supine and 15° left lateral tilt for 5 minutes, and then in the randomly assigned position every minute after spinal anesthesia until delivery.

Results: At baseline, mean CO was 8.2 ± 1.7 L/min in 15° left lateral tilt and 7.9 ± 1.5 L/min supine (p=0.37, Table 1). One patient in the TILT group became symptomatic after 3 min supine, with SBP fall from 122 mmHg to 75 mmHg and HR increase from 95 to 123/min. There was no statistical difference in CO between the supine and 15° tilt before the spinal. Over the 10 minutes that followed spinal injection, higher PE doses and lower mean CO were noted in the SUPINE group.

Conclusion: The effect of 15° left tilt on hemodynamic parameters was negligible at baseline and minor after anesthesia in healthy women undergoing elective CD with PE infusions titrated to maintain baseline hemodynamic parameters.

Table 1. Noninvasive cardiac output (CO) and phenylephrine (PE) dose.

Variable	Supine group n= 45	Tilt group n = 44	P value
Baseline systolic BP (mmHg)	115 ± 10	117 ± 11	0.47
Baseline CO in supine position (L/min)	8.2 (7.1, 9.3)	7.95 (7.0, 8.9)	0.49
Baseline CO with 15° left tilt (L/min)	8.6 (7.1, 9.3)	8.55 (7.05, 9.55)	0.62
CO 1 min post-spinal (L/min)	9.0 (7.8, 10.,5)	8.8 (7.45, 11.0)	0.84
CO 5 min post-spinal (L/min)	8.2 (6.9, 9.1)	8.35 (7.35, 9.95.)	0.26
CO 10 min post-spinal (L/min)	7.4 (6.15, 8.5)	8.65 (7.05, 9.55)	0.02
CO 15 min post-spinal (L/min)	7.2 (6.4, 8.7)	8.8 (7.5, 9.9)	0.003
Total PE dose at 15 min (mcg)	788.6 ± 321	611.4 ± 228	0.0024

CO values reported are median and interquartile range. PE doses are mean ± SD. P value is t-test for Baseline systolic BP and PE dose, Wilcoxon rank-sum for CO data.
Baseline systolic BP = average of 3 systolic BP's, 5 min apart, mean ± SD.
PE protocol aimed to maintain baseline systolic BP was:

- 50 mcg/min for SBP 90 – 99%
- 100 mcg/min for SBP 80 – 89%
- 200 mcg/min for SBP <80%
- For SBP > baseline, the infusion was halved or stopped.

References:

1. Obstet Gynecol 1953;1:371-7.
2. Anesthesiology 2015;122:286-93.

Abstract #:O1-06

Is Music Beneficial during Labor Epidural Technique Placement?: Unexpected Findings from a Randomized Controlled Trial

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Introduction: Many patients and health educators believe that music can have a positive impact on labor and delivery, and several music service playlists claim to "put your mind and body in a perfect place" during labor. (1-2) Because little scientific evidence exists to support these claims, we sought to determine if women who listened to music during labor epidural technique placement would experience greater satisfaction, less anxiety, and less pain.

Methods: One hundred laboring parturients were enrolled in a prospective, randomized, controlled trial to receive an epidural technique placement with (N=50) or without (N=50) music. Exclusion criteria included the preexisting use of music in the room, or the absence of labor. The intervention group listened to the patient's preferred music on a Pandora® station broadcast through an iPod with an external amplified speaker; the control group listened to no music. Music was started 10 minutes prior and ended 15 minutes after the epidural technique. All women received a standardized epidural technique and local anesthetic dose (3-5mL of 1.5% lidocaine with epinephrine followed by 10-15mL of 0.125% bupivacaine with 2mcg/mL fentanyl). The primary outcome was patient satisfaction, as measured by a Press Ganey-based survey. Secondary outcomes included anxiety, pain scores, and obstetric outcomes. Fisher's exact test was used to analyze satisfaction and delivery data, while t-test was used to analyze anxiety and pain scores.

Results: All 100 women completed the study, although 12 were excluded from analysis for protocol violations (music N=7; control N=5). Patient characteristics were similar in both groups, except for greater cervical dilation (4.12cm vs. 3.28cm) in the music group at time of the epidural technique (p=0.004). The mean duration of music was 32.5 minutes. Although no differences were observed in patient satisfaction (p=0.49) or pain (p=0.17), the music group experienced higher levels of anxiety after epidural placement (p=0.012) and a greater cesarean delivery rate (26% vs. 7%; p=0.02). Instrumented vaginal delivery rates were similar in both groups (7% vs. 5%; p=0.68).

Discussion: Music during labor epidural technique placement does not improve patient satisfaction or pain, but appears associated with higher post-procedure anxiety. A higher rate of cesarean delivery was also observed in the music group that could not be explained by the presence of operative delivery risk factors in both groups. Further investigation is needed to determine if music during labor epidural technique placement is more distracting than relaxing, and has an effect on mode of delivery. (2-3)

References:

1. Music for Labor and Delivery 2012.
2. Simavli 2014.
3. Ryding 1998.

Abstract #:O1-07

Racial Disparities in Parturients: Asian Women are at Increased Risk for In-Hospital Death

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Sajid S. Shahul M.D., MPH - University of Chicago - Chicago, IL

Background: Racial disparities in maternal mortality have been described. Most previous studies have focused on African-American women with or without co-existing diseases. These studies have consistently demonstrated that African-American women are at a disproportionally increased risk for maternal mortality. However, it is not well defined if Asian parturients in the US are also at increased risk for mortality. The objective of this study was to determine if Asian parturients were at increased risk for in-hospital mortality compared to white women.

Methods: In this IRB-exempt study, we obtained weighted estimates of the number of hospitalizations for deliveries in women aged 18-40 (ICD-9 codes) obtained through the National Inpatient Sample (NIS) from 2002 to 2013. NIS is a federal database, which contains discharge data from almost 5000 hospitals. The NIS samples 20% of discharges across all Health Care Utilization Project (HCUP) hospitals and is self-weighted to obtain accurate national estimates for all US hospital admissions. The results are reported as proportions with 95% confidence intervals.

Results: There were 20,846,418 weighted deliveries by women ages 18-40 in the NIS during the study period. Asian women represented 8.9% of these patients. When compared with other racial groups, Asian parturients were more likely to be older, of a higher socioeconomic status, and have a lower Charlson comorbidity score. After adjusting for various factors, Asian parturients had a higher odds ratio of in-hospital death compared with white women (1.806, 95% CI 1.200-2.716).

Conclusion: Racial disparities in peripartum outcomes have been well described. Our analysis reveals that despite Asian women presenting with lower Charlson comorbidity scores, they are at increased risk for in-hospital death when compared to white women. This was true even after adjusting for age group, Charlson comorbidity scores, and payor mix. Physicians need to appreciate that Asian parturients have increased mortality despite having lower 'traditional' risk factors (e.g. higher socioeconomic status) than white women.

References:

1. Creanga AA, Berg C, Syverson C, et al. Obstet Gynecol. 2012; 120:261-8.
2. Bryant AS, Worjoloh A, Caughey AB, Washington AE. Racial/Ethnic disparities in obstetric outcomes and care: prevalence and determinants. Am J Obstet Gynecol. 2010 Apr;202(4):335-43.

Table 1: Adjusted and Unadjusted Associations between Asian and White Parturients Ages 18-40

	Race	
	White	**Asian**
Unadjusted OR (95% CI)		
Maternal Mortality	1.0 [Reference]	1.559 [1.068, 2.274]
Adjusted OR* (95% CI)		
Maternal Mortality	1.0 [Reference]	1.86 [1.200, 2.716]

*Adjusted for age group, median household income, Charlson comorbidity score, and payer type

New Guidelines For Thromboprophylaxis In Pregnancy

Tufts Medical Center

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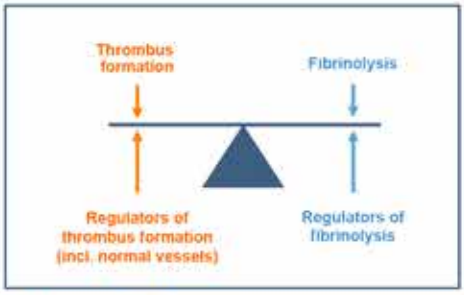
Disclosure

Errol R. Norwitz, M.D., Ph.D. has no conflicts of interest to disclose in regards to this topic

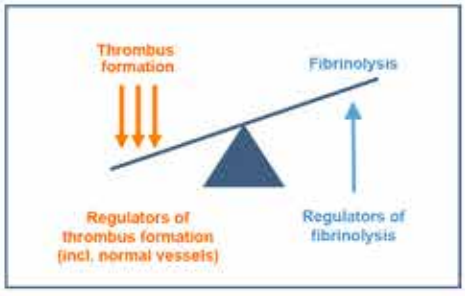
Objectives

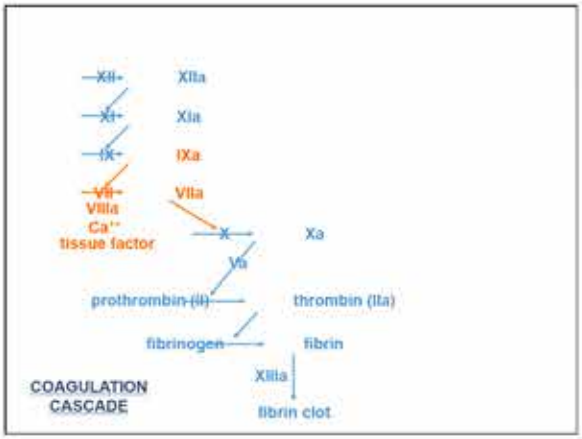
- Understand the evaluation for suspected inherited and acquired thrombophilias.
- Devise a clear and rational plan for the management of a pregnant woman with a venous thromboembolic event (DVT, PE).
- Appreciate the association between thrombophilia and adverse pregnancy outcome.

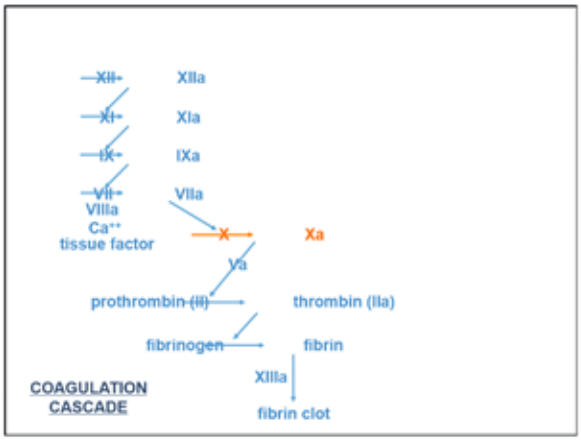
No thrombosis



Thrombus formation



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XIIIa
fibrin clot
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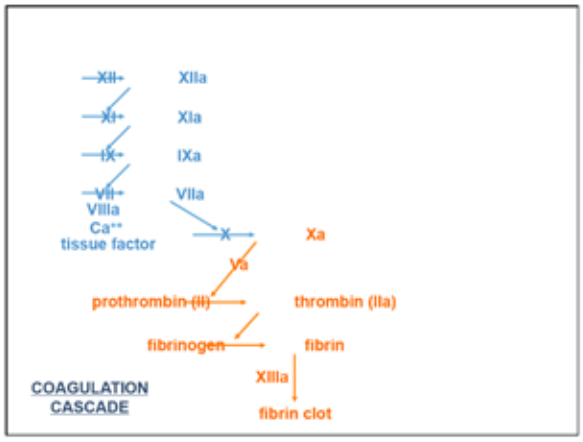
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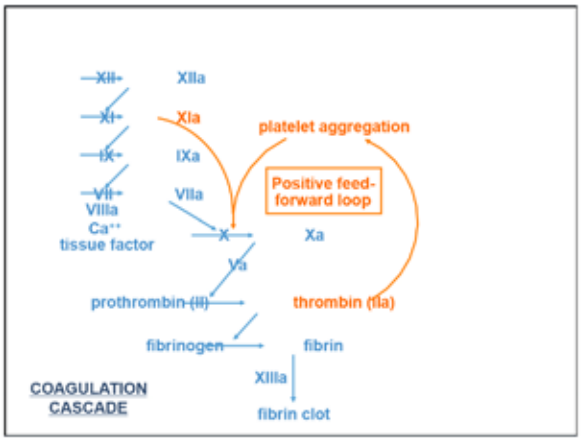
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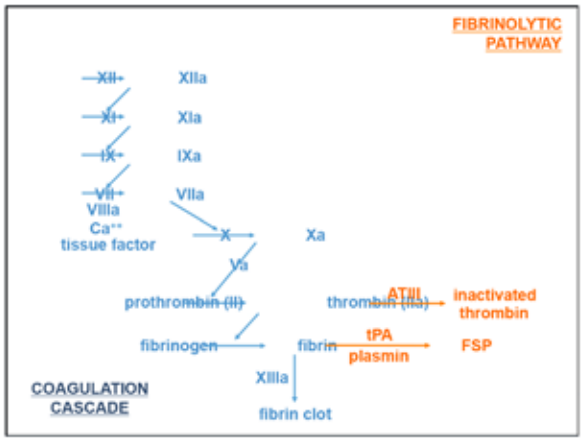
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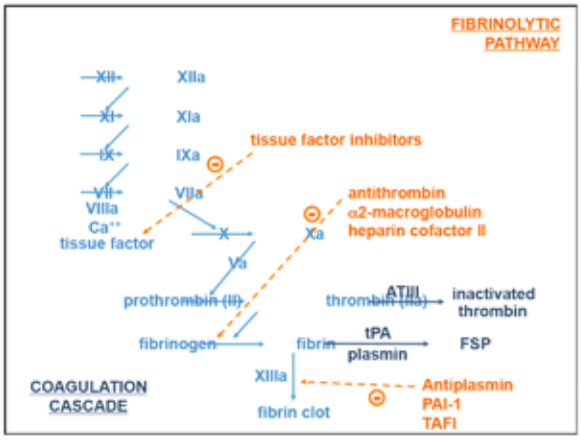
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α2-macroglobulin
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Xa
Va
prothrombin (II)
thrombin (IIa)
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inactivated thrombin
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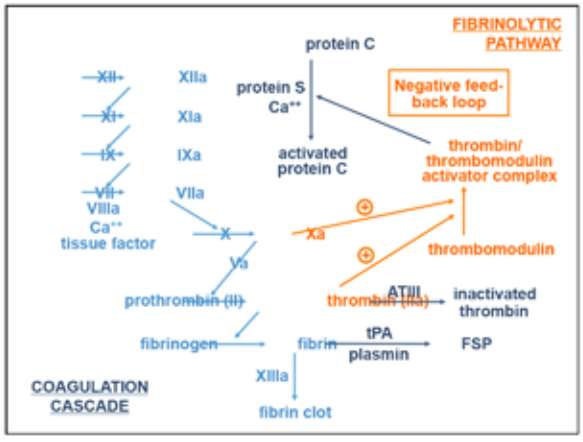
COAGULATION CASCADE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VII
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VIIIa
Ca++
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X
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Va
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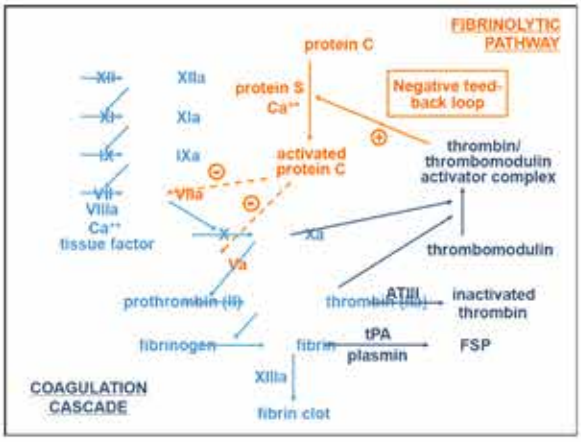

Risk factors for VTE

- Prior VTE
- Obesity
- Advancing age
- Bed rest, prolonged immobility
- Trauma, including surgery (cesarean)
- Pregnancy
- Antiphospholipid antibody syndrome
- Inherited thrombophilia
- Family history of VTE or thrombophilia

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VTE and pregnancy

- **Leading cause of maternal mortality in U.S.**
- **Incidence is 0.5-3.0 per 1,000 pregnancies.**
  - Complicates 1 in 1,500 pregnancies
- **Pregnancy is a thrombogenic state …**
  - ↑ in clotting factors (20-200% ↑ in fibrinogen, factor VIII, and vitamin K-dependent factors II, VII, IX and X)
  - ↓ in fibrinolytic activity (40% ↓ in protein S and 2- to 3-fold ↓ in PAI-1 levels)

Callaghan WM. *Semin Perinatol* 2012; 36:2-6

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VTE and pregnancy (cont)

- **Pregnancy is assoc with 5-fold ↑ in VTE.**
  - Further ↑ if advanced maternal age, multiparity, prolonged bed rest, infection
- **Further 3- to 5-fold ↑ in puerperium, and 3- to 16-fold ↑ after cesarean delivery.**
  - 33% of VTE events occur antepartum, 66% postpartum
  - 80% of fatal PE occur after cesarean

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Not all pregnant women are at equal risk of VTE

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Inherited thrombophilias

- **Common inherited thrombophilias caused by a single discrete gene mutation.**
  - Factor V^{Leiden} gene mutation (5% incidence in Caucasian populations, G1691A→Arg506Gln, causes resistant to inactivation by activated protein C, 40% VTE in pregnancy, hetero: 5- to 10-fold ↑ risk, homo: 50- to 100-fold ↑ risk)
  - Prothrombin (factor II)^{G20210A} gene mutation (2% incidence)

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ACOG Practice Bulletin No. 138. *Obstet Gynecol* 2013; 122:706-17

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Inherited thrombophilias (cont.)

- **Common inherited thrombophilias caused by multiple gene mutations.**
  - Antithrombin (ATIII) deficiency (most thrombogenic, risk of VTE is 50% in pregnancy, rare, only 1% of all VTE)
  - Protein C deficiency
  - Protein S deficiency
  - Hyperhomocysteinemia (don't check MTHFR^{C677T} mutation)

Gerhardt A, et al. *N Engl J Med* 2000; 342:374-80
Beauchamp NJ, et al. *Br J Haematol* 2004;125:647-54
Gomez K, Laffan MA. *Blood Coagul Fibrinolysis* 2004; 15:125-7
ACOG Practice Bulletin No. 138. *Obstet Gynecol* 2013; 122:706-17

Inherited thrombophilias (cont.)

- **Less thrombophilic thrombophilias.**
  - Protein Z deficiency
  - PAI-1$^{4G/4G}$ gene mutation
  - Factor V^{H1299R} gene mutation
  - β-fibrinogen^{G455A} polymorphism
  - Apolipoprotein B^{R3500Q} and E2/E3/E4 gene mutations
  - Factor XIII^{V34L} gene mutation

Lockwood CJ. *Obstet Gynecol* 2002; 99:333-41
Paidas MJ, et al. *J Soc Gynecol Invest* 2003; 10: 243-7
Heller L, et al. *J Soc Gyn Invest* 2004; 11:42-4
ACOG Practice Bulletin No. 138. *Obstet Gynecol* 2013; 122:706-17

Inherited thrombophilias

Condition	Inheritance	Prevalence
Factor V Leiden deficiency	Autosomal dominant	2-15%
Prothrombin gene mutation	Autosomal dominant	2-3%
Double hetero FVL / PGM	Autosomal dominant	0.5%
Protein C deficiency	Autosomal dominant	0.2-0.3%
Protein S deficiency	Autosomal dominant	0.1-2.1%
Antithrombin deficiency	Autosomal dominant	0.02%

Haemostasis and Thrombosis Task Force. *Br J Haematol* 2001; 114:512-28
ACOG Practice Bulletin No. 123. *Obstet Gynecol* 2011; 118:718-29
ACOG Practice Bulletin No. 138. *Obstet Gynecol* 2013; 122:706-17
Freeman AM, D'Alton ME. *Semin Perinatol* 2016; 40:87-92

Antiphospholipid syndrome

- **APLAS is an acquired disorder.**
- **It is an autoimmune disease.**
- **Characterized by the presence in the blood of a heterologous group of autoantibodies against membrane phospholipids and one or more specific clinical syndromes.**

Diagnosis of APLAS

Diagnosis requires 2 elements

- **The correct clinical setting …**
  - Recurrent pregnancy loss
  - Unexplained thromboembolic event
  - Autoimmune thrombocytopenia
  - ? Unexplained IUGR
  - ? Unexplained placental abruption
  - ? Recurrent early preeclampsia

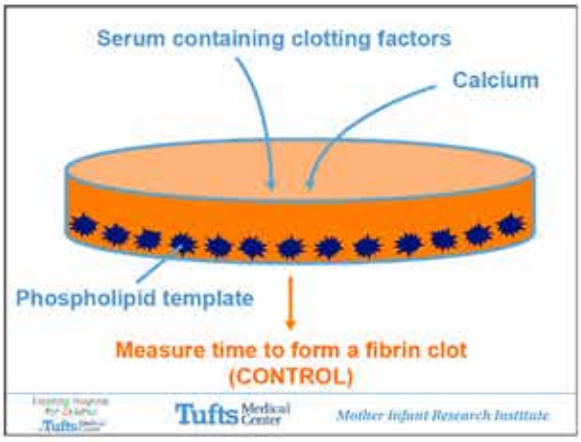
Wilson WA, et al. *Arthritis Rheum* 1999; 42:1309-11
Miyakis S, et al. *J Thromb Haemost* 2006; 4:295-306
ACOG Practice Bulletin No. 118. *Obstet Gynecol* 2011; 117:192-9

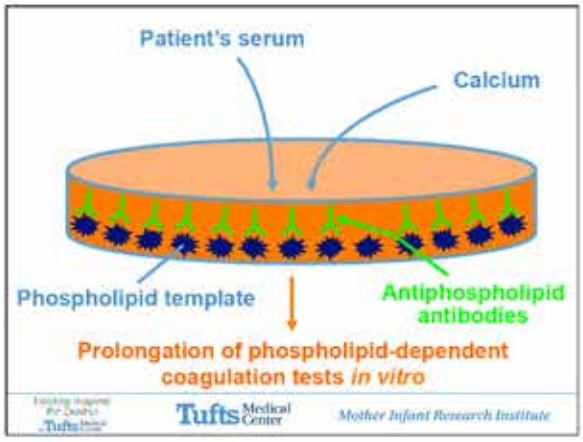
Diagnosis of APLAS (cont.)

AND

- **At least one confirmatory serologic test confirming circulating antiphospholipid antibodies …**
  - LAC (unidentified antibody causing prolongation of phospholipid-dependent coagulation tests *in vitro*)
  - Antibodies against specific phospholipids (e.g., ACA, anti-phosphatidylcholine, antiphosphatidylserine, anti-La, anti-Ro)
  - Anti-β2-glycoprotein I
  - (False-positive test for syphilis)

Two positive tests at least 12 weeks apart





Lupus anticoagulant

- LAC is an **unidentified** antibody or group of antibodies against phospholipids.
- Causes **prolongation of phospholipid-dependent coagulation tests** *in vitro* by binding to prothrombin-activator complex.
  - activated PTT (aPTT)
  - dilute Russel Viper Venom (RVV) test
  - plasma clotting time
  - kaolin clotting time (KCT)

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Lupus anticoagulant (cont.)

- To confirm diagnosis, the lab should …
  - Correct coagulation tests by adding excess phospholipids ("platelet neutralization test")
  - Exclude a **coagulation factor deficiency** by adding normal human plasma (volume 1:1)
- Results are reported as present or absent **(there are no titers).**
- LAC is a **misnomer** … it is not specific to SLE and it causes thrombosis *in vivo*.

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Identified autoantibodies

- **Identified** antibodies against specific membrane phospholipids …
  - -- Antiphosphatidylcholine
  - -- Antiphosphatidylserine
  - -- Antiphosphatidylethanolamine
  - -- Anti-Ro / Anti-La
  - -- **Anticardiolipin antibody (ACA)**
    - Cardiolipin is a negatively charged phospholipid isolated from ox heart
    - Cross-reacts with antiphospholipid antibody

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Testing in pregnancy

Condition	Effect of pregnancy	Test	Reliable in pregnancy?
Factor V Leiden deficiency	--	Genetic test	Yes
Prothrombin gene mutation	--	Genetic test	Yes
Protein C deficiency	↑/→	Serum protein	No
Protein S deficiency	↓↓	Serum protein	No
Antithrombin III deficiency	↓/→	Serum protein	No
LAC	↑	Antibody ELISA	Yes*
ACA	↑	Antibody ELISA	Yes*

* more false-positive tests

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Why treat in pregnancy?

- To prevent the formation of DVT.
- To prevent propagation of DVT.
- To prevent initial and/or recurrent PE.
  - If untreated, 15-25% of patients with DVT will have a PE with a mortality rate of 15%
  - If treated, 4-5% of patients with DVT will have a PE with a mortality rate of <1%

Barbour LA. *Obstet Gynecol Clin North Am* 1997; 24:469-521
ACOG Practice Bulletin No. 138. *Obstet Gynecol* 2013; 122:706-17
Friedman AM, D'Alton ME. *Semin Perinatol* 2016; 40:87-92

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Who to treat during pregnancy

- **Therapeutic anticoagulation**
  - Women with mechanical heart valve, AF, TIA
  - All women with VTE in index pregnancy
  - Multiple VTE episodes
  - Highly thrombogenic thrombophilia (ATIII deficiency, homo for FVL or prothrombin gene mutation, double heterozygote)
- **Prophylactic anticoagulation**
  - APLAS
  - Prior VTE with a known low-risk inherited coagulopathy
  - Prolonged bed rest or immobility (defined as >72h)
  - High-risk cesarean (morbidly obese, immobile)
  - ?? All patients with prior VTE vs those with a prior VTE in pregnancy or on oral contraceptives (5-12% recurrence)

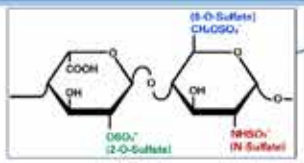
ACOG Practice Bulletin No. 123. *Obstet Gynecol* 2011; 118:718-29
Friedman AM, D'Alton ME. *Semin Perinatol* 2016; 40:87-92

Who not to treat during pregnancy

- **Incidental finding of thrombophilia of low thrombogenic potential or APLAS in the absence of a history of VTE.**
  - Even if family history is positive
  - Consider postpartum treatment after cesarean
- **History of first VTE in setting of an inciting event (e.g., trauma, surgery, OCPs) and negative thrombophilia workup.**
  - Consider postpartum treatment only

ACOG Practice Bulletin No. 123. *Obstet Gynecol* 2011; 118:718-29
Bates SM, et al. American College of Chest Physicians. *Chest* 2012; 141:e691S-736S
Friedman AM, D'Alton ME. *Semin Perinatol* 2016; 40:87-92

Unfractionated heparin



Alternating units of sulfated glucuronic acid with sulfated glucosamine

- **UFH is a complex glycosaminoglycan.**
  - Naturally occurring product of varying sizes (5,000-30,000 Da)
  - Metabolized by heparinase in liver / placenta, renally cleared
  - t½ in plasma = 1-2 hours
  - Does not cross placenta; as such, it is not teratogenic
  - Does not cross into breast milk

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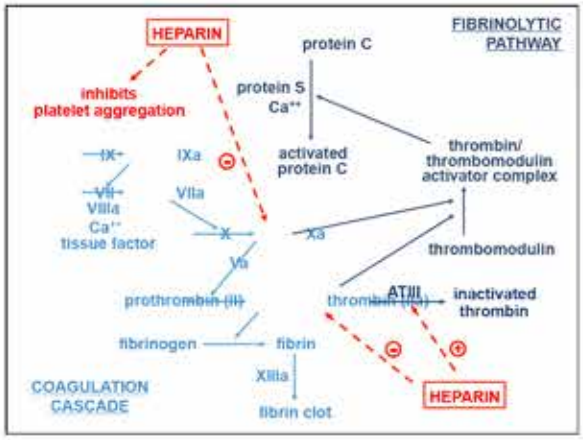
Unfractionated heparin (cont.)

- **Therapeutic UFH**
  - IV loading dose: 100 U/kg for DVT, 150 U/kg for PE
  - Maintenance infusion: 15-25 U/kg per h
  - √ aPTT or anti-Xa activity every 4-6 h, then daily
  - Goal is aPTT 1.5-2.5 x control / anti-Xa activity 0.6-1.0 U/mL
- **Prophylactic UFH**
  - 5,000 U sc bid in first trimester, ↑ 2,500-5,000 U q trimester
  - Consider increasing dose in obese patients
  - Adjust dose to give anti-Xa activity 0.1-0.2 U/mL measured 4-6 h after administration, if tested (does not affect aPTT)

ACOG Practice Bulletin No. 123. *Obstet Gynecol* 2011; 118:718-29
ACOG Practice Bulletin No. 138. *Obstet Gynecol* 2013; 122:706-17



Fractionated heparin

- Low molecular weight heparin (LMWH) is the 4,000-6,000 Da fraction of UFH.
  - t½ in plasma = 4-8 hours

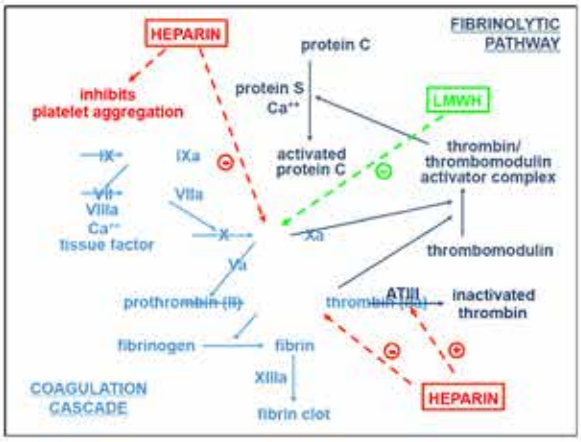
Advantages
- Outpatient setting
- Less aggressive laboratory monitoring
- Fewer side-effects

Contraindications
- Mechanical heart valve
- Morbid obesity
- Renal insufficiency
- Anticipated need for rapid reversal
- LMWH failure

Fractionated heparin (cont.)

- **Therapeutic LMWH**
  - Enoxaparin (Lovenox®) 1 mg/kg sc q 12 hourly
  - Dalteparin (Fragmin®) 200 U/kg sc q 12 hourly
  - Adjust does to give anti-Xa activity 0.6-1.0 U/mL measured 4-6 h after administration (does not affect aPTT)
- **Prophylactic LMWH**
  - Enoxaparin (Lovenox®) 30-40 mg sc q 12-24 hourly
  - Dalteparin (Fragmin®) 2,500-5,000 U sc daily
  - Adjust dose to give anti-Xa activity 0.1-0.2 U/mL measured 4-6 h after administration, if tested (does not affect aPTT)

ACOG Committee Opinion No. 276. *Int J Gynaecol Obstet* 2002; 79:299-300
ACOG Practice Bulletin No. 138. *Obstet Gynecol* 2013; 122:706-17



Risks of heparin therapy

Adverse event	Unfractionated heparin	LMWH
Hemorrhage	<5%*	?
Thrombocytopenia	1-3%**	<1%
Osteopenia	10-17%***	?
Vertebral fracture	2.2%	0.6%

* ↑ risk with aspirin, liver disease, surgery, low platelets
** Mainly mild and benign; severe IgG-mediated <0.2%
*** With doses of >15,000 U/day for >6 months

What about coumadin?

- Coumadin (warfarin) acts by inhibiting hepatic production of vitamin K-dependent clotting factors (factors II, VII, IX and X).
- Contraindicated in the first trimester.
  - Max teratogenicity at 6-12 weeks (warfarin embryopathy)
  - Optic neuritis occurs at any gestational age
- Used in the second half of pregnancy in UK and Europe, but not in U.S.

Antepartum management

- Once stable, follow aPTT and/or anti-Xa activity …
  - q weekly if therapeutic regimen
  - q trimester or not at all if prophylactic
- Heparin-induced thrombocytopenia (HIT).
  - Check platelets q week for first 3-4 weeks, then q month
- Ultrasound estimation of fetal growth q 3-4 weeks after 24 weeks.

Peripartum management

- Continue treatment throughout pregnancy.
- Switch LMWH to UFH at 35-36 weeks.
  - Shorter t½ (1-2 hours vs 6-8 hours)
  - Can be reversed by protamine sulfate
  - Possibly lower rate of epidural hematoma (?)
- Alternatively, discontinue LMWH >24 h prior to scheduled induction at 39 weeks.
  - Check anti-Xa activity on admission
  - Anesthesia consultation

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Intrapartum management

- Use regional analgesia with care.
- There should not be a significant increase in bleeding complications if …
  - patient is on prophylactic UFH <10,000 IU/day
  - >6 h after therapeutic UFH
  - >12 h after prophylactic LMWH
  - >24 h after therapeutic LMWH
- Consider protamine sulfate if bleeding or elevated aPTT prior to surgery.

Friedman AM, D'Alton ME. *Semin Perinatol* 2016; 40:87-92

Intrapartum management (cont.)

- Routine use of pneumatic compression devices at cesarean (not vaginal delivery).*
- Consider prophylactic anticoagulation at cesarean if other risk factors are present.
  - Unclear from ACOG / ACCP what these risk factors are
  - RCOG is more aggressive with peripartum anticoagulation
  - We don't generally use scoring systems (Caprini, Padua)

* Clark SL, et al. *Am J Obstet Gynecol* 2014; 211:32.e1-9
ACOG Practice Bulletin No. 123. *Obstet Gynecol* 2011; 118:718-29
Bates SM, et al. American College of Chest Physicians. *Chest* 2012; 141:e691S-736S
Wu P, et al. for NICE. *Eur J Obstet Gynecol Reprod Biol* 2012; 168:7-11
RCOG. Green-Top Guidelines No. 37a. 2015
Friedman AM, D'Alton ME. *Semin Perinatol* 2016; 40:87-92

Postpartum management

- √ baseline aPTT, PT (INR), anti-Xa activity.
- Restart anticoagulation 4-6 h after vaginal delivery or 6-8 h after cesarean.
- Start coumadin on postpartum day #1.
  - Give 10 mg po qhs x 2 doses
  - Thereafter adjust dose to give INR 1.5-2.0
  - Stop heparin 5 days after INR is therapeutic
  - Compatible with breastfeeding

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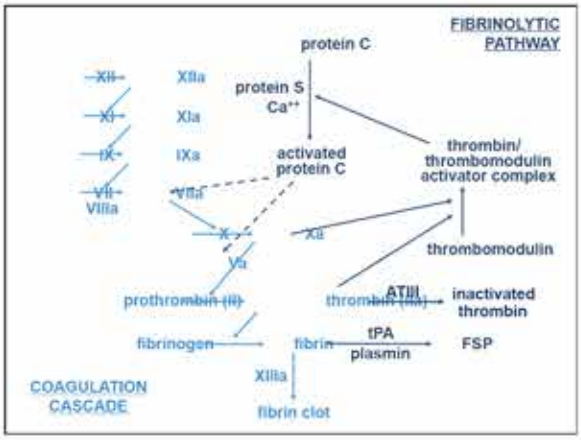
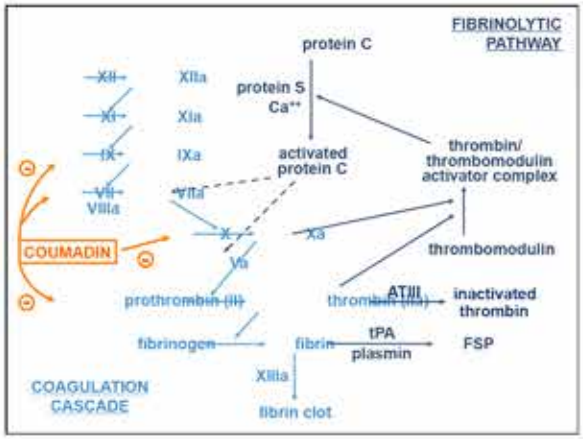
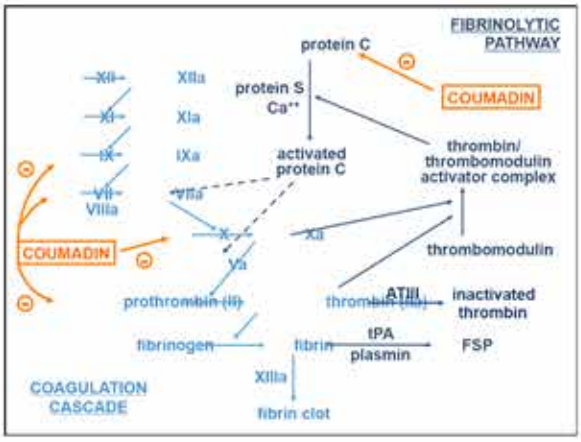


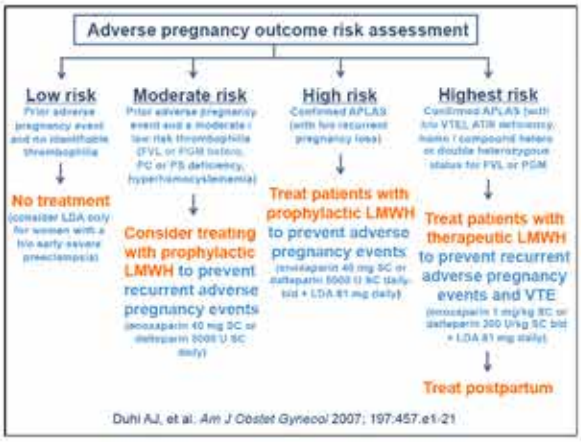




Duration of therapy postpartum

Indication	Duration
PE or iliofemoral DVT in index pregnancy; APLAS with MI or stroke	At least 4-6 months therapeutic
Multiple VTE episodes; VTE with high-risk thrombophilia or APLAS	At least 6 weeks therapeutic
VTE with no known/low-risk thrombophilia; a prior VTE while pregnant or on OCPs; no prior VTE but high-risk thrombophilia (with/without family history); no prior VTE but low-risk thrombophilia and a positive family history; VTE provoked	At least 6 weeks prophylactic
No VTE and low-risk thrombophilia	None

ACOG Practice Bulletin No. 123. *Obstet Gynecol* 2011; 118:718-29
Friedman AM, D'Alton ME. *Semin Perinatol* 2016; 40:87-92



Duhl AJ, et al. *Am J Obstet Gynecol* 2007; 197:457.e1-21

Adverse pregnancy events?

- Is there an association between thrombophilias and adverse pregnancy outcome?
- If an association does exist, can treatment prevent these adverse events?

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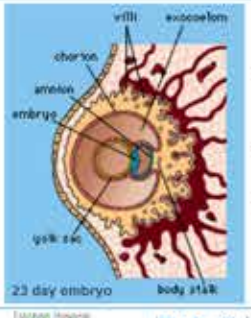
Biologic plausibility



- Until 8-10 weeks, maternal spiral arteries are filled with thrombotic 'plugs' which prevent gas and nutrient exchange
- The embryo is nourished by the endometrial glands
- The embryo exists in an hypoxic and hypoglycemic environment

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Acquired thrombophilias

- APLAS is associated with recurrent pregnancy loss, stillbirth, early-onset severe preeclampsia, and IUGR.

  Miyakis S, et al. *J Thromb Haemost* 2006; 4:295-306

- Treatment (prophylactic heparin + LDA) may reduce pregnancy loss.
  - Prophylactic and therapeutic heparin have equal efficacy
  - Better than prednisone, fewer side effects
  - No proven benefit in preventing preeclampsia, IUGR

  Empson M, et al. *Obstet Gynecol* 2002; 99:135-44
  Di Nisio , et al. *Cochrane Database Syst Rev* 2005; 2:CD004734

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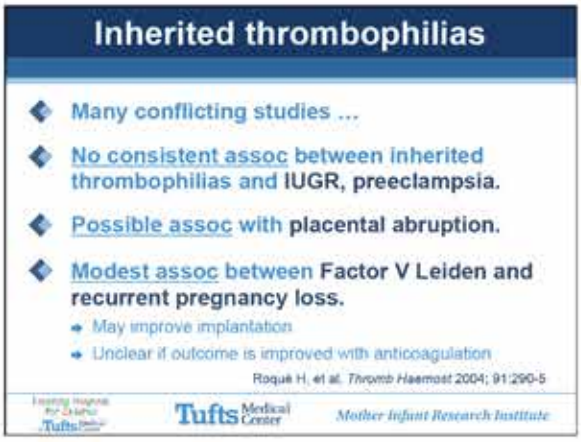
Inherited thrombophilias
Many conflicting studies …
No consistent assoc between inherited thrombophilias and IUGR, preeclampsia.
Possible assoc with placental abruption.
Modest assoc between Factor V Leiden and recurrent pregnancy loss.
May improve implantation
Unclear if outcome is improved with anticoagulation
Roqué H, et al. Thromb Haemost 2004; 91:290-5
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Neuraxial Anesthesia and Anticoagulation

Speaker: Richard M. Smiley, M.D., Ph.D.

NOTES

Friday, May 20, 2016

Best Paper Session
Moderator: *David H. Chestnut, M.D.*

Gertie Marx/FAER Education Lecture
Speaker: *Mary E. D'Alton, M.D.*

What's New in Neonatology?
Speaker: *Terrie E. Inder, M.D., Ph.D., M.B.Ch.B.*

Abstract #:BP-01

Optimization of Maternal Magnesium Sulfate Administration for Fetal Neuroprotection and Cerebral Palsy Prevention

Submitting Author: Brendan Carvalho M.B.BCh, FRCA

Submitting Author's Institution: Stanford University Medical Center - Stanford, CA

Co-Author: Felice Su M.D. - Stanford University Medical Center - Stanford, CA
Mohammed El-Komy Ph.D. - Beni Suef University - NA, NA
David R Drover M.D. - Stanford University Medical Center - Stanford, CA
Kathleen F Brookfield M.D. - Oregon Health and Science University - Portland, OR

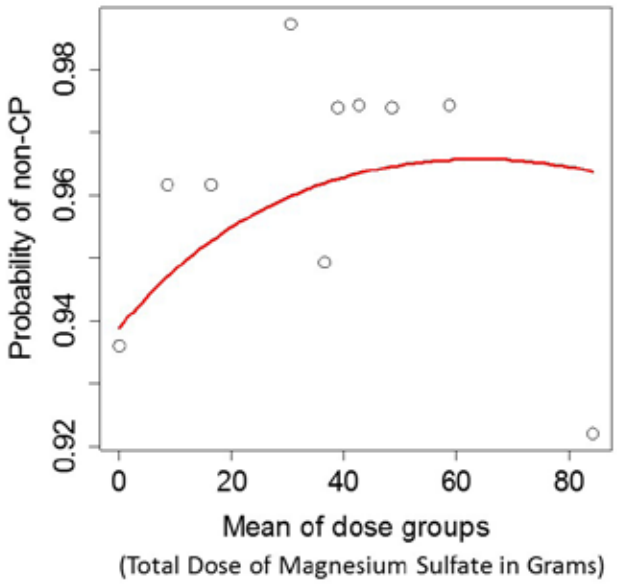
Introduction: Magnesium sulfate (MgSO4) is indicated for neuroprotection of the fetus delivering at < 32 weeks' gestation (1), however the optimal dosing schedule to prevent cerebral palsy is not known. The aim of the study was to identify the optimal therapeutic maternal magnesium drug exposure and concentrations to prevent cerebral palsy (CP) in the extremely preterm fetus.

Methods: We first developed a detailed population pharmacokinetic model describing magnesium disposition in pregnant women using multiple maternal and umbilical cord blood magnesium levels from 111 patients receiving antenatal MgSO4. We then applied our enriched population pharmacokinetic model to a prospective cohort of 1,905 deliveries to women at risk of preterm delivery who participated in the BEAM trial (2). We simulated the population-based individual maternal serum magnesium concentration at the time of delivery, and the total magnesium exposure for each woman in the cohort who received MgSO4. A logistic regression model was developed to determine the relationship between total magnesium exposure and magnesium concentration at time of delivery and the development of CP.

Results: The incidence of CP in the cohort was 3.6% for women who received MgSO4 and 6.4% for controls. The population-estimated mean maternal magnesium concentration at the time of delivery in women who received MgSO4 (n=636) and did not deliver an infant (n=611) with CP was 4.87 mg/dL (95% CI = 4.79-4.94). The total magnesium exposure associated with the lowest probability of delivering an infant with CP was 64 g (95% CI = 30–98; Figure 1). Magnesium exposure was a better predictor of delivery of an infant without CP than magnesium concentration at the time of delivery. There was no observed dose-response effect among total magnesium exposure and magnesium concentration at the time of delivery and the severity of CP.

Conclusion: Our population-based estimates of magnesium disposition suggest that a total dose exposure of 64 grams is required to optimize fetal neuroprotection. Using a 6 g bolus and 2 g/hour maintenance infusion protocol, nearly 30 hours of MgSO4 administration would be required to optimize CP protection. Current MgSO4 dosing regimens may need to be modified to achieve adequate magnesium exposure prior to delivery to optimize fetal neuroprotection.

Figure 1



References:

1. Am J Obstet Gynecol 2009;200: 595-609
2. N Engl J Med 2008;359(9):895-905

Abstract #:BP-02

Neighborhood- and Hospital-Level Factors Associated with Severe Peripartum Maternal Morbidity in New York State, 2009-2011.

Submitting Author: Jean Guglielminotti M.D., Ph.D.

Submitting Author's Institution: Hôpital Bichat-Claude Bernard, APHP - Paris, NA

Co-Author: Ruth Landau M.D. - Columbia University College of Physicians and Surgeons - New York, NY
Cynthia A. Wong M.D. - University of Iowa, Carver College of Medicine - Iowa City, IA
Catherine Deneux-Tharaux M.D., Ph.D. - INSERM, U1153, CRESS, EPOPé - Paris,
Guohua Li M.D., DrPH - Columbia University College of Physicians and Surgeons - New York, NY

Background: Severe maternal morbidity (SMM) is increasing in the US (1), affecting 1.6% of deliveries with marked variations among hospitals. Explanations include increases in maternal age, comorbidities, high-risk pregnancies, and cesarean deliveries. Research suggests that neighborhood characteristics such as long driving time to hospital or low obstetrician density are associated with adverse maternal outcomes (2). Similar associations are suggested for hospital characteristics such as rural location, low delivery volume, high proportion of minority patients, or low staffing (3). We examined associations of neighborhood- and hospital-level factors with SMM to identify potential targets for maternal safety improvement.

Methods: Discharge records indicating labor and delivery, patient characteristics, and SMM were identified with ICD-9-CM codes in the State Inpatient Database for New York 2009-2011. SMM encompassed organ failures and specific diseases, and included 15 diagnosis: disseminated intravascular coagulation (DIC); acute heart, respiratory, kidney, neurologic, and hepatic failure; postpartum hemorrhage (PPH) associated with blood transfusion or hysterectomy; eclampsia; stroke; pulmonary embolism; status asthmaticus; status epilepticus; severe sepsis; myocardial infarction; diabetic coma. Hospital and neighborhood characteristics were obtained from the AHA and AHRF Files 2010. Driving time to hospital and obstetrician density in the county of residence were calculated. Multilevel modeling was used to examine the association of neighborhood- and hospital-level factors with SMM.

Results: 605,534 discharges in 139 hospitals were analyzed; 7,627 discharges indicated SMM (1.3%) with an increase from 1.1% in 2009 to 1.4% in 2011 ($P < 0.0001$). The 3 most frequent SMMs were severe PPH (35%), DIC (27%), and heart failure (16%). No neighborhood characteristics were associated with SMM (Table). Four hospital characteristics were associated with decreased rate of SMM: urban location, low proportions of minority patients and high-risk pregnancies, and higher cesarean delivery rate. Between-hospital variation was equally explained by patient- and hospital-level characteristics.

Conclusions: Hospital-, but not neighborhood characteristics were associated with SMM, which may result in interventions to improve maternal safety.

References:

1. Obstet Gynecol 2012;120:1029-36
2. Am J Obstet Gynecol 2005;193:1083-8
3. Am J Obstet Gynecol 2014;211:647.e1-16

Table: Multivariable analysis of risk factors for severe peripartum maternal morbidity in New York State 2009-2011, and proportion of between-hospital variation (PBHV).

	Adjusted odds ratio (95% confidence interval)	P-value	PBHV
Patient			**-11%**
Age (per 1 year increase)	0.987 (0.983-0.992)	< 0.0001	
Race			
- White	Reference	Reference	
- Black	1.157 (1.079-1.241)	< 0.0001	
- Hispanic	1.101 (1.023-1.184)	0.01	
- Asian or Pacific Islander	1.050 (0.942-1.170)	0.37	
- Native American	0.799 (0.547-1.166)	0.24	
- Other	1.101 (1.007-1.204)	0.035	
Charlson comorbidity index			
- 0	Reference	Reference	
- 1	0.962 (0.880-1.052)	0.39	
- 2	4.876 (4.103-5.796)	< 0.0001	
- 3 and more	5.909 (4.076-8.566)	< 0.0001	
Pregnancy and delivery			**-8%**
Pregnancy resulting from assisted reproductive technology	1.647 (1.359-1.997)	< 0.0001	
Bateman comorbidity index			
- 0	Reference	Reference	
- 1	1.293 (1.208-1.384)	< 0.0001	
- 2	1.859 (1.717-2.012)	< 0.0001	
- 3 and more	4.626 (4.295-4.983)	< 0.0001	
Non-elective admission	1.201 (1.121-1.288)	< 0.0001	
Mode of delivery			
- Vaginal spontaneous	Reference	Reference	
- Vaginal induced	1.446 (1.321-1.582)	< 0.0001	
- Cesarean planned	2.455 (2.292-2.630)	< 0.0001	
- Cesarean unplanned	2.969 (2.791-3.158)	< 0.0001	
Neighborhood characteristics			**--**
Driving time from home to hospital (per 1 min increase)	1.000 (0.999-1.001)	0.81	
Obstetrician density in the county of residence (per 1 increase per 1,000 births)	0.999 (0.996-1.002)	0.50	
Hospital			**-15%**
Rural location	1.428 (1.118-1.824)	0.004	
Percent deliveries of non-white patients (per 1% increase)	1.003 (1.000-1.006)	0.023	
Percent deliveries of patients with Bateman index >1 (per 1% increase)	1.051 (1.033-1.068)	< 0.0001	
Cesarean delivery rate (per 1% increase)	0.978 (0.967-0.990)	0.0002	

Abstract #:BP-03

Transcutaneous Carbon Dioxide Measurements with the Topological Oscillation Search with Kinematical Analysis (TOSCA) Monitor in Women Receiving Intrathecal Morphine for Post-cesarean Delivery Analgesia

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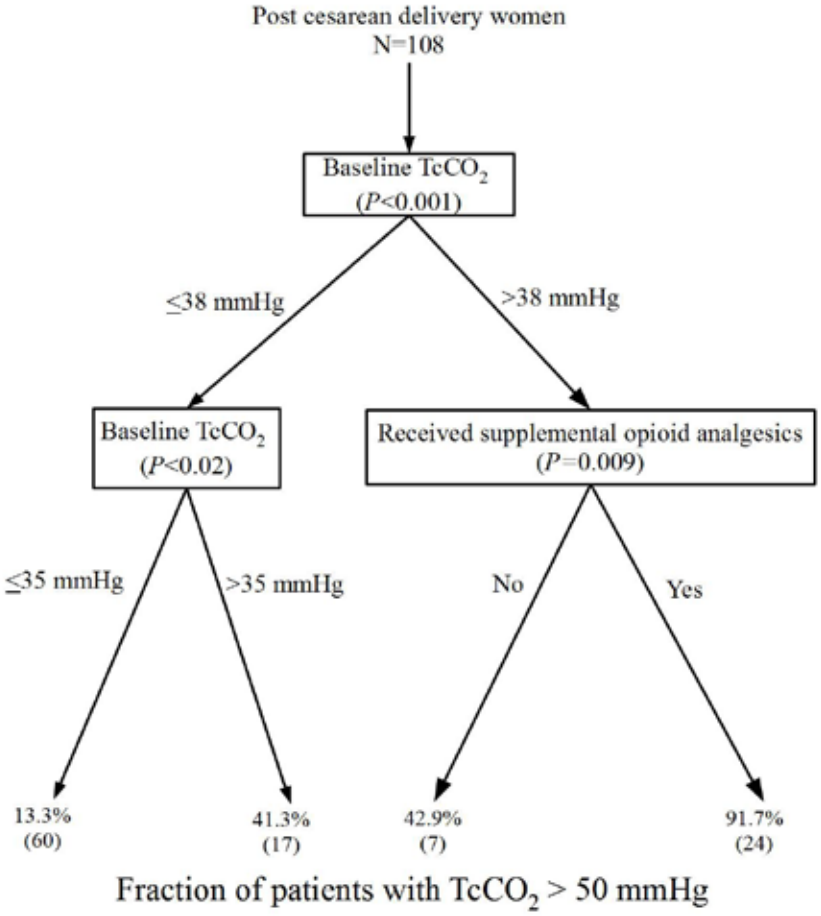
Submitting Author's Institution: Northwestern University Feinberg School of Medicine - Chicago, IL

Co-Author: Robert J McCarthy PharmD - Northwestern University Feinberg School of Medicine - Chicago, IL
Nicole Higgins M.D. - Northwestern University Feinberg School of Medicine - Chicago, IL
Paul C Fitzgerald RN, B.S.N, M.S. - Northwestern University Feinberg School of Medicine - Chicago, IL
Cynthia A Wong M.D. - University of Iowa - Iowa City, IA

Introduction: No standard definition of respiratory depression exists, so the true incidence of respiratory depression following intrathecal (IT) morphine for cesarean delivery (CD) is unknown.1 Respiratory depression is low (0.07-0.9%) when using respiratory rates (RR), oxygen saturation and sedation monitoring, but is much higher (17.8%) when defined by hypercapnia (>50mmHg).2,3 This is the first study evaluating hypercapnia using transcutaneous CO2 (TcCO2) levels in women receiving IT morphine for CD.

Method: This is a prospective observational study. Inclusion: ASA PS 2 women ≥37 wk, BMI <40kg/m2, scheduled for CD with spinal anesthesia and IT morphine. Baseline sleep apnea risk was assessed. TcCO2 levels were monitored for 24 h with the TOSCA monitor, which approximates PaCO2 (median difference 2-7 mmHg).4,5 Protocol: spinal anesthesia (hyperbaric bupivacaine + fentanyl + morphine 150 µg); postoperative analgesia (ketorolac 30 mg q 6h 24h, acetaminophen 325 mg/hydrocodone 10mg, 1-2 q6h prn). Routine orders for sedation and RR monitoring applied. Adverse respiratory events were recorded.

Results: 120 women were recruited; 108 completed the study. Median monitoring duration was 22 (16 to 23) hr. TcCO2 values increased from the baseline in 107 women. Median (IQR) baseline and maximal TcCO2 values following IT morphine were 30 (30 to 40) mmHg and 47 (42 to 53) mmHg, respectively. Median increase from baseline was 13 (9 to 17) mmHg. Forty women (37%) had ≥ 1 TcCO2 recording >50mmHg. Median number of TcCO2 events >50mmHg was 113 (26 to 760) events/subject and a median duration of 21 (7 to 146) min. Median time from IT morphine to first TcCO2 >50 mmHg was 400 (120 to 652) min. Binary logistic regression identified higher baseline TcCO2 and supplemental opioids as independent predictors of hypercarbia (Fig1). Predictive accuracy was 0.84 (95% CI 0.76 to 0.93). No respiratory depression (RR<10) or profound sedation events were recorded.



Discussion: This study confirms that hypercapnia occurs frequently in women receiving intrathecal opioids for CD. The perception that respiratory depression in this patient population is low may reflect sparse monitoring and the stimulating postpartum environment. Women with higher baseline TcCO2 may need to be more closely monitored postpartum.

References:

1. Can J Anesth 2003;50:679-88
2. Anesth Analg 2013;117:1368–70
3. Int J Obstet Anesth 2013;22:217–222
4. Br J Anaesth 2010;104:774-8
5. Can J Anaesth 1992;39:31-6

Abstract #:BP-04

Epidemiology of maternal cardiac arrest in Canada: A nationwide study

Submitting Author: Leyla Baghirzada M.D., FRCPC, MPH

Submitting Author's Institution: University of Calgary - Calgary, Alberta

Co-Author: Shiliang Liu M.B., Ph.D. - Centre for Chronic Disease Prevention, Public Health Agency of Canada - Ottawa, ON
Juan Andrés León M.D., M.S.c - Centre for Chronic Disease Prevention, Public Health Agency of Canada - Ottawa, ON
Mrinalini Balki M.D. - Department of Anesthesia and Obstetrics & Gynaecology, Mount Sinai Hospital, University of Toronto - Toronto, ON

Introduction: Cardiac arrest during pregnancy is a rare event with an estimated incidence of 1:30,000 to 1:50,000 deliveries.[1] Such events can be catastrophic,leading to a significant potential for major maternal and neonatal morbidity and mortality.[2]

The objective of this study was to generate information about maternal cardiac arrest in Canada by examining the frequency, temporal incidence, associated conditions, maternal survival and fatality rates.

Methods: This retrospective cohort study was based on the hospitalization database for childbirth in Canada (except Quebec)from 2002/03 to 2013/14. The study population included women with gestational age 20 weeks and higher having cardiac arrest during hospitalization for childbirth. Cardiac arrest was defined based on ICD-10-CA diagnostic (I46.0, I46.1, I46.9, I49.00, I49.01) and intervention codes (1.HZ.30.^^, 1.HZ.09.JA-FS, 1.HZ.09.LA-FS, 1.HZ.09.LA-CJ). Data were summarized using descriptive statistics. Multivariable logistic regression analysis was used to identify medical and obstetrical conditions independently associated with maternal cardiac arrest.

Results: There were 261 cases of maternal cardiac arrest among 3,282,150 hospitalizations for delivery.185 women (70.9%, 95% CI 65.2% to 76.2%)survived to hospital discharge. The fatality rate was 28.8%. The frequency of cardiac arrest in 2002-2014 varied from 5 to 11 per 100,000 deliveries; there was no difference between the years (p=0.26). There was no variation in the incidence among Canadian provinces (p=0.42). Women who suffered cardiac arrest were more likely to be 35 yr and older (OR 2.34; 95% CI 1.69 to 3.26). Aortic aneurysm and dissection was the most common condition associated with maternal cardiac arrest, followed by obstetric embolism and heart failure. Table 1 lists statistically significant associations between maternal obstetric/ medical conditions, and cardiac arrest.

Discussion: This is the first Canadian population based cohort study on the epidemiology of maternal cardiac arrest. The event rate is 8:100,000 deliveries. Survival rate reported in this study is higher than previously reported, potentially owing to the differences in case identification between the studies.[2] This information could be used to develop prospective database of the cases and guide development of the system approach in dealing with this condition.

Reference:

1. Cantwell R et al. BJOG 2011; 118:1–203.
2. Dijkman A et al.BJOG 2010;117: 282–7.

Table 1. The association between maternal medical and obstetric conditions, and cardiac arrest.

Maternal obstetric and medical conditions	**Adjusted OR***
Chorioamnionitis	2.30 (1.19-4.42)
Morbidly adherent placenta	3.06 (1.19-4.42)
Placenta praevia	1.62 (1.30-1.76)
Placental abruption	2.91 (1.05-8.07)
Stillbirth	3.03 (1.69-5.46)
Polyhydramnios	2.31 (1.01-5.30)
Gestational hypertension	1.97 (1.35-2.87)
Diabetes in pregnancy	1.87 (1.25-2.80)
Diseases of the nervous system	2.84 (1.52-5.32)
Maternal infectious and parasitic diseases	3.26 (2.19-4.85)
Complications of anesthesia	3.17 (1.22-8.20)
Eclampsia	11.04 (5.61-21.73)
Aortic aneurysm and dissection	21.95 (5.73-84.06)
Postpartum hemorrhage	1.46 (1.04-2.06)
Sepsis	4.03 (2.18-7.44)
Pulmonary edema	3.03 (1.32-6.99)
Trauma	9.34 (4.08-21.38)
Heart failure	13.00 (8.56-19.76)
Obstetric embolism	18.21 (8.92-37.18)
Amniotic fluid embolism	7.56 (3.10-18.46)

*ORs adjusted for maternal age, parity, gestational age, anesthesia type, maternal and obstetric conditions.

Abstract #:BP-05

IL-6-induced Fetal Neuroinflammation Upregulates Neuronal Progenitors in the Primordial Dentate Gyrus

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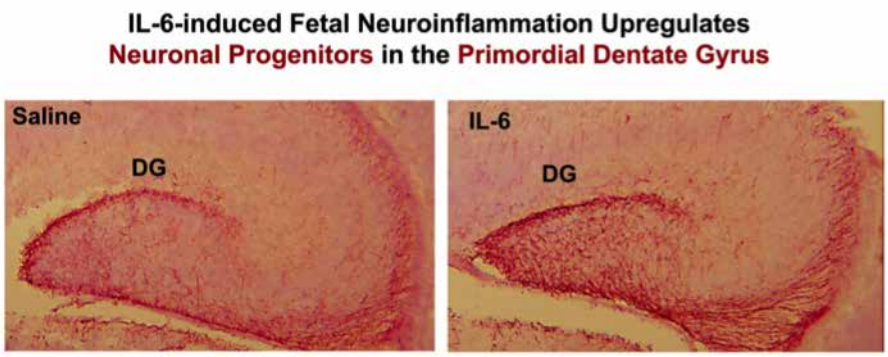
Co-Author: B Scott Segal M.D. - Wake Forest Baptist Medical Center - Winston-Salem, NC
Ruben Azocar M.D. - Tufts Medical Center - Boston, MA
Roman Schumann M.D. - Tufts Medical Center - Boston, MA
Iwona Bonney Ph.D. - Tufts Medical Center - Boston, MA
James E Marchand Ph.D. - Tufts Medical Center - Boston, MA

Background: Fever during labor is associated with a three-fold increased risk of unexplained neonatal seizures, a four-fold increased risk of cerebral palsy, and a four-fold decrease in intelligence scores. We have developed a model of maternal fever and fetal neuroinflammation, using systemic injection of IL-6 in near-term pregnant rats. We are using this model to test the hypothesis that fetal neuroinflammation results in disregulation of hippocampal development, which may be causal in the appearance of later occurring neurological deficits.

Methods: Six pregnant rats were injected on GD20 with either saline (n=3) or IL-6 (n=3). Three injections of saline, or IL-6 (1ug, 1.5 ug and 2.5 ug), were administered at 30 min. intervals. Core temperature was recorded. Twenty-four hours post injection (GD21), dams were anesthetized and brains of two fetuses from each dam analyzed for histochemistry of Glial Fibrillary Acidic Protein (GFAP), a marker of proliferating Radial Glia. The Optical Density of GFAP radial glial fibers and soma was computed using image analysis software (ImageJ). ANOVA repeated a measure was used for temperature differences. Student T test was used for GFAP staining differences. $P<0.05$ was considered statistically significant.

Results: Compared to saline, IL-6 injections resulted in a significant temperature difference (saline 37.1 ± 0.17 C and IL-6 37.5 ± 0.18), $p<0.05$. Within the hippocampus, proliferation of neural progenitors, identified by the extensive processes of neuroprogenitor radial glia, was primarily localized to the primordial dentate gyrus. Optical density analyses of GFAP label radial glia in the dentate gyrus showed a greater than 40% increase in radial glia soma and processes ($p< .01$) in IL6-exposed vs. Saline-exposed fetal brains.

Discussion: In fetuses at GD 20 hippocampal development, CA1/CA3 migration and proliferation are minimally developed. In contrast, GD20 is a time of critical development for dentate gyrus. Since the dentate gyrus is a critical component of the hippocampal memory processing circuit, disruption of the normal level of dentate proliferation is likely to produce memory related cognitive deficits during later development. These data provide insights into the role of neuroinflammation in hippocampal development. Future studies will be targeted at identification of inflammatory factors that alter neuronal proliferation.



This study was supported by the Department of Anesthesiology, Tufts Medical Center, and the Saltonstall Foundation.

Abstract #:BP-06

Defining the Friedman curve for post-cesarean delivery pain

Submitting Author: Jessica L Booth M.D.

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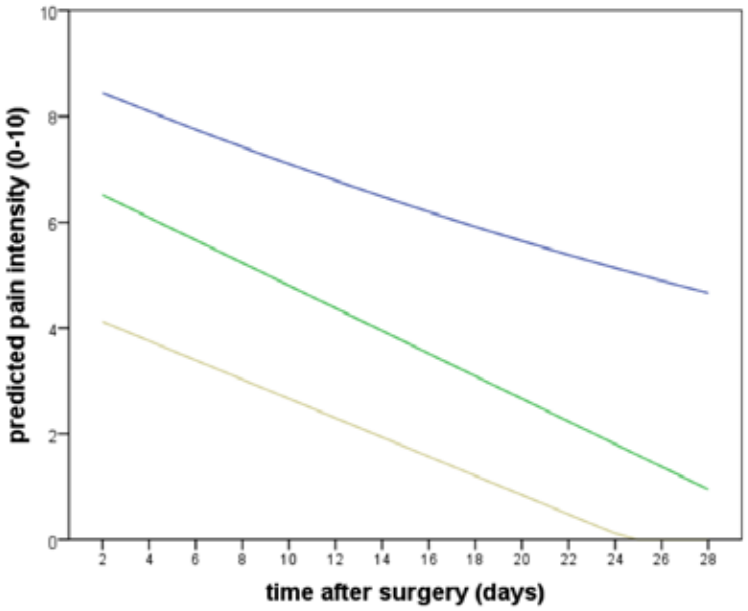
Lynette C Harris B.S.N - Wake Forest School of Medicine - Winston Salem, NC
Carol Aschenbrenner MA - Wake Forest School of Medicine - Winston Salem, NC
Tim T Houle Ph.D. - Wake Forest School of Medicine - Winston Salem, NC
James C Eisenach M.D. - Wake Forest School of Medicine - Winston Salem, NC

Introduction: Although much is known about pain experience in the first few days after surgery and at other isolated times accessing the health care system, usually once a few weeks and months after surgery, the pattern of recovery over the first several weeks is not well described. This is akin to knowing the time between the average cervical dilatation on admission to labor and delivery and the time of complete cervical dilatation, without any knowledge of the expected patterns of dilatation over time. Just as these patterns in labor are important, so too may they be in predicting and managing pain after surgery.

Methods: After IRB approval, 575 ASA I-III parturients presenting for elective cesarean delivery (C/D) were enrolled from April 2013-November 2015. Demographics, medical and OB history, and neonatal outcomes were collected. Patients completed validated preoperative questionnaires on perceived stress, emotional distress, and a three question pain prediction survey previously validated at our institution(1). On POD1, patients answered 4 questions assessing average and worst pain using a VAS sliding scale (0-100). From POD2 to POD60, patients answered 6 questions on current, worst, and average pain intensity and unpleasantness (0-10) by daily email or text message. Latent class analysis of the worst daily pain intensity scores from POD2 through POD28 was performed.

Results: Analysis of 530 evaluable patients identified 3 subgroups of pain recovery (see Figure). The model with the best fit showed two groups with linear trajectories (58% and 32%) and one group (10%) with a quadratic trajectory of pain recovery after C/D. While 58% of women have no pain by POD25, 10% of women report a pain score >5 on POD28. The distributions of scores on the perceived stress scale and emotional distress survey were significantly different among all 3 groups ($p<.01$) and correlate with postoperative pain scores.

Conclusions: The use of daily pain scores, rather than infrequent sampling, shows large variability in recovery pattern from pain after elective C/D and that these patterns segregate into 3 trajectories. This approach and these data could in the future be used by patients and clinicians to gauge recovery from pain in real time and by researchers to better identify risk factors for slow recovery and test whether interventions speed recovery in all patients or only in subgroups.



References

1. Pan PH, et al. Anesthesiology 2013;118(5);1170-1179.

Supported by R37 GM48085

Columbia University Medical Center
Discover. Educate. Care. Lead.

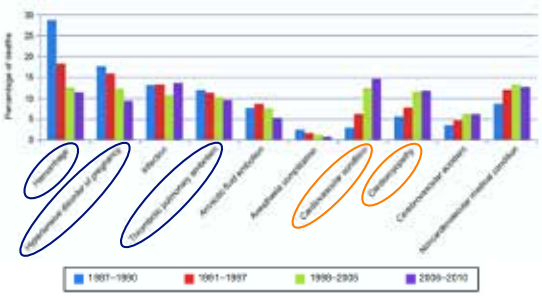
Reducing Maternal Mortality and Morbidity in New York and Beyond

Mary E. D'Alton, M.D.
Willard C. Rappleye Professor and Chair,
Department of Obstetrics & Gynecology
Columbia University College of Physicians & Surgeons

Disclosure

Dr. D'Alton is a member of the advisory board for Merck for Mothers.

Pregnancy Related Mortality United States (1987-2010)



Creanga AA, et al. Obstet Gynecol 2015;125:5–12

The Burden of Maternal Morbidity

- Reviewed Nationwide Inpatient Sample (ICD-9) for 1998-2009
- Severe morbidity 12.9 per 1000 deliveries
  - Increased by 75% and 114% for delivery and postpartum from 1998/99 to 2008/09
  - Increase in shock, ARF, PE, RDS, Acute MI, blood transfusion, aneurysm, cardiac surgery
- Overall mortality in postpartum period increased by 66%
- Impacts **>50,000** women each **year**

Callaghan WM et al. Obstet Gynecol. 2012 Nov;120(5):1029-36.

Factors Increasing Maternal Mortality and Morbidity

- Maternal age
- Obesity
- Cesarean delivery
- More pregnancies in women with significant chronic medical conditions
  - Hypertension
  - Pregestational diabetes
  - Congenital heart disease
  - Organ transplant

Lessons Learned from Reviews

- Hemorrhagic death
  - 93% of all deaths were potentially preventable
  - Lack of appropriate attention to clinical signs of hemorrhage
  - Failure to restore blood volume, to act decisively with life saving interventions
- Severe Hypertension
  - 60% of maternal deaths were potentially preventable
  - Failure to control blood pressure, to recognize HELLP syndrome, to diagnosis and treat pulmonary edema
- Pulmonary Embolism
  - "single cause of death most amenable to reduction by systematic change in practice"
  - Failure to use adequate prophylaxis

Berg CJ, et al. Obstet Gynecol 2005;106:1228-34
Cantwell R, et al. BJOG 2011 Mar;118 Suppl 1:1-203
Clark, SL. Semin Perinatol 2012;36(1):42-7

Advances in Fetal and Neonatal Medicine

- Prenatal diagnosis and screening programs
  - Genetic disorders and congenital anomalies
- Near eradication of Rh disease
- Therapies for women at high risk for PTB
  - steroids, antibiotics for PPROM, magnesium
- Progesterone to decrease recurrent PTB
- Reduction of stillbirth
- Fetal therapy
  - TTTS, NAIT, myelomeningocele

Changes in Modern Obstetrical Practice

- Significant decrease in rate of operative vaginal deliveries
- Near-extinction of vaginal breech deliveries
- Generalists and laborists managing labor and delivery
- Increased reliance on medical subspecialists to manage chronic disease in pregnancy
- Increased utilization of GYN oncologists to assist in complicated obstetrical surgery
- **7 MFMs certified in critical care**

A Call to Action


Current Commentary

Where Is the "M" in Maternal–Fetal Medicine?

Mary E. D'Alton, MD

What are we doing to reduce maternal mortality and morbidity in a maternal population with an increasing incidence of chronic disease?

D'Alton ME, Obstet Gynecol 2010;116:1401–4

SMFM Meeting Dallas 2012

ABOG The American Board of Obstetrics & Gynecology

Eunice Kennedy Shriver NICHD National Institute of Child Health & Human Development

Society for Maternal-Fetal Medicine

ACOG THE AMERICAN CONGRESS OF OBSTETRICIANS AND GYNECOLOGISTS

SMFM Meeting 2012 The Objectives

- Organized, national approach to decrease maternal mortality and morbidity in the US
  - Enhance the training in maternal care for residents and fellows
  - Improve medical care and management of pregnant women
  - Address the critical research gaps in maternal medicine

Putting the "M" back in maternal-fetal medicine. Am J Obstet Gynecol. 2013 Jun;208(6):442-8

Current MFM Fellowship Requirements

- Advances in medical knowledge
- Accelerating adoption of technology
- Increasing restrictions on resident duty hours

↓

MORE TO LEARN IN LESS TIME

MFM Fellowship Training Recommendations

- Modification of MFM Fellowship requirements to include:
  - 18 months of CLINICAL rotations (increase from 12)
  - 12 months research (decrease from 18)
  - 6 months elective
- Inclusion of mandatory rotations
  - Labor and Delivery/Inpatient Obstetrical Services 4 months
  - Intensive Care Units 2 months

Putting the "M" back in maternal-fetal medicine. Am J Obstet Gynecol. 2013 Jun;208(6):442-8

MFM Fellowship Training ABOG's Response

Modified 2013 requirements to increase requirements for:

- **Clinical rotations -** 15 months
  - L& D/Inpatient Services rotation - 2 months
  - ICU rotation - 1 month
- **Research -** 12 months
- **Elective** - 9 months

Available at : http://www.abog.org/bulletins/

Critical Care in Obstetrics
An Innovative and Integrated Learning Model

- Increase in simulation and case-based learning methodologies

- D'Alton ME, et al. Am J Obstet Gynecol. 2013 Jun;208(6):442-8

SMFM Planning Committee	
Mike Foley, Director	Shad Deering, Co-Director
Helen Feltovich, Co-Director	Bill Goodnight, Co-Director
Loralei Thornburg, Content Co-Chair	Deirdre Lyell, Content Co-Chair
Suneet Chauhan, Testing Chair	Mary D'Alton
Daniel O'Keeffe	Andrew Satin
Barbara Shaw	

Course Fundamentals

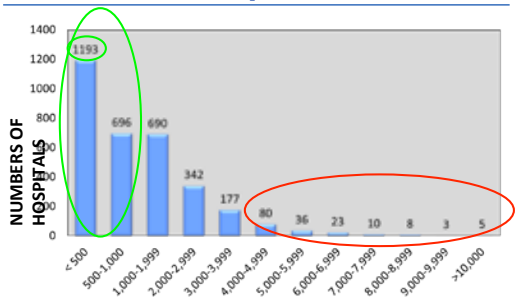
- Innovative, multi-faceted, simulation-based course
- 18 topics
- **Web-based component**
  - Recorded expert lectures
  - Recorded case simulations
- **Hands-on component**
  - November 2014 - 2016 in Phoenix AZ (Banner Health)
  - Expert covers highlights of his/her online lecture
  - Faculty/staff led hands-on case simulations (with both mobile application and mannequin) via Metrics Medicus technology

SMFM 2012 Obstetrical Care and Services

- High-risk women:
  - Timely identification and referral of patients for tertiary care
- Low-risk women:
  - Comprehensive national effort to educate all providers on the prevention and treatment of obstetrical complications

Am J Obstet Gynecol. 2013 Jun;208(6):442-8

Annual Birth Volume in U.S. Hospitals, 2008



n = 3,265

Simpson KR, JOGNN 40, 2011

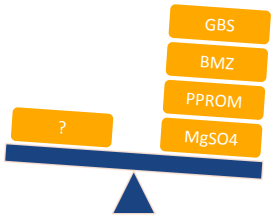
Recommended Guidelines

- Urgent development of national management guidelines:
  - Hypertensive disorders in pregnancy
  - Postpartum hemorrhage
  - Prevention of venous thromboembolism
  - Diagnosis and management of placenta accreta
  - Management of the obese obstetrical patient
  - Management of cardiac disease in pregnancy

Am J Obstet Gynecol. 2013 Jun;208(6):442-8

Where are the protocols for maternal health?

Maternal Perinatal



ACOG Committee Opinion No. 485: Prevention of Early Onset Group B Streptococcal Disease in Newborns
ACOG Committee Opinion No. 475: Antenatal corticosteroid therapy for fetal maturation
ACOG Practice Bulletin No. 80: Premature rupture of membranes. Clinical management guidelines for obstetrician-gynecologists
ACOG Practice Bulletin No. 455: Magnesium Sulfate Before Anticipated Preterm Birth for Neuroprotection

Building Consensus

- ACOG-CDC Maternal Mortality/Severe Morbidity Action Meeting occurred in Atlanta, November 2012
- Participants identified key priorities:

Core Patient Safety Bundles
Obstetric Hemorrhage
Severe Hypertension in Pregnancy
Venous Thromboembolism Prevention in Pregnancy

Supplemental Patient Safety Bundles
Maternal Early Warning Criteria
Facility Review
Family and Staff Support

- 6 multidisciplinary working groups were formed
- Work product presented in New Orleans 2013

D'Alton ME, et al. Obstet Gynecol 2014 May;123(5):973-977.

IHI Evidence-Based Care Bundles

- Concept of bundles developed by Institute for Healthcare Improvement (IHI)
- Goal: to help health care providers more reliably deliver the best care for patients
- Provide a structured way of improving processes of care
- Includes a straightforward set of evidence-based practices
- When performed correctly and consistently has proven to improve patient outcomes

IHI. Evidence–Based Care Bundles. Available at: http://www.ihi.org/topics/bundles/

Organizations Represented at May 2013 SMFM-ACOG Meeting

Professional Organizations	Patient Safety and Quality Care Organizations
American Association of Blood Banks American Academy of Family Practice American College of Nurse Midwives American College of Obstetricians and Gynecologists Association of Maternal and Child Health Programs Association of Women's Health Obstetric & Neonatal Nurses Society for Maternal and Fetal Medicine Society of Obstetric Anesthesia & Perinatology National Association of Nurse Practitioners in Women's Health	California Maternal Quality Care Collaborative CRICO Cynosure Health Ohio Perinatal Quality Collaborative Patient Safety Council The Joint Commission
Federal Agencies	**Perinatal Care Facilities**
Armed Services Centers for Disease Control Indian Health Service Maternal and Child Health Bureau National Institute of Child Health and Development	American Association of Birth Centers American Hospital Association Hospital Corporation of America Voluntary Hospital Association
	Foundations and Advocacy
	Merck for Mothers Preeclampsia Foundation

Implementation

- The National Partnership for Maternal Safety
- The Council on Patient Safety in Women's Health Care will:
  - provide oversight for the implementation of the 3 safety bundles within 3 years
  - track implementation throughout the US using lessons learned from IHI 5 Million Lives Campaign
  - provide a platform for facilities to share best practices
  - systematically review the impact of these initiatives
- *www.**safe**healthcareforeverywoman.org*

IHI. 5 Million Lives Campaign. Available at: http://www.ihi.org
D'Alton ME, et al. Obstet Gynecol 2014 May;123(5):973-977

Venous Thromboembolism Prevention Safety Bundle

READINESS (Every Unit)
- Use a standardized thromboembolism risk assessment tool for VTE during:
  - Outpatient prenatal care
  - Antepartum hospitalization
  - Hospitalization after cesarean or vaginal deliveries
  - Postpartum period (up to 6 weeks after delivery)

RECOGNITION (Every Patient)
- Apply standardized tool to all patients to assess VTE risk at time points designated under "Readiness"
- Apply standardized tool to identify appropriate patients for thromboprophylaxis
- Provide patient education
- Provide all healthcare providers education regarding risk assessment tools and recommended thromboprophylaxis

RESPONSE (Every Unit)
- Use standardized recommendations for mechanical thromboprophylaxis
- Use standardized recommendations for dosing of prophylactic and therapeutic pharmacologic anticoagulation
- Use standardized recommendations for appropriate timing of pharmacologic prophylaxis with neuraxial anesthesia

REPORTING/SYSTEMS LEARNING (Every Unit)
- Review all thromboembolism events for systems issues and compliance with protocols
- Monitor process metrics and outcomes in a standardized fashion
- Assess for complications of pharmacologic thromboprophylaxis

Narrative versus Evidence-Based Medicine — And, Not Or

"Facts and figures are essential, but insufficient, to translate data and promote the acceptance of evidence-based practices and policies..."

Stories, when compared with statistical evidence, can have more impact and help to make sense of population-based evidence.

Guideline developers must recognize the value of stories to explain the science of guidelines to patients and families, health care professionals, and policy makers to promote optimal understanding, uptake, and use.

Meisel ZF, et al. JAMA 2011 Nov;306(18).

Personal Case Presentation

34 yo G3P0020 at 33 weeks with Preterm PROM (2012)
- No significant medical or surgical history
- BP 126/78, HR 87, SpO2 99%, BMI 22
- Benign physical exam
  - SSE visually 1cm dilated
- Betamethasone, latency antibiotics
- Hospital day 3, spontaneous preterm labor
- Arrest of dilation at 5cm
  - Face presentation
- Primary LTCD without complication
  - Intrapartum compression devices
  - Male infant, Apgars 8/9
  - EBL 800cc

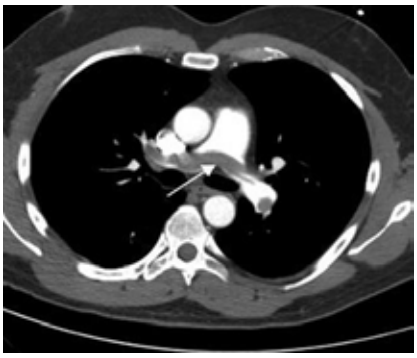
Personal Case Presentation

- Postoperative
  - BP 110s-120s/60s-80s
  - HR 70s-90s
  - RR 15-18
  - SpO2 97-99%
- Postoperative DVT prophylaxis
  - Sequential compression devices (SCDs)
  - Early ambulation

Personal Case Presentation - POD #1

- 0800, Ambulating around the room
  - HR 118/88, HR 93, RR 19, SpO2 97%
- 0900, Acute chest pain, shortness of breath
- Patient unresponsive, without palpable pulse
- Medical response team called
  - MFM, Cardiology, anesthesia at bedside
- CPR was performed, sinus rhythm was restored
- Transferred intubated to CCU
- Right heart failure on echo
- Patient never regained consciousness
- Cerebral edema, pupils fixed
- On POD#9, support was removed

CT Angiogram



Research Recommendations

- Develop standardized methods for national surveillance of maternal mortality **In Progress**
- ✓ Define significant maternal morbidity and "near misses"
- Determine appropriate patients for transfer to level III care **In Progress**
- ✓ Research impact of adverse pregnancy outcomes on long-term maternal health

Putting the "M" back in maternal-fetal medicine. Am J Obstet Gynecol. 2013 Jun;208(6):442-8

Severe Maternal Morbidity

- Define significant maternal morbidity and "near misses"
- All hospitals should identify women who:
  - Are admitted to an ICU during pregnancy (3-4 per 1000 deliveries)
  - Have been transfused with ≥4 units of blood (2 per 1000 deliveries)
- Not meant to discourage an individual site to use additional clinical criteria to define morbidity
- Cases of SMM should be reviewed for ongoing quality improvement
- 'We believe they will serve as a good starting point'

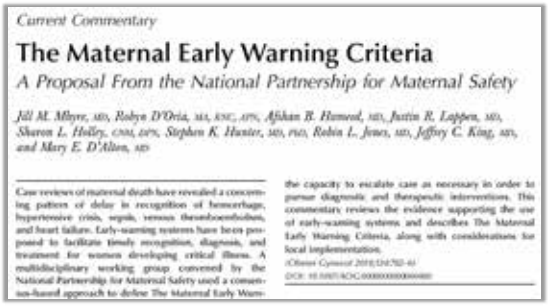
You WB, et al. Am J Perinatol 2013;30:21-4
Wanderer JP, et al. Crit Care Med 2013;41:1844-52
Callaghan WM, et al. Obstet Gynecol. 2014 May;123(5):978-981
D'Alton ME, et al. Am J Obstet Gynecol. 2013 Jun;208(6):442-8

Progress Over Past 3 Years

- Organized national response

Title	Journal/Date
Putting the "M" back in maternal-fetal medicine	Am J Obstet Gynecol. 2013 Jun
The National Partnership for Maternal Safety	Obstet Gynecol. 2014 May
Facility-based identification of women with severe maternal morbidity: it is time to start	Obstet Gynecol. 2014 May
Standardized severe maternal morbidity review: rationale and process	Obstet Gynecol. 2014 Aug
The maternal early warning criteria: a proposal from the national partnership for maternal safety.	Obstet Gynecol. 2014 Oct
Center of excellence for placenta accreta	Am J Obstet Gynecol. 2014 Nov
Obstetric Care Consensus: Levels of Maternal Care	Am J Obstet Gynecol. 2015 Feb

- AFM Fellowship changed effective July 2013
- SMFM's Simulation program for Maternal Critical Care



Current Commentary

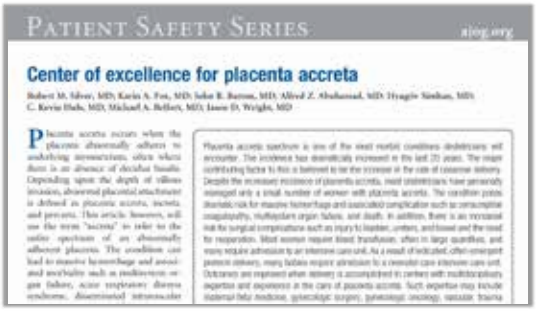
The Maternal Early Warning Criteria

A Proposal From the National Partnership for Maternal Safety

Jill M. Mhyre, MD, Robyn D'Oria, MA, RNC, APN, Afshan B. Hameed, MD, Justin R. Lappen, MD, Sharon L. Holley, CNM, DrPH, Stephen K. Hunter, MD, PhD, Robin L. Jones, MD, Jeffrey C. King, MD, and Mary E. D'Alton, MD

Case reviews of maternal death have revealed a concerning pattern of delay in recognition of hemorrhage, hypertensive crisis, sepsis, venous thromboembolism, and heart failure. Early-warning systems have been proposed to facilitate timely recognition, diagnosis, and treatment for women developing critical illness. A multidisciplinary working group convened by the National Partnership for Maternal Safety used a consensus-based approach to define The Maternal Early Warning Criteria, along with considerations for the capacity to escalate care as necessary in order to pursue diagnostic and therapeutic interventions. This commentary reviews the evidence supporting the use of early-warning systems and describes The Maternal Early Warning Criteria, along with considerations for local implementation.

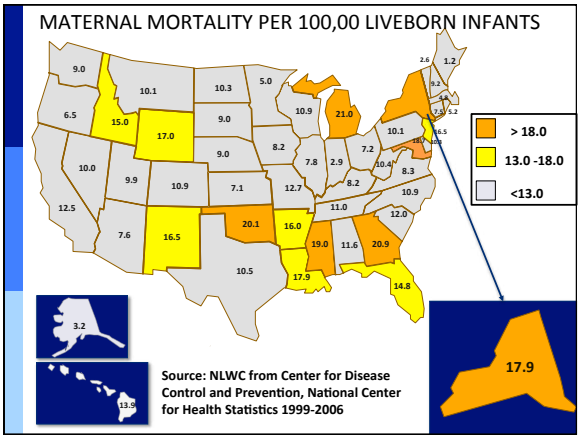
Obstet Gynecol 2014;124:782–6



PATIENT SAFETY SERIES

Center of excellence for placenta accreta

AJOG 2015;12(5):561–68

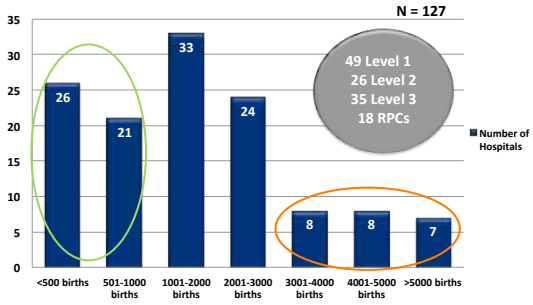


Maternal Mortality in New York State

- NYS ranks 46th among 50 states
  - Only 4 states have higher rates - Oklahoma, Mississippi, Michigan, Georgia
- Peaked at 29.2 per 100,000 live births in 2008
- Decreased to 22.4 per 100,000 live births in 2010
- Decreased to 17.9 per 100,000 live births in 2013
- 1.5 higher than the Healthy People 2020 objective of 11.4 per 100,000 live births

*http://hrc.nwlc.org/status-indicators/maternal-mortality-rate-100000 (Accessed 1/21/2016)

Birth Volume NYS Hospitals, 2012



Source: http://hospitals.nyhealth.gov/

Reducing Maternal Mortality in New York State

- First working group met January 2013
- Meetings held quarterly at rotating institutions throughout the state (13 meetings to date)
- Consensus driven and multidisciplinary
- Implementation of standardized care management plans for 3 leading causes of maternal mortality & morbidity:
  - Hemorrhage
  - Severe hypertension
  - Venous thromboembolism
- **Currently in 93% of obstetric hospitals in NYS (117 out of 124)**

SMI Bundle Development

- Working groups developed safety bundles for Hem, HTN, VTE
- Bundles presented and revised during multiple phone calls and in-person meetings
- Monthly data collection to assess process and outcomes
- Support resources developed: SMI Website, Educational Videos and Print materials
- Implementation site visits and grand rounds presentations from ACOG representatives

OBSTETRIC BUNDLE COMPOSITION

- PowerPoint slide decks w/ implementation guidance
- Visual aids: posters, brochures
- Checklists
- Algorithms
- Risk assessment tables
- Medication dosing tables
- Debriefing forms

http://www.acog.org/About_ACOG/ACOG_Districts/District_II/Safe_Motherhood_Initiative

Bundle Implementation Support

- ✓ Online and print materials
- ✓ Educational videos
- ✓ Clinical simulations & assessment guides
- ✓ Implementation visits
- ✓ Grand Rounds
- ✓ Quarterly meetings
- ✓ Monthly conference calls
- ✓ Updated FAQ

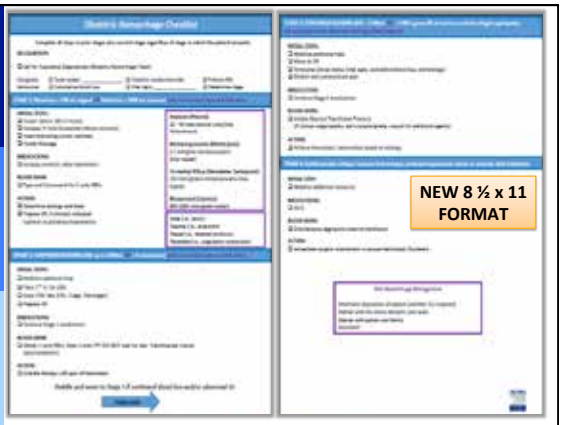
Quarterly Meetings

2016
- January: Maimonides Medical Center: **95+**

2015
- October: Annual District Mtg, New York **100+**
- July: Skidmore College **105+**
- April: University at Buffalo, SUNY **65+**
- January: Harlem Hospital Center **120+**

2014
- Annual District Mtg in New York **115+**
- Albany Medical Center **95+**
- SUNY Upstate Medical University **75+**
- Hofstra University **65+**

2013
- Annual District Mtg, New York **60+**
- Malta, NY **50+**
- Montefiore Medical Center **50+**
- Columbia University **45+**



Models of Care for the "M" in MFM

"Develop models for comprehensive, antenatal care for mothers with chronic or acute medical complications"
- D'Alton, et al. Am J Obstet Gynecol. 2013;208:442-8

Formally recognize the subspecialty of obstetric physicians. Train and increase their numbers.
- Nelson-Piercy C, et al. BMJ. Editorial 2011, V. 343

MFM subspecialists work with teams of expert physicians and midwives in multidisciplinary clinics at Tertiary centers.
-Kilby MD, Response to Editorial, BMJ 2011; 343:d4993

"Before calling for increased training we should look at the training already in place. There would appear to be plenty of room for improvement."
- David R. Hogg GP, Response to Editorial, BMJ 2011; 43:d4993

Center for Prenatal Pediatrics

- January 2004 - Established virtual center
- January 2011 - Carmen and John Thain Center opened
- Program dedicated to the care of pregnant women and their families after a significant birth defect is identified
- Multidisciplinary integration of all services with close collaboration between prenatal and pediatric specialists
- 6072 cases referred
  - 27% for Congenital Heart Disease (CHD)

Columbia's Mothers Center

- Modeled after the Carmen and John Thain Center for Prenatal Pediatrics
- 413 patients have been referred since opening in October 2013
- Provides comprehensive, multidisciplinary care to medically and surgically complicated pregnant women
- Most commonly referred:
  - **Cardiovascular disease (23%)**
  - **Abnormal placental invasion (17%)**
  - **Complex surgical history (13%)**
  - Neurologic disease
  - Autoimmune disease
  - Cancer in pregnancy
  - Pulmonary disease
  - Renal disease
  - Hematologic disease
  - Gastrointestinal and liver disease
  - Endocrine disease
  - Solid organ transplant

What's Next for the SMI in New York?

Phase 2:

- Continue national collaboration
- Strengthen collaboration with NYS and NYC healthcare organizations
- Target disparities in maternal mortality and morbidity

Expand clinical reach:

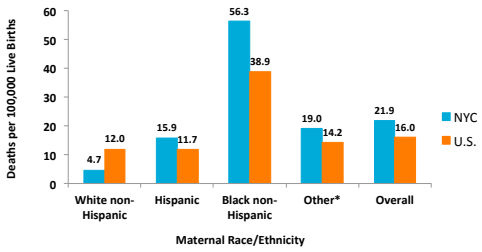
- Emphasize patient & family support
- Bolster postpartum discharge planning

Implementation:

- Continue to simplify implementation tools
- Mobile App?

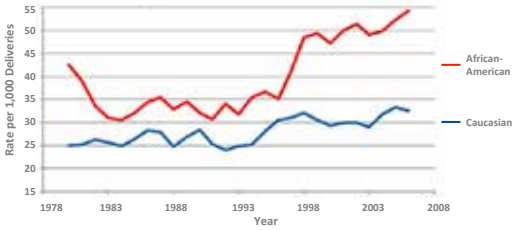
Reducing Racial/Ethnic Disparities

NYC and U.S. Pregnancy-Related Mortality Ratios by Race/Ethnicity, 2006-2010



NYC Department of Health and Hygiene, Bureau of Maternal, Infant and Reproductive Health. Report of the Pregnancy-Associated Mortality Review Project. 2015

2-Year Rolling Averages of Pre-eclampsia Rates by Race



Breathett, Khadljah, et al. "The Incidence of Pre-Eclampsia Remains Higher in African-American Women Compared to Caucasian Women: Trends from the National Hospital Discharge Survey 1979-2006." *CIRCULATION*. Vol. 127. No. 12, 2013.

Outcomes for African-American Women With Preeclampsia/eclampsia

- In-hospital mortality for African-American women higher than that for white women (OR 2.85, 95% CI: 1.38-5.53) with preeclampsia
- Compared to white women with preeclampsia, African-American women had an increased odds of IUFD (adjusted OR 2.45, 95% CI: 2.14-2.82)

Shahul S, et al. Racial Disparities in Comorbidities, Complications, and Maternal and Fetal Outcomes in Women With Preeclampsia/eclampsia. Hypertens Pregnancy. 2015 Nov;34(4):506-515.

SMFM Annual Meeting Atlanta 2016

- To think out of the box
- To stimulate discussion and develop recommendations for concrete ways that we can reduce racial and ethnic disparities in maternal morbidity and mortality
- What can we do starting **NOW**?

Contraception

- Women with medical conditions who receive no form of contraception
  - 55% between ages of 15-34
  - 70% between ages of 35-44
- Regardless of age, majority of women with chronic conditions used short-acting contraception methods: Pill, Ring or Patch
- Opportunity for collaboration Family Planning

"There are currently 21 family planning fellowships offered in the United States, which are centers of excellence offering best advice to clinicians and care to patients with complex medical histories."

D'Alton, ME. Every Woman, Every Time: Opportunity for Improvement. Obstet Gynecol. 2015 Dec;126(6):1133-5.

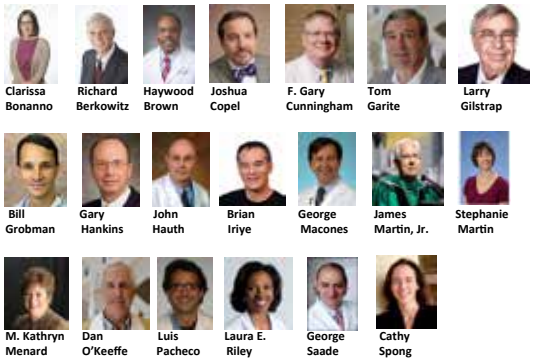
Personal Reflections

- Recognition took too long nationally, regionally and locally
- Collaboration at all levels is key and rewarding
- Enormous progress has been made in 2 years

However…

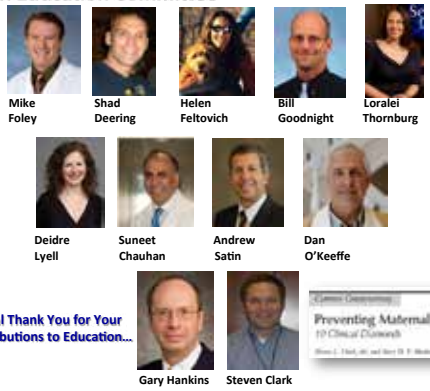
- Too many mothers experience preventable harm and suboptimal outcomes
- Represents opportunities for fellows and young faculty in educational, clinical and research efforts

"M" in MFM



National Partnership for Maternal Safety

SMFM Education Committee



ACOG District II

Columbia University Team


Cande Ananth


Clarissa Bonanno


Magda Brown


Anna Burgansky


Kirsten Cleary


Michelle DiVito


Alex Friedman


Mary D'Alton, Richard Smiley, Lynn Simpson, Richard Berkowitz


Anita LaSala


Annette Perez-Delboy


Ron Wapner


Jason Wright

What's New in Neonatology?

Speaker: Terrie E. Inder, M.D., Ph.D., M.B.Ch.B.

NOTES

Saturday, May 21, 2016

Oral Presentations 2
Moderator: *Erica N. Grant, M.D., M.Sc.*

Obstetric Applications of Echocardiography
Speaker: *Alicia Dennis, Ph.D., M.B.B.S., PG, DipEcho, FANZCA*

Echocardiography Education
Speaker: *Feroze-Ud-Din Mahmood, M.D.*

Gerard W. Ostheimer Lecture: What's New in OB Anesthesia?
Speaker: *Philip E. Hess, M.D.*

Fred Hehre Lecture
Speaker: *Lawrence C. Tsen, M.D.*

Blood Management in Obstetrics
Speaker: *Walter H. Dzik, M.D.*

Point of Care Coagulation Testing
Speaker: *Roshan Fernando, M.B.Ch.B.*

Research Hour - Of Bacteria and Babies: Determinants and Impact of Infant Gut Microbiota
Moderator: *Richard A. Smiley, M.D., Ph.D.*
Speaker: *Caroline Mitchell, M.D., M.P.H.*

Abstract #:O2-01

Effect of Low Rate vs. High Rate Oxytocin Maintenance Infusions on Blood loss during Elective Cesarean Section.

Submitting Author: Alexander Butwick M.B.B.S., FRCA, M.S.

Submitting Author's Institution: Stanford University School of Medicine - Stanford, CA

Co-Author: Adrienne Duffield M.D. - Stanford University School of Medicine - Stanford, CA
Christine Piascik M.D. - Stanford University School of Medicine - Stanford, CA
Brendan Carvalho M.D. - Stanford University School of Medicine - Stanford, CA
Edward Riley M.D. - Stanford University School of Medicine - Stanford, CA
Yasser El-Sayed M.D. - Stanford University School of Medicine - Stanford, CA

Background: During elective cesarean delivery (CD), the uterotonic effect of oxytocin, given as a bolus, is well-characterized.(1) After bolus administration, an oxytocin infusion is recommended to maintain adequate uterine tone (UT). (2) However, there is a dearth of studies investigating the effect of different oxytocin infusion rates to maintain adequate uterine tone. Our primary aim was to compare blood loss with a low rate vs. high rate maintenance infusion of oxytocin during elective CD.

Table. Blood loss and Perioperative Outcomes of Women Receiving Oxytocin as a Low Rate (2.5U/hr) vs. High Rate (15U/hr) Maintenance Infusion.

	Low Rate Oxytocin Infusion (n=24)	High Rate Oxytocin Infusion (n=27)	P value
EBL (ml)	634 [340-886]	512 [405-740]	0.73
Crystalloid (ml)	1323 (482)	1411 (539)	0.54
Colloid (ml)	500 (0)	500 (138)	1.0
Total dose of oxytocin boluses (U)	1 [1-1.5]	1 [1-2]	0.96
Intraoperative second-line uterotonic	1 (4.2%)	1 (3.7%)	1.0
Surgical intervention	1 (4.2%)*	0	0.47
Transfusion in PACU	1 (4.2%)	0	0.47
Post-CD Hb level in PACU (g/dl)	11 (1.6) n=22	11 (1.2)	0.95
Hospital length of stay (days)	5 [4-5]	4 [4-5]	0.96

CD = cesarean delivery; EBL = estimated blood loss; Hb = hemoglobin; PACU = post-anesthesia care unit

* One patient required cystectomy

Methods: After obtained IRB approval, 51 healthy patients undergoing elective CD with neuraxial anesthesia were enrolled in this double-blind study. After receiving a 1U oxytocin bolus, patients were randomized to receive either 2.5U/hr (low rate) or 15U/hr (high rate) of oxytocin for UT maintenance. Our primary outcome was estimated blood loss (EBL) derived from measuring blood in the suction chamber, weighing blood-soaked surgical swabs, and visual estimation around the surgical field. Secondary outcomes included: uterine tone (UT) (0-10, 0=absent tone; 10=optimal tone), use of second-line

uterotonics, post-CD hemoglobin (Hb) levels, maternal side-effects, surgical intervention and length of stay. Between-group differences were assessed using t-tests or Mann Whitney U tests (continuous data) and $\chi 2$ test or Fishers exact test (categorical data). Using a GEE model, we also performed a longitudinal analysis to assess the effect of study group on UT, with study group and time as fixed effects. $P<0.05$ as statistically significant.

Results: Maternal characteristics were similar between groups. No significant differences in EBL were observed between groups: low rate= 634 [340-886] ml vs. high rate=512 [405-740] ml; P=0.73. We observed no between-group differences for any secondary outcome (Table), and no significant effect of oxytocin group on UT over time.

Conclusion: Despite a 6-fold difference in the oxytocin infusion rate, we detected no significant between-group differences in EBL, use of additional uterotonics, or maternal side-effects. In keeping with data from prior studies, our findings provide further evidence to support the use of low dose oxytocin regimens for achieving adequate UT during elective CD. Further oxytocin dose-finding studies are needed to determine the optimal maintenance rate and duration to facilitate efficacy and limit side-effects post-CD.

References:

1. Curr Opin Anaesthesiol 2011;24:255-61.
2. Anaesth Intensive Care 2012; 40: 247-52

Abstract #:O2-02

Evaluation of Right Sided Heart Pathology, Right Ventricular Systolic Pressure and Brain Natriuretic Peptide in Patients with Preeclampsia with Severe Features

Submitting Author: Sara M Seifert M.D.

Submitting Author's Institution: The Johns Hopkins University School of Medicine - Baltimore , Maryland

Co-Author: Arthur J Vaught M.D. - The Johns Hopkins University School of Medicine - Baltimore , Maryland
Anna O'Kelly Medical Student - The Johns Hopkins University School of Medicine - Baltimore, Maryland
Linda M. Szymanski M.D., Ph.D. - The Johns Hopkins University School of Medicine - Baltimore , Maryland
Sammy Zakaria M.D., MPH - The Johns Hopkins University School of Medicine - Baltimore , Maryland
Jamie Murphy M.D. - The Johns Hopkins University School of Medicine - Baltimore , Maryland

Objective: Preeclampsia with severe features (PEC-SF) is associated with increased systemic vascular resistance and hyperdynamic cardiac function. With alterations in cardiac function, brain natriuretic peptide (BNP) levels could fluctuate since it is produced by the ventricles in response to stress. However, little is known about right cardiac parameters, particularly right ventricular systolic pressures (RVSP), as they relate to BNP in patients with preeclampsia (PEC). Therefore, we sought to compare right-sided cardiac parameters and BNP levels in women with PEC-SF compared to normal controls.

Table : Right and Left Sided Cardiac Parameters

	Normal Values	Control (36)	PEC-SF (46)	SI-PEC (17)	p-value
RAA (mL/m^2)	15-27	14.56 (3.17)	15.03 (3.02)	14.55 (2.81)	0.750
IVC (cm)	< 2.1	1.38 (0.43)	1.45 (0.41)	1.53 (0.32)	0.596
RVSP	**< 39**	**22.48 (6.13)**	**31.74 (7.33)**	**28.55 (9.39)**	**<0.001***
RV FAC	> 35	49.60 [46-54]	49.50 [45-58]	50.60 [45-58]	0.770
Tissue Doppler S'	> 9.5	14.68 (2.31)	15.39 (3.08)	16.12 (3.48)	0.299
TAPSE (cm)	> 1.7	2.44 (0.41)	2.66 (0.42)	2.55 (0.36)	0.060
LAA (mL/m^2)	**< 20**	**17.29 (2.85)**	**20.00 (3.85)**	**20.50 (3.75)**	**<0.001***
LVEF (%)	> 55	61.20 (5.08)	63.25 (6.10)	66.11 (4.64)	0.012
Mitral Septal E (cm/s)	73 (19)	84.28 (17.93)	98.78 (24.41)	97.84 (18.94)	0.009
Mitral A (cm/s)	**57 (12)**	**57.33 (12.65)**	**76.06 (21.55)**	**71.10 (27.24)**	**<0.001***
Mitral Septal e' (cm/s)	**14.9 (2.4)**	**11.63 (1.85)**	**9.83 (2.52)**	**8.90 (1.87)**	**< 0.001***
Mitral E/e'	**6.7 (2.2)**	**7.35 (1.58)**	**10.60 (2.90)**	**11.42 (2.69)**	**<0.001***
Mitral E/A	1.88 (0.45)	1.4 [1.2 – 1.8]	1.3 [1.1 – 1.6]	1.4 [1.0 – 1.7]	0.261
Mitral DT (msec)	200 (40)	198.29 (38)	192.37 (53)	195.69 (35)	0.917
BNP (pg/mL)	< 200	44 [20-81]	61 [26 – 110]	57 [20 -106]	0.434

*Statistically significant difference between controls and PEC groups
** Statistically significant difference among all groups
Data are mean (SD) or median [interquartile range]
RAA =right atrial area; IVC = Inferior vena cava; RSVP = Right ventricular systolic pressure; RV FAC = Right ventricular fractional area of change; TAPSE = Transannular planar systolic excursion; LAA = Left atrial area; E= Mitral inflow velocity of early diastolic filling; A=Mitral inflow velocity of late diastolic filling; e' = mitral annular velocity of tissue Doppler, DT = Deceleration Time, BNP=Brain natriuretic peptide level

Study Design: Participants were recruited from the Johns Hopkins Health System. Inclusion criteria were singleton pregnancies > 23 weeks. Diagnosis of PEC-SF was per ACOG (Hypertension in Pregnancy, 2013). Exclusion criteria included multiples gestation, known valvular malformations, previous cardiac surgery, known pulmonary hypertension, history of pulmonary embolism, or interstitial lung disease. Preeclampsia (PEC) participants were subdivided in two groups for subanalyses: PEC-SF and PEC superimposed based on preexisting hypertension (SI-PEC). Echocardiography (ECHO) was performed at time of consent for controls and time of diagnosis of PEC for cases. Statistical analyses were performed using ANOVA (Stata, version 14).

Results: We recruited 36 controls, 46 with PEC-SF, and 17 with SI-PEC. There were no differences in demographic data among groups, except race. Right ventricular systolic pressures (RVSP) was significantly higher in both PEC-SF and SI-PEC groups when compared to controls. Mitral septal E/e' were also significantly higher when compared to controls. BNP levels trended higher in PEC-SF and SI-PEC groups, but were not statistically significant.

Conclusions: There was a significant elevation in RVSP in the PEC-SF and SI-PEC group when compared to controls. We also found a significant elevation in mitral septal E/e'and e' suggestive of increased left atrial filling pressure and diastolic dysfunction more consistent with Class II pulmonary hypertension secondary to occult left-sided disease.

Abstract #:O2-03

Risk Factors and Indications for Postpartum Readmission: A Retrospective Cohort Study

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Submitting Author's Institution: Massachusetts General Hospital - Boston, MA

Co-Author: Stephanie Hopp MHS, M.S. - Massachusetts General Hospital - Boston, MA
Stephanie Radoslovich none - Reed College - Portland, OR
Lisa Leffert M.D. - Massachusetts General Hospital - Boston, MA
Brian Bateman M.D., M.S.c - Massachusetts General Hospital - Boston, MA

Introduction: The Centers for Medicare and Medicaid Services has identified readmissions within 30 days as a marker of healthcare quality and a target for limiting reimbursement. There are few population-level studies examining patterns and predictors of readmission in obstetric patients. The aim of this study was to identify key causes and risk factors for postpartum readmission to serve as targets for subsequent quality improvement initiatives.

Materials and Methods: Data were obtained from the Agency for Healthcare Research and Quality's California State Inpatient Database. Delivery admissions were identified from 2010- 2011 and linked to readmissions that occurred within 30 days of discharge. Timing and indications for readmission were defined, and associated hospital charges were calculated. Independent predictors of readmission were defined based on patient characteristics, conditions, and complications recorded during the delivery hospitalization using multivariable logistic regression.

Results: There were 731,087 deliveries in the cohort, of which 7,765 (1.1%) were readmitted within 30 days of discharge. The median time to readmission was 7 days (IQR 3-15) with a median length of stay of 2 days (IQR 1-4) and median hospital charges of $24,886 (IQR 14,925-41,909). The most common indication for readmission was infection, at 56.7% (22.1% puerperal). Other leading indications were hypertension (18%), surgical/wound complications (17%), cardiac complications (12%), hemorrhage/retained placenta (9.3%), asthma exacerbation (6.4%) and headache (5.8%).

The logistic regression model predicting readmission had a c-statistic of 0.7, indicating moderate discrimination. Readmission rates were higher at extremes of age, with women <20 (adjusted odds ratio (aOR) 1.21, 95% confidence interval (CI) 1.12 to 1.31) and ≥40 (aOR 1.26, 95% CI 1.14 to 1.39) at increased risk compared to those age 20 to 34. African-Americans were more likely to be readmitted than Caucasians (aOR 1.41, 95% CI 1.3-1.54), as were women with Medicaid insurance (aOR 1.24, 95% CI 1.18-1.31) compared to those with private insurance. Cesarean delivery was associated with an increased incidence of readmission (aOR 1.87, 95% CI 1.78-1.96) compared to vaginal birth. Women with hypertensive disorders of pregnancy, particularly severe preeclampsia (aOR 1.93, 95% CI 1.73-2.15) were at increased risk of readmissions as were those who required blood transfusion (aOR 2.4, 95% CI 2.11-2.72).

Discussion: Postpartum readmissions are associated with significant healthcare costs. Most readmissions occur soon after discharge, and are concentrated in patients with high risk conditions that are evident at the time of the delivery hospitalization. This suggests that there may be a preventable component to readmissions that could be addressed with careful discharge planning and close follow up of at-risk patients. Further research is needed to identify potential targeted interventions.

Abstract #:O2-04

Nitrous Oxide during Labor: What Matters, Analgesic Effectiveness or Patient Satisfaction?

Submitting Author: Brandon Lopez M.D.

Submitting Author's Institution: Vanderbilt University - Nashville, Tennessee

Co-Author: Michael Richardson M.D. - Vanderbilt University - Nashville, Tennessee
Curtis Baysinger M.D. - Vanderbilt University - Nashville, Tennessee
David Chestnut M.D. - Vanderbilt University - Nashville, Tennessee

Introduction: Studies of patient satisfaction and analgesic effectiveness with nitrous oxide (N2O) during labor are limited. [1] While N2O appears less effective than neuraxial analgesia,[1,2] N2O remains a popular choice for many parturients. We sought to compare the relationship between analgesic effectiveness and patient satisfaction with analgesia in women who delivered vaginally using neuraxial analgesia, N2O, or N2O followed by neuraxial analgesia.

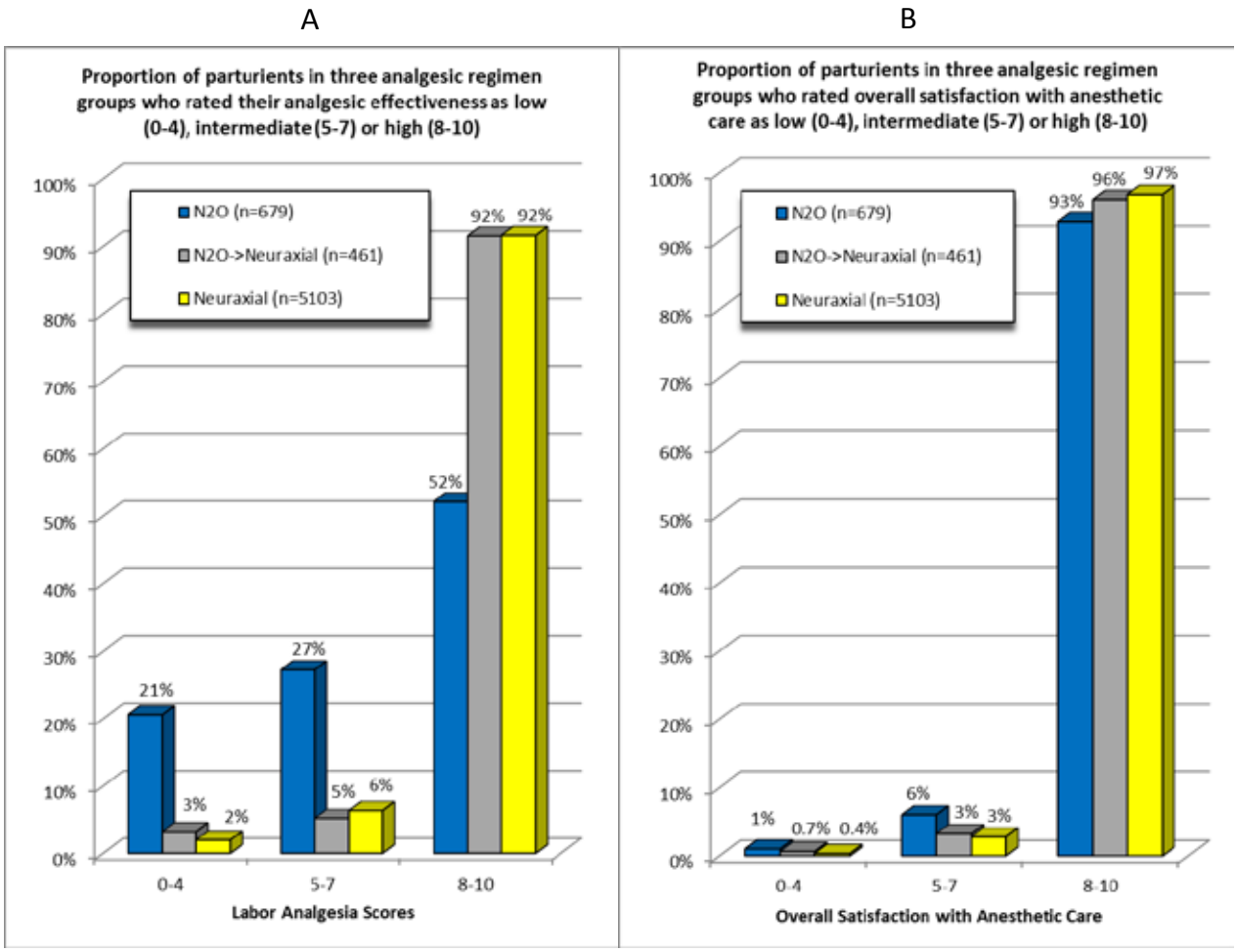


Figure: 5,103 woman who delivered vaginally after receiving labor analgesia with nitrous oxide, neuraxial, or both (neuraxial after a trial of nitrous oxide), during a 34-month period, rated their analgesic effectiveness (Panel A) and overall satisfaction with anesthetic care (Panel B) on a scale from 0 (poor) to 10 (best). Those receiving neuraxial analgesia, whether as the sole modality, or after a trial of nitrous oxide analgesia, rated analgesic effectiveness uniformly highly (Panel A). Those who used nitrous oxide only reported variable analgesic effectiveness, although over half reported a high level of effectiveness (Panel A). All three groups rated satisfaction highly (Panel B).

Methods: A standardized survey was recorded on the first postpartum day for all women who received anesthetic care. Data were queried for women who delivered vaginally with N2O and/or neuraxial labor analgesia over a 34-month period in 2011-14. Parturients with complete data for analgesia quality and patient satisfaction were included. Analgesia and satisfaction scores were compared using logistic regression for three groups: N2O, neuraxial analgesia, or both.

Results: 6506 women received anesthesia and delivered vaginally. Complete data were available for 6243 (96%) women. Of these, 5103 (82%) chose neuraxial analgesia and 1140 (18%) chose N2O. Of the latter, 461 (40%) switched to neuraxial analgesia after first receiving N2O. These patients mirrored the neuraxial-only group in analgesia quality and patient satisfaction. Analgesia and satisfaction scores for all three groups are shown in the figure. Among women who reported poor analgesia (0-4; n=258), those who received N2O alone were more likely to report high satisfaction (8-10) than women who received neuraxial analgesia alone (OR 2.6, 95%CI 1.5-4.6, P=0.001). Among those who reported a high analgesia score (8-10, n=5451), odds of patient satisfaction were uniformly high in all three groups (P>0.05).

Discussion: Patients who received N2O alone were as likely to express satisfaction with anesthesia care as those who received neuraxial analgesia, even though they were less likely to have analgesia with excellent effectiveness. While pain relief contributes to satisfaction with labor analgesia care, our results suggest that other factors are also important.[2-4] Whether this reflects different patient expectations/goals, preservation of patient autonomy, and/or other factors remains to be determined.

References:

Liskis F. Anesth Analg 2014;118:153

Waldenstrom U. Obstet Gynaecol 2006;27:147

King T. Anesth Analg 2014;118:12

Angle P. Can J Anesth 2010;57:468

Abstract #:O2-05

Modulation of human myometrial ANO1 attenuates contractile agonist induced f-actin formation and myosin light chain phosphorylation.

Submitting Author: Thomas R Pfeiffer M.D.

Submitting Author's Institution: Columbia University Medical Center - New York, NY

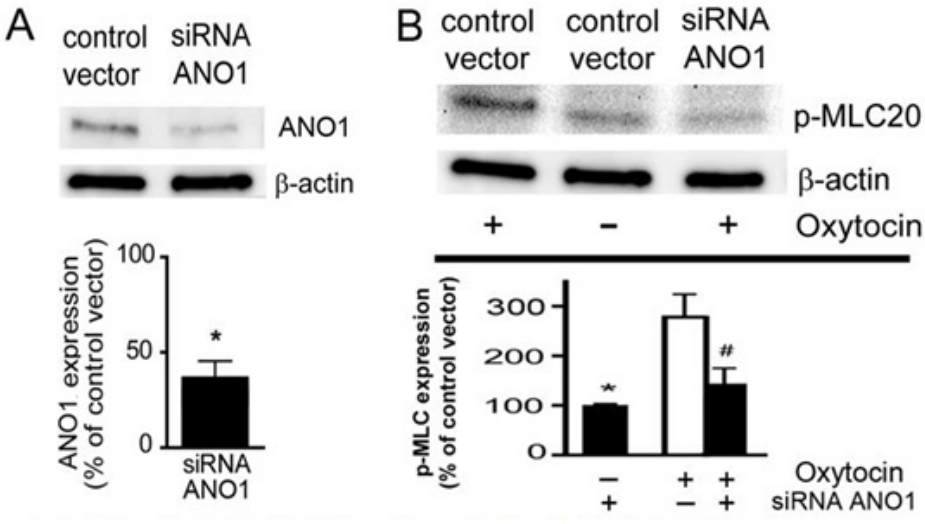
Co-Author: Victoria Danhakl M.D. - Columbia University Medical Center - New York, NY
George Gallos M.D. - Columbia University Medical Center - New York, NY

Calcium-activated chloride channel anoctamin 1 (ANO-1) leads to significant attenuation of human uterine smooth muscle (USM) contractility in vitro and completely abolishes intracellular calcium elevations in human myometrial cells. At a cellular level, USM contractions mechanistically result from actin-myosin cytoskeletal effects including phosphorylation of myosin light chain (MLC20) and increases in thin filamentous actin (f-actin) formation. In this study, we questioned if ANO1 antagonism modulates contractile agonist-induced f-actin formation and if siRNA targeted genetic knockdown of ANO1 similarly leads to an alteration in the contractile-regulatory protein MLC20 phosphorylation state.

Primary human myometrial cells (HuUSM) were grown to 70% confluence on sterile coated coverslips and transfected with a red fluorescent indicator (pCMVLifeAct-TagRFP) of f-actin formation according to manufacturer's recommendations. Subsequent live cell imaging utilizing confocal microscopy allowed for real-time quantitative measurement of changes in f-actin (555/584 nm) evoked by contractile agonist (oxytocin 1uM) in the presence or absence (vehicle controls) of the ANO1 antagonist benzbromarone (100uM). In parallel studies, HuUSM cells underwent genetic editing with siRNA directed at ANO1 or scrambled siRNA (negative control) according to manufacturer's recommendations. Treated cells were subsequently challenged with oxytocin and assessed for MLC20 phosphorylation (procontractile cellular signaling event) by protein immunoblotting. Data was compiled and analyzed by ANOVA or student t-test, and $p<0.05$ was taken as significant.

The ANO-1 antagonist benzbromarone (100uM) suppressed oxytocin mediated elevations in f-actin fluorescence [TRITC] by 95.1% + 6.3% ($p < 0.001$, N=7) compared to vehicle controls (N=5). In separate experiments, siRNA induced knock down of ANO1 reduces oxytocin-induced MLC20 phosphorylation by 59% + 5% (n=3, $p < 0.05$) compared to human USM cells treated with scrambled siRNA.

ANO1 channel modulation exerts positive pro-relaxant effects on two critical components of the contractile apparatus in human myometrial cells. Our results provide exciting evidence that ANO-1 antagonism exerts a pro-relaxant effect at the level of cellular actin-cytoskeletal regulatory mechanisms.



Genetic Knockdown of ANO1 attenuates contractile agonist-induced myosin light chain phosphorylation. A) ANO1 siRNA results in significant protein knockdown in human 1° USM cells. B) ANO1 knockdown in USM cells results in reduced levels of p-MLC20 following oxytocin treatment compared to scrambled siRNA controls.

References:

Taggart MJ, Morgan KG, Regulation of the uterine contractile apparatus and cytoskeleton. Semin Cell Dev Biol. 2007 June ; 18(3): 296–304.

Obstetric Applications of Transthoracic Echocardiography

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NHMRC Fellow
Associate Professor, University of Melbourne
Staff Specialist Anaesthetist
Director of Anaesthesia Research
The Royal Women's Hospital
Parkville, Australia

Disclosures

None

Institutional ethics approval and participant written consent

Yes

Overview

1. Maternal mortality and morbidity
2. Diagnosis using echocardiography
3. Monitoring and management using echocardiography
4. Clinical uptake

Why do pregnant women die?

Mortality

- Cardiac disease
- Hemorrhage
- Sepsis
- Preeclampsia
- Thromboembolism
- Neurological conditions

- Less access to resources
- Less education
- Less research
- Gender inequity

Dennis AT. Science, Sex and Society - Why maternal mortality is still a global health issue. Anaesthesia 2016 early view published online March 28th DOI: 10.1111/anae.13481

Why do pregnant women get very sick?

Morbidity

Risk of short term severe morbidity

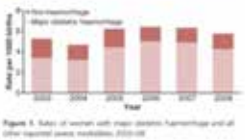
1 in 200

Long term morbidity
- Hypertension
- Ischaemic heart disease
- Stroke
- Renal disease
- Blood transfusions
- Psychological
- ? Cognitive function

Lack of recognition of disease

Lack of education in obstetric critical disease

Reduced skills by health care workers



Cantwell, R., T. Clutton-Brock, et al. (2011). BJOG 118 Suppl 1: 1-203
Allen, V. M., M. Campbell, et al. (2010) J Obstet Gynaecol Can 32(12): 1140-1146

Improving health in pregnant women

Education
Skilled Multidisciplinary team
Access to resources
Clinical excellence

But diagnostic uncertainty can exist when faced with common clinical situations (Lewis 2007)

Why does diagnostic uncertainty exist?

Can we do better?

Cantwell, R., T. Clutton-Brock, et al. (2011). BJOG 118 Suppl 1: 1-203
Lewis, G. (2007). The Seventh report on Confidential Enquiries into Maternal Deaths in the United Kingdom 2003 - 2005. London, CEMACH
WHO (2004). Beyond the numbers - reviewing maternal deaths and complications to make pregnancy safer. Geneva, WHO

Diagnostic uncertainty

- Lack of understanding of physiology and pathophysiology especially hemodynamics
- Lack of clinical observations
- Lack of knowledge about maternal physiology and pathophysiology

Sometimes it is hard…..

But most of the time obtaining more data will enable us to make intervention choices based on facts.

Diagnostic dilemma

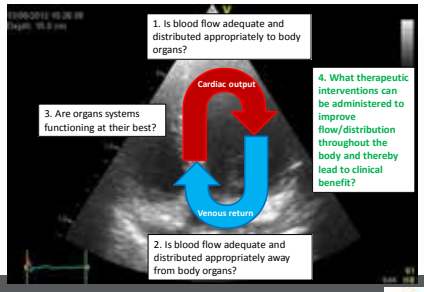
A 32 year old woman is experiencing a postpartum haemorrhage (blood loss 750 ml) and the informal bedside haemoglobin value is 9 g/dl after 2000 ml of intravenous crystalloid.

Vital signs: Heart Rate 120 Sinus rhythm, Blood pressure 86/42 mmHg, Respiratory rate 30 Breaths per minute, oxygen saturation 94% on room air, temperature 38.1° Celsius. The formal haemoglobin measurement and bedside arterial blood gases are sent but pending.

What treatment do you commence?

Dennis AT. (2015). Goal directed transthoracic echocardiography – A translational education program. Australasian Anaesthesia 2015 ISBN 978-0-9873236-5-1

Physiology, pathophysiology and hemodynamics



Dennis AT, Dyer RA. Cardiac output monitoring in obstetric anaesthesia. International Journal of Obstetric Anesthesia 2014;23:1-3

Can we do better - diagnosis?

- What is the cause of ongoing hypotension? Sepsis, hypovolaemia, reduced ejection fraction heart failure (HFrEF), preserved ejection fraction heart failure (HFpEF), right heart failure
- What is the reason for unexplained tachycardia?
- Is intravenous fluid therapy beneficial in a woman with severe preeclampsia?
- What is the cause of acute chest pain during cesarean section?
- Can we understand disease mechanisms, maternal physiology and maternal pathophysiology better?

Can we do better – monitoring and management?

- Can we better monitor responses to interventions?
- Can we better manage women?

Repeated hemodynamic or anatomic assessments over a period of minutes, hours, days in the same woman to guide management

Porter et al. Guidelines for the Use of Echocardiography as a Monitor for Therapeutic Intervention in Adults: A Report from the American Society of Echocardiography. J Am Soc Echocardiogr 2015;28:40-56

Clinical monitoring and scientific observation

- Safe
- Acceptable
- Appropriate

- Provide clinically useful information within the correct time-frame
- Impact positively on clinical care – does the device provide clinically relevant information from which the clinician will be able to make informed decisions?

Transthoracic echocardiography

Cardiologists

Emergency physicians

Intensive care physicians

Anesthesiologists

Transthoracic echocardiography

Gives the clinician who asks the clinical question the power to immediately answer that question at the point of clinical care

Advantages

- non-invasive
- portable
- lightweight
- easy to use
- connectivity
- durable
- battery powered
- better than PAC for
  - valvular assessment
  - systolic and diastolic function assessment

Versatile

- birthing suite
- emergency department
- operating theatres
- post-anaesthetic care unit
- intensive care unit
- patient transport vehicles
- remote and rural settings

Transthoracic echocardiography

Gives the researcher the opportunity to answer hemodynamic questions relating to physiology and pathophysiology using the same observational tool in pregnant women that can be used in clinical practice thereby immediately translating research findings to clinical practice.

*With research using transthoracic echocardiography in pregnant women the **Bench is the Bedside***

Dennis AT. The bench is the bedside – the role of transthoracic echocardiography in translating pregnancy research into clinical practice. Anaesthesia 2013;68(12):1207-1209

Transthoracic echocardiography – diagnosis

Indications for TTE:

1. **Hypotension or hemodynamic instability of uncertain or cardiac etiology**
2. **Initial investigation of suspected hypertensive heart disease**
3. **Initial evaluation of known or suspected heart failure including pulmonary edema**
4. **Initial evaluation of known or suspected cardiomyopathy**
5. **Acute chest pain**
6. **Suspected aortic dissection**
7. **Respiratory failure or hypoxemia of uncertain etiology**
8. **Likely pericardial tamponade**
9. **Likely massive pulmonary embolism**

Douglas PS et al. ACCF/ASE/AHA/ASNC/HFSA/HRS/SCAI/SCCM/ SCCT/SCMR 2011 Appropriate Use Criteria for Echocardiography. J Am Soc Echocardiogr 2011;24:229-67
Salem R et al Current Opinion in Critical Care 2008, 14:561– 568
Porter et al. Guidelines for the Use of Echocardiography as a Monitor for Therapeutic Intervention in Adults: A Report from the American Society of Echocardiography .J Am Soc Echocardiogr 2015;28:40-56

What are our clinical questions?

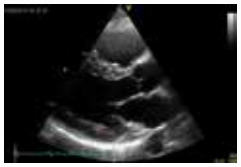
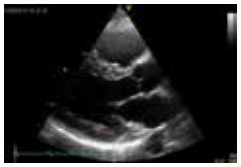


Table 2 Clinical scenarios in obstetric critical illness

	Clinical scenarios
Obstetric critical illness	Major obstetric haemorrhage Myocardial ischaemia Cardiac failure Sepsis Embolism – pulmonary, amniotic fluid, air Pre-eclampsia Cardiomyopathy Aortic dissection Respiratory emergencies (asthma) Endocrine emergencies Extreme obesity Trauma
Clinical symptoms and signs	Bleeding Unexplained tachycardia Hypotension Chest pain Shortness of breath Severe hypertension Fever Reduced consciousness state Collapse
Clinical questions addressed with the use of TTE	What is the intravascular volume status? Are there regional wall motion abnormalities? What is the left ventricular contractility? Is there right ventricular outflow tract obstruction? What is the right ventricular size and contractility? Is there pericardial tamponade? Is there pulseless electrical activity? What is the final heart rate?

Dennis AT. Transthoracic echocardiography in obstetric anaesthesia and obstetric critical illness .IJOA 2011;20:160-8

What are our research questions?



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Dennis AT. Transthoracic echocardiography in obstetric anaesthesia and obstetric critical illness .IJOA 2011;20:160-8

Table 1. Differential Diagnosis of New Onset Hypotension in the Postpartum Period Using the Rapid Obstetric Screening Echocardiography Scanning Technique

	Disease						
	Obstetric hemorrhage	Myocardial infarction	Cardiac failure	Sepsis*	Pulmonary embolism	Aortic dissection	Other
Clinical symptoms and signs	Hypotension, tachycardia, diaphoresis, evidence of (dark) clots + distending hemoglobin pool	Hypotension, chest pain, ischemic ECG changes, arrhythmias	Hypotension, tachypnea, tachycardia	Hypotension, fever, tachycardia	Hypotension, pleuritic chest pain, tachypnea, ECG changes	Hypotension, chest pain, interscapular pain	Unwarm and sore toe/ • Trauma • Pericardial effusion with hemoptysis • Stroke, pneumothorax
Parasternal long- and short-axis views (2D images and M-mode)							
End-diastolic diameter	Reduced (LVEDD <3.0 cm)	Normal (LVEDD 3.0–5.6 cm)	Dilated (LVEDD >5.6 cm)	Normal (LVEDD 3.0–5.6 cm)	Increased RVEDD		
Positional shortening	Normal or increased FS >28%	Decreased FS <28%, regional wall motion abnormalities	Decreased FS <28%	Increased FS >44%	RV systolic function decreased		
Apical 4-chamber (2D images, pulse wave, color flow Doppler)							
Ventricular volumes	Reduced LV and RV volumes	Normal LV and RV volumes	Increased LV and RV volumes	Normal LV and RV volumes	Increased RV size compared with LV		
Contractility	Normal or increased LV and RV contractility	Reduced LV and RV contractility, regional wall motion abnormalities	Reduced LV and RV contractility	Increased LV and RV contractility	Normal, reduced, or increased RV function		
Doppler findings	Reduced cardiac output	Normal or reduced cardiac output	Reduced cardiac output	Normal or reduced cardiac output	Moderate to severe tricuspid regurgitation		
Hemodynamic state of hypotension	Reduced preload	Reduced contractility, arrhythmia	Primary contractility	Vasodilation	Right heart failure		

FAN = electrocardiogram; 2D = 2-dimensional; LVEDD = left ventricular end-diastolic diameter; FS = fractional shortening; RVEDD = right ventricular end-diastolic diameter.

Dennis AT, Stenson A. The use of transthoracic echocardiography in postpartum hypotension. Anesthesia and Analgesia 2012;115:1033-1037

Hypertensive pregnant women – preeclampsia

REVIEW

Transthoracic echocardiography in women with preeclampsia

- Hemodynamic findings in women with untreated preeclampsia include normal or increased cardiac output, normal or increased contractility, a nondilated left ventricle, diastolic dysfunction, increased pericardial effusions, and increased left ventricular mass.
- Echocardiography is recommended as a diagnostic and monitoring tool for acute hemodynamic complications of preeclampsia, such as acute pulmonary edema, significant arterial hypertension, and chest pain.

Diagnosis of **reduced ejection fraction heart failure** or **preserved ejection fraction heart failure**

Dennis AT. Transthoracic echocardiography in women with preeclampsia. Current opinion in anesthesiology 2015;28(3):254-260
Dennis AT. Focused Review: Heart failure in pregnant women - is it peripartum cardiomyopathy? Anesthesia and Analgesia 2015;120(3):638-643
Dennis AT, Castro JM. Echocardiographic differences between pre-eclampsia and peripartum cardiomyopathy. International Journal of Obstetric Anesthesia 2014;23(3):260-266

Transthoracic echocardiography – monitoring and management

Clinical trails have demonstrated the role of echocardiography monitoring in guiding management in:

- fluid resuscitation in critically ill adults at risk of heart failure or tissue hypoperfusion
- acute pulmonary emboli
- thrombosed prosthetic valves
- pericardial effusions
- acute heart failure

Large trials are needed

Porter et al. Guidelines for the Use of Echocardiography as a Monitor for Therapeutic Intervention in Adults: A Report from the American Society of Echocardiography .J Am Soc Echocardiogr 2015;28:40-56

Clinically meaningful changes

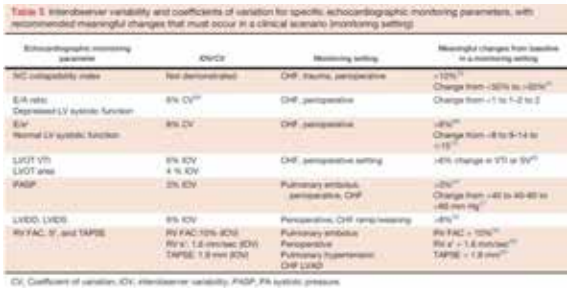


Table 3 Interobserver variability and coefficients of variation for specific echocardiographic monitoring parameters, with recommended meaningful changes that must occur in a clinical scenario (monitoring setting)

Echocardiographic monitoring parameter	IOV/CV	Monitoring setting	Meaningful changes from baseline in a monitoring setting
IVC collapsibility index	Not demonstrated	CHF, trauma, perioperative	>10%[19]
E/A ratio Depressed LV systolic function	6% CV[20]	CHF, perioperative	Change from −50% to >50%[20] Change from <1 to 1–2 to ≥
E/e' Normal LV systolic function	8% CV	CHF, perioperative	>8%[20] Change from <8 to 9–14 to >15[20]
LVOT VTI LVOT area	6% IOV 4 % IOV	CHF, perioperative setting	>6% change in VTI or SV[20]
PASP	3% IOV	Pulmonary embolism, perioperative, CHF	>5%[20] Change from <40 to 40–60 to >60 mm Hg[20]
LVEDD, LVESD	6% IOV	Perioperative, CHF ramp weaning	>6%[20]
RV FAC, S', and TAPSE	RV FAC 10% (IOV) RV s': 1.0 cm/sec (IOV) TAPSE: 1.9 mm (IOV)	Pulmonary embolism Perioperative Pulmonary hypertension CHF LVAD	RV FAC < 10%[20] RV s' < 1.5 cm/sec[20] TAPSE < 1.8 mm[20]

CV, Coefficient of variation; IOV, interobserver variability; PASP, PA systolic pressure.

Porter et al. Guidelines for the Use of Echocardiography as a Monitor for Therapeutic Intervention in Adults: A Report from the American Society of Echocardiography .J Am Soc Echocardiogr 2015;28:40-56

Clinical uptake – Disadvantages, pitfalls and cautionary notes

Disadvantages of transthoracic echocardiography

- Non-continuous
- Slower assessment (compared with PAC)
- Indirect measures only of filling pressure (compared with PAC)
- Intraoperative application harder with IPPV/PEEP
- Subcostal views difficult in pregnancy
- Additional training required – few integrated educational programs with hospital based continuity
- Can be expensive or not easily available

Clinical uptake – Disadvantages, pitfalls and cautionary notes

Wrong or missed diagnosis
by inexperienced or over confident operators

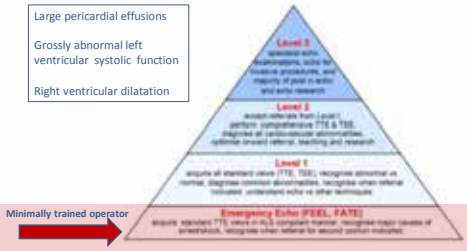
Lau G, Swanefelder J. Echocardiography in intensive care – where are we heading ?Anaesthesia 2011: 66; 649-658
Oxorn D, Pearlman A. Physician-performed ultrasound: The time has come for routine use in acute care medicine. Anesthesia Analgesia 2012:115;1004-1006

Clinical uptake – education

Large pericardial effusions

Grossly abnormal left ventricular systolic function

Right ventricular dilatation



Price, S., G. Via, et al. Echocardiography practice, training and accreditation in the intensive care: document for the World Interactive Network Focused on Critical Ultrasound (WINFOCUS). Cardiovasc Ultrasound 2008;6:49

Clinical uptake – education

As part of a broader

Obstetric critical care curriculum

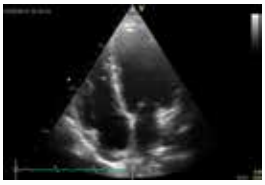
including
Resuscitation
Hypertensive disease of pregnancy
Obstetric hemorrhage
Embolism
Sepsis

- Minimum training requirements
- Documentation
- Supervision
- Quality Assurance
- Development and maintenance of professional standards

The future

Integrated obstetric critical care and echocardiography curriculum

- Minimum training requirements
- Documentation
- Supervision
- Quality Assurance
- Development and maintenance of professional standards



Echocardiography outreach services

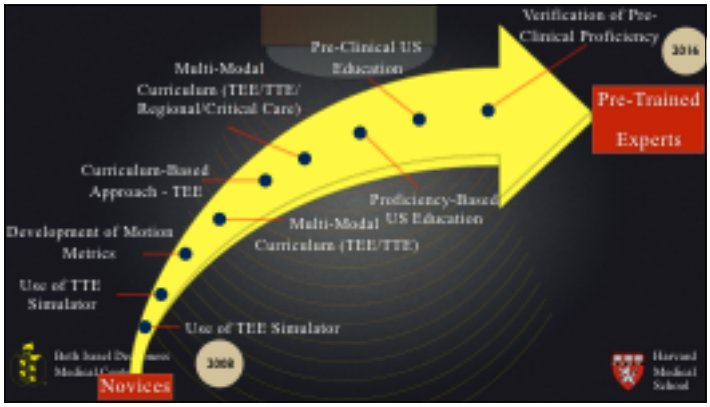
Ongoing hemodynamic research using echocardiography

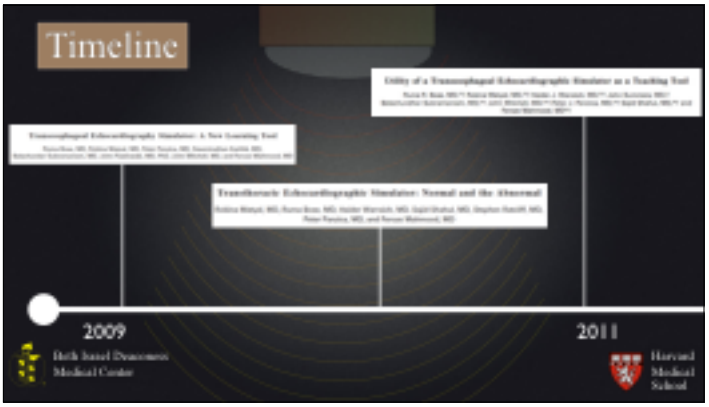
Summary

1. Maternal mortality and morbidity
2. Diagnosis with echocardiography
3. Monitoring and management with echocardiography
4. Clinical uptake


Perioperative Ultrasound Education & Training
Challenges and Opportunities
Feroze Mahmood, MD.
Associate Professor

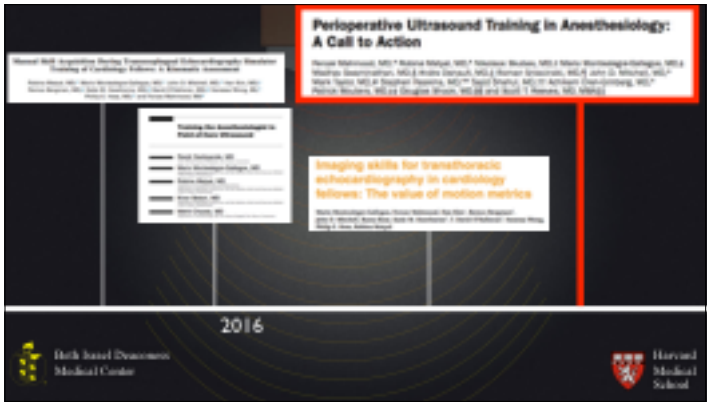

Palpation
Visualization


Verification of Pre-Clinical Proficiency
2016
Pre-Clinical US Education
Multi-Modal Curriculum (TEE/TTE/ Regional/Critical Care)
Pre-Trained Experts
Curriculum-Based Approach - TEE
Proficiency-Based US Education
Multi-Modal Curriculum (TEE/TTE)
Development of Motion Metrics
Use of TTE Simulator
Use of TEE Simulator
2008
Novices

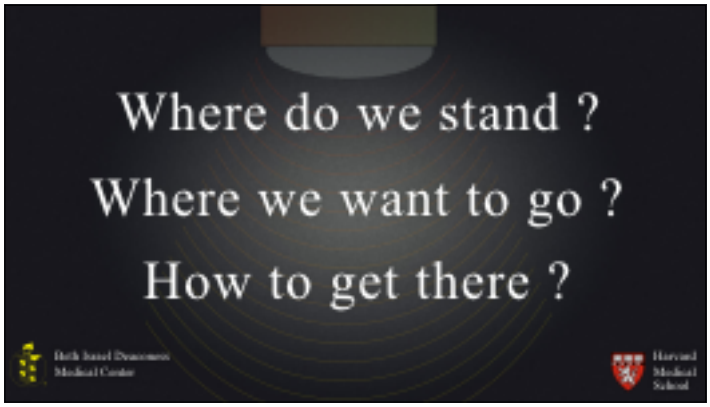

Timeline
2009
2011


2012
2013
2014

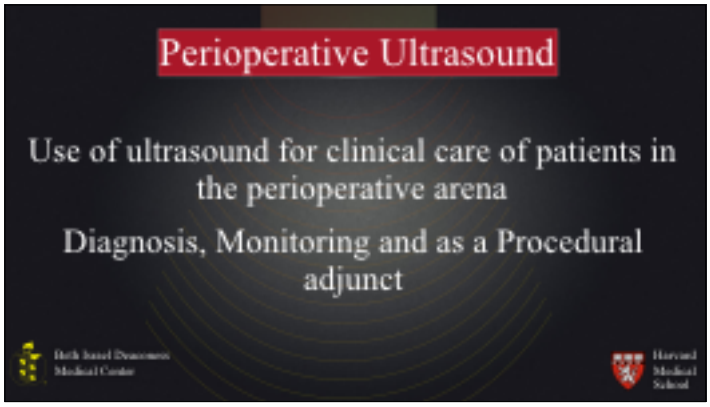

2014
2015


Perioperative Ultrasound Training in Anesthesiology: A Call to Action
Imaging skills for transthoracic echocardiography in cardiology fellows: The value of motion metrics
2016

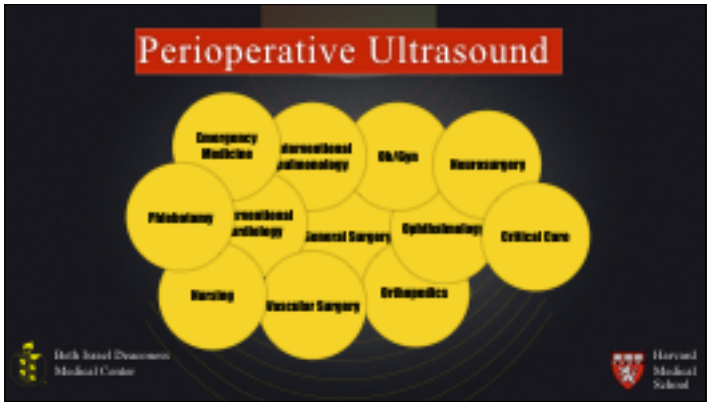

Outline
Current Status
Challenge
Opportunity


Where do we stand ?
Where we want to go ?
How to get there ?


Where do we stand ?
PERIOPERATIVE ULTRASOUND is a recently appreciated term


Perioperative Ultrasound
Use of ultrasound for clinical care of patients in the perioperative arena
Diagnosis, Monitoring and as a Procedural adjunct


Status
Ultrasound used across multiple specialties
Use determined by local credentialing rules
Specialty specific recommendations by professional organizations


Perioperative Ultrasound
Emergency Medicine
Ob/Gyn
Neurosurgery
Phlebotomy
General Surgery
Ophthalmology
Critical Care
Nursing
Vascular Surgery
Orthopedics

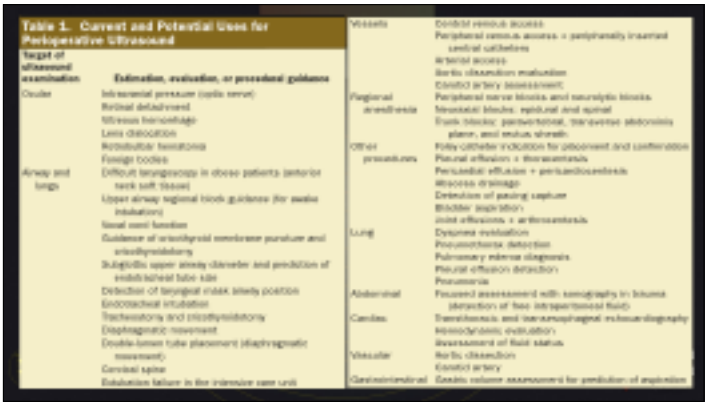
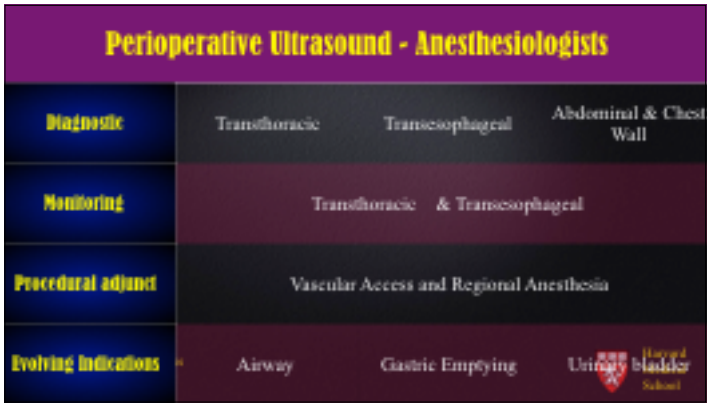


Table 1. Current and Potential Uses for Perioperative Ultrasound


Perioperative Ultrasound - Anesthesiologists
Diagnostic
Transthoracic
Transesophageal
Abdominal & Chest Wall
Monitoring
Transthoracic & Transesophageal
Procedural adjunct
Vascular Access and Regional Anesthesia
Evolving Indications
Airway
Gastric Emptying
Urinary bladder


What brought about this change ?
Size
Computation
Performance


Ultrasound Education - Grass Root Level


Dilemma
"Innovation precedes legislation"
Technology gets introduced and established prior to guidelines for its use are developed
Anesthesiology is not the first specialty to face this dilemma

Dilemma

Laparoscopy | Robotics | Int. Cardiology

Perioperative Ultrasound - Current Status

Widely practiced

No formalized curriculum

Significant variation in exposure

Practicing anesthesiologists use ultrasound with on the job training and repetitive exposure

Ultrasound Education - Current Model

Current Training Model

Residents learn various applications on specialty rotations

No unified curriculum for basic applications that are common to all applications

Other than TEE - no methodology to assess cognitive knowledge

Manual dexterity is implied after repetitive clinical exposure

Residency Training Milestone Project

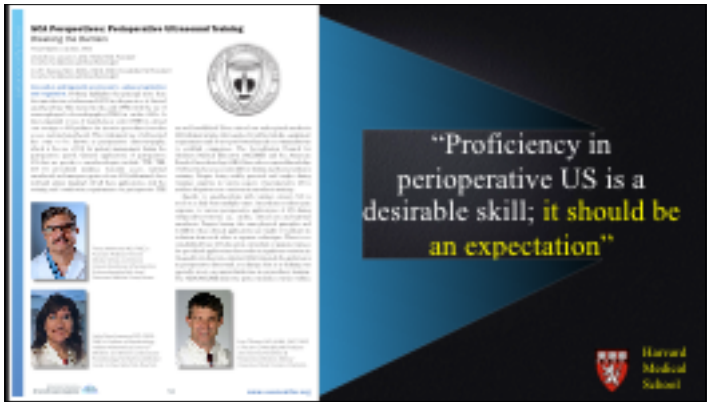
Accreditation Council for Graduate Medical Education (ACGME) and American Board of Anesthesiology (ABA) have recognized ultrasound guided techniques as training milestones (2013)

Where do we want to go?

Use of perioperative ultrasound should be ubiquitous to anesthesiology

Anesthesiologists should be considered experts in perioperative ultrasonography

Obviate any need or attempts to introduce any special certification



Challenge: Practicing Anesthesiologist

Faced with the situation of introduction of a new technology without any prior training

Expectation of proficiency

Risk of exclusion and getting disenfranchised

Lack of guidance for resolution

How to introduce NEW technology ?

Top down ?

Bottom up ?

Top down approach

Establishing our destination i.e. certification without defining a pathway to to get there

Bottom up approach

Developing pathways i.e. training programs to define our own destination i.e. proficiency

Bottoms up Approach Example

Fundamentals of Laparoscopic Surgery

Fundamentals of Endoscopic Surgery

American College of Surgeons Mandated FLS Program

Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) - Recently introduced

Top down Approach Example

Introduction of Echocardiography in Anesthesiology

Table 2. Training and Certification Guidelines for Perioperative Ultrasound Modalities

Reference	Society	Year	Subject matter	Training levels	Requirements for proficiency attainment
[1]	American Society of Echocardiography	1987	Echocardiography	Three levels (basic, advanced, and director)	Number of studies performed; months of training
[2]	American Society of Echocardiography and Society of Cardiovascular Anesthesiologists	2002	Perioperative echocardiography (TTE, TEE, epicardial, and epiaortic)	Two levels: basic and advanced	Number of studies performed
[3]	American society of Regional Anesthesia and Pain Medicine and the European Society of Regional Anesthesia and Pain Therapy Joint Committee	2009	Regional anesthesia	No	Complete a curriculum; no minimal number of procedures specified
[4]	Council of Emergency Medicine Residency Directors	2009	Emergency ultrasound	No	Length of training; structured curriculum; number of examinations
[5]	Canadian Cardiovascular Society and Canadian Society of Echocardiography	2010	Echocardiography (TTE and TEE)	Three levels: limited, basic, and advanced	Number of studies performed; weeks of training
[6]	European Society of Intensive Care Medicine	2011	Critical care ultrasonography	Two levels: basic and advanced	Basic: formal certification not required; advanced: echocardiography curriculum with minimal number of hours; number of studies performed
[7]	European Society of Intensive Care Medicine	2016	Advanced critical care echocardiography (TEE and TTE)	No	Number of studies performed (some under expert faculty supervision); constant standard evaluation of competency

How do we get there ?

CHALLENGE

OPPORTUNITY

BEING ADDRESSED

Practicing Anesthesiologist

Personal Initiative

Departmental Initiative

Specialty Initiative

Personal Investment

Your education is your own responsibility

Personal commitment towards continued training

Levels of commitment

Ideally with minimal financial/logistic hardships

Goal directed - towards a specific end point

Departmental Initiatives

Recognizing the value skill progression

Patient safety

Quality of clinical care

Mechanisms for recognizing expertise/credentialing

Fiscal value

Specialty Initiatives

Continuing medical education courses

Hands-on workshops

E-Learning

Webcasts

Books/Journals/Handouts

Ultrasound Credentialing at BIDMC

Ultrasound credentialing committee

Composition:

Director of Cardiac Anesthesia

Director of Critical Care

Director of Regional Anesthesia

Director of Vascular Anesthesia

Ultrasound Credentialing at BIDMC

Cardiac	Critical Care	Regional
Minimum Requirement	**Minimum Requirement**	**Minimum Requirement**
Testamur status - NBE	Ideally - ASCeXAM Testamur	Evidence of specific training during anesthesia residency
Basic: Non-Cardiac	Evidence of specific training	Rotation under observation
Advanced: Cardiac	One week rotation under observation	Evidence of attendance of a hands on CME activity pertaining to ultrasound for regional anesthesia
One week rotation under observation	Continued QA over reads	
Evidence of annual CME activity	Evidence of annual CME activity	

Ultrasound Training for Staff at BIDMC

1. Five day preceptorship training in cardiac/critical care (staff has to take meeting/vacation time)
2. Regional anesthesia workshops at dedicated faculty hours (every Tuesday 6:45 - 7:30 am)
3. Equipment fairs for introduction to ultrasound machine use for regional/vascular access
4. Staff request for privileges is evaluated on case by case basis

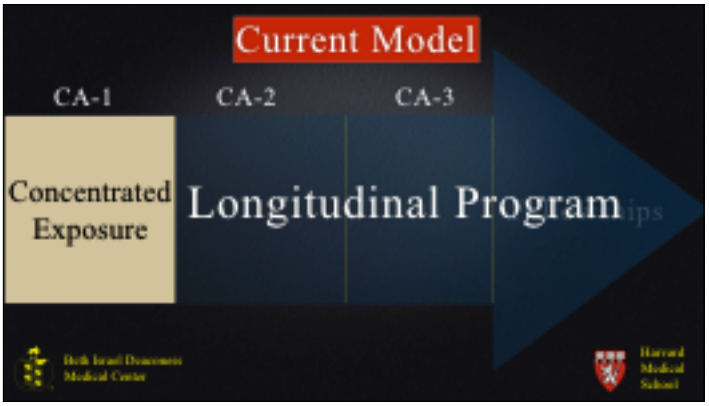
Ultrasound Training for Residents at BIDMC

Based on acquisition of proficiency

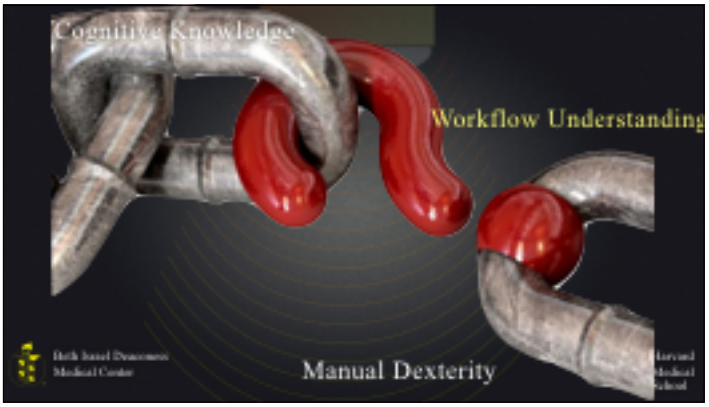
Simple

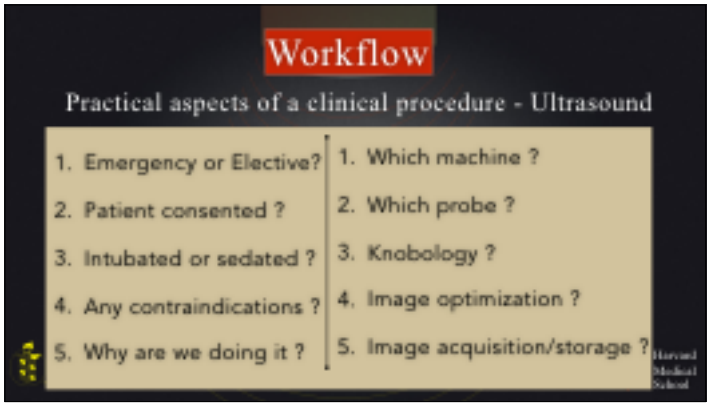
Practical

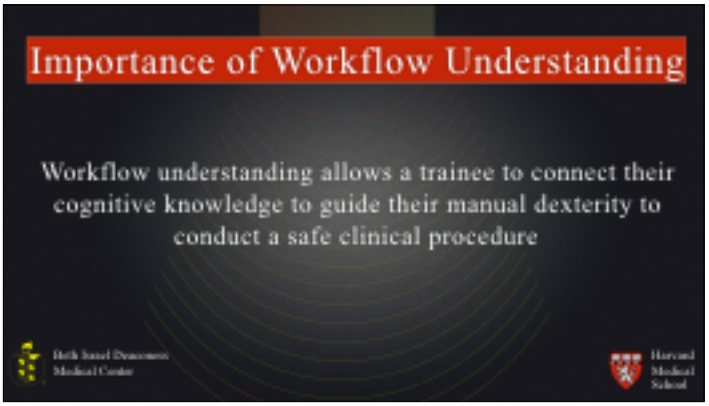
Reproducible


Current Model
CA-1
CA-2
CA-3
Concentrated Exposure
Longitudinal Program


Echo Lab BIDMC


Cognitive Knowledge
Workflow Understanding
Manual Dexterity


Workflow
Practical aspects of a clinical procedure - Ultrasound
1. Emergency or Elective?
2. Patient consented ?
3. Intubated or sedated ?
4. Any contraindications ?
5. Why are we doing it ?
1. Which machine ?
2. Which probe ?
3. Knobology ?
4. Image optimization ?
5. Image acquisition/storage ?


Importance of Workflow Understanding
Workflow understanding allows a trainee to connect their cognitive knowledge to guide their manual dexterity to conduct a safe clinical procedure

Workflow - Case Example

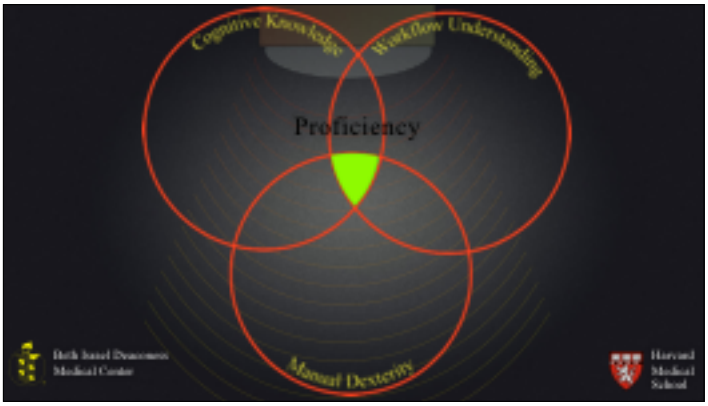
An emergency case of blunt chest trauma shows up in the middle of the night

Suspected of cardiac tamponade

Resident correctly chooses TEE for monitoring and diagnosis

TEE probe was successfully inserted

Resident and the attending physician DID NOT know how to turn on the machine



Perioperative Ultrasound Education

Curriculum should be designed to introduce proficiency

Multi-Modal	Content	Frequency	End Point
Within the 80 hour work limit	Integrated (Read what you will see)	Longitudinal & Incremental	Does not replace clinical training
Multi-modal (Online component)	Graduated from simple to complex	Individualized and interactive	Reduce the orientation phase
Interactive	End-point based	Performance tracking	Learning form day #1
Focused to proficiency	Hands-on component	Evaluation	Preclinical proficiency

The 2016 Gerard W. Ostheimer Lecture: What's New in Obstetric Anesthesia

Speaker: Philip E. Hess, M.D.

Goal: The goal of this review is to identify and present papers published in the calendar year 2015 that have major scientific or clinical relevance to practicing obstetric anesthesiologists. This includes not only advances in obstetric anesthesia, but also studies published in related fields of anesthesiology, obstetrical medicine, perinatology, pediatrics, epidemiology, maternal health, midwifery, health policy, simulation, and affiliated medical specialties (e.g. internal medicine, surgery, pathology).

Methods: Eighty-four (84) journals[1] published in the English language between January 2015 and December 2015, and indexed in Pubmed, were searched to identify the key papers that, directly or indirectly, might be relevant to the obstetric anesthesiologist. This search included basic research, human studies using standard methodologies (systematic reviews, randomized controlled trials, observational studies) and investigations of diagnostic tests/monitoring devices, as well as input from opinion papers and editorials. Each study was evaluated using criteria previously described by the Research Triangle Institute, University of North Carolina for the US Agency for Healthcare Research and Quality.[2] Articles were then categorized by topic (see Index of Topics) and a matrix-analytical approach[3] was used to assess the scientific value of the publication. Studies were entered into a matrix table to attempt to identify whether the new publication adds scientific or clinical knowledge to the topic.

Selecting the final list of papers for the syllabus was challenging often because two or more publications covered the same topic. With deep apologies to investigators whose articles were not selected in the final syllabus – valid arguments can be made for some alternate choices – this syllabus is an attempt to present the material in a meaningful fashion.

References for Introduction:

1. Acta Obstetrica & Gynecologica Scandinavica, American Journal Of Emergency Medicine, American Journal Of Epidemiology, American Journal Of Obstetrics And Gynecology, American Journal Of Perinatology, Anaesthesia, Anaesthesia & Intensive Care, Anesthesia & Analgesia, Anesthesiology, Anesthesiology Clinics, Annals Of Internal Medicine, Australian And New Zealand Journal Of Obstetrics And Gynaecology, Best Practices And Research In Clinical Obstetrics, Birth, Blood, BMC Anesthesiology, BMC Pediatrics, BMC Pregnancy And Childbirth, BMJ Quality And Safety, British Journal Anaesthesia, British Journal Of Obstetrics And Gynecology, British Journal Of Haemotology, Canadian Journal Anaesthesia, Chest, Circulation, Clinical Obstetrics And Gynecology, Critical Care Medicine, Current Opinion In Anesthesiology, Current Opinion In Obstetrics And Gynecology, Developmental Neurobiology, Early Human Development, Epidemiology, European Heart Journal, European Journal Of Anaesthesiology, European Journal Of Obstetrics & Gynecology & Reproductive Biology, European Journal Of Pain, Fertility And Sterility, Gynecologic And Obstetric Investigation, Health Affairs, Heart, Hypertension In Pregnancy, International Journal Of Developmental Neuroscience, Intensive Care Medicine, International Anesthesiology Clinics, International Journal Obstetric Anesthesia, International Journal Of Gynecology And Obstetrics, Journal Of Anesthesia, Journal Of Clinical Anesthesia, Journal Of American College Of Cardiology, Journal Of Clinical Epidemiology, Journal Of Maternal-Fetal And Neonatal Medicine, Journal Of Midwifery And Women's Health, Journal Of Paediatrics And Child Health, Journal Of Pain, Journal Of Pediatrics, Journal Of The American Medical Association, Journal Of Thrombosis And Hemostasis, Journal Of Women's Health, Joint Commission Journal On Quality And Safety, Journal Of Perinatology, Lancet, Nature –Medicine, Neural Development, New England Journal Of Medicine, Obstetric Medicine: The Medicine Of Pregnancy, Obstetrical And Gynecological Survey, Obstetrics And Gynecology, Obstetrics And Gynecology Clinics Of North America, Pain, Pediatrics, Pediatrics And Neonatology, Physiology, Placenta, Plos One, PNAS - Proceedings Of National Academy Of Sciences Of USA, Pregnancy Hypertension, Regional Anesthesia & Pain Medicine ,Reproduction, Resuscitation, Science, Simulation In Healthcare, Thrombosis Research, Transfusion, Trends In Anesthesia And Critical Care.
2. West S, King V, Carey TS, et al. Systems to Rate the Strength of Scientific Evidence. Evidence Report/Technology Assessment No. 47 (AHRQ Publication No. 02-E016. Rockville, M.D.: April 2002); URL: http://www.thecre.com/pdf/ahrq-system-strength.pdf
3. Harald Walach, Martin Loef. Using a matrix-analytical approach to synthesizing evidence solved incompatibility problem in the hierarchy of evidence. Journal of Clinical Epidemiology 2015; 68: 1251 – 1260.

Index of Topics

Guidelines

Maternal Mortality and Morbidity

Obstetric Anesthesia

Cesarean anesthesia

Labor analgesia

Patient Safety

Anesthesia

Maternal Comorbidity

Hemorrhage

Postpartum hemorrhage

Uterotonics

Transfusion practice

Obstetric Medicine

Cesarean delivery

Fever and inflammation

The Fetus and Neonate

Prematurity

Neurologic outcomes

Exposure to anesthetics

Neonatal resuscitation

General Interest

List of Papers

1. Practice Guidelines for Perioperative Blood Management: An Updated Report by the American Society of Anesthesiologists Task Force on Perioperative Blood Management. Anesthesiology 2015;122:241-75.

The guidelines represent the ASA effort to improve care during the perioperative period. The guideline places emphasis on preoperative assessment of the patient, assessment of the risk for transfusion, and the use of adjunct medications. This includes: greater use of pharmacologic therapies to minimize blood transfusions, such as erythropoietin for the anemic patient, prothrombin complex concentrates for urgent reversal of warfarin, and intraoperative antifibrinolytic therapy during selected cardiac and non-cardiac procedures having a high risk for bleeding. Also, the use of transfusion algorithms, especially those based on thromboelastographic testing, blood ordering schedules, and restrictive transfusion strategies.

2. Ahlsson F, Kaijser M, Adami J, et al. School Performance after Preterm Birth. Epidemiology 2015;26:106-11.

Several studies have demonstrated an association between school performance and preterm birth. It is hypothesized that some of this association may be confounded by socioeconomic and educational contribution from the mother. The study examined a cohort of over 1.6 million births in Sweden, categorizing subjects by their gestational age, and comparing them with their school-age accomplishments. Analysis was also performed controlling for maternal education and for siblings who were born at 40 weeks. The study found that the unadjusted cohort of children who were born before or after 40 weeks had a significantly lower school age success performance compared to those who were born at exactly 40 weeks. However, after adjusting for maternal education and also siblings who were born at 40 weeks, this difference disappeared. School performance was not affected by preterm birth for children who were born after 31 weeks.

3. Aiken CE, Aiken AR, Cole JC, et al. Maternal and Fetal Outcomes Following Unplanned Conversion to General Anesthetic at Elective Cesarean Section. Journal of Perinatology 2015;35:695-9.

While regional anesthesia has become the preferred technique for cesarean delivery, general anesthesia is sometimes required. This study examined unplanned conversion to general anesthesia in 4300 women over a six-year period. The study excluded urgent and emergent cesarean delivery, and focused only on those where adequate time to provide neuraxial anesthesia was available. Epidural anesthesia had the highest rate of conversion (11%: 15/132), followed by spinal (1.7%: 67/3831), and combined spinal-epidural (0%: 0/291). Conversion was associated with maternal hemorrhage and neonatal respiratory compromise.

4. Ajetunmobi OM, Whyte B, Chalmers J, et al. Breastfeeding Is Associated with Reduced Childhood Hospitalization: Evidence from a Scottish Birth Cohort (1997-2009). Journal of Pediatrics 2015;166:620-5 e4.

This large retrospective study linked multiple databases together to identify health risks/benefits of breastfeeding versus bottle (or both). In the first six months of life there was a 20% and 40% increase in the risk of hospitalization for partial- and bottle- fed babies compared to exclusive breast feeding. Similarly, there was a small, but real, increased risk of illness later in life for bottle fed children – mostly due to higher risk of infections or immune-related illnesses.

5. American College of Obstetricians and Gynecologists, The Society for Maternal-Fetal Medicine. Levels of Maternal Care. American Journal of Obstetrics and Gynecology 2015;212:259-71.

ACOG declaration of maternity care levels similar to neonatal care levels. Importantly, in this document the need for anesthesiologists as consultant (Level II), and specifically obstetric-anesthesia trained or experienced as director (Levels III & IV) are mandated.

6. Amrock LG, Starner ML, Murphy KL, et al. Long-Term Effects of Single or Multiple Neonatal Sevoflurane Exposures on Rat Hippocampal Ultrastructure. Anesthesiology 2015;122:87-95.

Multiple studies have demonstrated an effect of volatile anesthetics on the growth, development or survival of neurons in the young animal brain. This study examined neuronal and mitochondrial effects of repeated neonatal exposure to sevoflurane affects rat brain development. Rat pups were exposed to 2 hour, 6 hour, or three 2-hour exposures. Repeated exposure was worse on dendritic spike formation than single, 6-hour exposure, but both affect apoptosis and mitochondrial toxicity equally.

The pattern of neuronal loss was similar regardless of the duration of damage. This demonstrated an anesthetic-specific effect.

7. Armstrong S, Fernando R, Tamilselvan P, et al. The Effect of Serial in Vitro Haemodilution with Maternal Cerebrospinal Fluid and Crystalloid on Thromboelastographic Blood Coagulation Parameters, and the Implications for Epidural Blood Patching. Anaesthesia 2015;70:135-41.

After a dural puncture, cerebrospinal fluid (csf) enters the epidural space. Blood injected during an epidural blood patch (EBP) will encounter this csf. The effect of csf on the formation and strength of blood clot is little studied. In this in vitro study, samples of blood and csf were collected from 34 women during spinal anesthesia for cesarean delivery. Samples were then serially diluted up to 30% with either csf or Hartmann's solution as a control group. Clot formation was measured using thromboelastography (TEG). Dilution with csf produced progressive shortening of the r-time, k-time, and alpha angle, interpreted as facilitating coagulation. There was also a 10% reduction in MA, interpreted as reduction clot strength. Of note, the MA was still within normal values - even on the upper end of normal. The authors interpret this to support larger volumes for injection during EBP, and also a delay in performance to avoid excess csf.

8. Armstrong-Wells J, Donnelly M, Post M.D., et al. Inflammatory Predictors of Neurologic Disability after Preterm Premature Rupture of Membranes. American Journal of Obstetrics and Gynecology 2015;212:212 e1-9.

Fetal and maternal inflammation is associated with poor neurologic outcome in the child. Neurologic outcome has been correlated with increased cytokine levels; however, these studies have not discriminated between maternal and fetal generation of cytokines. The authors studied 25 parturients and examined the levels of cytokines (Il-1, Il-6, Il-8, Tnf-a) in the mother at ROM, and delivery, and in the umbilical vessels, and correlated them to the placental pathologic findings. Neurologic evaluations were performed at six months. Clinical chorioamnionitis (CCA), histologic chorioamnionitis (HCA) and fetal-sided inflammation (funisitis) were concordant in a minority. IL-6 and IL-8 were higher in <32 week gestations, and all cytokines were elevated in both mothers and fetus when funisitis was present. Fetal-sided placental inflammation and cytokine elevations were associated with poor neurologic outcome. Funisitis, and not HCA or CCA, may be the link between inflammatory cytokines and neurologic outcome.

9. Aslaksen PM, Zwarg ML, Eilertsen HI, et al. Opposite Effects of the Same Drug: Reversal of Topical Analgesia by Nocebo Information. Pain 2015;156:39-46.

The nocebo effect is the opposite of the placebo effect – a negative effect caused by an inactive treatment. In this study, investigators applied a study cream to 150 healthy volunteers divided into six groups: placebo instruction, nocebo instruction, and reduced information for both EMLA cream and inert cream. Nocebo effect led to an increase in subjective pain to heat, even when EMLA cream was applied. Placebo reduced the subjective sensation of pain.

10. Bailit JL, Grobman WA, Mcgee P, et al. Does the Presence of a Condition-Specific Obstetric Protocol Lead to Detectable Improvements in Pregnancy Outcomes? American Journal of Obstetrics and Gynecology 2015;213:86 e1-6.

This investigation was conducted to determine whether condition-specific protocols would improve patient care in obstetrics. Data from 4 years at 25 hospitals was examined resulting in 115,502 patient deliveries. Protocols for hemorrhage and shoulder dystocia were not associated with any change in outcome (risk adjusted multivariate model). The preeclampsia protocol was associated with fewer ICU admissions and less persistent hypertension, but not with any change in morbidity. The assumption that having a protocol improves outcome was not supported in this study.

11. Baldwin EA, Borowski KS, Brost BC, et al. Antepartum Nonobstetrical Surgery at >/=23 Weeks' Gestation and Risk for Preterm Delivery. American Journal of Obstetrics and Gynecology 2015;212:232 e1-5.

Non-obstetric surgery in the pregnant patient occurs in 1:645 patients in the United States. This review of 23 years of experience at a single center found 121 surgeries in 111 patients (1 per 325 deliveries). The mean gestational age was 29 weeks (range 23 to 36). Eighty-eight (73%) were performed under general anesthesia. Of the 86 patients for whom perinatal data was available, 32 (37%) delivered prematurely, and 9(10%) within one week of the surgery. No association with the type of anesthesia, or the site of surgery (intraabdominal vs. extraperitoneal) was found.

12. Balki M, Erik-Soussi M, Ramachandran N, et al. The Contractile Effects of Oxytocin, Ergonovine, and Carboprost and Their Combinations: An in Vitro Study on Human Myometrial Strips. Anesthesia and Analgesia 2015;120:1074-84.

Postpartum hemorrhage has increased in frequency in the developed world. The choice of uterotonic agent – which to use, either alone or in combination – remains poorly studied. In this in vitro study, the authors examined the contractile strength of oxytocin-naive and oxytocin-desensitized myometrial strips. In oxytocin-naive strips, the effect of oxytocin alone produced a maximal contraction, and the addition of ergonovine or carboprost had no added benefit. In oxytocin-desensitized strips, oxytocin alone had a reduced effect. The combination with ergonivine and carboprost with high-dose oxytocin produced the greatest contractile strength, similar to that of oxytocin in the naive strips.

13. Bauchat JR, Mccarthy RJ, Koski TR, et al. Labor Analgesia Consumption and Time to Neuraxial Catheter Placement in Women with a History of Surgical Correction for Scoliosis: A Case-Matched Study. Anesthesia and Analgesia 2015;121:981-7.

The success of labor analgesia for parturients who have previously had spinal hardware implantation for spinal scoliosis is poorly defined. This prospective study compared these patients with a cohort of normal labor patients - selected as the next sequential patient for the same operator. The time required to place the catheter was slightly longer in the spinal instrumentation patients (6.5 min vs. 4.5 min); however, there was no difference in the bupivacaine requirements during labor. The spinal instrumentation patients also were more likely to require a senior operator to assist in placement.

14. Bauer ME, Lorenz RP, Bauer ST, et al. Maternal Deaths Due to Sepsis in the State of Michigan, 1999-2006. Obstetrics and Gynecology 2015;126:747-52.

This paper studied sepsis-related death in the state of Michigan during the years 1999 to 2006. The rate of death due to sepsis was 2.1 per 100,000, which was 15% of all pregnancy-relate maternal mortality. The authors found a very high rate of delay in diagnosis, of inappropriate antibiotic choices, and of failure in escalation of care.

15. Belfort MA, Saade GR, Thom E, et al. A Randomized Trial of Intrapartum Fetal ECG ST-Segment Analysis. The New England Journal of Medicine 2015;373:632-41.

Fetal ECG analysis was approved for use in the US primarily based on several European studies. There has been significant concern that these studies were poorly conducted or that the results may not be generalizable to current clinical practice. This multicenter (16 universities with 26 delivery centers) trial randomized 11,000 term parturients to either fetal ECG or standard fetal heart rate monitoring. There were no differences in any neonatal outcome between groups. Even when assessment of protocol violations was performed (reassigning failures) there was no difference between groups. Fetal ECG analysis was no better than continuous fetal heart rate monitoring (which is no better than intermittent monitoring!).

16. Burchill LJ, Lameijer H, Roos-Hesselink JW, et al. Pregnancy Risks in Women with Pre-Existing Coronary Artery Disease, or Following Acute Coronary Syndrome. Heart 2015;101:525-9.

Maternal cardiac disease is increasing in incidence and is the most common cause of indirect maternal mortality in most developed nations. This study examined 50 pregnancies in 43 patients with a history of acquired cardiac disease (ACS, MI). Although the timing of the primary cardiac event was not available. Adverse maternal outcomes occurred in 10% of patients, including one death 2 weeks postpartum. The incidence of preeclampsia and IUGR were 10% each. Adverse fetal outcomes occurred in 50%, and were mostly related to premature birth.

17. Butwick AJ, Carvalho B, Blumenfeld YJ, et al. Second-Line Uterotonics and the Risk of Hemorrhage-Related Morbidity. American Journal of Obstetrics and Gynecology 2015;212:642 e1-7.

The use of a second-line uterotonic agent for the treatment of refractory postpartum hemorrhage after cesarean delivery has been minimally studied. This was a secondary analysis of the MFMU multicenter collection of women who underwent cesarean delivery. After exclusion criteria, 1335 women were included in the study. Using propensity score matching, 369 women who received either methylergonovine or carboprost were compared. The women who received carboprost were more likely to suffer hemorrhage-related complications (hysterectomy, uterine artery ligation) as those who received ergot as a second line agent. Examining those women who had first undergone labor with oxytocin, this difference remained, but the confidence intervals crossed equality. Methylergonovine may be a more effective second-line agent for the treatment of

uterine atony after cesarean delivery.

18. Callaghan WM, Creanga AA, Jamieson DJ. Pregnancy-Related Mortality Resulting from Influenza in the United States During the 2009-2010 Pandemic. Obstetrics and Gynecology 2015;126:486-90.

The severe H1N1 influenza (4/15/2009 to 6/30/2010) affected pregnant women disproportionately and resulted in significant morbidity and mortality. During the time period of the study, 75 women were confirmed to have died from H1N1, and an additional 34 were probable, which accounts for at least 1.5 deaths per 100,000, and may have been as much as 2.2 per 100,000. This represented 12% of all maternal mortality.

19. Chaillet N, Dumont A, Abrahamowicz M, et al. A Cluster-Randomized Trial to Reduce Cesarean Delivery Rates in Quebec. The New England Journal of Medicine 2015;372:1710-21.

This cluster randomized trial attempted to decrease the cesarean delivery rate at multiple hospitals. The intervention consisted of audits and reviews, attempting to influence caregivers to employ best practices. There was a significant, but miniscule decrease in the rate (1.7%). The decrease was solely due to the intervention reducing cesarean delivery in low risk pregnancies.

20. Chantry AA, Deneux-Tharaux C, Bonnet MP, et al. Pregnancy-Related ICU Admissions in France: Trends in Rate and Severity, 2006-2009. Critical Care Medicine 2015;43:78-86.

This database study combined data from several sources in the French health care system. They identified 11,824 pregnancy-related ICU admissions in France from 2006 to 2009. The rate of ICU admission was 3.6 per 1000 deliveries, and decreased over the course of the study. The mortality rate of patients admitted to the ICU was 1.3% and was stable over time. The highest ICU admission rate occurred in hemorrhage followed by circulatory complications, but the highest mortality and morbidity occurred with AFE and infectious conditions. The rate of anesthesia related ICU admission was 0.2 per 1000 deliveries, but the mortality was above average (6%). In addition to the sample size, the strength of this study was the quality of the data and the linkage of ICU admissions with severity of illness scores and organ injury data.

21. Chettri S, Adhisivam B, Bhat BV. Endotracheal Suction for Non-vigorous Neonates Born through Meconium Stained Amniotic Fluid: A Randomized Controlled Trial. The Journal of Pediatrics 2015;166:1208-13 e1.

Intubation and tracheal suction for meconium aspiration has changed from routine use to virtually being eliminated from resuscitation protocols - being used only in non-vigorous neonates. This prospective study identified 122 non-vigorous neonates (out of 16,000 live births) who were born through meconium stained amniotic fluid, and randomized them to tracheal suction or conservative support. Tracheal suctioning had no effect on the outcome of neonates. Meconium induced lung injury is an in utero event, and is not influenced by the provider at the point of delivery.

22. Chowdary P, Adamidou D, Riddell A, et al. Thrombin Generation Assay Identifies Individual Variability in Responses to Low Molecular Weight Heparin in Pregnancy: Implications for Anticoagulant Monitoring. British Journal of Haematology 2015;168:719-27.

The hypercoagulable state of pregnancy results in a significant risk of thrombosis and complications such as pulmonary embolism. Thromboembolic complications have risen to become one of the leading causes of maternal mortality in the developed world. Current measures of low molecular weight heparin (LMWH) are indirect measures that determine serum concentration, not the degree of anticoagulation. This study examined the thrombin generation assay (TGA) vs. Factor Xa levels in 41 pregnant women with thrombophillias and 40 normal controls. The study found significant individual variation in the anticoagulant effects of LMWH, including two patients who had normal coagulation at high Factor Xa levels. As a measure of anticoagulation effect, the TGA may become a more useful test during pregnancy. Importantly, this may aid the anesthesiologist in determining the safety of neuraxial anesthesia in patients receiving LMWH.

23. Chung W, Park S, Hong J, et al. Sevoflurane Exposure During the Neonatal Period Induces Long-Term Memory Impairment but Not Autism-Like Behaviors. Paediatric Anaesthesia 2015;25:1033-45.

The implication of medications, specifically anesthetics, on the neurodevelopment of the fetal and neonatal brain remain controversial, but the number of studies demonstrating a deleterious effect in animals is concerning. This study attempted to

identify whether sevoflurane administered in the early neonatal period led to autism-like behavior. The study found it did not, but did induce long-term learning impairment.

24. Cirillo PM, Cohn BA. Pregnancy Complications and Cardiovascular Disease Death: 50-Year Follow-up of the Child Health and Development Studies Pregnancy Cohort. Circulation 2015;132:1234-42.

The maternal response to pregnancy has been associated with long term outcomes such as diabetes, cardiac disease, and stroke. This 5-decade longitudinal study of >15,000 women examined outcome the cardiovascular disease (CVD) based on disorders in pregnancy. The study found that hypertensive disorders in pregnancy including preexisting hypertension, small for gestational age neonate, and glycosuria were associated with significant increases in CVD in later years. This may provide knowledge for early intervention in women.

25. Clifford L, Jia Q, Subramanian A, et al. Characterizing the Epidemiology of Postoperative Transfusion-Related Acute Lung Injury. Anesthesiology 2015;122:12-20.

Transfusion-related acute lung injury (TRALI) is the leading cause of transfusion related mortality in the US. The incidence in the ICU has been found to range between 0.04 % to 8%, but the incidence is believed to be clinically underreported. This retrospective audit of cases of a single-institution, non-cardiac surgery over two years identified 3379 cases of transfusions (2.5% of surgical cases). The authors found 1.3% of surgical transfusions were associated with TRALI. Importantly, there were no cases in obstetrics / gynecologic surgeries.

26. Clifford L, Jia Q, Yadav H, et al. Characterizing the Epidemiology of Perioperative Transfusion-Associated Circulatory Overload. Anesthesiology 2015;122:21-8.

Transfusion associated circulatory overload (TACO) is the second leading cause of mortality associated with transfusion. Leukocyte reduction was hypothesized to reduce the rate due to reduction in antigenic activation. This study examined the incidence of TACO in 2004 and 2011. Of the 4000 hemorrhages, 400 had TACO. Multivariate modeling found age and year to be the important factors. The rate in obstetrics and gynecologic patients (1.5%) was significantly lower than other surgeries.

27. Cox KJ, Bovbjerg ML, Cheyney M, et al. Planned Home VBAC in the United States, 2004-2009: Outcomes, Maternity Care Practices, and Implications for Shared Decision Making. Birth 2015;42:299-308.

Homebirth has increased in recent years. While there are no firm recommendations for advising patients based on risk, the concerns over women with a previous cesarean should be taken in to consideration. Unfortunately, there is minimal data on these patients. This secondary analysis of a previous data collection on homebirths in the US examined these patients. There were more neonatal deaths (4.75 per 1000 births) among women who had a VBAC, which was even higher for women with no previous vaginal birth (9.7/1,000). Considering that these are already a selected group of patients, one should recommend homebirth after a cesarean with caution.

28. Craig MG, Grant EN, Tao W, et al. A Randomized Control Trial of Bupivacaine and Fentanyl Versus Fentanyl-Only for Epidural Analgesia During the Second Stage of Labor. Anesthesiology 2015;122:172-7.

The effect of epidural analgesia, and specifically motor blockade, on the efficiency of second stage labor is controversial. This study randomized nulliparous women to receive either Bupivacaine – fentanyl mix vs. high-dose fentanyl solution. No difference on any obstetric, neonatal or maternal outcome were identified (2 min difference in second stage (95%CI -6 to 18). However, the fentanyl-only group received 5 times as much opioid.

29. Creanga AA, Bateman BT, Butwick AJ, et al. Morbidity Associated with Cesarean Delivery in the United States: Is Placenta Accreta an Increasingly Important Contributor? American Journal of Obstetrics and Gynecology 2015;213:384 e1-11.

This investigation using the National Inpatient Sample examined the complications associated with cesarean delivery. During the period of 2000 to 2011 there was a gradual increase in the cesarean delivery rate. Approximately 0.76% of all cesarean (1% or primary and 0.5% of repeat) deliveries experienced at least one of the 12 pre-determined complications. There was a slight (3.6%) increase in the morbidity rate among primary cesarean deliveries, mostly due to transfusions, renal failure, and shock, but there was a significant decrease in the incidence of anesthesia complications. Over the course

of the study period there was an increase in the incidence of placenta accreta among women with repeat cesarean delivery of about 30%.

30. Creanga AA, Berg CJ, Syverson C, et al. Pregnancy-Related Mortality in the United States, 2006-2010. Obstetrics and Gynecology 2015;125:5-12.

This is a national review of the 5-year maternal mortality in the US based on the statistics of the CDC, and state records. This examines the 1 year (WHO calculation is based only on the 42-day mortality) pregnancy-related deaths. The overall mortality rate in the US was 16/100,000 births. Most deaths occurred prior to delivery (23%), or within the 42-day peripartum period (64%). Only 13.5% died after 42 days until one year. The incidence of potentially 'preventable' deaths (hemorrhage, thromboembolism, PIH) have decreased over time, while the incidence of cardiovascular disease, other medical comorbidities, infection, and cardiomyopathy have increased. H1N1 occurred in 2009 and had a significant impact in that year. There is a large disparity with non-Hispanic, black women, and socio-health care issues were identified.

31. Curtin WM, Katzman PJ, Florescue H, et al. Intrapartum Fever, Epidural Analgesia and Histologic Chorioamnionitis. Journal of Perinatology 2015;35:396-400.

This is a secondary analysis of a retrospective data collection from a single medical center. The authors reviewed the results of placentas examined during one year of clinical care. Approximately 50% of those sent in for pathology had evidence of infection. The authors then combined the data with outcomes of epidural use and fever (>38 ^{o}C) during labor. On multivariate analysis, they found that epidural use and placental infection were independent causes of maternal fever during labor. This suggests that epidural analgesia does not cause infection, but is another etiology of fever.

32. Dahlke JD, Mendez-Figueroa H, Maggio L, et al. Prevention and Management of Postpartum Hemorrhage: A Comparison of 4 National Guidelines. American Journal of Obstetrics and Gynecology 2015;213:76 e1-10.

This review examined 4 national guidelines on postpartum hemorrhage. There was considerable variation among the guidelines for definition, diagnosis, prevention, risk factors, and treatment. Furthermore, the evidence used for construction of the guidelines varied considerably. Finally, the authors noted that few randomized studies were quoted. Improvements in how guidelines are created are needed.

33. De Jonge A, Geerts CC, Van Der Goes BY, et al. Perinatal Mortality and Morbidity up to 28 Days after Birth among 743 070 Low-Risk Planned Home and Hospital Births: A Cohort Study Based on Three Merged National Perinatal Databases. British Journal of Obstetrics and Gynaecology 2015;122:720-8.

This study evaluated the perinatal outcome of 740,000 women who delivered in the Netherlands over 10 years. All patients were selected as low-risk, and were provided primary care with a midwife. The patients self-selected home birth (60%) vs. hospital birth, with about 10% having no selection until the onset of labor. There were no differences in neonatal outcomes, including mortality up to 28 days, APGAR scores <7 or <4, and NICU admissions, with the exception of a slightly higher NICU admission risk among parous women. Important baseline differences in maternal characteristics did exist, including socioeconomic status and ethnicity, both of which were more common in the hospital-birth choice group. With the acceptance of the limitations of the study, primary midwifery care of very-low risk patients in the Netherlands does not have significant difference in perinatal outcome compared to hospital birth.

34. Declercq E, Luke B, Belanoff C, et al. Perinatal Outcomes Associated with Assisted Reproductive Technology: The Massachusetts Outcomes Study of Assisted Reproductive Technologies (Mosart). Fertility and Sterility 2015;103:888-95.

This large database study of the birth outcomes of Assisted Reproductive Technology (ART) patients included the comparison of patients who used ART with patients who were sub-fertile, but did not use ART to achieve conception, and also fertile women as a third comparison group. Compared to fertile control, both sub-fertile groups had higher rates of pre-term birth and low birth weight, with those using ART having higher rates than spontaneous conception. Among patients with twins, ART was associated with lower risk of perinatal death. The cause of these perinatal complications is unclear.

35. Dilli D, Aydin B, Fettah ND, et al. The ProPre-Save Study: Effects of Probiotics and Prebiotics Alone or Combined on Necrotizing Enterocolitis in Very Low Birth Weight Infants. The Journal of Pediatrics 2015;166:545-51 e1.

Necrotizing enterocolitis (NEC) is a major morbidity in very premature infants, which has not changed in incidence despite improvements in neonatal care. This multicenter trial randomized 400 very premature neonates to probiotics (gut bacteria), prebiotics (dietary inulin), a combination of both, versus a control group. The authors found a significant reduction in the rate of NEC among neonates who received probiotic feedings compared to the placebo control and also the prebiotics. On multivariate analysis, antenatal maternal steroids, probiotic use were associated with lower rates of NEC, and maternal antibiotic exposure with higher.

36. Dossou M, Debost-Legrand A, Dechelotte P, et al. Severe Secondary Postpartum Hemorrhage: A Historical Cohort. Birth 2015;42:149-55.

Secondary postpartum hemorrhage (PPH) is defined as occurring after 24 hours up to 6 weeks. This study identified a large cohort of secondary PPH patient to better define causes. The incidence of severe secondary PPH was 0.23 percent (n = 60/26,023), with the mean time of diagnosis being 13 days after delivery (SD 10.8). The incidence was more common after vaginal than cesarean (0.28% vs. 0.08%) delivery. One in five had a primary PPH, while almost half had some perineal trauma during delivery. Retained placenta was most frequently the cause (30.0%), along with subinvolution of the placental bed and endometritis. Twenty one percent (21%) of patients required blood transfusions, surgical management or arterial embolization was required in the majority, including one hysterectomy. While not as common as primary PPH, it is important to maintain awareness so that patients present early.

37. Douma MR, Stienstra R, Middeldorp JM, et al. Differences in Maternal Temperature During Labour with Remifentanil Patient-Controlled Analgesia or Epidural Analgesia: A Randomised Controlled Trial. International Journal of Obstetric Anesthesia 2015;24:313-22.

“Epidural fever” has gained attention in recent years. The cause of a well-documented association between epidural analgesia and a rise in temperature remains undefined. This study randomized women who requested analgesia to epidural vs. IV remifentanil via PCA. A third group of women who had been enrolled by did not request analgesia were included as a comparator group. Women who received epidural analgesia had a higher incidence of temperature >38 C, as well as use of antibiotics. Women administered remifentanil PCA had significantly greater pain and hypoxia. There were some unfortunate differences in obstetric characteristics, including longer labor and higher cesarean rates in the epidural group, which would have perhaps been diluted in from a larger study population. Statistical analysis would be improved with repeated measures analysis, to reduce error, and elimination of the ‘control’ that were not randomized participants.

38. Downe S, Finlayson K, Melvin C, et al. Self-Hypnosis for Intrapartum Pain Management in Pregnant Nulliparous Women: A Randomised Controlled Trial of Clinical Effectiveness. British Journal of Obstetrics and Gynaecology 2015;122:1226-34.

Hypnobirthing is popular in the natural childbirth movement. This study of training patients in hypnosis randomized 680 women. There were no differences in any outcome between groups. Nuff said!

39. Drake EJ, Coghill J, Sneyd JR. Defining Competence in Obstetric Epidural Anaesthesia for Inexperienced Trainees. British Journal of Anaesthesia 2015;114:951-7.

Defining competence in procedures is challenging - When does a trainee progress from novice to competent practitioner? This retrospective study examined the success rates for trainees in performance of epidural catheterization. Success was first defined by the performance plateau. Then Cumulative sum analysis (CUSUM) was used to identify the average number of placements that was required before the trainee became competent. The mean number of placements required to achieve 65% success (46 attempts) and 80% success (77 attempts) were calculated.

40. Edwards SE, Grobman WA, Lappen JR, et al. Modified Obstetric Early Warning Scoring Systems (Moews): Validating the Diagnostic Performance for Severe Sepsis in Women with Chorioamnionitis. American Journal of Obstetrics and Gynecology 2015;212:536 e1-8.

Modified Early Warning Systems (MEWS; aka triggers) have been developed to more rapidly identify patients who might deteriorate. MEWS have been shown to perform poorly in diagnosing maternal sepsis, in part because of the changes of pregnant physiology. This study examined the test characteristics of six obstetric-specific systems (MOEWS) on a database of patients with known chorioamnionitis and sepsis. None of the six MOEWS performed well and all were similar to the

MEWS. This raises the question of whether it is possible to identify impending sepsis in this population with vital signs alone. It also raises the concern of producing alarm fatigue from the boy who cried wolf (or the MOEWS who identified sepsis).

41. Elfil H, Crowley L, Segurado R, et al. A Randomised Controlled Trial of the Effect of a Head-Elevation Pillow on Intrathecal Local Anaesthetic Spread in Caesarean Section. International Journal of Obstetric Anesthesia 2015;24:303-7.

The use of a ramped pillow has become common to improve visualization during laryngoscopy in the morbidly obese. This study examined the use of a ramped pillow after neuraxial anesthesia for cesarean delivery. One hundred (100) non-obese patients were recruited, randomized to be placed supine or to remain on an upper torso ramp after CSE placement. A significantly higher percentage of ramped patients required supplementation (44% vs. 2%) or general anesthesia (9% vs. 0).

42. Elterman KG, Tsen LC, Huang CC, et al. The Influence of a Night-Float Call System on the Incidence of Unintentional Dural Puncture: A Retrospective Impact Study. Anesthesia and Analgesia 2015;120:1095-8.

Sleep deprivation leads to an increase in mental and physical error rates. Leading authorities have recommended reduction in the impact of sleep deprivation on physicians - especially those in training. This study evaluated the impact of instituting a night float system for anesthesia residents on the OB anesthesia rotation. Compared with the traditional single-night call structure, night float lead to an increase in accidental dural punctures (relative risk of 2.06), with more of the dural punctures being committed by the first year (i.e. least skilled) residents. This study highlights that the impact of circadian rhythm and cumulative sleep disruption on learning and performance are much greater than a single episode of sleep disturbance.

43. Farber MK, Schultz R, Lugo L, et al. The Effect of Co-Administration of Intravenous Calcium Chloride and Oxytocin on Maternal Hemodynamics and Uterine Tone Following Cesarean Delivery: A Double-Blinded, Randomized, Placebo-Controlled Trial. International Journal of Obstetric Anesthesia 2015.

The administration of oxytocin during cesarean delivery varies in the literature considerably. This prospective trial randomized women receiving a 5 IU oxytocin IV bolus to receive either 200 mg of calcium chloride, 400 mg of calcium chloride, or placebo. The administration of calcium had no effect on the change of blood pressure after bolus administration of oxytocin. There was no change in the assessment of uterine tone. Although this study was slightly underpowered it does not appear promising to use a bolus of calcium to avoid the hypotension expected after a 5 IU bolus of oxytocin.

44. Fattahi Z, Hadavi SM, Sahmeddini MA. Effect of Ondansetron on Post-Dural Puncture Headache (PDPH) in Parturients Undergoing Cesarean Section: A Double-Blind Randomized Placebo-Controlled Study. Journal of Anesthesia 2015;29:702-7.

Post-dural puncture headache remains a significant morbidity after spinal anesthesia. This randomized study examined the incidence of PDPH after prophylactic treatment of ondansetron vs. placebo. 212 parturients were randomized, and there was a reduction in the incidence of PDPH from 20.75 % in the placebo group to 4.7% for those given ondansetron; P = 0.001. Criticism of this comes in the use of 25 gauge Quincke needles (similar pencil point needles result in <1% PDPH), the very high incidence of headache in the placebo group, and a question of why a single dose of a medication with a short half-life would result in 3-days of prophylaxis.

45. Freedman RL, Lucas DN. M.B.rrace-Uk: Saving Lives, Improving Mothers' Care - Implications for Anaesthetists. International Journal of Obstetric Anesthesia 2015;24:161-73.

MBRRACE-UK is the national survey system for identifying and assessing causes of maternal mortality. The system has evolved over the years, but provides some insight into the changes in causes (aspiration has been restricted) and highlights the potential for improvement in care.

46. Fuerch JH, Yamada NK, Coelho PR, et al. Impact of a Novel Decision Support Tool on Adherence to Neonatal Resuscitation Program Algorithm. Resuscitation 2015;88:52-6.

Multiple studies have demonstrated that trained clinicians do not adhere to algorithms such as ACLS, or NRP. This study examined the implementation of a specialized software loaded on a tablet. Subjects (trained neonatal resuscitation teams) were randomized to standard care vs. having the tablet in the crib. The success of decision to provide positive pressure ventilation and chest compressions increased from 60% – 80% in the standard care up to >90% in the intervention group.

Decision support tools will become more common in the future.

47. Fuhrmann L, Pedersen TH, Atke A, et al. Multidisciplinary Team Training Reduces the Decision-to-Delivery Interval for Emergency Caesarean Section. Acta anaesthesiologica Scandinavica 2015;59:1287-95.

This interventional trial of team training examined the incidence of emergency cesarean delivery within 30 minutes of declaration. The intervention consisted of a 3-hour training session including lecture and simulation. Data on 100 pre-intervention (baseline) and 100 post-intervention emergency cesarean deliveries was collected. The measure was how many 30-minute cesarean deliveries actually had a decision to delivery interval of ≤30 minutes. The baseline incidence of 74% was increased after training of the staff to 87.5% of all emergency cases. There are several factors that may have impacted the outcome, but it is a good example of a success of a systems-based approach.

48. Gambling DR, Bender M, Faron S, et al. Prophylactic Intravenous Ephedrine to Minimize Fetal Bradycardia after Combined Spinal-Epidural Labour Analgesia: A Randomized Controlled Study. Canadian journal of Anaesthesia 2015;62:1201-8.

Fetal bradycardia after a combined spinal-epidural (CSE) technique for labor analgesia continues to be a topic of interest. In this randomized, double blind study, 596 women were randomized to receive 50 mg of ephedrine vs. placebo immediately after injection of the spinal medication of a CSE technique. The ephedrine group had higher lowest BP during the study period and the placebo group less supplemental ephedrine. The incidence of fetal bradycardia (<90 bpm for >2 min within) 30 min of placement in the ephedrine group was 2.7% vs. 4.7% in the placebo group, which was not significant (p=0.18). The lack of success may be due to the hypotension not being the cause of fetal bradycardia, multivariate causes of fetal bradycardia, or the study being underpowered due to a lower than expected incidence. Routine administration of ephedrine appears to not be effective in a large majority of cases.

49. Garrouste-Orgeas M, Perrin M, Soufir L, et al. The Iatroref Study: Medical Errors Are Associated with Symptoms of Depression in ICU Staff but Not Burnout or Safety Culture. Intensive Care Medicine 2015;41:273-84.

This study, conducted in the ICU, examined staff and patient interactions which would lead to adverse events. Staff depression was associated with an increased rate of medical errors, but symptoms of burnout or 'safety culture' were not. Other important associations included team turnovers (defined as >40% of that day's staff having been off the day before) and patients who required labor-intensive care (i.e. the more ill patient).

50. Gebb J, Dar P, Rosner M, et al. Long-Term Neurologic Outcomes after Common Fetal Interventions. American Journal of Obstetrics and Gynecology 2015;212:527 e1-9.

This qualitative analysis study examined the neurologic outcome of newborns reported with in utero fetal procedures. While there have been fewer randomized studies comparing current fetal therapies with conservative management, the outcomes of some therapies are positive (e.g. laser therapy for twin-twin transfusion syndrome), whereas others do not appear to result in positive neurologic outcomes. Without truly randomized studies it is difficult to say with precision how the interventions affect neonatal neurologic outcome. However, this paper allows for a more informed conversation with patients.

51. Glied SA, Ma S, Pearlstein I. Understanding Pay Differentials among Health Professionals, Nonprofessionals, and Their Counterparts in Other Sectors. Health Affairs 2015;34:929-35.

Physician pay has increased over the last 30 years for multiple reasons. Political and economic pressures are destined to change the financial compensation in medicine. This study demonstrates that reducing physician salaries to levels of comparative professionals would reduce overall health expenditures by only 4% to 6%. Healthcare professional salaries do not explain the growth of healthcare costs.

52. Goodier CG, Lu JT, Hebbar L, et al. Neuraxial Anesthesia in Parturients with Thrombocytopenia: A Multisite Retrospective Cohort Study. Anesthesia and Analgesia 2015;121:988-91.

The impact of thrombocytopenia on neuraxial procedures is a frequent discussion in obstetric anesthesia. The precise "platelet count" where clinicians should feel safe will never be known. This paper adds data to the issue by increasing the number of patients with documented uncomplicated neuraxial placement in the setting of thrombocytopenia (defined as

a count of <100,000/ml). Based on the analysis, the 95%CI of a spinal-epidural hematoma would be 0 to 0.6%. However, the data only supports platelet counts above 75,000. One must also consider that the patients who received a neuraxial placement are a selected cohort within a larger population.

53. Grobman WA, Bailit JL, Rice MM, et al. Racial and Ethnic Disparities in Maternal Morbidity and Obstetric Care. Obstetrics and Gynecology 2015;125:1460-7.

Stark racial and ethnic differences exist in maternal mortality. This study examined the incidence of maternal morbidity (postpartum hemorrhage, infection, and perineal laceration) among racial groups. Using a prospectively collected database, 115,000 women were examined for delivery morbidity. Non-Hispanic white women were least likely to experience PPH and infections. Asian women were most likely to suffer a perineal laceration. It is unclear if these differences are due to variations of care – which is unlikely as the patterns of adverse outcomes were consistent among different hospitals – or other factors.

54. Guglielminotti J, Li G. Monitoring Obstetric Anesthesia Safety across Hospitals through Multilevel Modeling. Anesthesiology 2015;122:1268-79.

Comparisons of anesthesia-related adverse events (ARAE) are hard due to both patient comorbidities and hospital-related factors. Multilevel modeling can be used to adjust for both of these complex factors and to produce rankings of hospitals based on ARAE rates. Data from the years 2008-2009 were collected to develop the model. There was an ARAE rate of 4.6/1000 discharges. Logistic regression modeling, followed by multilevel risk adjustment was performed to develop the final model. This model was then used to predict the ARAE rates at each hospital based on the known 2010-2011 outcomes. Multilevel modeling and simple risk-adjusted modeling has similar predictive power.

55. Guglielminotti J, Wong CA, Landau R, et al. Temporal Trends in Anesthesia-Related Adverse Events in Cesarean Deliveries, New York State, 2003-2012. Anesthesiology 2015;123:1013-23.

Improving patient safety by reducing preventable harm should be a goal of everyone. This study examined the incidence of anesthesia-related adverse events (ARAE) in New York from 2003 to 2012 among 785,000 cesarean deliveries. The incidence of ARAE was 730 per 100,000 deliveries, with a decrease in the rate over the study period. At the same time, the rate of non-anesthesia adverse events increased. The vast majority (94%) of ARAE were minor, with headache representing half of these. Major adverse events were strongly associated with maternal mortality. There was a decrease in both minor (23%) and major (43%) adverse events over the study period, despite an increase in maternal comorbidity indices.

56. Hameed AB, Lawton ES, Mccain CL, et al. Pregnancy-Related Cardiovascular Deaths in California: Beyond Peripartum Cardiomyopathy. American Journal of Obstetrics and Gynecology 2015;213:379 e1-10.

Cardiac disease is an increasingly important cause of maternal mortality. This examination of cardiovascular deaths in California from 2002 to 2006 found 64 deaths (2.35 per 100,000), with two-thirds due to dilated cardiomyopathy, and the remaining mostly due to pulmonary hypertension and aortic dissection. African-American women were 8 times more likely to have a cardiovascular death; other associations were public insurance and poor prenatal care, hypertension and obesity. The study review committee felt that there was a strong chance to alter the outcome in 24% of cases with better and earlier diagnosis and treatment.

57. Heesen M, Bohmer J, Brinck EC, et al. Intravenous Ketamine During Spinal and General Anaesthesia for Caesarean Section: Systematic Review and Meta-Analysis. Acta Anaesthesiologica Scandinavica 2015;59:414-26.

Ketamine is occasionally used in obstetric anesthesia for maternal pain control during cesarean delivery. This meta-analysis concluded that after intravenous ketamine use, the time to first analgesic request after cesarean delivery is slightly delayed, and there is a small reduction in overall pain and analgesic medication requirement. Side effects were similar between ketamine and control groups. The doses varied greatly among the studies. There was no benefit when used as an adjunct after general anesthesia.

58. Higuchi H, Takagi S, Zhang K, et al. Effect of Lateral Tilt Angle on the Volume of the Abdominal Aorta and Inferior Vena Cava in Pregnant and Nonpregnant Women Determined by Magnetic Resonance Imaging. Anesthesiology 2015;122:286-93.

Previous evaluations of aortocaval compression during pregnancy have used radiography with single images, or MRI with limited number of subjects. This study evaluated 10 parturients and 10 control subjects who were placed in the MRI scanner at various angles (0, 15, 30, 45 degrees). Non-pregnant women had no differences in the size of their great vessels at any angle. Pregnant women had compression of the vena cava at 0 and 15 degrees, with relief at 30 degrees. Minimal difference was noted between 30 and 45 degrees. No evidence of artic compression was noted. Finally, there were no hemodynamic consequences to any tilt in the pregnant women. Of note, women who experienced supine hypotension syndrome were eliminated from the study (i.e. those who would have had hemodynamic consequences).

59. Hirtz DG, Weiner SJ, Bulas D, et al. Antenatal Magnesium and Cerebral Palsy in Preterm Infants. The Journal of Pediatrics 2015;167:834-9 e3.

Magnesium is used for the prevention of neonatal ischemic injury and cerebral palsy. In this large, multicenter study, magnesium given prior to 32 weeks was associated with decreased risk of echo-densities and echo-lucencies on cranial ultrasound. This explains only part of the reduction of cerebral palsy. No MRI data was collected, which might have been a better method.

60. Holcomb JB, Tilley BC, Baraniuk S, et al. Transfusion of Plasma, Platelets, and Red Blood Cells in a 1:1:1 Vs a 1:1:2 Ratio and Mortality in Patients with Severe Trauma: The PROPPR Randomized Clinical Trial. Journal of the American Medical Association 2015;313:471-82.

Separation of whole blood into component therapies allows for a greater number of patients to receive necessary and specific treatment. Recent studies of the resuscitation of trauma patients has suggested that there might be a survival benefit to a ratio of blood components that is closer to whole blood (1:1:1), when compared to a red cell heavy transfusion strategy (1:1:2). This prospective comparison of 1:1:1 versus 1:1:2 transfusion strategies in the initial care of the trauma patient found no difference in 24-hr or 30-day mortality. Furthermore, there was no difference in transfusion-related complications. Fewer patients in the 1:1:1 exsanguinated in the first hour (~10 patients total) and this led to fewer exsanguination deaths in the first 24 hours. After the initial resuscitation period, patients receiving the lower ratio did require additional plasma to normalize coagulation testing. Despite the predetermined outcomes of the study being negative, the authors recommend the higher ratio for trauma patients.

61. Hu LQ, Zhang J, Wong CA, et al. Impact of the Introduction of Neuraxial Labor Analgesia on Mode of Delivery at an Urban Maternity Hospital in China. International Journal of Gynaecology and Obstetrics 2015;129:17-21.

This study examined the effects of instituting a labor analgesia program in a hospital in China. Prior to the program, no labor analgesia was used at the center. Baseline and post-program rates of labor analgesia, cesarean delivery, episiotomy and neonatal depression (APGAR<3) were captured. There was a steady increase in the use of labor analgesia, and a decrease in the cesarean delivery rate, episiotomy rate, and improvement in neonatal depression, despite an increase in the delivery volume.

62. Husk JS, Keim SA. Breastfeeding and Autism Spectrum Disorder in the National Survey of Children's Health. Epidemiology 2015;26:451-7.

Small studies have suggested that breastfeeding is protective for autism spectrum disorder in the child. In this large study of data collected by telephone survey, breast feeding (either partial or exclusive) for any period of time was not associated with a reduction in the incidence of autism spectrum disorder.

63. Islam MT, Yoshimura Y. Rate of Cesarean Delivery at Hospitals Providing Emergency Obstetric Care in Bangladesh. International Journal of Gynaecology and Obstetrics 2015;128:40-3.

This evaluation of obstetric care in Bangladesh found that, among the hospitals involved with government sponsored safe motherhood programs, the increase in obstetric care, access and training resulted in an increased the cesarean delivery rate (16% to 36%). The most common indications were repeat, fetal distress and long labor. The authors were concerned that unnecessary cesarean deliveries were being performed, although the complication rate was low and there were no mortalities.

64. Jeejeebhoy FM, Zelop CM, Lipman S, et al. Cardiac Arrest in Pregnancy: A Scientific Statement from the American Heart Association. Circulation 2015;132:1747-73.

Cardiac arrest during pregnancy is rare, occurring in about 1:12,000 delivery admissions. While most aspects of cardiac resuscitation are similar to the non-pregnant protocol, some differences do exist. This is the first evidence-based expert consensus document detailing recommendations for maternal cardiac arrest. A MUST!

65. Kessous R, Shoham-Vardi I, Pariente G, et al. Long-Term Maternal Atherosclerotic Morbidity in Women with Pre-Eclampsia. Heart 2015;101:442-6.

This investigation of a longitudinal database assessed the association between preeclampsia (Pre-E) and future development of cardiovascular disease (CVD). The mean follow-up of patients was 11 years. The authors found a significant relationship between Pre-E and CVD, which has been demonstrated previously. Unique to this study was the investigation of both severity of the Pre-E and the recurrence in subsequent pregnancies. There was a significant correlation between severe and recurrent Pre-E and future CVD.

66. Khaw KS, Lee SW, Ngan Kee WD, et al. Randomized Trial of Anaesthetic Interventions in External Cephalic Version for Breech Presentation. British Journal of Anaesthesia 2015;114:944-50.

The use of neuraxial anesthesia has been reported to increase the success rate of external cephalic version. This study aimed to determine whether the facilitation of version was due to analgesia or anesthesia. In Phase 1, women were randomized to three groups: spinal anesthesia, vs. remifentanil analgesia vs. standard care. Spinal anesthesia resulted in greater success (83%) than either analgesia or standard care (64% for both). In Phase 2, the 18 unsuccessful standard care patients were randomized to spinal anesthesia vs. remifentanil analgesia, and 7/9 successfully verted in the anesthesia cohort, whereas none did with analgesia. Of the secondary endpoints, pain was lowest with spinal anesthesia, sedation highest with remifentanil.

67. Kovacheva VP, Soens MA, Tsen LC. A Randomized, Double-Blinded Trial of a "Rule of Threes" Algorithm Versus Continuous Infusion of Oxytocin During Elective Cesarean Delivery. Anesthesiology 2015.

Methods of oxytocin administration vary both by facility and by provider. High doses are known to be associated with side effects and adverse events. This study compared two methods of administration in a placebo controlled, blinded randomized fashion. 60 patients were randomized to receive either a timed bolus administration or a continuous infusion of oxytocin (1 IU per min). There were no differences in uterine tone, blood pressure or side effects. The mean dose of oxytocin received was about half in the timed-rule group (4 vs. 8.4 IU).

68. Kovesdy CP, Norris KC, Boulware LE, et al. Association of Race with Mortality and Cardiovascular Events in a Large Cohort of US Veterans. Circulation 2015;132:1538-48.

The racial differences in outcome can be attributed to various causes. This study examining the US Veterans' Administration examined the outcomes of more than 2 million patients between 1999 and 2004. African American patients had lower overall mortality, and coronary heart disease. Because the Veterans' Administration provides equal opportunity for care, this study demonstrated that it is conceivably possible to improve the disparity in maternal mortality.

69. Lannon SM, Guthrie KA, Vanderhoeven JP, et al. Uterine Rupture Risk after Periviable Cesarean Delivery. Obstetrics and Gynecology 2015;125:1095-100.

This retrospective cohort study examined the incidence of uterine rupture after cesarean delivery in the state of Washington. The cohorts being compared included periviable (22 to 26 weeks) vs. viable (36+ weeks) gestation. Cesarean delivery at periviability compared with term was associated with an increased risk for uterine rupture in a subsequent pregnancy, even after accounting low transverse incision. This study is limited by the retrospective nature, and by several important differences between cohorts, including maternal age, race, hypertension and tobacco use.

70. Lavecchia M, Abenhaim HA. Cardiopulmonary Resuscitation of Pregnant Women in the Emergency Department. Resuscitation 2015;91:104-7.

This study examined the retrospective outcomes of pregnant women who received CPR in the emergency room compared to age-matched controls. The 157 pregnant women had better overall survival of 36.9% compared to 25.9% than those who were not pregnant women. Among subgroup analysis of patients having a cardiac arrest, non-traumatic injury and being in a setting of an urban teaching hospitals were found to have the best outcomes for pregnant women.

71. Lavigne-Lissalde G, Aya AG, Mercier FJ, et al. Recombinant Human FVIIa for Reducing the Need for Invasive Second-Line Therapies in Severe Refractory Postpartum Hemorrhage: A Multicenter, Randomized, Open Controlled Trial. Journal of Thrombosis and Haemostasis 2015;13:520-9.

This randomized open-label trial of activated Factor VII for the use in severe postpartum hemorrhage was carried out in eight centers. Of note, much of the clinical treatment of hemorrhage was left to the clinicians in the field. Eighty-four (84) patients were enrolled in the setting of hemorrhage treated with standard methods followed by a one-hour sulprostone infusion (prostaglandin E2). Patients were randomized to receive FVIIa or standard care (no additional uterotonics). The composite outcome was statistically significant for the intervention arm (93% of standard care vs. 52% of intervention arm); there were no differences in blood transfusions between groups. Two patients in the intervention group had postpartum thrombotic events, with one having a PE.

72. Leffert LR, Clancy CR, Bateman BT, et al. Hypertensive Disorders and Pregnancy-Related Stroke: Frequency, Trends, Risk Factors, and Outcomes. Obstetrics and Gynecology 2015;125:124-31.

Pregnancy related stroke has increased in prevalence in the past 20 years. In this study, strokes were identified from a database of 81 million admissions (not individual patients). The incidence of strokes has increased by 61% over the 20-year period, with a higher rate among patients with hypertensive disorders of pregnancy (100% increase) than normotensive patients (45% increase). Thirty-one percent (31%) of all strokes occurred in patients with hypertensive disorders of pregnancy and most (69%) were in patients who were normotensive. Strokes in women with hypertensive disorders were associated with more frequent complications and death and having traditional risk factors as well as hypertensive disorders compounded the risk.

73. Li Y, Townend J, Rowe R, et al. Perinatal and Maternal Outcomes in Planned Home and Obstetric Unit Births in Women at 'Higher Risk' of Complications: Secondary Analysis of the Birthplace National Prospective Cohort Study. British Journal of Obstetrics and Gynaecology 2015;122:741-53.

The data suggests that, in a healthcare system that is designed accordingly, low-risk parturients who deliver at home or in a birthing center have comparable outcomes with fewer interventions and fewer cesarean deliveries. Little is known about what comorbidities or obstetric conditions define low- vs. high- risk. This study was a secondary analysis of the outcomes of 8180 high-risk women in England: 6691 planned a hospital birth and 1489 planned a home birth. These subjects were previously collected in a cohort of 79,000 deliveries. Significant differences between these groups existed, including the hospital birth group being more frequently nulliparous, having multiple risk factors and especially medical risk factors. The hospital birth group had a higher composite outcome due to neonatal NICU admissions; when this was removed the trend was reversed (not statistically significant due to small number of events). Compared with low-risk women, high-risk women who planned a home birth had a significantly higher risk of an adverse perinatal outcome. While this study is underpowered, it begins to shed light on the question of who should not be encouraged to have a homebirth.

74. Lilley G, Burkett-St-Laurent D, Precious E, et al. Measurement of Blood Loss During Postpartum Haemorrhage. International Journal of Obstetric Anesthesia 2015;24:8-14.

Visual estimation of blood loss has been documented in multiple studies to underestimate the actual volume. In this study, the authors developed a gravimetric system of estimating blood loss. The study then tested the error of visual estimation among clinicians in a simulated environment. There was a 34% error in visual estimation of blood loss (overestimation) but only 4% of gravimetric. They then evaluated the real-case hemorrhages to assess the performance of their gravimetric system. The found good correlation ($r = 0.7$) with drop in hemoglobin concentration, with larger EBL having better correlation.

75. Lista G, Boni L, Scopesi F, et al. Sustained Lung Inflation at Birth for Preterm Infants: A Randomized Clinical Trial. Pediatrics 2015;135:e457-64.

Bronchopulmonary dysplasia (BPD) remains a devastating complication of prematurity. Although the pathogenesis of BPD is multifactorial, damage from mechanical ventilation is believed to play an important role. Immediate ventilatory support with CPAP and PEEP in the delivery room have been shown to reduce the need for mechanical ventilation. The authors investigated the use of a sustained lung inflation (SLI) on the incidence of mechanical ventilation at 72 hours in a multicenter randomized study. Of note, the study was randomized, but was not blinded. There was a slight reduction in the need for mechanical ventilation at 72 hours (68% to 55%, p=0.04). However, all other outcomes, including the incidence of BPD at 36 weeks were similar. The SLI group had non-significantly higher incidence of pneumothorax and interstitial emphysema. SLI does not appear to reduce the incidence of BPD, despite a slight reduction in MV at 72 hours. This may be due to a recruitment on FRC in premature lungs with the use of PEEP, but without an effect on the course of the disease.

76. Liu X, Landon M.B., Cheng W, et al. Cesarean Delivery on Maternal Request in China: What Are the Risks and Benefits? American Journal of Obstetrics and Gynecology 2015;212:817 e1-9.

The rate of cesarean delivery has increased internationally for multiple reasons. In China, the one-baby policy has led to a very high rate of cesarean delivery (CD: 46%) and of CD with no medical indication (12%). This study examined 66,000 deliveries from the International Peace Maternity & Child Healthcare Hospital (IPMCHH), Shanghai, China over the course of seven years. Maternal and neonatal outcomes were compared between women who attempted a vaginal delivery (61%, 40,000) and those who requested a cesarean without indication (25%, 16,000). There were no differences in maternal outcomes, including death, hemorrhage, embolism, infection of ICU admission. The neonatal outcome slightly favored on-demand cesarean delivery, with reductions in birth trauma (0.2% vs. 1.1%) neonatal infection (0.4% vs. 0.7%), and encephalopathy (0.4% vs. 1.8%). This data suggests that for nulliparous patients, a primary cesarean on maternal request may not have negative maternal consequences and may improve neonatal outcomes.

77. Loftfield E, Freedman ND, Graubard BI, et al. Association of Coffee Consumption with Overall and Cause-Specific Mortality in a Large US Prospective Cohort Study. American Journal of Epidemiology 2015;182:1010-22.

This study examined the impact of coffee intake on 90,000 subjects over a four-year period. The data was collected as part of a longitudinal cancer trial (the Prostate, Lung, Colorectal and Ovarian Cancer Screening Trial). Coffee (both caffeinated and decaf) reduce the risk of death during the study period. Drink 2 to 5 cups a day and don't feel guilty!

78. Looney AM, Walsh BH, Moloney G, et al. Downregulation of Umbilical Cord Blood Levels of Mir-374a in Neonatal Hypoxic Ischemic Encephalopathy. The Journal of Pediatrics 2015;167:269-73 e2.

MicroRNA modulates gene expression and resultant protein synthesis, and importantly the expression of microRNA changes with physiologic and disease states. In this study, term infants were identified and umbilical cord blood sampled for microarray analysis (73 total infants, 18 controls, 33 with perinatal asphyxia, and 19 with hypoxic ischemic encephalopathy). Umbilical cord blood was associated with down regulation of 67 of the measured microRNA, and upregulation of three. While the clinical meaning of this remains to be determined, this study is the first to demonstrate that there is a specific microRNA identified in cord blood that correlated with neonatal ischemic synthesis.

79. Lyell DJ, Faucett AM, Baer RJ, et al. Maternal Serum Markers, Characteristics and Morbidly Adherent Placenta in Women with Previa. Journal of Perinatology 2015;35:570-4.

This study assessed maternal serum biomarkers for evidence of abnormally adherent placentation among 736 women with placenta previa who proceeded to cesarean delivery. Thirty seven (37) of these patients had an accreta confirmed at delivery. Among women with a previous cesarean delivery, high levels of pregnancy-associated plasma protein-A (PAPP-A) had a relative risk of placenta accreta of 8.7. Of the 37 women with confirmed abnormal placentation, 23 (62.2%) underwent cesarean hysterectomy and 32 (86.5%) experienced a postpartum hemorrhage, compared with 9 (1.3%) cesarean hysterectomy and 244 (34.9%) with hemorrhage if the diagnosis was only a previa. This may aid in the early diagnosis and treatment planning for patients with suspected accreta.

80. Lyons R, Lazzara EH, Benishek LE, et al. Enhancing the Effectiveness of Team Debriefings in Medical Simulation: More Best Practices. Joint Commission Journal of Quality and Patient Safety 2015;41:115-25.

Teamwork is essential for optimal patient care. An important component of teamwork is debriefing - after events, after

training, or after routine care. This article identifies 13 best practices believed to be important to for optimal debriefing that should be used to enhance the safety culture at every center.

81. MacDorman MF, Reddy UM, Silver RM. Trends in Stillbirth by Gestational Age in the United States, 2006-2012. Obstetrics and Gynecology 2015;126:1146-50.

This assessment of national stillbirth rate (fetal mortality >20 weeks) from 2006 to 2012 examined the effect of preventing elective deliveries prior to 39 weeks. The rate of still births by gestational age remained the same throughout the study period. There is an increase in the rate of stillbirth that peaks in the 20-22 week range, and then tapers until 38 weeks. The authors claim that this is evidence that adhering to the 39-week limit for inductions / delivery has not resulted in an increase in stillbirths.

82. Maged AM, Helal OM, Elsherbini MM, et al. A Randomized Placebo-Controlled Trial of Preoperative Tranexamic Acid among Women Undergoing Elective Cesarean Delivery. International Journal of Gynaecology and Obstetrics 2015;131:265-8.

Tranexamic acid (TXA), an antifibrinolytic agent, has been used to treat bleeding in gynecology, urology, as well as cardiac surgery, liver transplantation and orthopedic surgery. The efficacy in obstetric hemorrhage remains less defined. This study examined the use of prophylactic TXA during cesarean delivery. Two hundred (200) patients were randomized to 1 g TXA given 5 minutes prior to incision vs. placebo. Patients also received oxytocin and IM methergine after delivery. The estimated blood loss (EBL) was calculated from the change in hematocrit. The difference in EBL was statistically significant (460 ml vs. 700 ml). While awaiting the results of the WOMAN trial, this is of interest, but does not change practice.

83. Magee LA, Von Dadelszen P, Rey E, et al. Less-Tight Versus Tight Control of Hypertension in Pregnancy. The New England Journal of Medicine 2015;372:407-17.

The Control of Hypertension in Pregnancy Study was conducted as an open, multicenter, international, randomized, controlled trial to compare tight vs. not tight control of hypertension in patients with non-proteinuric hypertension in pregnancy (chronic or gestational). Mean protocol time was 11 to 12 weeks in each group. There were no maternal or perinatal differences between groups.

84. Main EK, Goffman D, Scavone BM, et al. National Partnership for Maternal Safety: Consensus Bundle on Obstetric Hemorrhage. Anesthesia and Analgesia 2015;121:142-8.

The Council on Patient Safety in Women's Health Care commissioned a hemorrhage bundle with the goal of defining evidence-based recommendations on four categories: Readiness, Recognition and Prevention, Response, and Reporting and Systems Learning. The goal is to promote quality improvement projects at facilities to reduce morbidity and mortality from obstetric hemorrhage.

85. Main EK, McCain CL, Morton CH, et al. Pregnancy-Related Mortality in California: Causes, Characteristics, and Improvement Opportunities. Obstetrics and Gynecology 2015;125:938-47.

The California Pregnancy-Associated Mortality Review collects extensive data on maternal mortality in California. This database was evaluated for the years 2002 to 2005, which included 2,163,457 live births and 207 pregnancy-related deaths (out of 732 pregnancy-associated deaths). Cardiovascular disease was the leading cause of death (2.3 per 100,000) with African American women being disproportionately represented. Preeclampsia (1.7 per 100,000), hemorrhage and thromboembolism (both 0.9) and AFE (0.8). 41% of deaths were believed to be preventable, with hemorrhage (70%) and preeclampsia (60%) being most common.

86. Mallaiah S, Barclay P, Harrod I, et al. Introduction of an Algorithm for ROTEM-Guided Fibrinogen Concentrate Administration in Major Obstetric Haemorrhage. Anaesthesia 2015;70:166-75.

Uncontrolled observational study examining the use of a protocol using ROTEM measured fibrinogen effect. The A5 measure, available in 5 minutes, correlates with fibrinogen level. The authors used the A5 to guide administration of fibrinogen concentrate. This was compared with their experience using 'Shock packs' containing 1:1 FFP:pRBC. They found fewer cases of TACO, and trend toward better outcomes.

87. Marcus H, Gerbershagen HJ, Peelen LM, et al. Quality of Pain Treatment after Caesarean Section: Results of a Multicentre Cohort Study. European Journal of Pain 2015;19:929-39.

This was a review of pain scores and opioid consumption after cesarean delivery in Germany. Women who did not receive a PCA had the highest pain scores and reported wishing for more pain medication. The use of a PCA was still associated with poor pain control. Neuraxial opioids were not used (est. 4%). The primary reason to not use more pain medication was due the effects on the infant during breastfeeding.

88. Maxwell JR, Denson JL, Joste NE, et al. Combined in Utero Hypoxia-Ischemia and Lipopolysaccharide Administration in Rats Induces Chorioamnionitis and a Fetal Inflammatory Response Syndrome. Placenta 2015;36:1378-84.

This laboratory study attempted to produce a model of chorioamnionitis; the hope is to study the fetal neurologic effects in future investigations. This model consisted of transient hypoxia-ischemia of the fetus, followed by lipopolysaccharide injection into the amniotic fluid. Pro-inflammatory cytokines and biomarkers of fetal inflammation developed within one day. This mimics the inflammatory processes of chorioamnionitis.

89. Mcnamara DM, Elkayam U, Alharethi R, et al. Clinical Outcomes for Peripartum Cardiomyopathy in North America: Results of the IPAC Study (Investigations of Pregnancy-Associated Cardiomyopathy). Journal of the American College of Cardiology 2015;66:905-14.

Peripartum cardiomyopathy is a significant cause of maternal morbidity and mortality. This prospective, 30 center collaborative studied 100 women with the diagnosis of PPCM over three years. There were six major events (4 deaths, 4 LVAD implantations, and 1 heart transplantation), with more events occurring in patients with a lower ejection fraction (<30%). Women who presented early in the postpartum course, had a baseline higher EF tended to recover cardiac function to a greater extent. African American were less likely to recover systolic function after diagnosis.

90. Mendola P, Mumford SL, Mannisto TI, et al. Controlled Direct Effects of Preeclampsia on Neonatal Health after Accounting for Mediation by Preterm Birth. Epidemiology 2015;26:17-26.

Preeclampsia is known to be associated with poor neonatal outcomes; however, the degree to which these outcomes are solely a function of preterm birth is unclear. This study examined a database of over 200,000 births and compared the neonatal outcome for both preterm and term deliveries between normotensive and preeclamptic mothers. Extensive statistical modelling was performed to ensure the most robust results. Preeclampsia was associated with greater neonatal morbidity even accounting for preterm birth, including an increased odds of perinatal mortality, Small for gestational age, NICU admission, and respiratory distress syndrome, as well as increased odds at term for transient tachypnea of newborn, peri- or intraventricular hemorrhage, apnea, and asphyxia.

91. Milne ME, Yazer MH, Waters JH. Red Blood Cell Salvage During Obstetric Hemorrhage. Obstetrics and Gynecology 2015;125:919-23.

Intraoperative red blood cell salvage and reinfusion remains controversial in obstetrics. While the safety seems to be adequate for clinical acceptance, the utilization and cost are poorly defined. The cost of setting up the machine is (est.) $64 while reinfusing units if successful add another $62. This retrospective review of 8 years examined the success of cell salvage overall, and also by indication. Of the 884 patients, only 21% (189) received reinfused blood. The indication that appeared most appropriate was cesarean hysterectomy (79% of cases) and postpartum hemorrhage ((69% of cases), while simple cesarean delivery was not likely to require reinfusion (13% of cases). It is not clear from the report whether cases of cesarean hysterectomy were identified preoperatively or during the case.

92. Mohta M, Harisinghani P, Sethi AK, et al. Effect of Different Phenylephrine Bolus Doses for Treatment of Hypotension During Spinal Anaesthesia in Patients Undergoing Elective Caesarean Section. Anaesthesia and Intensive Care 2015;43:74-80.

The treatment of hypotension after spinal anesthesia remains a heavily discussed topic. Phenylephrine dosing varies among centers and studies between bolus dosing and continuous infusion. In this randomized study comparing three doses of phenylephrine administered by bolus, these authors found that 100 mcg, 125 mcg, and 150 mcg were equally effective at treating the first episode of hypotension. Furthermore, there was no difference in side effects, including N/V, hypertension or bradycardia, or need for further treatment. Neonatal outcome, including blood gas analysis was similar between groups.

93. Molina G, Weiser TG, Lipsitz SR, et al. Relationship between Cesarean Delivery Rate and Maternal and Neonatal Mortality. Journal of the American Medical Association 2015;314:2263-70.

The World Health Organization recommends that the cesarean delivery rate for countries be limited to 10 to 15 percent. This analysis of contemporary outcomes studied national cesarean rates and examined both maternal and neonatal mortality. Cesarean rates below 19% were associated with increased maternal and neonatal mortality. Above 20% the outcomes were stable among countries in terms of neonatal and maternal mortality. The ideal modern cesarean rate is likely above 20%.

94. Morelius E, Ortenstrand A, Theodorsson E, et al. A Randomised Trial of Continuous Skin-to-Skin Contact after Preterm Birth and the Effects on Salivary Cortisol, Parental Stress, Depression, and Breastfeeding. Early Human Development 2015;91:63-70.

Skin to skin contact (SSC) has been demonstrated to be of mild benefit to term births. The effects on preterm infants was investigated in this study. Families were randomized pre-birth to continuous (~19 hours) of SSC versus standard care (voluntary SSC which resulted in approximately 6 hours per day). Infants were similar at birth. The measured outcomes were salivary cortisol, measured in both mom and infant, as well as stress and depression scales. The infants in the SSC group had lower response to diaper change at one month and lower baseline resting cortisol at 4 months. The correlation of cortisol in response to stress between mom and infant was present in the SSC group. Fathers in the SSC group were slightly more distressed.

95. Morgan L, New S, Robertson E, et al. Effectiveness of Facilitated Introduction of a Standard Operating Procedure into Routine Processes in the Operating Theatre: A Controlled Interrupted Time Series. BMJ Quality & Safety 2015;24:120-7.

Workflow consistency, including devices such as checklists, has been demonstrated to improve productivity in many industries. Translation into the operating room has been promoted as a method to enhance patient safety. In this study, a group of Standard Operating Procedures (SOP) were developed in operating theaters using a cohort control/active design. A pre-intervention period of assessment was undertaken, followed by training in the Active group. Staff were the cornerstone of the SOP development, including timeouts and sign outs. A PDCA cycle of training and education was used to ensure best practice. The outcomes measured were time, glitches, readmissions, and completion of timeouts and sign outs using a validated measuring devices. After the training period, the Active and Control groups were indistinguishable. The glitch rate increased in both groups which was believed to be due to a new IT system.

96. Morgan L, Pickering SP, Hadi M, et al. A Combined Teamwork Training and Work Standardisation Intervention in Operating Theatres: Controlled Interrupted Time Series Study. BMJ Quality & Safety 2015;24:111-9.

Patient safety can be achieved through process improvement and systems engineering. The study examined two quality improvement methods, used in combination, to attempt to determine if they could enhance patient safety in orthopedics. Standard Operating Procedures (SOP) and Crew Resource Management (CRM) team training. The combination of the two produced improvements in non-technical skills and improved completion of checklists, but did not significantly impact technical performance or clinical outcomes.

97. Murphy M, Butler M, Coughlan B, et al. Elevated Amniotic Fluid Lactate Predicts Labor Disorders and Cesarean Delivery in Nulliparous Women at Term. American Journal of Obstetrics and Gynecology 2015;213:673 e1-8.

Muscle fatigue leads to the production of lactic acid. This study of 905 consecutive nulliparous women found that women with higher amniotic fluid lactate levels has higher rates of labor dystocia and were more likely to require an operative delivery. Unfortunately, the only laboratory machine available for this measurement is currently unavailable for clinical use - but this may eventually add information in the management of labor dystocia.

98. Mushambi MC, Kinsella SM, Popat M, et al. Obstetric Anaesthetists' Association and Difficult Airway Society Guidelines for the Management of Difficult and Failed Tracheal Intubation in Obstetrics. Anaesthesia 2015;70:1286-306.

This paper documents the obstetric-specific difficult airway guidelines for the UK. Three algorithms cover 1) preparation of the theatre, team, and patient, 2) failed intubation, and 3) can't intubate / can't ventilate situations. While the incidence of death from failed maternal airway has decreased, the incidence of failed intubation has not changed; one can never be too prepared for this challenge.

99. Nair M, Kurinczuk J, Brocklehurst P, et al. Factors Associated with Maternal Death from Direct Pregnancy Complications: A UK National Case-Control Study. British Journal of Obstetrics and Gynaecology 2015;122:653–662.

This was an unmatched case-control retrospective analysis of direct maternal mortality in the UK collected from national data. Cases of mortality (n=135) were obtained primarily from the M.B.RRACE-UK database (2009 to 2012). The comparative cohort of patients with life-threatening complications were obtained from the UK Obstetric Surveillance System (UKOSS n=1661) database during the period of 2005 to 2013. Six factors accounted for 70% of the maternal mortality, including poor antenatal care; substance misuse; medical comorbidities; hypertensive disorders of pregnancy; previous pregnancy problems; and Indian ethnicity. Several medical comorbidities, including asthma, autoimmune diseases, inflammatory/atopic disorders, mental health problems, essential hypertension, hematological disorders, musculoskeletal disorders, and infections, contributed 49% to the increased risk of fatality.

100. Nathan H, El Ayadi A, Hezelgrave N, et al. Shock Index: An Effective Predictor of Outcome in Postpartum Haemorrhage? British Journal of Obstetrics and Gynaecology 2015;122:268-75.

Hemorrhage remains the leading cause of maternal mortality worldwide and a leading cause of morbidity in high income countries. The authors postulate that early identification of hemorrhage using the Shock Index (SI = HR/SBP) might capture women at an earlier stage of hemorrhage where intervention could possibly lead to improved outcome. They then studied 10000 deliveries at a single center (high income country), and identified 243 women with PPH>1500 (no description of method). SI was calculated for these women and was highest 15 min after identification of PPH. SI was associated with ICU admission and transfusion, but not a hemoglobin <7g/dl or the need for surgical intervention. There was marginal difference in the SI compared to using HR, SBP, DBP, or PP alone. The target of this study was low income countries, but the index does not appear to be of distinct value.

101. Neal JL, Lamp JM, Lowe NK, et al. Differences in Inflammatory Markers between Nulliparous Women Admitted to Hospitals in Pre-active Vs Active Labor. American Journal of Obstetrics and Gynecology 2015;212:68 e1-8.

The inflammatory system is involved in preparation and activation of the myometrium for labor. Blood samples were obtained from women <6 cm of cervical dilation at admission, and at 2 and 4 hours. They found that neutrophils, IL-6, and IL-10 were in greater concentrations among low-risk, nulliparous women admitted in active labor as compared with women in pre-active labor. IL-8, macrophages, and TNF-a were not increased. The levels also increased in both groups over the 4 hours. Inflammation is an essential component of active labor.

102. Ngai IM, Van Arsdale A, Govindappagari S, et al. Skin Preparation for Prevention of Surgical Site Infection after Cesarean Delivery: A Randomized Controlled Trial. Obstetrics and Gynecology 2015;126:1251-7.

This study compared the efficacy of skin prep for cesarean surgery of chlorhexidine-alcohol vs. povidone-iodine with alcohol vs. a combination of both. Forteen hundred (1400) parturients were randomized to three groups, resulting in about 455 per group after dropouts. There were no differences between group based on skin prep. Higher BMI, hemorrhage, surgical time, preeclampsia, and dysfunctional labor were risk factors for surgical site infection.

103. Ngan Kee WD, Lee SW, Ng FF, et al. Randomized Double-Blinded Comparison of Norepinephrine and Phenylephrine for Maintenance of Blood Pressure During Spinal Anesthesia for Cesarean Delivery. Anesthesiology 2015;122:736-45.

This study compared the effectiveness of norepinephrine vs. phenylephrine for the management of spinal-anesthesia induced hypotension for cesarean delivery. One hundred and four (104) parturients (101 completed study) were randomized using a computer-controlled infusion program. The computer maintained blood pressure in the programmed range in both groups. The cardiac output was 10% higher in the norepinephrine group as was the heart rate. Calculated stroke volume was similar between groups. Under these tight study conditions, norepinephrine was effective due to the increased heart rate. The safety of this medication will need to be evaluated in multiple contexts.

104. Nguyen-Lu N, Carvalho JC, Farine D, et al. Carbetocin at Cesarean Delivery for Labour Arrest: A Sequential Allocation Trial to Determine the Effective Dose. Canadian Journal of Anaesthesia 2015;62:866-74.

Women who require cesarean delivery after failure to progress in labor have higher requirements for oxytocin to achieve

adequate uterine tone compared to those who have elective, non-laboring surgery. Carbetocin, a synthetic oxytocin analogue with a longer half-life, was studied in using an up/down sequential allocation technique, with a biased coin design to estimate the ED90. The ED90 was found to be above the package insert recommended dose (121 mcg; 95%CI 111 to 130); however, this was suspected of being an underestimate. Unfortunately, the side effect profile was also significant, with 80% of patients having at least one side effect, the most common being tachycardia (57.5%), hypotension (45%), and nausea (37.5%).

105. Nguyen-Lu N, Downey K, Carvalho JC. Controversy between Anesthesiologists and Obstetricians on the Labour Ward: The Delphi Method Is Used as a Consensus-Building Technique. Canadian Journal of Anaesthesia 2015;62:271-7.

This study used a Delphi methodology to identify topic of disagreement between anesthesiologists and obstetricians. Each specialty created a list of topics using the iterative method. These were then cross referenced between specialties. Both groups substantially agreed with the list of topics developed by the other, although the obstetricians often disagreed with the explanation created by the anesthesiologists. This is a good read.

106. Noskova P, Blaha J, Bakhouche H, et al. Neonatal Effect of Remifentanil in General Anaesthesia for Caesarean Section: A Randomized Trial. BMC Anesthesiol 2015;15:38.

Unless indicated, many practitioners avoid opioid medications prior to delivery during cesarean section under general anesthesia. Due to a very short half-life, remifentanil has been suggested as a way to provide maternal analgesia during laryngoscopy, while avoiding neonatal depression. This double blind, randomized study compared 1 mcg/kg of remifentanil vs. placebo in 151 parturients. There was a greater incidence of 1-minute APGAR score <8 and of the need for tactile stimulation to encourage breathing in the neonate. However, by 5 minutes this difference had disappeared. Maternal hemodynamics (maximum systolic BP and HR) were lower in the remifentanil group. With the knowledge that a transient depression of the newborn is likely, remifentanil may aid in controlling maternal hemodynamics during induction of general anesthesia.

107. Ogawa S, Tanaka KA, Nakajima Y, et al. Fibrinogen Measurements in Plasma and Whole Blood: A Performance Evaluation Study of the Dry-Hematology System. Anesthesia and Analgesia 2015;120:18-25.

Fibrinogen represents 85% of the proteins responsible for clot formation. A depletion of fibrinogen has been associated with a greater severity of postpartum hemorrhage. The current methods to measure fibrinogen (Clauss and Prothrombin-derived) require extensive time, or may be inaccurate in the presence of heparin or colloids. This investigation examined a novel method (Dry hematology system (DH)) of measuring fibrinogen in healthy volunteers, and also in samples from cardiac surgical patients. The DH was found to be a rapid and accurate measure of fibrinogen which correlated well with the Clauss method. The thromboelastometric fibrinogen measure (FIBTEM) showed lower correlation with the Clauss method than did the DH method.

108. Okabe T, Terashima H, Sakamoto A. Determinants of Liquid Gastric Emptying: Comparisons between Milk and Isocalorically Adjusted Clear Fluids. British Journal of Anaesthesia 2015;114:77-82.

Gastric emptying is essential to prevent major injury if aspiration should occur. This study demonstrated that milk emptied at a rate identical to other liquids of similar caloric size (orange juice). Liquid gastric emptying chiefly depends on total number of calories (energy density) rather than compositional differences such as fat content, osmolality, or viscosity. While performed in healthy volunteers, it poses an interesting question for obstetric NPO status.

109. Olufolabi AJ, Atito-Narh E, Eshun M, et al. Teaching Neuraxial Anesthesia Techniques for Obstetric Care in a Ghanaian Referral Hospital: Achievements and Obstacles. Anesthesia and Analgesia 2015;120:1317-22.

This paper describes the results of the Kybele organization's work in Ghana Ridge Regional Hospital starting in 2007 through 2011. Teams of volunteers spent 1 to 2 weeks at a time, 2 to 3 times a year, training local caregivers. These efforts resulted in a significant and sustained increase in spinal anesthesia for cesarean delivery (6% pre-program to 95% after completion) despite a large increase in cesarean volume. The effectiveness of spinal analgesia for labor pain control was poor, mostly due to manpower issues. This was an impressive success!

110. Ozkan Seyhan T, Orhan-Sungur M, Basaran B, et al. The Effect of Intra-Abdominal Pressure on Sensory Block Level of Single-Shot Spinal Anesthesia for Cesarean Section: An Observational Study. International Journal of Obstetric Anesthesia 2015;24:35-40.

Spinal anesthesia sensory height is affected by several known, and several hypothesized, factors. One such factor includes the pressure in the intra-abdominal cavity. This pressure is often used to explain the higher sensory block achieved in the parturient - without evidence. One hundred and forteen (114) women at term were enrolled during spinal anesthesia for cesarean. Intraabdominal pressure (IAP) was measured using intra-bladder catheter. When spinal height was T4, the IAP was measured. No correlation between sensory height and IAP was found. In essence, this study examined whether spinal height affects IAP, and not the other way around.

111. Paech M, Sng B, Ng L, et al. Methylnaltrexone to Prevent Intrathecal Morphine-Induced Pruritus after Caesarean Delivery: A Multicentre, Randomized Clinical Trial. British Journal of Anaesthesia 2015;114:469-76.

Pruritus is a common side effect of spinal morphine after cesarean delivery. A significant percentage of women report moderate or severe pruritus and request treatment for relief. This study of 137 women found no statistically significant difference between the methylnaltrexone, a peripherally acting mu- receptor antagonist, and placebo. The incidence of pruritus was 84% in the methylnaltrexone group vs. 88% in the placebo group.

112. Patel EM, Swamy GK, Heine RP, et al. Medical and Obstetric Complications among Pregnant Women with Cystic Fibrosis. American Journal of Obstetrics and Gynecology 2015;212:98 e1-9.

This evaluation of the US administrative database was performed to identify the complication rates among women with cystic fibrosis. Eleven hundred (1100) women out of 12 million had cystic fibrosis. Women with the disease were significantly more likely to die during admission (1000 vs. 7.3 per 100,000) and to have other complications. No difference in obstetric outcome or the incidence of hypertensive disorders was noted.

113. Patel S, Loveridge R. Obstetric Neuraxial Drug Administration Errors: A Quantitative and Qualitative Analytical Review. Anesthesia and Analgesia 2015;121:1570-7.

Errors happen; sometimes errors result in patient harm. This study collected the published case reports of medication errors during neuraxial anesthesia. Twenty-nine (29) cases were identified and were classified into 9 error categories. The authors then polled the 5 anesthetic department heads for their opinion on how to prevent these errors. Four practice patterns were recommended to prevent these errors.

114. Patterson JA, Irving DO, Isbister JP, et al. Age of Blood and Adverse Outcomes in a Maternity Population. Transfusion 2015;55:2730-7.

The duration of storage of red blood cells may affect the quality of the oxygen carrying capacity. Some, but not all, studies have demonstrated higher morbidity associated with 'old' stored blood. This study examined >2500 parturients who were transfused 1 to 4 units of blood (greater transfusion amounts were eliminated). Using generalized propensity matching, they were not able to detect any difference in outcome based on the age of blood received.

115. Peralta F, Higgins N, Lange E, et al. The Relationship of Body Mass Index with the Incidence of Postdural Puncture Headache in Parturients. Anesthesia and Analgesia 2015;121:451-6.

Post-dural puncture headache (PDPH) remains a common adverse event in obstetric anesthesia. Not all patients with a dural puncture experience a PDPH. This single-center retrospective study of 10 years of identified accidental dural punctures with a large-bore epidural needle found an incidence of 51% (263/518). There was an inverse association with BMI and a positive association with pushing in labor. Confounders in this study included the greater use of intrathecal catheters in the obese, but no difference in PDPH incidence was found with an intrathecal catheter.

116. Plamondon A, Akbari E, Atkinson L, et al. Spatial Working Memory and Attention Skills Are Predicted by Maternal Stress During Pregnancy. Early Human Development 2015;91:23-9.

Maternal stress during pregnancy has been shown to adversely affect the neonate, impacting attention and memory. The authors examined the effects of maternal stress, maternal anxiety, depression and maternal postnatal care on infants.

M.S.DP in the form of life events during pregnancy is associated with both attention skills and spatial working memory during early childhood. Also having some impact were child sex, MADP and/or maternal care.

117. Popic J, Pesic V, Milanovic D, et al. Induction of TNF-Alpha Signaling Cascade in Neonatal Rat Brain During Propofol Anesthesia. International Journal of Developmental Neuroscience 2015;44:22-32.

Propofol induces both pro- and anti- apoptotic mechanisms in the neonatal rat brain. In younger rats (7-days old) this is predominantly widespread apoptotic neurodegeneration, whereas in juvenile rats (14-days old) it results in protective effects. In this study, 14 day old rats were administered propofol by intraperitoneal injection. There was a spike in TNF-α in the cortex and thalamus within 4 hours, which induced multiple downstream pathways, but notably anti-apoptotic proteins especially in the thalamus to different degrees. This could potentially describe the development of neuronal protection by propofol in the juvenile and adult rat, but neurodegenerative effects in the newborn.

118. Poterman M, Vos JJ, Vereecke HE, et al. Differential Effects of Phenylephrine and Norepinephrine on Peripheral Tissue Oxygenation During General Anaesthesia: A Randomised Controlled Trial. European Journal of Anaesthesiology 2015;32:571-80.

Norepinephrine and phenylephrine both can be used to maintain blood pressure. Norepinephrine produced a small but statistically significant decrease in peripheral tissue oxygenation. Might this have implications for the use of norepinephrine in the treatment of spinal hypotension?

119. Rasanen J, Quinn MJ, Laurie A, et al. Maternal Serum Glycosylated Fibronectin as a Point-of-Care Biomarker for Assessment of Preeclampsia. American Journal of Obstetrics and Gynecology 2015;212:82 e1-9.

Serum Fibronectin (FN) has previously been shown to be elevated in preeclampsia. It was recently found to be elevated in Gestational DM. In this study, Glycosolated FN was noted to be elevated in all trimesters of pregnancy in women who developed preeclampsia. The predictive Receiver Operator Curve was as good as the sFlt/PlGF ratio at identifying preeclampsia. Is this an early gestational marker of endothelial cellular injury?

120. Rehberg B, Wickboldt N, Juillet C, et al. Can Remifentanil Use in Obstetrics Be Improved by Optimal Patient-Controlled Analgesia Bolus Timing? British Journal of Anaesthesia 2015;114:281-9.

The rapid onset and short duration of remifentanil make it attractive as a labor analgesic. However, the ideal efficacy and safety have yet to be determined - several adverse cases have been reported. Using a manual device to signal pain, the authors calculated the onset and duration of labor contractions in parturients. Several predictive models were applied to identify when a bolus of remifentanil should be administered. While the complex models performed slightly better, a simple predictive model was found to be adequate. Furthermore, the more complex predictive models did not enhance safety (identified as low serum concentrations between contractions and no bolus without a subsequent contraction). Because of the inherent randomness and short time between contractions, the authors found that concentrations would always be high and continuous monitoring is required.

121. Rhee KY, Goetzl L, Unal R, et al. The Relationship between Plasma Inflammatory Cytokines and Labor Pain. Anesthesia and Analgesia 2015;121:748-51.

Plasma cytokines are a key part of the process of cervical ripening and the onset of labor. This secondary analysis of a previous study examined the association between plasma cytokine concentration and labor pain score. Parturients with a lower plasma IL-1β in early labor reported higher pain scores. This is difficult to interpret due to 1) IL-1beta usually being associated with hyperalgesia; 2) higher levels of cytokines being associated with more efficient labor; 3) unmeasured factors in this dataset. It is possible that low levels of plasma cytokines in early labor are associated with more painful/difficult labor.

122. Robson EJ, Campbell JP, Yentis SM. The Value of Surveys in Obstetric Anaesthesia. International Journal of Obstetric Anesthesia 2015;24:46-52.

This survey assessed the quality and utility of obstetric anesthesia surveys from the UK. The OAA created a system requiring approval of national surveys, and controlled the volume of their use. The study evaluated the surveys in years 1998 – 2012 and found that the number of surveys had increased, and the response rate decreased over time. About

70% of surveys were published in abstract form, and only 25% in manuscript. A survey to assess the surveys was then performed. Approximately 60% of respondents felt the number and quality of surveys was appropriate, and used the information.

123. Roelants F, Lavand'homme P. Clonidine Versus Sufentanil as an Adjuvant to Ropivacaine in Patient-Controlled Epidural Labour Analgesia: A Randomised Double-Blind Trial. European Journal of Anaesthesiology 2015;32:805-11.

This randomized study of PCEA labor analgesia compared three solutions of ropivacaine 0.1% with either sufentanil 0.25 mcg/ml, clonidine 1.5 mcg/ml or clonidine 3 mcg/ml. The outcome measure was the number of provider administered supplemental boluses for breakthrough pain. There were no differences among groups in most measured outcomes and side effects, with the exception of slightly more nausea in the sufentanil group.

124. Rumboll CK, Dyer RA, Lombard CJ. The Use of Phenylephrine to Obtund Oxytocin-Induced Hypotension and Tachycardia During Caesarean Section. International Journal of Obstetric Anesthesia 2015;24:297-302.

The administration of a 3 UI bolus of oxytocin after placental delivery during cesarean has gained popularity as a method of initiating uterine tonicity. Intravenous oxytocin is associated with hypotension and tachycardia, even in small doses. This double blind randomized trial examined the hemodynamic effects of 50 mcg of phenylephrine immediately prior to oxytocin administration. There were no differences between groups, with a 15% to 20% reduction in blood pressure and 14% increase in HR in both groups. This dose of phenylephrine is inadequate to block the effects of an oxytocin bolus.

125. Saxena A, Izmirly PM, Han SW, et al. Serum Biomarkers of Inflammation, Fibrosis, and Cardiac Function in Facilitating Diagnosis, Prognosis, and Treatment of Anti-SSA/Ro-Associated Cardiac Neonatal Lupus. Journal of the American College of Cardiology 2015;66:930-9.

This interesting study demonstrated the ability to measure serum biomarkers in the maternal and fetal cord blood. These biomarkers are potential causative agents for cardiac injury found in neonatal lupus.

126. Schummers L, Hutcheon JA, Bodnar LM, et al. Risk of Adverse Pregnancy Outcomes by Prepregnancy Body Mass Index: A Population-Based Study to Inform Prepregnancy Weight Loss Counseling. Obstetrics and Gynecology 2015;125:133-43.

Obesity is a well-known risk factor for preeclampsia. This study investigated the distribution of fat among parturients to determine if this was a better predictor of the development of preeclampsia. Truncal obesity is known to be worse in cardiovascular risk. Both BMI and truncal fat were predictors, with truncal fat being more predictive only among obese patients. The use of fat distribution did not improve preeclampsia prediction over traditional BMI.

127. Schwarzman P, Baumfeld Y, Bar-Niv Z, et al. The Effect of Non-Obstetric Invasive Procedures During Pregnancy on Perinatal Outcomes. Archives of Gynecology and Obstetrics 2015.

Non-obstetric surgery during pregnancy occurs in less than 1% of gestations. This study examined the outcomes of 61 women who had invasive procedures during their pregnancy, and compared them to 122 women of a control cohort. Invasive procedures consisted of intraabdominal or urologic procedures. Women who had an invasive procedure delivered earlier (38.5 weeks vs. 40 weeks) and were more likely to have a cesarean delivery.

128. Shields LE, Wiesner S, Fulton J, et al. Comprehensive Maternal Hemorrhage Protocols Reduce the Use of Blood Products and Improve Patient Safety. American Journal of Obstetrics and Gynecology 2015;212:272-80.

Postpartum hemorrhage remains one of the largest causes of preventable maternal harm. A 'hemorrhage bundle' was developed and disseminated to 29 hospitals in California. Compliance with the bundles was monitored in a systematic fashion. During the observational study period, 2-month time periods were assessed, one prior to, and two after dissemination. The authors found that the rate of Stage 2 and Stage 3 hemorrhage increased by 40% to 60%, but the use of blood products decreased by 25%. Institution of a protocol, as well as awareness of hemorrhage increased the available resources at the point of care, which may have led to earlier treatment. This is hypothesized to have resulted in less need for rescue treatment.

129. Smith R, Silversides C, Downey K, et al. Assessing the Incidence of Peripartum Subclinical Myocardial Ischemia Using the Troponin T Assay: An Observational Pilot Study. International Journal of Obstetric Anesthesia 2015;24:30-4.

The incidence of ischemic injury to the heart in pregnancy is low, but some studies suggest close to 5% of parturients will have elevations of cardiac enzymes. This investigation evaluated 140 women within 24 hours of delivery with a single blood draw for tropinin T. They discovered that 4.5% of patients had elevated levels suggestive of injury. Interestingly, patients selected as high risk based on published risk factors for coronary artery disease had a lower incidence than the low risk population.

130. Sng BL, Zhang Q, Leong WL, et al. Incidence and Characteristics of Breakthrough Pain in Parturients Using Computer-Integrated Patient-Controlled Epidural Analgesia. Journal of Clinical Anesthesia 2015;27:277-84.

This evaluation of patients receiving a computer-adjusted intermittent bolus of epidural analgesia with continuous infusion demonstrated a marked reduction in breakthrough pain during labor. The computer adjusted the intermittent bolus based on the frequency of patient request (PCEA demand). Breakthrough pain occurred in about 10% of patients, with associated characteristics of dysfunctional labor, high maternal BMI, and excessive number of analgesia demand/received ratio. Breakthrough pain was associated with reduced maternal satisfaction

131. Snowden JM, Tilden EL, Snyder J, et al. Planned out-of-Hospital Birth and Birth Outcomes. The New England Journal of Medicine 2015;373:2642-53.

Out-of-hospital births have increased over the last decade, with home births (2.4%) and birth center births (1.6%) being the highest in the state of Oregon. Comparisons between in- and out of- hospital births have been complicated by being segregated by *final* place of delivery, as opposed to *intended* delivery with home to hospital transfers are treated as a hospital birth. This intent-to-treat evaluation of births in Oregon of almost 80,000 births included 4% out-of-hospital births. Less than 1% (0.8%) (n=601) were transferred to a hospital for delivery. Intended out-of-hospital birth was associated with a higher rate of neonatal and perinatal death (0.63 neonatal deaths per 1000 births and 1.52 perinatal deaths per 1000 births). The odds of most interventions were higher with in-hospital births, except for the need for blood transfusions (adjusted odds ratio, 1.91).

132. Spann MN, Serino D, Bansal R, et al. Morphological Features of the Neonatal Brain Following Exposure to Regional Anesthesia During Labor and Delivery. Magnetic Resonance Imaging 2015;33:213-21.

The neurologic effects of anesthetics have become an important field of research. Concern that anesthesia administered in the first few years (and potentially during gestation) may affect brain development is real. This study examined magnetic resonant imaging (MRI) within the first 6 weeks of life. Thirty seven (37) participants (12 with cesareans, 12 with labor epidural analgesia and 13 controls) were examined. Infants whose mothers received any anesthesia had greater local volume in the dorsal frontal lobes bilaterally, left hemisphere of the occipital lobes, and posterior portion of the cingulate gyrus in the right hemisphere. On testing at 12 months, communication and fine and gross motor measures did not differ significantly between the groups. This is a small study, and the limitations are large, and the clinical impact of these findings remains unclear.

133. Strouch ZY, Dakik CG, White WD, et al. Anesthetic Technique for Cesarean Delivery and Neonatal Acid-Base Status: A Retrospective Database Analysis. International Journal of Obstetric Anesthesia 2015;24:22-9.

Spinal anesthesia has been reported in various studies to be associated with fetal acidosis compared to general anesthesia or epidural anesthesia. The majority of these studies included the use of ephedrine as the vasopressor for treatment of hypotension after spinal anesthesia. Ephedrine is known to be associated with a lower fetal pH than phenylephrine. This retrospective investigation found that spinal anesthesia was not associated with acidosis in the fetus with phenylephrine use, in non-emergent surgeries. In emergent cases, general anesthesia, non-reassuring fetal heart tracing, maternal BMI, maternal DM, fetal anomalies, and any BP<90, or phenylephrine bolus were associated with a lower fetal pH. Then the statistics got over parsed.

134. Sviggum HP, Yacoubian S, Liu X, et al. The Effect of Bupivacaine with Fentanyl Temperature on Initiation and Maintenance of Labor Epidural Analgesia: A Randomized Controlled Study. International Journal of Obstetric Anesthesia 2015;24:15-21.

Warming of epidural medications has been shown to increase the speed of onset for cesarean anesthesia. The authors used warmed medications (37 vs 20 ^{O}C) in a double blinded study of labor analgesia. Bupivacaine 0.125% with fentanyl 2

mcg/cc (20 ml initial bolus) was used. An intermittent bolus technique was used for administration. The time to onset was shorter (9 minutes) with warming, but there were no other differences in continued analgesia or side effects.

135. Tao W, Grant EN, Craig MG, et al. Continuous Spinal Analgesia for Labor and Delivery: An Observational Study with a 23-Gauge Spinal Catheter. Anesthesia and Analgesia 2015;121:1290-4.

Continuous spinal anesthesia has been recommended as a method of providing reliable analgesia/anesthesia to parturients with certain characteristics (e.g. morbid obesity, spine hardware). This prospective observational study examined the attempts to place continuous spinal catheters in 113 women. Nine (9) catheters kinked, 3 were dislodged, the remaining 101 were successful for labor analgesia. Fifteen [(15 of 16) (94%)] were effective for cesarean anesthesia. The PDPH rate was 2.3%. Spinal catheters are as effective/ineffective as epidural catheters, with a higher PDPH rate.

136. Thompson JL, Kuklina EV, Bateman BT, et al. Medical and Obstetric Outcomes among Pregnant Women with Congenital Heart Disease. Obstetrics and Gynecology 2015;126:346-54.

The incidence of patients with congenital heart disease who have reached childbearing age and have become pregnant has increased. This investigation of the National Inpatient Sample Database found an increase in the incidence from 2000 to 2010 (6.4 to 9 per 10,000 deliveries). Not surprisingly, the patients with congenital heart disease had higher rates of maternal mortality and cardiovascular, pulmonary and obstetric complications. Parturients who had concomitant pulmonary hypertension had worse outcomes compared to those with congenital heart disease without pulmonary hypertension.

137. Tornell S, Ekeus C, Hultin M, et al. Low Apgar Score, Neonatal Encephalopathy and Epidural Analgesia During Labour: A Swedish Registry-Based Study. Acta Anaesthesiologica Scandinavica 2015;59:486-95.

Recent investigations have found a link between fever in labor and neonatal encephalopathy. The inclusion of 'epidural fever' has made this relationship concerning. This study of the Swedish Birth Registry included almost 300,000 deliveries over 10 years, 44% of which had received epidural analgesia. Epidural analgesia was associated with a lower APGAR score, but not with neonatal neurologic complications; whereas maternal fever was associated with convulsions and neonatal cerebral ischemia. This study suggests that epidural fever is a benign rise in temperature that is not associated with neonatal neurologic consequences.

138. Valentine AR, Carvalho B, Lazo TA, et al. Scheduled Acetaminophen with As-Needed Opioids Compared to As-Needed Acetaminophen Plus Opioids for Post-Cesarean Pain Management. International Journal of Obstetric Anesthesia 2015.

This retrospective review examined the use of pain medications after cesarean delivery. Patients received either on demand opioid/acetaminophen (historic control) or round-the-clock acetaminophen with on demand oral opioids. The round-the-clock group required less opioid medication, but received more NSAID's.

139. Van Hagen IM, Roos-Hesselink JW, Ruys TP, et al. Pregnancy in Women with a Mechanical Heart Valve: Data of the European Society of Cardiology Registry of Pregnancy and Cardiac Disease (ROPAC). Circulation 2015;132:132-42.

This prospective review of 212 parturients with mechanical heart valves examined the maternal and fetal outcomes. Maternal mortality was 1.4% and fetal mortality was 18%. There were also high rates of thrombosis (5%) and hemorrhagic events (23%). While the use of heparin was more likely to be associated with thrombosis, Coumadin was more likely to be associated with fetal loss. Parturients with tissue valves had better outcomes than mechanical valves.

140. Wang HY, Hong SK, Duan Y, et al. Tranexamic Acid and Blood Loss During and after Cesarean Section: A Meta-Analysis. Journal of Perinatology 2015;35:818-25.

Meta-analysis of the use of tranexamic acid (TXA) in elective cesarean delivery. Eleven randomized studies were included, with 2300 patients. TXA administration was associated with less intraoperative blood loss (average difference of only 140 ml) and a smaller decrease in hemoglobin concentration.

141. Wassen M, Smits L, Scheepers H, et al. Routine Labour Epidural Analgesia Versus Labour Analgesia on Request: A Randomised Non-Inferiority Trial. British Journal of Obstetrics and Gynaecology 2015;122:344-50.

This investigation used the non-inferiority design to test the theory that routine epidural analgesia (EA) was equivalent to

on-request services with respect to cesarean delivery rate. The analysis was with intent to treat, as only 89% of women in the routine epidural cohort received the assigned treatment. There was a non-statistically significant higher incidence of cesarean delivery in the routine EA group; however, because the confidence intervals lay outside of the pre-determined lower bound of inferiority (10%), it could not be concluded that routine use was equivalent. Adverse events related to epidural analgesia were more common in the routine EA group, but there were no differences in the obstetric outcomes.

142. Widmer M, Cuesta C, Khan KS, et al. Accuracy of Angiogenic Biomarkers at 20weeks' Gestation in Predicting the Risk of Pre-Eclampsia: A WHO Multicentre Study. Pregnancy Hypertension 2015;5:330-8.

The early diagnosis of preeclampsia might lead to improvement of maternal and fetal care. Recent discoveries of the role of the angiogenic / anti-angiogenic system in the etiology of preeclampsia have led to the potential for improved diagnostic markers. In this study, the use of these anti-angiogenic biomarkers measured prior to 20 weeks, either alone or in conjunction with other signs, did not identify patients who would develop preeclampsia. This, along with other smaller single-center studies demonstrate that anti-angiogenic biomarkers measured prior to 20 weeks do not predict preeclampsia.

143. Wiegand SL, Stringer EM, Stuebe AM, et al. Buprenorphine and Naloxone Compared with Methadone Treatment in Pregnancy. Obstetrics and Gynecology 2015;125:363-8.

Chronic opioid use during pregnancy has increased in recent years. Little data exists regarding the risks and neonatal side effects of various medications used for management of these patients. In this retrospective study, 62 women treated with either methadone, or buprenorphine and naloxone were compared for maternal and neonatal outcomes. Infants born to women who received buprenorphine and naloxone had half the rate of neonatal abstinence syndrome compared to the methadone cohort. They also had lower peak neonatal abstinence syndrome scores and had shorter hospital stays.

144. Wikkelso AJ, Edwards HM, Afshari A, et al. Pre-Emptive Treatment with Fibrinogen Concentrate for Postpartum Haemorrhage: Randomized Controlled Trial. British Journal of Anaesthesia 2015.

The severity of postpartum hemorrhage (PPH) has been inversely associated with fibrinogen in the parturient. Replacement of fibrinogen (which represents the majority of hemostatic protein) might reduce the amount of blood loss. This prospective, multi-center, randomized, double blinded trial assessed the administration of fibrinogen concentrate (FIB) vs. placebo for PPH. Patient were included if they had a cesarean or vaginal delivery while meeting strict criteria. The subjects who received FIB had a higher fibrinogen at 15 minutes after administration, but the difference was diminished subsequently. No difference was noted between groups for the primary outcome of transfusions in the 6-week period after delivery. Additionally, there was no difference in any secondary measure. While very well designed for preemptive, all-inclusive PPH, a shortcoming of the study was the small number of patients with major hemorrhage, very low fibrinogen (~2%), or need for plasma and platelets (0%).

145. Wrench IJ, Allison A, Galimberti A, et al. Introduction of Enhanced Recovery for Elective Caesarean Section Enabling Next Day Discharge: A Tertiary Centre Experience. International Journal of Obstetric Anesthesia 2015;24:124-30.

Enhanced recovery has been applied to several surgical specialties with positive results. This papers reports the outcome of an 11-point pathway applied to elective cesarean deliveries during 2013. Of the 760 cesarean deliveries, 15% (n=114) had early discharge (Postop day 1) and only 4.4% (n=5) of those required readmission. The readmission rate for patients discharged after POD2 were higher than the rate for those discharged on POD1 or POD2. This is not surprising, as the patients who were discharged early were those with an uncomplicated recovery. This observational study of a bundle of interventions demonstrates that selective enhanced recovery after cesarean is possible. The maternal and neonatal benefits or detriments will need to be elucidated in future investigations.

146. Yamada N, Sato Y, Moriguchi-Goto S, et al. Histological Severity of Fetal Inflammation Is Useful in Predicting Neonatal Outcome. Placenta 2015;36:1490-3.

Intrauterine inflammation consists of both chorioamnionitis (inflammation of the maternal tissues) and funisitis (inflammation of the fetal tissues, e.g. umbilical cord). This pathologic examination of 272 placentas from singleton neonates born <34 weeks of gestation found 41% had evidence of inflammation. Eighty percent (80%) of cases of chorioamnionitis had associated funisitis. After adjusting for gestational age, fetal inflammation was independently associated with low birth

weight, chronic lung disease, and necrotizing enterocolitis. Maternal inflammation was associated only with necrotizing enterocolitis.

147. Yang Y, Zhang J, Gong Y, et al. Increased Expression of Prostasin Contributes to Early-Onset Severe Preeclampsia through Inhibiting Trophoblast Invasion. Journal of Perinatology 2015;35:16-22.

Prostasin, a protease that enhances migration and insertion of trophoblasts, is believed to be integral in placental insertion. MMP (2 and 9) are proteins active in vascular remodeling and are probably associated with placental spiral artery and placental bed remodeling with gestational growth. Both were found to be reduced in women with early-onset PEC, less so with late-onset PEC, compared with controls. Prostasin and MMP9 levels were inversely correlated with SBP, DBP, and with urine protein.

148. Yi XY, Li QF, Zhang J, et al. A Meta-Analysis of Maternal and Fetal Outcomes of Pregnancy after Bariatric Surgery. International Journal of Gynaecology and Obstetrics 2015;130:3-9.

Bariatric surgery is increasingly used to treat the obesity epidemic. This meta-analysis demonstrated a reduction in the risk of gestational DM, hypertensive disorders, and macrosomia among pregnant women who had bariatric surgery. Unfortunately, there was an increased risk of SGA newborns. Of note, the authors detected no differences in cesarean delivery, postpartum hemorrhage, and pre-term delivery.

149. Yousef AA, Salem HA, Moustafa MZ. Effect of Mini-Dose Epidural Dexmedetomidine in Elective Cesarean Section Using Combined Spinal-Epidural Anesthesia: A Randomized Double-Blinded Controlled Study. Journal of Anesthesia 2015;29:708-14.

A randomized double-blind investigation examining the addition of dexmedetomidine to a combined spinal-epidural (CSE) anesthetic. The CSE consisted of 5mg hyperbaric spinal bupivacaine followed by 10 ml of 0.25% epidural bupivacaine with 50 mcg of fentanyl. Patients were randomized epidural administration of 0.5 mcg/kg dexmedetomidine vs. saline in the placebo group. The authors found a reduction in the need for intraoperative supplementation and postoperative analgesia.

150. Zaremba S, Mueller N, Heisig AM, et al. Elevated Upper Body Position Improves Pregnancy-Related OSA without Impairing Sleep Quality or Sleep Architecture Early after Delivery. Chest 2015;148:936-44.

Obstructive sleep apnea (OSA) has been reported to occur in about 5% of pregnant women. Postpartum, OSA and narcotic pain medications may produce risk. This study reports the results of polysomnographic testing on 30 women on day-2 post-cesarean. Using a crossover design, women slept in the horizontal vs. 45-degree upper body elevated positions. Twenty percent (20%) of the subjects had evidence of moderate to severe OSA. The elevated position resulted in a 50% reduction in moderate-to-severe sleep apnea (categorized by an apnea-hypopnea index >15), along with increased airway diameter, improved apnea-hypopnea index, and lesser arterial oxygen desaturation. The 45-degree elevated position may be helpful for women with OSA post-partum.

151. Zhang H, Du L, Du Z, et al. Association between Childhood Exposure to Single General Anesthesia and Neurodevelopment: A Systematic Review and Meta-Analysis of Cohort Study. Journal of Anesthesia 2015;29:749-57.

Exposure to anesthesia in early infancy has been linked to negative developmental outcomes. This meta-analysis examined exposure to anesthesia by age (before 3 and after 3) and outcome. They found a small, 18% (95%CI 7% to 30%), increase in risk of negative outcome with early exposure. Significant heterogeneity among studies raises questions, as does the impact of selection bias (infants who require surgery are not an identical cohort to those who do not).

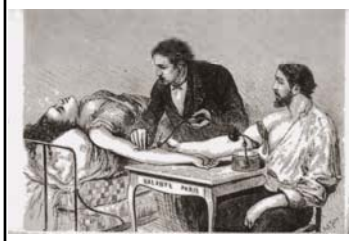
Fred Hehre Lecture

Speaker: Lawrence C. Tsen, M.D.

NOTES

Society for Obstetric Anesthesia and Perinatology, 2016

Blood Management in Obstetrics



Walter (Sunny) Dzik, MD
Massachusetts General Hospital
Harvard Medical School

I have no disclosures to make.

Walter (Sunny) Dzik

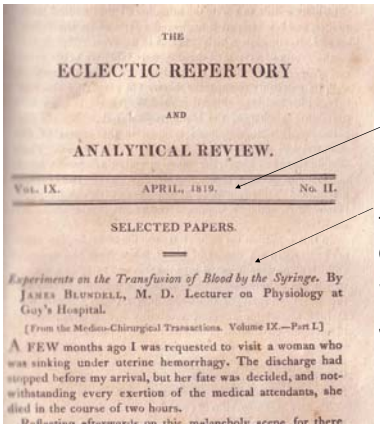
I do not recommend putting sheep placenta on your face.

4 "stages" of my talk …

- Scope of peri-partum hemorrhage (PPH)
- Hemostatic disorder of persistent PPH
- Transfusion therapy in the context of the 4T's
  - Blood replacement
  - Anti-fibrinolytics
  - Fibrinogen
  - rVIIa
- Current approach including
  - 2 RCTs completed in the last 12 months
  - 1 RCT on the way.

In the early 19th C, post-partum hemorrhage was the most dramatic bleeding disorder known

James Blundell
(1790-1878)



THE
ECLECTIC REPERTORY
AND
ANALYTICAL REVIEW.

Vol. IX. APRIL, 1819. No. II.

SELECTED PAPERS.

Experiments on the Transfusion of Blood by the Syringe. By JAMES BLUNDELL, M. D. Lecturer on Physiology at Guy's Hospital.

[From the Medico-Chirurgical Transactions. Volume IX.—Part I.]

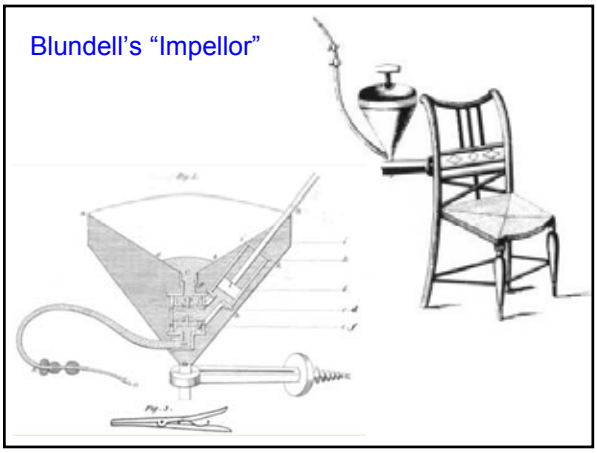
A FEW months ago I was requested to visit a woman who was sinking under uterine hemorrhagy. The discharge had stopped before my arrival, but her fate was decided, and notwithstanding every exertion of the medical attendants, she died in the course of two hours.

1819

"Experiments on the Transfusion of Blood by the Syringe"

James Blundell

Blundell's "Impellor"




THE LANCET.

LONDON, SATURDAY, JUNE 14.

OBSERVATIONS ON TRANSFUSION OF BLOOD.

1828-29

~200 years ago…

"… the patient expresses herself very strongly on the benefits resulting from the injection of the blood; her observations are equivalent to this-- that *she felt as if life were infused into her body*."

- James Blundell, 1829

In the 21st C, post partum hemorrhage is *still* the most dramatic bleeding disorder known !

- A woman dies every 2 minutes from complications of childbirth.
- The most common cause of maternal death is severe bleeding.
- 14 million PPH each year
- 290,000 annual deaths at childbirth (2013 data)
  - 25-33% are PPH
- Average PPH to death: 2-4 hours
- WHO: "It is the quickest of maternal killers."

Maternal death in the developing world

62% of all maternal death occurs in sub-Saharan Africa

	Lifetime risk of maternal death
Europe	1 : 3,400
Sub-Sahara	1: 20
South Asia	1 : 46

"Girls in southern Sudan are more likely to die giving birth to a child than to complete primary education…"

- BMJ 2006: 328; p 1514

WHO Maternal Mortality in 2013.

Persistent PPH

"Active bleeding >1000 mL within 24 hours after birth that continues despite the initial measures including first-line uterotonic agents and uterine massage."

Four T's	Cause	Approximate Incidence
Tone	Atonic uterus	70%
Trauma	Lacerations, hematomas, inversion, rupture	20%
Tissue	Retained tissue, invasive placenta	10%
Thrombin	Coagulopathies	1%

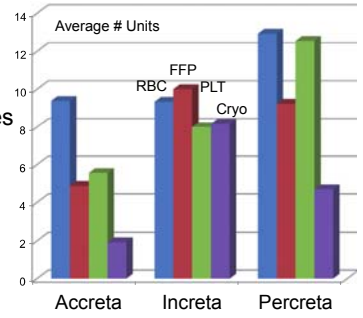
Risk factors for persistent PPH

Risk Factor	Odds for > 500 EBL
Accreta / percreta	High !
Placenta previa	4 - 13
Placenta abruption	3 - 13
Retained placenta	4 - 8
Prolonged stage 3	8
Pre-eclampsia	4 - 8
Von Willebrand's	3
Asian ethnicity	2
Age > 30	1.4
Obesity	1.6

Abdul-Kadir et al. Transfusion 2014; 54: 1756-68

Blood use in placenta accreta

- Retrospective review of 66 patients with accreta over 14 years @ Columbia Univ NY (1994-2008).
- RBCs: 0-46
- FFP:0-64 units
- Platelets: 0-8 doses
- Cryo: 0-30 units

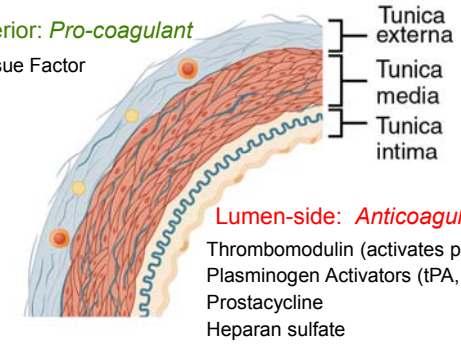


Stotler et al Transfusion 2011;51:2627-33.

Different Goals on the Inside and the Outside !

Exterior: *Pro-coagulant*

Tissue Factor

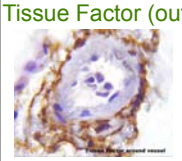


Lumen-side: *Anticoagulant*

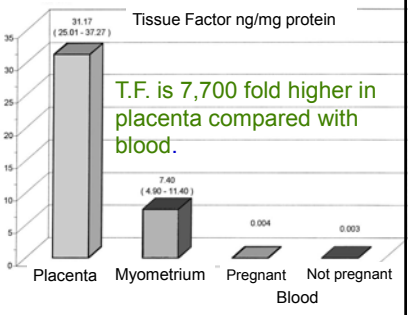
Thrombomodulin (activates protein C)
Plasminogen Activators (tPA, uPA)
Prostacycline
Heparan sulfate

Pro-coagulants in Placenta

Tissue Factor (outside)



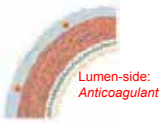
Negative control



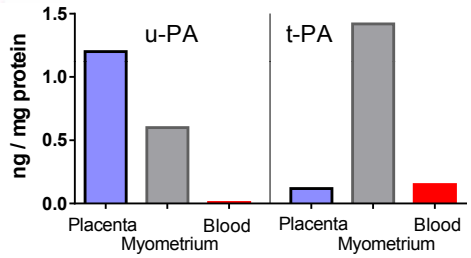
T.F. is 7,700 fold higher in placenta compared with blood.

Kuczynski et al Euro J Ob Gyn Repro Biol 2002; 105: 15-19

Anti-coagulants in Placenta



34 women: C-section, tissues extracted, ELISA testing for fibrinolytic proteins.



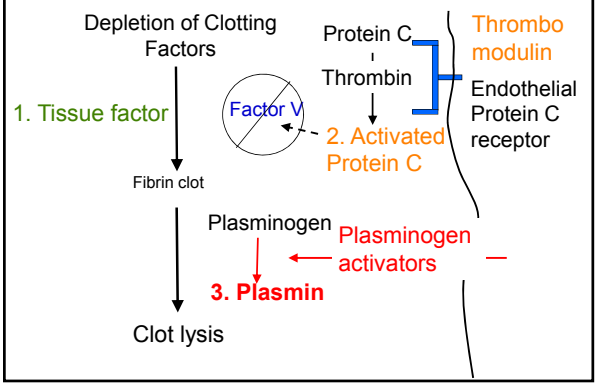
Uszynski et al Gynecol Obstet Invest 2001;52(3):189-93; Eur J Ob Gyn Repro Biol 2004;114:54-48.

Summary of Measurements

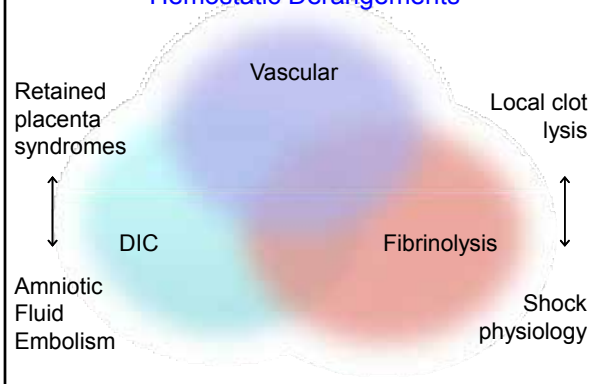
Factor	Placenta	Myometrium	Maternal blood	Placenta to Blood Ratio
Tissue Factor	31	7.4	0.004	7,700
Thrombo modulin	18,700	4.700	0.063	300,000
Annexin V	122	65	0.02	6,000
u-PA	1.09	0.52	0.01	100
u-PA receptor	0.95	1.99	0.015	63
t-PA	0.12	1.42	0.15	1

Multiple papers by Uszynski et al.

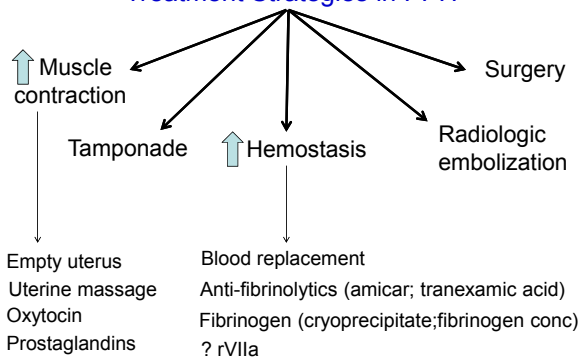
3-strikes: Consumption, Inhibition, and Lysis



Hemostatic Derangements



Treatment Strategies in PPH

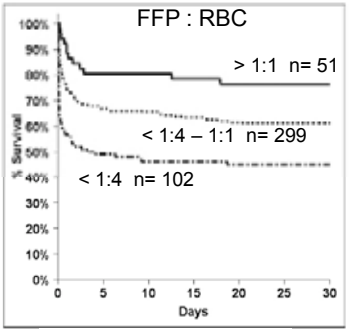


This is not an OB case...

Photo credit: N.Y. Times, Nov 6, 2007

Does a high ratio of FFP to RBC improve survival ?

Retrospective review of 452 patients receiving >10 units RBCs in 24 hours.



Survival

Zink KA, Am J Surg 2009; 297: 565

Reducing the FFP to RBC ratio: no effect in the UK

2012 retrospective from Royal London Hospital: before vs after use of more aggressive massive hemorrhage protocol*

Patients receiving > 10 RBCs	2007-08 (n=40)	2008-09 (n=56)	p-value
Age	37 (25-51)	34 (26-60)	0.33
ISS	32 (9 – 54)	29 (22-41)	0.72
Admit to ICU	25 (63%)	37 (66%)	0.66
FFP:RBC	1:3	1:2	0.003
Mortality ?			

* Did NOT include routine use of anti-fibrinolytics

Khan S et al. Injury Nov 2012 epub ahead of print.

Reducing the FFP to RBC ratio: no effect in the UK

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ISS	32 (9 – 54)	29 (22-41)	0.72
Admit to ICU	25 (63%)	37 (66%)	0.66
FFP:RBC	1:3	1:2	0.003
Mortality	22 (55%)	32 (57%)	0.84

* Did NOT include routine use of anti-fibrinolytics

Khan S et al. Injury Nov 2012 epub ahead of print.

PROPPR

RCT #1 Done

RCT: 12 trauma sites in N. Amer. Aug 2012 – Dec 2013

11,185 Eligible

10,505 Excluded (not severe)

n= 680 randomized

	1:1:1 group	2:1:1 group	p-value
24 hour mortality	12.7%	17%	0.12
30 day mortality	22.4%	26.1%	0.26
RBC	9	9	n.s
FFP	7	5	n.s
Platelets	12	6	n.s

23 pre-specified secondary outcome measures were not different.
Only 19% received anti-fibrinolytics.

JAMA 2015; 313: 471-482.

Spill-over of 1:1 ratios to non-trauma surgery

- Retrospective review, 2008-2012.
- All MGH surgical patients with ≥ 20 RBCs in 24 hrs.
- Low ratio: < 1 FFP for each 1.5 RBCs
- High ratio: ≥ 1 FFP for each 1.5 RBCs

Finding: n=265 received ≥ 20 RBCs in 24 hrs
Trauma = 38 68% got high ratio
Non-trauma= 227 79% got high ratio

Non-trauma:
General surgery, cardiac, ortho, transplant.

Spill-over of 1:1 ratios to non-trauma surgery: Outcomes

Units per patient	Low FFP:PRBC ratio (N=47) Median (Q1-Q3)	High FFP:PRBC ratio (N=180) Median (Q1-Q3)	p-value
PRBC	34.3 (25.5 – 50)	32.2 (24 – 43.7)	0.277
FFP	20 (13 – 26.5)	30 (22.5 – 42)	0.001
Platelets	36 (18 – 69)	42 (24 – 72)	0.194
Cryoprecipitate	10 (2 – 20)	10 (0 – 20)	0.714

	Low FFP:PRBC ratio (N=47)	High FFP:PRBC ratio (N=180)	p-value
Survival N (%)	28 (59.6)	111 (61.7)	0.79
LOS (mean ± SD)	22.8 ± 24.2	25.3 ± 27.6	0.4
Survivors' LOS	32.6 ± 23.7	31.6 ± 23.4	0.4
Discharge home N (%)	10 (21.3)	64 (35.6)	0.79
Days from transfusion to death (median, IQR)	1 (0 – 3)	2 (0 – 5.5)	0.31

Ring....ring....

Hello.... blood bank, may I help you?

This is Dr "garbled voice". Activate the MASSIVE transfusion protocol.

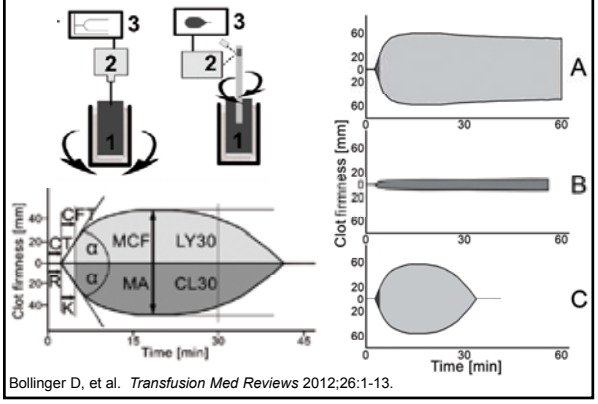
(hangs up)...dial tone.

MTP: unique to each hospital

Elements of MTP at MGH

- What are criteria for transfer to O.R.
- Who: OR desk, anesthesia, surgeons, radiology
- Materials: rapid transfuser, cell-saver, drugs,
- Calling the blood bank.
- ABO sample; Stat labs.
- Blood bank paperwork ("pick up slip")
- Runners (not just one !)
  - Keys to elevators
  - Exactly where is the blood bank?
- Designated "communicator" during case.
- Fire drills !!!

Thromboelastography (TEG / ROTEM)



Bollinger D, et al. *Transfusion Med Reviews* 2012;26:1-13.

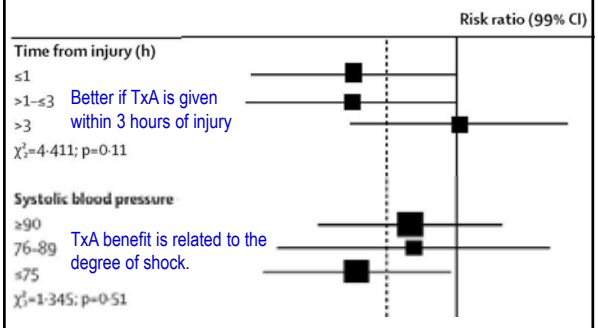
CRASH-2

- Multicenter, prospective randomized trial
- 274 hospitals in 40 countries.
- n = 20,211injured patients randomized to:
  - tranexamic acid: 1 gm bolus & 1 gm in 8 hrs
  - vs, placebo infusion.
- Primary outcome: Death in hospital within 4 weeks
  - Tranexamic: 14.5%
  - Placebo: 16%

  } p < 0.0035
- Secondary outcome: bleeding-related death
  - Tranexamic: 4.9%
  - Placebo: 5.7

  } p < 0.0077

CRASH-2



CRASH-2 Lancet 2010

Tranexamic Acid in PPH: Prospective RCT

At 500 mL PPH: manual removal of placenta, genital tract exam, uterine exploration, & oxytocin, then sulprostone.

At 800 mL PPH, randomized:
- Placebo (n=72)
- TxA 4 gm in 1 hr load; then 1 g/hr x 6 hrs (n=72)

	TxA	Placebo	p-value
Blood loss in first 6 hrs	173 (59-377)	221 (105-564)	0.04
Hb drop > 4 g/dL	15 (21%)	34 (47%)	0.001
PPH stopped after uterotonics & RBCs	93%	79%	0.016

Ducloy-Bouthors et al. Crit Care 2011;15:R117

STUDY PROTOCOL Open Access

The WOMAN Trial (World Maternal Antifibrinolytic Trial): tranexamic acid for the treatment of postpartum haemorrhage: an international randomised, double blind placebo controlled trial

RCT #2

Haleema Shakur*[1], Diana Elbourne[4], Metin Gülmezoglu[2], Zarko Alfirevic[3], Carine Ronsmans[5], Elizabeth Allen[4] and Ian Roberts[1]

20,000 women with PPH in 20 countries

- 1 gm i.v. TxA (may repeat within 24 hrs)
- Placebo

Endpoint: mortality or hysterectomy

Results are due summer of 2016.

http://www.thewomantrial.lshtm.ac.uk/

Should you give fibrinogen ?

Lower fibrinogen is associated with greater bleeding.

Association may not represent causality, so be careful if you are "treating" an association.

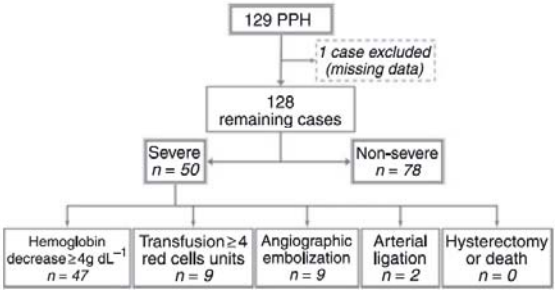
Examples:

"Higher leukocytosis is associated with worse infection. Therefore, we now give chemo to our infected patients to bring the WBC count down."

"Lower albumin is a marker of severe liver disease. We give albumin infusions to reverse cirrhosis."

Low fibrinogen is an early predictor of severe PPH

* Retrospective review of 129 women with PPH.



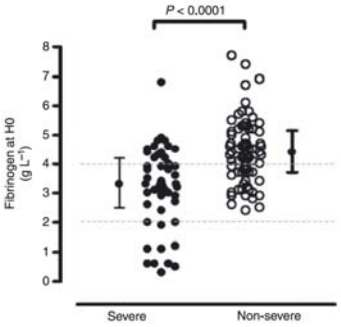
Charbit B et al. J Thromb Haemost 2007; 5: 266–73.

Many laboratory features were different at time=0

	Severe PPH n=50	Non-severe PPH n=78	p-value
Fibrinogen (g/L)	3.3	4.4	<0.001
Factor V	72%	90%	0.004
Protein C antigen	69%	76%	0.038
Factor II	83%	93%	0.005
AT-3	72%	79%	0.005
D-dimer ug/mL	9	6	0.007
Soluble fibrin monomer	55%	36%	0.04
INR	1.16	1.10	0.02
TAT complex (ug/L)	39	20	0.014
Platelets	173k	181k	0.4

Charbit B et al. J Thromb Haemost 2007; 5: 266–73.

Lower Fibrinogen was statistically associated with the severe PPH group.



1. Helpful at the extremes of fibrinogen.

2. Not so helpful in the common range of 2 to 4 g/L (200-400 mg/dL).

3. Does not imply that adding fibrinogen will change outcome.

Charbit B et al. J Thromb Haemost 2007; 5: 266–73.

RCT #3 done

British Journal of Anaesthesia 114 (4): 623–33 (2015)
Advance Access publication 13 January 2015 · doi:10.1093/bja/aeu444

BJA

Pre-emptive treatment with fibrinogen concentrate for postpartum haemorrhage: randomized controlled trial†

A. J. Wikkelsø[1*], H. M. Edwards[2], A. Afshari[3], J. Stensballe[4], J. Langhoff-Roos[5], C. Albrechtsen[3], K. Ekelund[3], G. Hanke[3], E. L. Secher[3], H. F. Sharif[5], L. M. Pedersen[6], A. Troelstrup[6], J. Lauenborg[7], A. U. Mitchell[1], L. Fuhrmann[1], J. Svare[2], M. G. Madsen[8], B. Bødker[9], A. M. Møller[1] and FIB-PPH trial group

Double blind RCT: Early treatment with: 2 gms fibrinogen / Saline
4 centers in Denmark, 2 years.

At inclusion, mean blood loss 1.5 L.	Fibrinogen n=123	Placebo n=121	P value
Need for RBCs up to 6 weeks post			
Composite defining severe PPH			
Transfusion of ≥4 RBCs			

Brit J of Anaesthesia 2015; 114: 623-33

Effect of supplemental fibrinogen concentrate of fibrinogen level

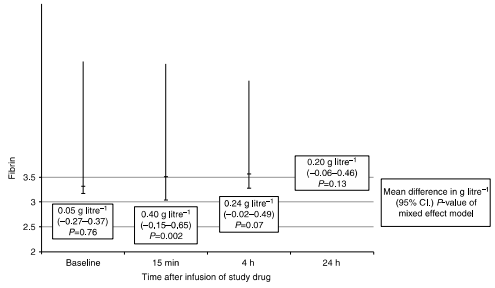


Fig 2 Mean fibrinogen concentrations in placebo and fibrinogen groups from baseline to 24 h after study drug administration, with whiskers indicating standard deviation. Mean difference of the fibrinogen concentration between the fibrinogen and placebo group is given below at each time point from baseline to 24 h after the study drug administration, with 95% confidence interval (CI) given in parenthesis and P-value.

Brit J of Anaesthesia 2015; 114: 623-33

RCT #3 done

British Journal of Anaesthesia 114 (4): 623–33 (2015)
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BJA

Pre-emptive treatment with fibrinogen concentrate for postpartum haemorrhage: randomized controlled trial†

A. J. Wikkelsø[1*], H. M. Edwards[2], A. Afshari[3], J. Stensballe[4], J. Langhoff-Roos[5], C. Albrechtsen[3], K. Ekelund[3], G. Hanke[3], E. L. Secher[3], H. F. Sharif[5], L. M. Pedersen[6], A. Troelstrup[6], J. Lauenborg[7], A. U. Mitchell[1], L. Fuhrmann[1], J. Svare[2], M. G. Madsen[8], B. Bødker[9], A. M. Møller[1] and FIB-PPH trial group

Double blind RCT: Early treatment with: 2 gms fibrinogen / Saline
4 centers in Denmark, 2 years.

At inclusion, mean blood loss 1.5 L.	Fibrinogen n=123	Placebo n=121	P value
Need for RBCs up to 6 weeks post	20%	22%	0.88
Composite defining severe PPH	40%	52%	0.31
Transfusion of ≥4 RBCs	6.5%	2.5%	0.22

No difference in any pre-defined secondary outcomes.
"Real world": 25% were <3.7 g/L; and only 2.2% with <2 g/L

Brit J of Anaesthesia 2015; 114: 623-33

Summary Points…

- Be vigilant.
- If known high risk, get a huge team.
- Basic O.B. principles: 4 T's.
- An MTP is *much more* than coolers of blood.
- Liberal transfusion (RBC, FFP, Plts).
- Use an anti-fibrinolytic.
- No benefit to pre-emptive fibrinogen conc.
- Cryo has fibrinogen plus von Willebrand's
- Await results of WOMAN (TxA)

Further reading…

1. Collis RE. Haemostatic management of obstetric haemorrhage. Anaesthesia 2015; 70: Supp1; 78-86.
2. Holcomb JB et al. Transfusion of plasma, platelets, and red cells in a 1:1:1 vs a 1:1:2 ratio and mortality in patients with severe trauma. JAMA 2015; 313: 471-82.
3. Sentilhes L, et al. Tranexamic acid for the prevention and treatment of postpartum haemorrhage. Br J Anaesth 2015; 114: 576-87.
4. Wilkkelso J, et al. Pre-emptive treatment with fibrinogen concentrate for pospartum haemorrhage. Br J Anaes 2015; 114: 623-33.
5. Lavigne-Lissalde G, et al. Recombinant human FVIIa for reducing the need for invasive second-line therapies in severe refractory postpartum hemorrhage. J Thromb Haemostasis 2015; 13: 520-529.

Point of care testing

Laboratory tests

- Time consuming
- Not 'real time'
- Only able to identify when blood is not clotting
- Current tests were initially aimed at clotting abnormalities due to warfain/ heparin/ haemophillia

Haemoglobin

- Portable haemoglobinometers
  - Battery operated spectrometer
- Non invasive Hb
  - Multi-wave length pulse co-oximetry

British Journal of Anaesthesia **108** (2): 271–7 (2012)
Advance Access publication 23 November 2011 · doi:10.1093/bja/aer373

BJA

OBSTETRICS

Non-invasive haemoglobin measurement in patients undergoing elective Caesarean section

A. Butwick*, G. Hilton and B. Carvalho
Department of Anaesthesia (MC: 5640), Stanford University School of Medicine, 300 Pasteur Drive, Stanford CA 94305, USA
* Corresponding author. E-mail: ajbut@stanford.edu

Table 2 Differences in measured Hb at baseline, immediately post-CS, and at 24 h post-CS (least mean squares). Hb values presented as g dl^{-1}. Hb, laboratory haemoglobin; SpHb, haemoglobin from Pulse CO-Oximeter; CS, Caesarean section

Time	Difference in SpHb – laboratory Hb	*P*-value	95% confidence intervals	
			Lower	Upper
Pre-CS	1.22	<0.001	0.89	1.54
Immediately post-CS	0.14	0.39	−0.18	0.46
24 h post-CS	1.36	<0.001	1.04	1.68

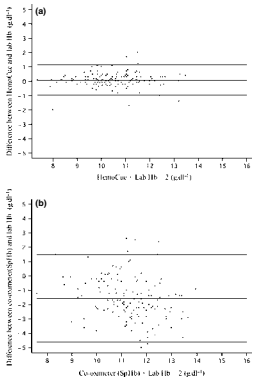
Anaesthesia 2013, 68, 40–45 doi:10.1111/anae.12039

Original Article

Evaluation of point-of-care haemoglobin measuring devices: a comparison of Radical-7™ pulse co-oximetry, HemoCue® and laboratory haemoglobin measurements in obstetric patients*

V. A. Skelton,[1] N. Wijayasinghe,[2] S. Sharafudeen,[3] A. Sange,[4] N. S. Parry[1] and C. Junghans[5]

1 Consultant Anaesthetist, 3 Locum Consultant Anaesthetist, King's College Hospital, London, UK
2 Locum Consultant Anaesthetist, Brighton and Sussex University Hospitals, UK
4 Fellow in Clinical Leadership, Barking Havering and Redbridge University Hospitals, UK
5 Research Fellow in Epidemiology, Department of Public Health and Epidemiology, University College London Medical School, London, UK



- Poor correlation of agreement of agreement of co-oximeter Hb and laboratory Hb.
- Maybe due to
  - Pregnancy
  - Spinal anaesthesia
  - Oxytocin
  - Vasopressors
- These factors may impact finger perfusion

Anaesthesia 2015, 70, 803–809 doi:10.1111/anae.13028

Original Article

Continuous monitoring of haemoglobin concentration after in-vivo adjustment in patients undergoing surgery with blood loss*

D. Frasca,[1] H. Mounios,[2] B. Giraud,[2] M. Boisson,[2] B. Debaene[3] and O. Mimoz[4]

1 Assistant Professor, 2 Senior Anaesthetist, 3 Professor and Head of Department, 4 Professor and Head of Surgical Intensive Care Unit, Department of Anaesthesia and Intensive Care, University Hospital of Poitiers, Poitiers, France

Clotting studies

- INR
- PT
- aPTT
- ACT

British Journal of Anaesthesia **112** (3): 514–20 (2014)
Advance Access publication 12 December 2013 · doi:10.1093/bja/aet384

BJA

CRITICAL CARE

Limits of agreement between measures obtained from standard laboratory and the point-of-care device Hemochron Signature Elite® during acute haemorrhage

T. Gauss[1,3]*, S. Hamada[1,3], I. Jurcisin[1], S. Dahmani[4,5], L. Boudaoud[2], J. Mantz[1,3,5] and C. Paugam-Burtz[1,3,5]

Editor's key points

- These data suggest that this device should not be used to diagnose coagulopathy and guide treatment in acute haemorrhage.

International Journal of Obstetric Anesthesia (2011) **20**, 135–141
0959-289X/$ - see front matter Published by Elsevier Ltd.
doi:10.1016/j.ijoa.2010.12.002

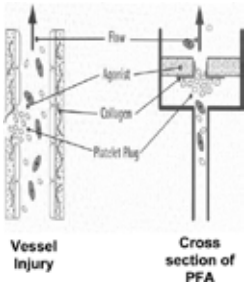
ELSEVIER
www.obstetanesthesia.com

ORIGINAL ARTICLE

Standard haemostatic tests following major obstetric haemorrhage

L. de Lloyd,[a] R. Bovington,[b] A. Kaye,[c] R.E. Collis,[a] R. Rayment,[b] J. Sanders,[c] A. Rees,[c] P.W. Collins[b]
Department of [a]Anaesthesia, [b]Haematology and [c]Obstetrics and Gynaecology, University Hospital of Wales and School of Medicine, Cardiff, UK

Platelet function analyser



- Need normal plt count

Haemostatic changes in MOH

PT/aPTT

- May remain normal until 5000ml blood loss

Fibrinogen

- Progressive fall with blood loss
- Critically low levels reached early
- May be used as marker for prediction of severity of PPH

British Journal of Anaesthesia Page 1 of 6
doi:10.1093/bja/aes096

BJA

Association between fibrinogen level and severity of postpartum haemorrhage: secondary analysis of a prospective trial

M. Cortet[1,2,3,4*], C. Deneux-Tharaux[5], C. Dupont[6,7], C. Colin[8], R.-C. Rudigoz[9], M.-H. Bouvier-Colle[5] and C. Huissoud[2,9,10]

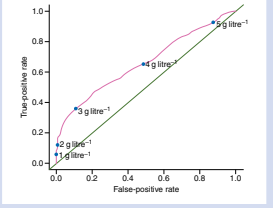


Fig 3 ROC curve of fibrinogen concentration at diagnosis for the prediction of severe PPH. Area under the curve=0.66, 95% CI=(0.64–0.68).

Haemostatic changes with aetiology of PPH

Aetiology	% transfused with FFP *	Time of onset of coagulopathy	Main mechanism of coagulopathy
Uterine atony	14	Late	Dilution/ consumption
Genital tract/ surgical trauma	4	Late	Dilution/consumption
Placental abruption	42	Early	Consumption
Retained/ adherent placenta	8	Early or late	Dilution
Uterine rupture	66	Early	Dilution
AFE	100	Early	DIC

* Likelihood of coagulopathy

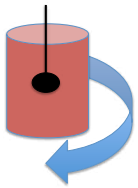
Collis, Collins. Anaesthesia, 2015,70 S1 78-86

Evaluation of haemostasis

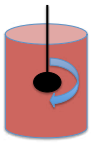
- Clinical + formulaic blood product replacement
- Laboratory based testing
- Point of care testing

Viscoelastic measurements

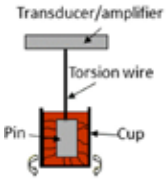
Thrombelastography- TEG



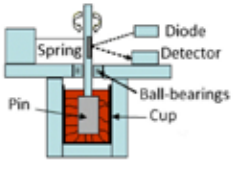
Thrombelastometry- ROTEM



Viscoelastic measurements



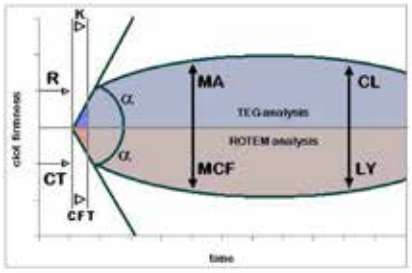
TEG



ROTEM

Viscoelastic measurements

Viscoelastic measurements



http://wjes.biomedcentral.com/articles/10.1186/1749-7922-7-S1-S3

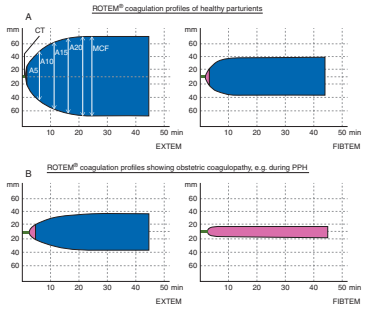
TEG/ ROTEM in antenatal assessment

British Journal of Anaesthesia Page 1 of 8
doi:10.1093/bja/aes480

BJA

Peri-partum reference ranges for ROTEM® thromboelastometry

N. M. de Lange[1*], L. E. van Rheenen-Flach[2], M. D. Lancé[3], L. Mooyman[4], M. Woiski[5], E. C. van Pampus[6], M. Porath[7], A. C. Bolte[2], L. Smits[8], Y. M. Henskens[9] and H. C. Scheepers[4]



British Journal of Anaesthesia 109 (6): 851–63 (2012)
Advance Access publication 16 October 2012 · doi:10.1093/bja/aes361

BJA

Haemostatic monitoring during postpartum haemorrhage and implications for management

C. Solomon[1*], R. E. Collis[2] and P. W. Collins[3]

TEG®-based tests			ROTEM®-based tests			Diagnostic use
Test (reagent name)	Activator	Additional modifications*	Test (reagent name)	Activator	Additional modifications*	
—	—	—	NATEM (star-tem®)	None added	—	Sensitive test measuring coagulation without added activator, although not applicable in emergencies due to slow clotting times
Kaolin-activated TEG®	Kaolin	—	INTEM (in-tem®)	Ellagic acid	—	Defects in the intrinsic pathway of coagulation activation; heparin anticoagulation
—	—	—	EXTEM (ex-tem®)	Recombinant tissue factor	—	Defects in the extrinsic pathway of coagulation activation; prothrombin complex deficiency; platelet deficiency (in parallel with FIBTEM)
RapidTEG (RapidTEG™ reagent)	Kaolin + tissue factor	—	—	—	—	Defects in the intrinsic and extrinsic pathways of coagulation activation; more rapid assessment than using kaolin activation alone
FF/functional fibrinogen test (FF reagent)	Tissue factor	Abciximab	FIBTEM (fib-tem®)	Recombinant tissue factor	Cytochalasin D	Fibrin-based clot defects, fibrin/ fibrinogen deficiency
—	—	—	APTEM (ap-tem®)	Recombinant tissue factor	Aprotinin	Hyperfibrinolysis (in comparison with EXTEM)
Kaolin-activated TEG® + heparinase	Kaolin	Heparinase	HEPTEM (hep-tem®)	Ellagic acid	Heparinase	Heparin/protamine imbalance (in conjunction with INTEM or kaolin-activated TEG)

British Journal of Anaesthesia 109 (6): 851–63 (2012)
Advance Access publication 16 October 2012 · doi:10.1093/bja/aes361

BJA

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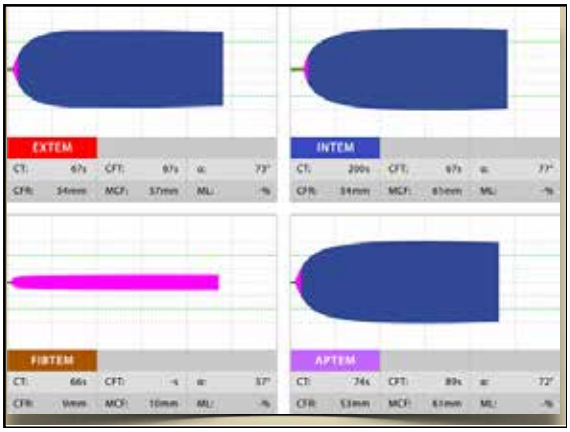
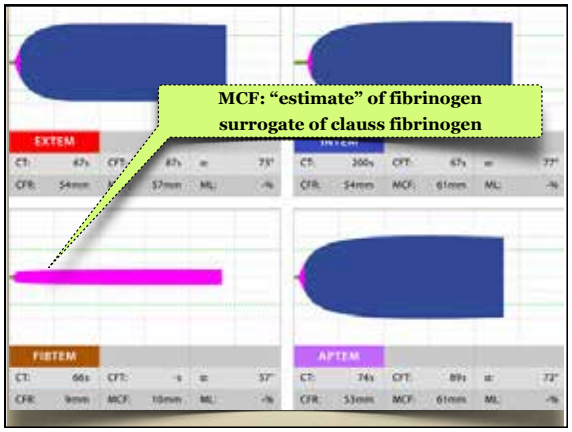
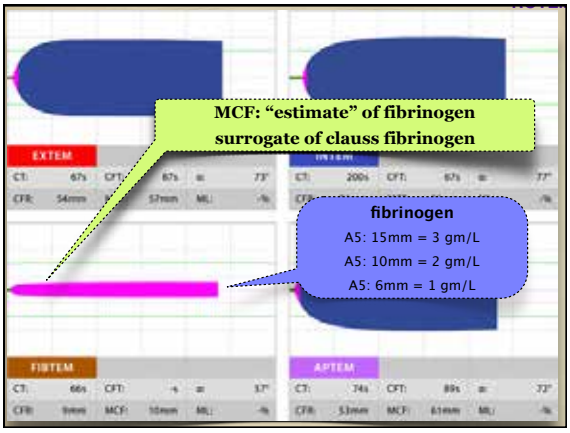
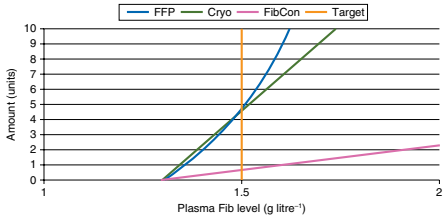






Calculated amount of haemostatic agent

	FFP	Cryo	FibCon	
Amount	5	5	1	units
Volume	1250	62.5	50	ml
Resultant Fib level	1.51	1.52	1.61	g litre^{-1}



Collins et al. Theoretical modelling of fibrinogen supplementation with therapeutic plasma, cryoprecipitate, or fibrinogen concentrate BJA 2014

Intra operative use of TEG/ ROTEM

General obstetrics

Bedside assessment of fibrinogen level in postpartum haemorrhage by thrombelastometry

C Huissoud,[a,b] N Carrabin,[a] F Audibert,[c] A Levrat,[d] D Massignon,[a] M Berland,[c,e] R-C Rudigoz[a,c,b]

General obstetrics

Bedside assessment of fibrinogen level in postpartum haemorrhage by thrombelastometry

C Huissoud,[a,b] N Carrabin,[a] F Audibert,[c] A Levrat,[d] D Massignon,[a] M Berland,[c,e] R-C Rudigoz[a,c,b]

Table 3. Cut-off values for CA_{5}-FIBTEM in postpartum haemorrhage

Fibrinogen levels (g/l)	FIBTEM cut-off values (mm)	Sensitivity % (95% CI)	Specificity % (95% CI)	PPV % (95% CI)	NPV % (95% CI)	AUC
Fibrinogen < 2	CA_{5} = 6	100 (100–100)	87 (77–96)	50 (36–64)	100 (100–100)	0.97
Fibrinogen < 1.5	CA_{5} = 5	100 (100–100)	85 (76–95)	30 (17–43)	100 (100–100)	0.96
Fibrinogen < 1	CA_{5} = 4	100 (100–100)	86 (76–96)	13 (3–22)	100 (100–100)	0.96
Fibrinogen < 2	CA_{15} = 8	100 (100–100)	84 (75–94)	46 (32–60)	100 (100–100)	0.96
Fibrinogen < 1.5	CA_{15} = 6	100 (100–100)	88 (78–97)	33 (20–46)	100 (100–100)	0.97
Fibrinogen < 1	CA_{15} = 5	100 (100–100)	88 (79–97)	14 (5–24)	100 (100–100)	0.97

AUC, area under curve; CI, confidence interval; NPV, negative predictive value; PPV, positive predictive value.

A&A ANESTHESIA & ANALGESIA

TEG® Functional Fibrinogen Analysis May Overestimate Fibrinogen Levels

Anna Ågren, MD, PhD,*† Agneta Taune Wikman, MD, PhD,†§ Anders Östlund, MD, PhD,‖ and Gustaf Edgren, MD, PhD¶*

Fibrinogen is of crucial importance in patients with ongoing bleeding. In this study, we compared fibrinogen concentration measured by thrombelastography (TEG®) with fibrinogen plasma concentration determined by Clauss. Sixty-three surgical patients and 38 healthy controls were included. For the whole group (patients and controls, n = 101), TEG® functional fibrinogen was on average 1.0 g/L higher than the plasma fibrinogen concentration (3.5 vs 2.5 g/L, 95% confidence interval for difference 0.8 to 1.2 g/L, P < 0.0001). Similar patterns were observed when patients and healthy controls were analysed separately. The fibrinogen level may be overestimated when assessed using TEG® compared with the fibrinogen plasma concentration measured by the conventional method. (Anesth Analg 2014;118:933–5)

May 2014 (118)5

British Journal of Anaesthesia Page 1 of 8
doi:10.1093/bja/aet480

BJA

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Use of TEG/ ROTEM to diagnose hyperfibrinolysis in PPH

Normal

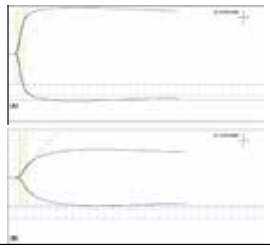
Hyperfibrinolysis

International Journal of Obstetric Anesthesia (2014) 23, 10-17
0959-289X/$ - see front matter © 2013 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.ijoa.2013.07.003

ORIGINAL ARTICLE

Major obstetric haemorrhage: monitoring with thromboelastography, laboratory analyses or both?

O. Karlsson,[a] A. Jeppsson,[b] M. Hellgren[c]

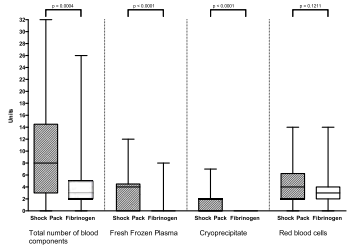


Anaesthesia 2015, 70, 166–175 doi:10.1111/anae.12859

Original Article

Introduction of an algorithm for ROTEM-guided fibrinogen concentrate administration in major obstetric haemorrhage

S. Mallaiah,[1] P. Barclay,[1] I. Harrod,[2] C. Chevannes[1] and A. Bhalla[2]



Anaesthesia 2015, 70, 166–175 doi:10.1111/anae.12859

Original Article

Introduction of an algorithm for ROTEM-guided fibrinogen concentrate administration in major obstetric haemorrhage

S. Mallaiah,[1] P. Barclay,[1] I. Harrod,[2] C. Chevannes[1] and A. Bhalla[2]

	Shock Pack (n = 42)	Fibrinogen (n = 51)	p value
ICU admission	4 (9%)	1 (2%)	NS
TACO	4 (9%)	0	0.0367
TRALI	0	0	NS
Postpartum hysterectomy	6 (14%)	3 (6%)	NS
Death	0	0	NS

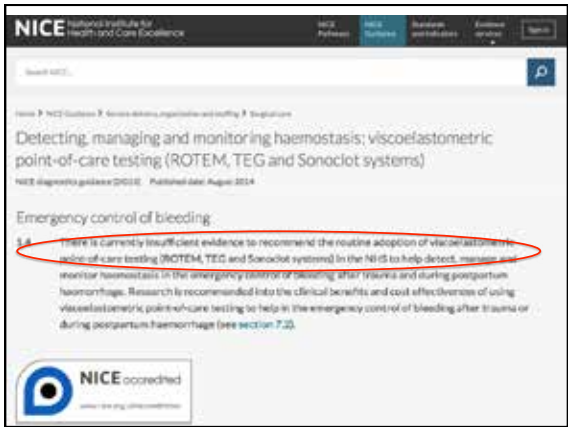
Collis, Collins. Anaesthesia, 2015,70 S1 78-86

Cochrane Library

Cochrane Database of Systematic Reviews

Thrombelastography (TEG) or thromboelastometry (ROTEM) to monitor haemotherapy versus usual care in patients with massive transfusion (Review)

Afshari A, Wikkelsø A, Brok J, Møller AM, Wetterslev J


NICE National Institute for Health and Care Excellence

Detecting, managing and monitoring haemostasis: viscoelastometric point-of-care testing (ROTEM, TEG and Sonoclot systems)

Emergency control of bleeding

1.4 There is currently insufficient evidence to recommend the routine adoption of viscoelastometric point-of-care testing (ROTEM, TEG and Sonoclot systems) in the NHS to help detect, manage and monitor haemostasis in the emergency control of bleeding after trauma and during postpartum haemorrhage. Research is recommended into the clinical benefits and cost effectiveness of using viscoelastometric point-of-care testing to help in the emergency control of bleeding after trauma or during postpartum haemorrhage (see section 7.2).

NICE accredited

Quality Assurance and Quality Control of Thromboelastography and Rotational Thromboelastometry: The UK NEQAS for Blood Coagulation Experience

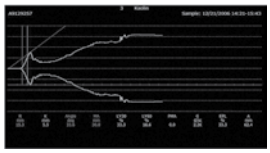
Dianne P. Kitchen, F.I.B.M.S.,[1] Steve Kitchen, Ph.D.,[1] Ian Jennings, Ph.D.,[1] Tim Woods, M.B.A.,[1] and Isobel Walker, M.D.[1]

- Quality assurance and quality control of thromboelastometry showed that the precision tests for both TEG and ROTEM varied greatly.
- < 10% is accepted for a lab test.
  - TEG precision coefficient was between 7 - 39.9%
  - ROTEM 7-83%.

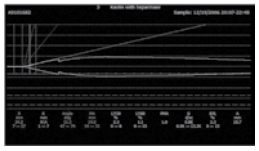
Disadvantages of POC coagulation tests

- Lack of training
- Poor standardisation in obtaining samples
- Poor internal/ external quality assurance

Artifact problems



TEG Artifact due to pin slippage



TEG artifact due to vibrations against TEG machine

Clinica Chimica Acta 436 (2014) 143–148

Advantages of POC coagulation tests

- Allows identification of normal coagulation
- Identifies type of coagulopathy
- Allows early and focused blood products

Conclusions

- POC testing useful if you know how to use them!
- Need quality assurance testing

Of bacteria and babies:

Determinants and impact of the infant gut microbiota

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MASSACHUSETTS GENERAL HOSPITAL
VINCENT OBSTETRICS & GYNECOLOGY

Disclosures

Dr. Mitchell sits on a scientific advisory board for Perrigo Pharmaceuticals

Dr. Mitchell has served on a data safety and monitoring board for Paraxel, Inc.

2

Objectives

- Participants will be able to discuss determinants of the infant gut microbial community
- Participants will be able to discuss how the infant gut microbial community may influence infant health
- Participants will be able to describe the normal evolution of the infant gut microbial community

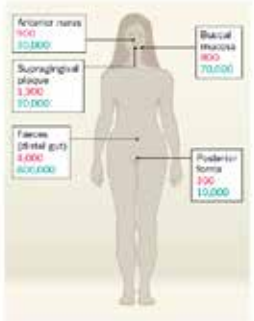
3

4

Microbial diversity

Community

Function



Relman Nature 2012

What have your microbes done for you lately?

6

Infant microbiota

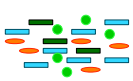
- Is the fetal gut sterile?
- Where do we get our gastrointestinal bacterial community?
- Does it matter when we have what kind of community?
- Can we change our gut bacterial communities for the better?

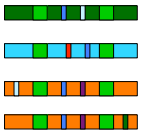
7

Our tools

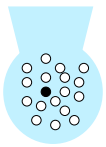
- Next generation sequencing
  - 16S rRNA
  - Metagenomics

Identification





Probability

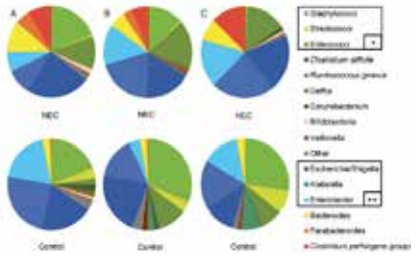


8

Meconium

- Prospective cohort of NICU babies at risk of NEC
- Stool samples 2x/week

Birth 2 samples before NEC

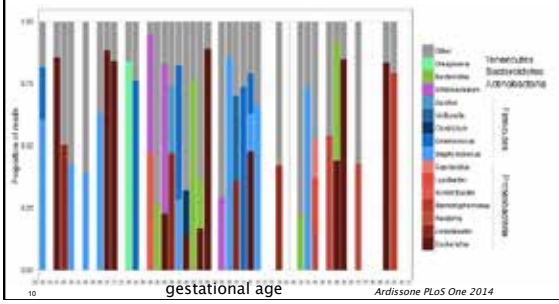


Heida CID 2016

9

Meconium

52 babies, 3 hospitals in FL.
67% had detectable 16S sequences



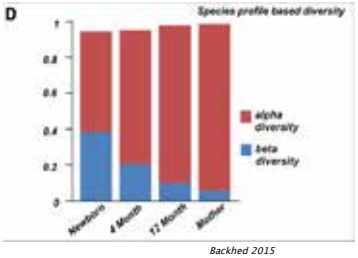
gestational age

Ardissone PLoS One 2014

10

Infant microbiota

- Progression over time toward a more diverse community

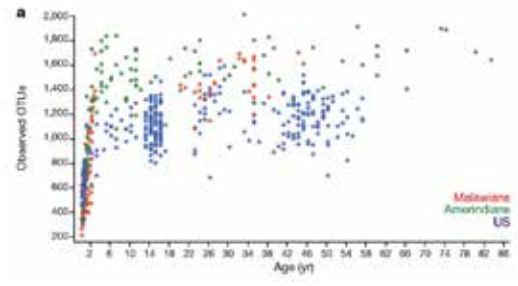


Backhed 2015

Alpha diversity = diversity of organisms within an individual's community

Beta diversity = diversity of communities between subjects

Progression of communities

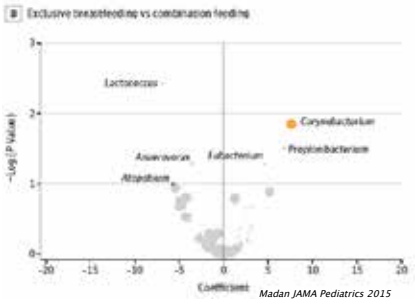


Yatsunenko Nature 2012

12

Infant feeding

- 102 infants, sampled at 6 weeks of life



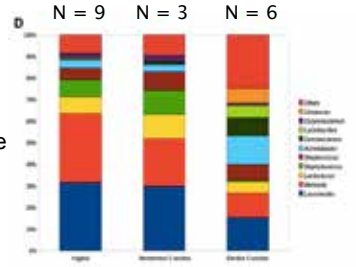
Madan JAMA Pediatrics 2015

13

Breastfeeding

1 month breastmilk microbiome, 16 S

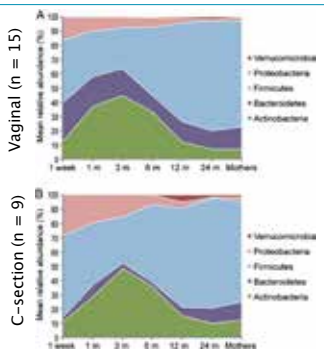
- Breastmilk isn't sterile
- Differences in milk microbiome by delivery mode



Cabrera-Rubio et al Am JI Clinical Nutrition 2012

Mode of delivery

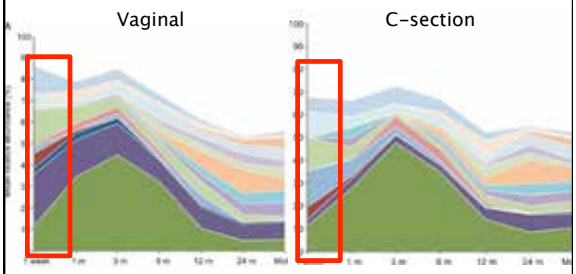
- 24 mother/infant pairs with stool samples
- Fewer *Bacteroides* in C-section babies
- Less diversity compared to vaginally delivered, or adult



Hedvig E Jakobsson et al. Gut 2014;63:559-566

15

Mode of delivery

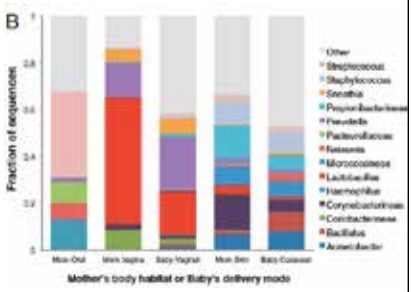


Hedvig E Jakobsson et al. Gut 2014;63:559-566

16

Mode of delivery

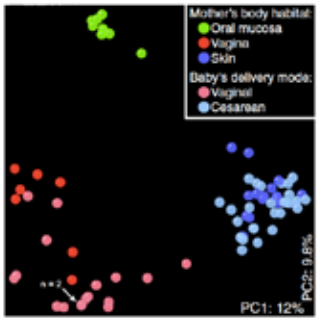
- 9 mom/infant pairs from Venezuela
- "baby" = combination of skin, oral and rectal swabs



Dominguez-Bello PNAS 2010

17

Mode of delivery



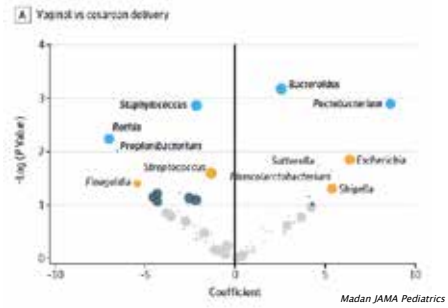
- 9 mother/infant pairs form Venezuela
- Principal components analysis

Dominguez-Bello PNAS 2010

18

Mode of delivery

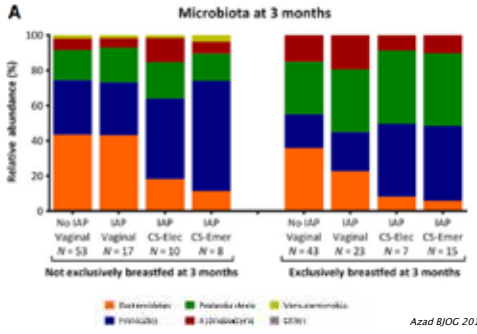
- 102 infants, sampled at 6 weeks of life



Madan JAMA Pediatrics 2015

19

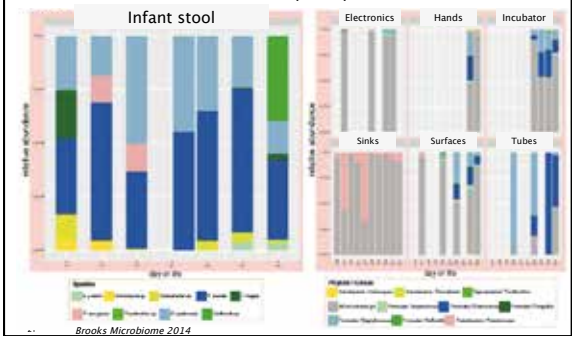
Delivery mode, feeding & antibiotics



Azad BJOG 2015

Environment

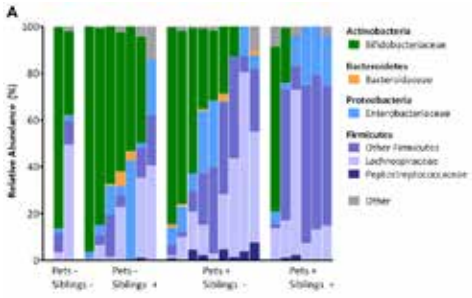
- NICU infant, < 31 weeks, sampled q3d x1mo



Brooks Microbiome 2014

Environmental influences

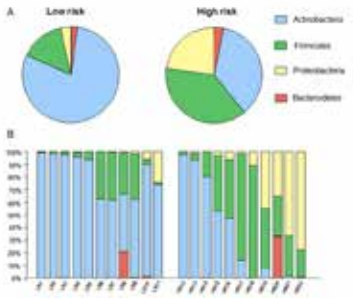
CHILD study, 24 infants at ~4 months age



Azad, All Asthma Clin Immunol 2013

Genetics

- 22 vaginally delivered, breastfed infants at 1 month of age
- High or low genetic risk for celiac disease by HLA-DQ2 genotype

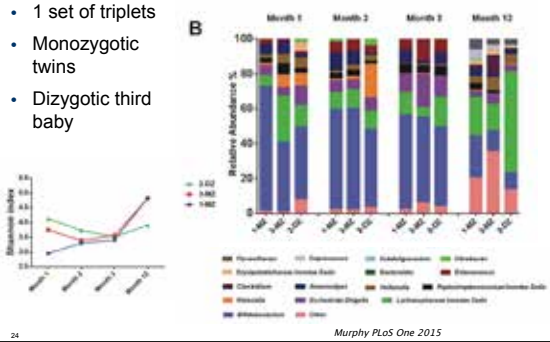


Olivares Gut 2015

23

Genetics

- 1 set of triplets
- Monozygotic twins
- Dizygotic third baby

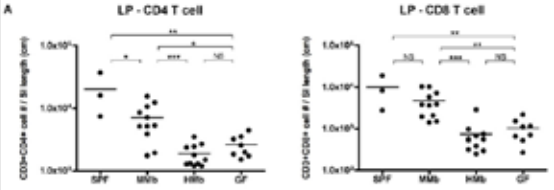


Murphy PLoS One 2015

24

Immune education

- Germ free mice innoculated with a mouse vs. human microbial community

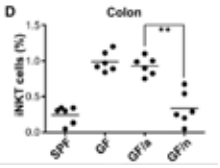


Chung Cell 2012

25

Immune education

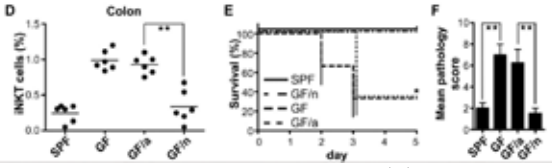
- 4 groups of mice:
  - Normal bacteria
  - Germ free
  - Germ free as pups, given gut bacteria as adults
  - Germ free at birth, given gut bacteria as pups



26

Immune education

- 4 groups of mice:
  - Normal bacteria
  - Germ free
  - Germ free as pups, given gut bacteria as adults
  - Germ free at birth, given gut bacteria as pups

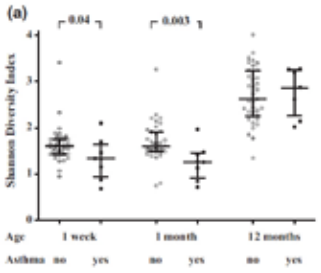


Olszak Science 2012

27

Risk of asthma/allergy

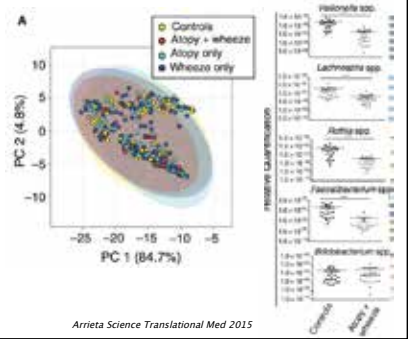
- 48 children at risk for atopic disease
- Asthma outcome measured at 7 years
- Stool samples from 1 week, 1 month, 12 months



Abrahamsson Clin Exp Allergy 2013

Risk of asthma/allergy

- 319 children from CHILD study
- Atopic outcome at 1 year
- Stool from 3 months



Arrieta Science Translational Med 2015

29

Can we change the microbiome?

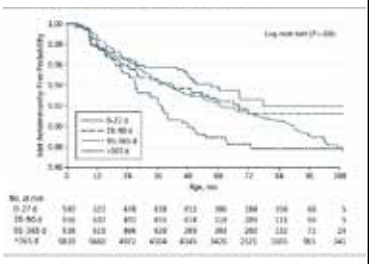
30

Changing immunity with microbes

TEDDY study:

- 7473 infants in US and Europe, with HLA type at risk for T1DM.
- Probiotic use assessed by questionnaire.
- Outcome = Ab to islet cell antigens

Risk of Ab by age first probiotic

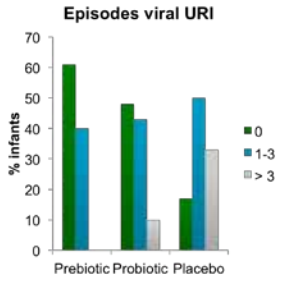


Uusitalo JAMA Pediatrics 2016

31

Changing immunity with microbes

- Preterm infants 32-36+6d, in Finland
- Enrolled day 1-3 of life
- Randomized to prebiotic, probiotic (L. rhamnosus GG) or placebo
- Outcome = viral URI, defined by nasal swab testing for virus
- Followed for 12 months



Luoto JI All Clin Immunol 2014

32

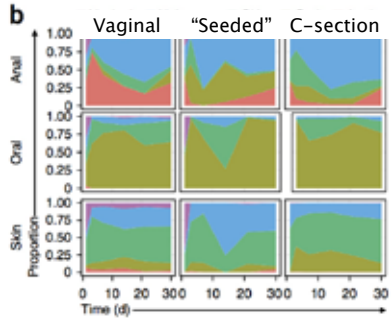
"Seeding"

- Recent coverage on NPR, New York Times
- Not randomized
- 4 "seeded" babies
- 7 C-section controls
- 7 vaginal delivery controls
- All "seeded" had to be GBS negative, STD-free, asymptomatic

Dominguez-Bello Nature Medicine 2015

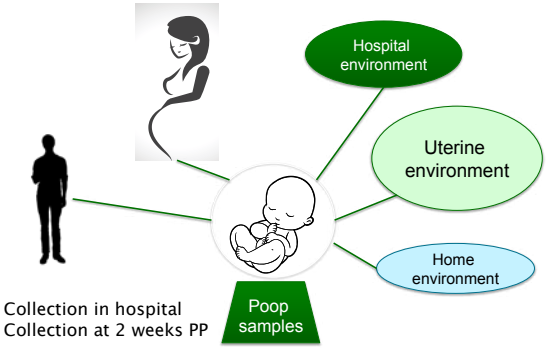
33

"Seeding"



Estimated maternal source: Vaginal Unknown Skin Oral Anal

OriGiN Study - MGH



Collection in hospital
Collection at 2 weeks PP

Thank you

NIAID

Sunday, May 22, 2016

Panel: Obstetric Anesthesia Quality Measures
Moderator: *Jill M. Mhyre, M.D.*
Panelists: *Jill M. Mhyre, M.D.; Barbara M. Scavone, M.D.; B. Scott Segal, M.D., M.S.*

Sepsis in the Parturient
Speaker: *Nuala Lucas, M.D.*

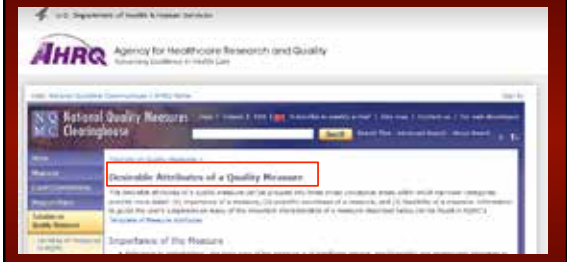
Advances in Sepsis Treatment
Speaker: *Andrew L. Ciaranello, M.D.*

Best Practice Panel - Case Report Review with the Experts
Moderator: *Katherine W. Arendt, M.D.*
Panelists: *Katherine W. Arendt, M.D.; Brendan Carvalho, M.B.B.Ch., F.R.C.A., M.D.C.H.; Robert D'Angelo, M.D.; Roshan Fernando, M.B., Ch.B.*

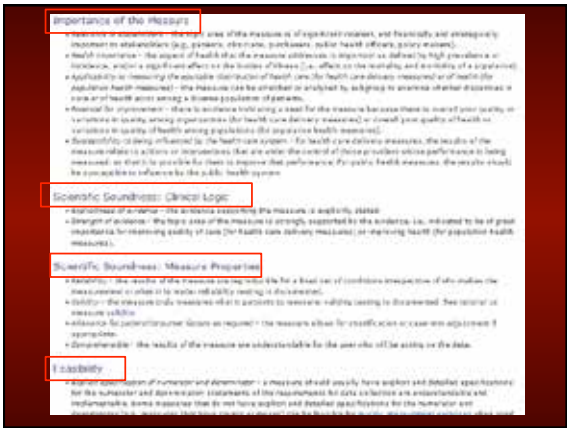
Obstetric Anesthesia Quality Measures

Barbara M. Scavone, MD

Professor
Department of Anesthesia and Critical Care
Department of Obstetrics and Gynecology
University of Chicago Medical Center



http://www.qualitymeasures.ahrq.gov/tutorial/attributes.aspx

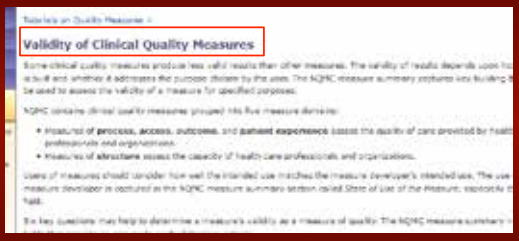


IMPORTANCE
Relevance to stakeholders
Health importance
Measures equitable distribution
Potential for improvement
Susceptible to influence by healthcare system

SCIENTIFIC SOUNDNESS: CLINICAL LOGIC
Explicitness of evidence
Strength of evidence

SCIENTIFIC SOUNDNESS: MEASURE PROPERTIES
Reliability
Validity
Allowance for patient factors
Comprehensible

FEASIBILITY
Specified numerator and denominator
Data availability



VALIDITY
Strong scientific evidence supporting measure?
Individuals in denominator equally included in numerator?
Measure under control of those it is evaluating?
Measure specifications capture event?
Measure provide for fair comparisons among performers?
Allow for adjustment of measure to exclude patients when appropriate?

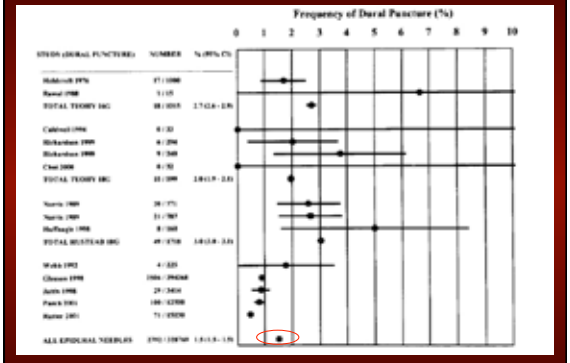
Obstetric Anesthesia Quality Measures

Accidental Dural Puncture Epidural Blood Patch

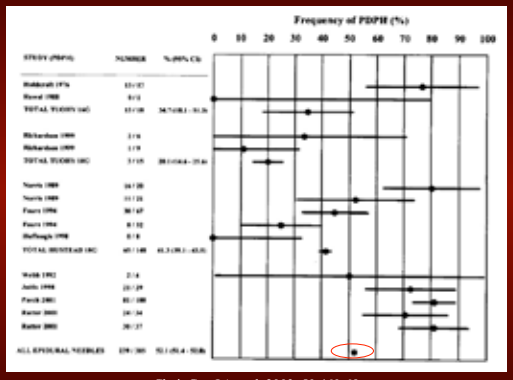
Barbara M. Scavone, MD

Professor
Department of Anesthesia and Critical Care
Department of Obstetrics and Gynecology
University of Chicago Medical Center

IMPORTANCE	
Relevance to stakeholders	
Health importance	
Measures equitable distribution	
Potential for improvement	
Susceptible to influence by healthcare system	



Choi: Can J Anesth 2003; 50:460-69



Choi: Can J Anesth 2003; 50:460-69

PDPH:

- Severe pain
  - Median pain score 6 (5-9)
  - Interference with activities of daily living
- Increased hospital/ED visits
- Increases length of stay

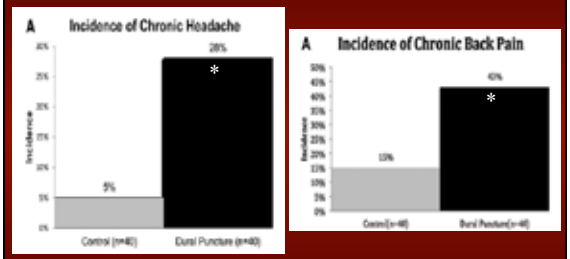
Scavone: Anesthesiology 2004;101:1422-27
Angle: Can J Anesth 2005; 52:397-401

Unintentional Dural Puncture with a Tuohy Needle Increases Risk of Chronic Headache

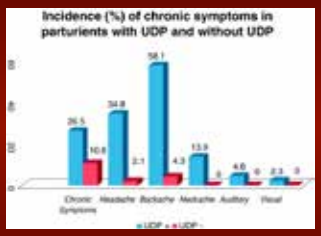
Christopher Allen-John Webb, MD, Paul David Weyker, MD, Li Zhang, MD, PhD, Susan Stanley, MD, D. Tyler Coyle, MD, Timothy Tang, Richard M. Smiley, MD, PhD, and Pamela Flood, MD

Chronic headache and backache are long-term sequelae of unintentional dural puncture in the obstetric population☆

Pavithra Ranganathan MD (Assistant Professor)[c],
Chaim Golfeiz BA (Medical Student)[a],



Webb: Anesth Analg 2012;115:124-32:



Raganathan: J Clin Anesth 2015;27:201-06

Does postdural puncture headache left untreated lead to subdural hematoma? Case report and review of the literature

A. Zeidan, O. Farhat, H. Maaliki, A. Baraka

Departments of Anesthesiology and Neurosurgery, Sabel General Hospital, and Department of Anesthesiology, American University of Beirut Medical Center, Beirut, Lebanon

Cranial Nerve VI Palsy After Dural-Arachnoid Puncture

Jennifer E. Hobbs, MD., and Barbara M. Scavone, MD

IMPORTANCE	
Relevance to stakeholders	YES
Health importance	YES
Measures equitable distribution	
Potential for improvement	
Susceptible to influence by healthcare system	

IMPORTANCE	
Relevance to stakeholders	YES
Health importance	YES
Measures equitable distribution	YES?
Potential for improvement	
Susceptible to influence by healthcare system	

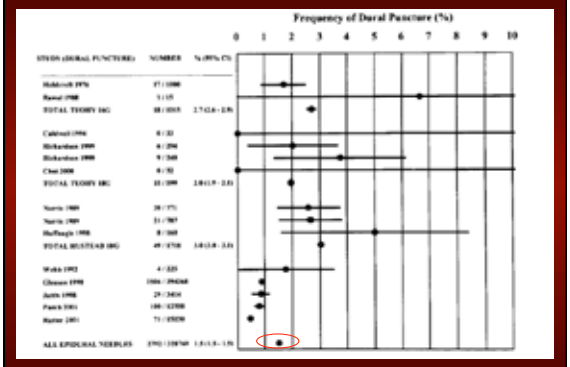
IMPORTANCE	
Relevance to stakeholders	YES
Health importance	YES
Measures equitable distribution	YES?
Potential for improvement	YES
Susceptible to influence by healthcare system	

IMPORTANCE	
Relevance to stakeholders	YES
Health importance	YES
Measures equitable distribution	YES?
Potential for improvement	YES
Susceptible to influence by healthcare system	YES

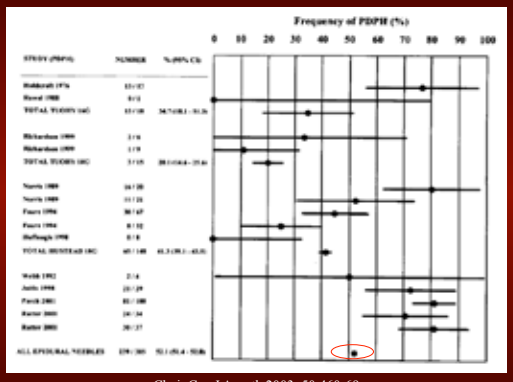
SCIENTIFIC SOUNDNESS: CLINICAL LOGIC	
Explicitness of evidence	
Strength of evidence	

SCIENTIFIC SOUNDNESS: CLINICAL LOGIC	
Explicitness of evidence	YES
Strength of evidence	YES

SCIENTIFIC SOUNDNESS: MEASURE PROPERTIES	
Reliability	
Validity	
Allowance for patient factors	
Comprehensible	



Choi: Can J Anesth 2003; 50:460-69



Choi: Can J Anesth 2003; 50:460-69

SCIENTIFIC SOUNDNESS: MEASURE PROPERTIES	
Reliability	NO
Validity	NO
Allowance for patient factors	
Comprehensible	

Effect of body habitus on ADP/PDPH

- More likely ADP
- Less likely PDPH?
- EBP more effective?

Vandam: JAMA 1956;161:586-91
Hollister: IJOA 2012;21:236-41
Faure: Reg Anesth 1994;19:361-63
Kokki: IJOA 2013;22;303-09
Miu: IJOA 2014;23:371-75

SCIENTIFIC SOUNDNESS: MEASURE PROPERTIES	
Reliability	NO
Validity	NO
Allowance for patient factors	YES
Comprehensible	

SCIENTIFIC SOUNDNESS: MEASURE PROPERTIES	
Reliability	NO
Validity	NO
Allowance for patient factors	YES
Comprehensible	YES

FEASIBILITY	
Specified numerator and denominator	
Data availability	

ADP
(Epidural + CSE) – Intentional DP

EBP
(Epidural + CSE) – Intentional DP

ADP
(Epidural + CSE) – Intentional DP

EBP
(Epidural + CSE) – Intentional DP

PDPH
(Epidural + CSE) – Intentional DP

FEASIBILITY	
Specified numerator and denominator	YES
Data availability	

FEASIBILITY	
Specified numerator and denominator	YES
Data availability	YES/NO

VALIDITY	
Strong scientific evidence supporting measure?	
Individuals in denominator equally included in numerator?	
Measure under control of those it is evaluating?	
Measure specifications capture event?	
Measure provide for fair comparisons among performers?	
Allow for adjustment of measure to exclude patients when appropriate?	

VALIDITY	
Strong scientific evidence supporting measure?	YES
Individuals in denominator equally included in numerator?	
Measure under control of those it is evaluating?	
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VALIDITY	
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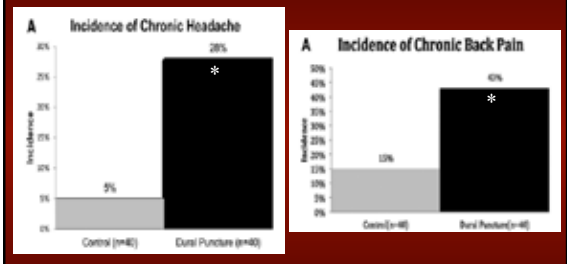
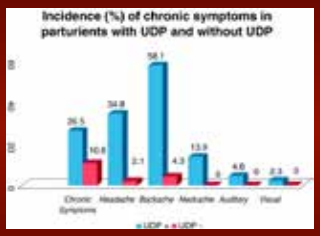
VALIDITY	
Strong scientific evidence supporting measure?	YES
Individuals in denominator equally included in numerator?	YES/ NO
Measure under control of those it is evaluating?	YES
Measure specifications capture event?	YES
Measure provide for fair comparisons among performers?	YES
Allow for adjustment of measure to exclude patients when appropriate?	YES

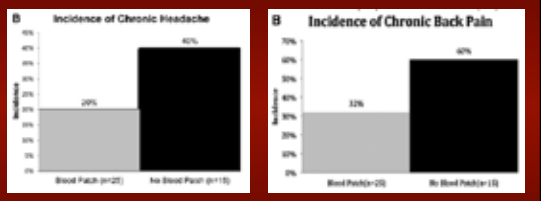
reference



Webb: Anesth Analg 2012;115:124-32:

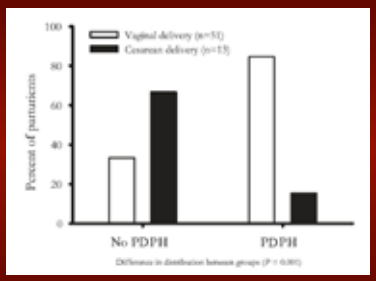


Raganathan: J Clin Anesth 2015;27:201-06

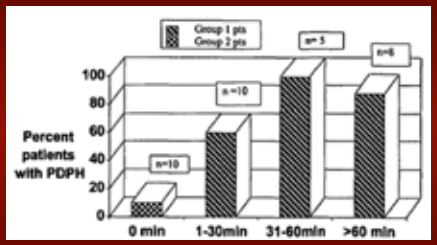


Webb: Anesth Analg 2012;115:124-32:

Cranial Nerve VI Palsy After Dural-Arachnoid Puncture



Scavone: Anesthesiology 2004;101:1422-27



Angle: Can J Anesth 1999;46:861-66

- Reliability and Validity dependent on
  - Reporting
  - Follow up
- Unintended consequences

Sepsis in the parturient

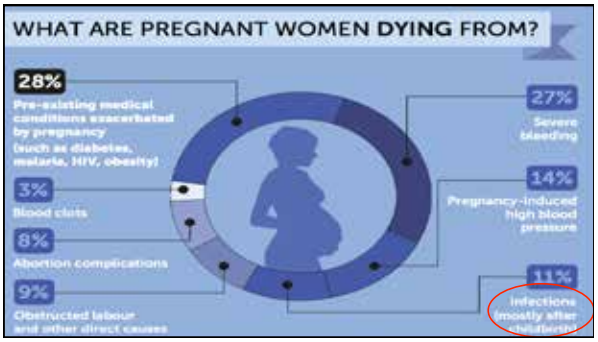
Nuala Lucas

- Historical context
- Clinical picture
- Management strategies
- Anything new?

Millennium development goals

http://www.who.int/topics/millennium_development_goals/en/

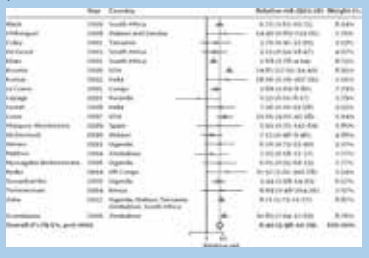
WHAT ARE PREGNANT WOMEN DYING FROM?



The impact of HIV infection

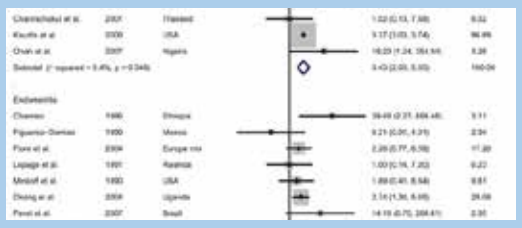
- 2008 - 342 900 maternal deaths worldwide
  - HIV disease accounted for 60 000 of these deaths
- HIV infection
  - Increased susceptibility to infection
  - More aggressive course e.g. Pneumocystis jirovecii
  - Most significant associated infection TB
- Without HIV (Sub-Saharan Africa)
  - MMR 580/100 000 (640)

Relative risk of death during pregnancy for women with HIV infection compared with women without HIV infection



Calvert, 2013

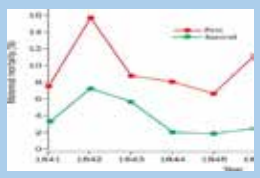
Strength of association between HIV & intrauterine infection



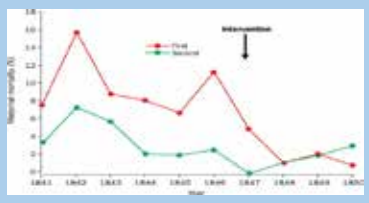
Calvert, 2013

- Historical context
- Clinical picture
- Management strategies
- Anything new?

Obstetric sepsis, 1846



After the introduction of hand washing…

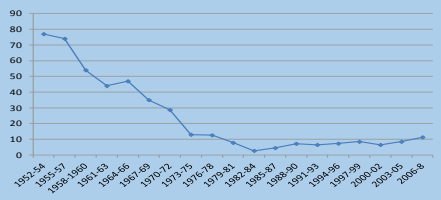


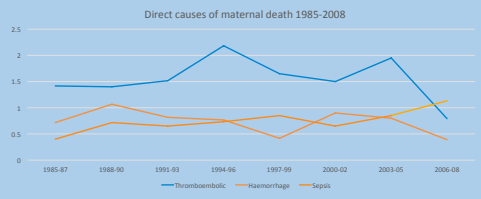
'The first patient was admitted with a temperature of 104°F. She was given Prontosil in the evening and the team was in and out of the ward all night in the oddest assortment of nightwear. The next morning the patient's temperature was normal and she recovered rapidly'

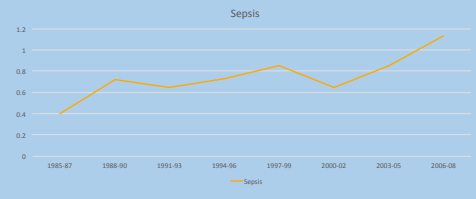
Lancet 1936; 2:1319-1322.

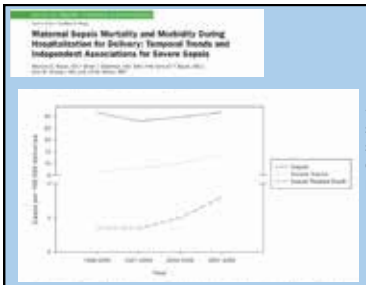
- Historical context
- Clinical picture
- Management strategies
- Anything new?

Changing patterns – deaths from sepsis

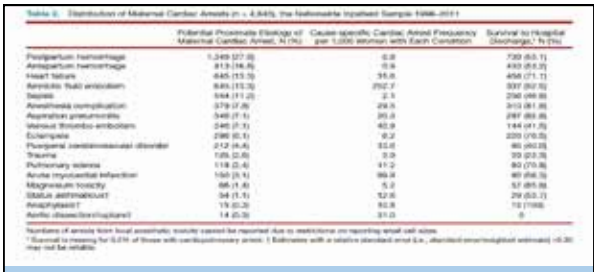




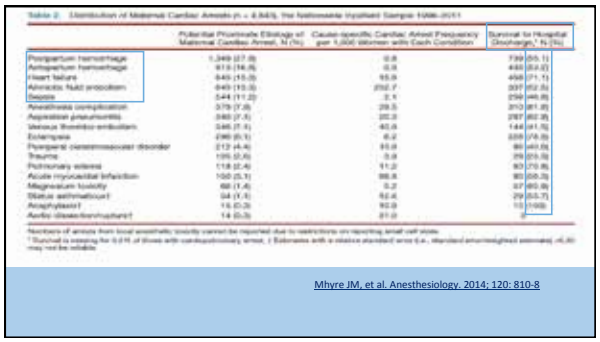




'While the overall frequency of sepsis was stable, the risk of severe sepsis and sepsis-related death increased during the study period'

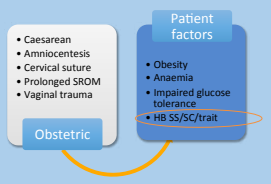


Mhyre JM, et al. Anesthesiology. 2014; 120: 810-8



Mhyre JM, et al. Anesthesiology. 2014; 120: 810-8

Causes & risk factors



CMACE, 2011

'Uncomplicated' sepsis

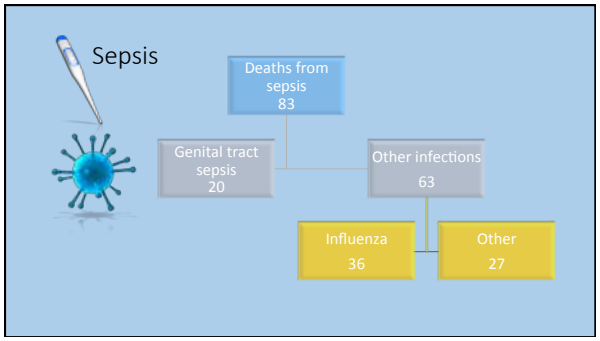
	aOdds ratio
Age <25 years	5.15
Obesity	2.12
Anaemia	3.44
Operative vaginal delivery	2.2
Caesarean section	3.23
>500 ml blood loss	
Severe PET	

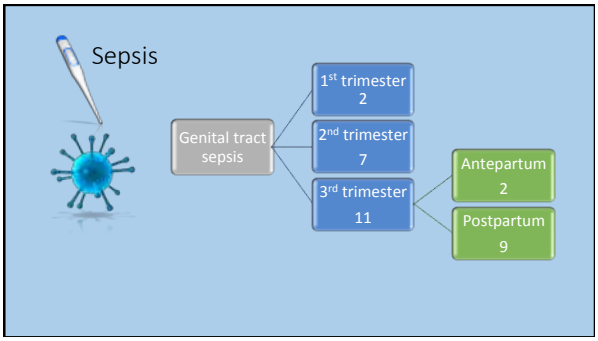
Acosta et al, BJOG, 2012

Progression to 'severe sepsis'

	aOdds ratio
Age <25 years	10.17
Obesity	0.71
Anaemia	21.5
Operative vaginal delivery	2.89
Caesarean section	8.74
>500 ml blood loss	7.96
Severe PET	3.35

Acosta et al, BJOG, 2012





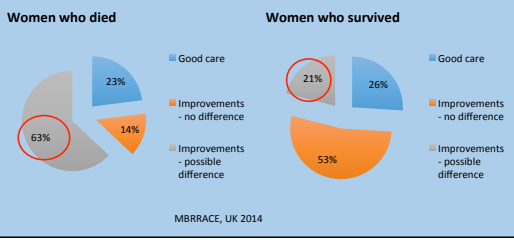
What organisms are responsible?

Table 3. Proportion of Specific Types of Severe Maternal Sepsis During 1998 to 2008 in the United States

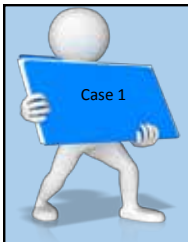
Most common types of organisms coded for severe sepsis	N = 1680 n (%)
Escherichia coli septicemia	450 (26.7)
Staphylococcal septicemia	373 (22.2)
Streptococcal septicemia	337 (20.1)
Gram-negative septicemia	324 (19.3)
Pneumococcal septicemia	63 (3.8)
Pseudomonas septicemia	40 (2.4)
Anaerobe septicemia	34 (2.0)
Systemic candidiasis	30 (1.8)
Haemophilus influenzae septicemia	19 (1.1)
Serratia septicemia	NR

NR = not reported due to number <10

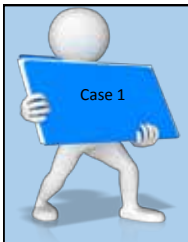
Quality of care



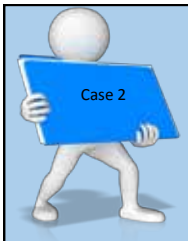
MBRRACE, UK 2014



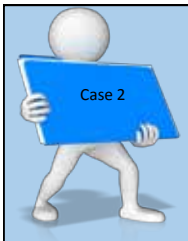
A woman was admitted in preterm labour & delivered rapidly. Three hours after delivery she was noted to be tachycardic and had a low BP. These observations were not plotted on a MEOWS or similar chart. She was not reviewed by an obstetrician & was discharged for low risk postnatal care. Her community midwife saw her 24 hours later. No observations were taken. On day 4 she was admitted to the A&E as an emergency but found to be dead on arrival. A post mortem revealed Group A Streptococcal sepsis. Further enquiries revealed that investigations taken in the hospital during her labour were abnormal. Blood results indicated sepsis and a high vaginal swab cultured Group A Streptococcus.



Delayed recognition
Incomplete assessment
No antibiotics
Communication
Care setting



A woman who was seven days post SVD became unwell at home with a fever. She was advised to attend the maternity unit immediately. On admission she was noted to be tachycardic, tachypnoeic and febrile. She was prioritised for urgent medical review. A diagnosis of acute sepsis from retained products was made and fluid resuscitation started immediately. IV antibiotics were started within 1 hour of diagnosis and she was transferred to the high dependency unit. The retained products of conception were removed promptly and she made a full recovery. Blood culture subsequently grew Klebsiella.



Early recognition, clear advice & prompt treatment

Key messages for Sepsis

Missed opportunities

1. Failure to recognise/respond to the sick woman
2. Antibiotic failings
3. Fluid balance in the septic parturient
4. Removing the source of the sepsis

Which situations might obstetric early warning scores be useful?

- Haemorrhage?
  - acute & obvious **or** concealed
  - physiological reserves may well keep MEWS low
  - *may be useful in monitoring resuscitation response and post-operatively*

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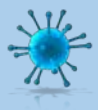


- Sepsis?
  - Yes!
- Respiratory rate abnormalities are early markers of disease

---

Difficulties with diagnosis?

- Fever
- D&V
- Anxious
- Vaginal discharge
- **Abdominal/perineal pain**
- Temp
  - high/normal/low
- Tachycardia
- Tachypnoea
- Hypotension/poor perfusion

Improving diagnostic accuracy?

Serum biomarkers

- CRP
- Lactate
- Procalcitonin

CMACE - areas of concern

1. Failure to recognise/ **respond** to the sick woman

"Detection of life threatening illness alone is of little value…it is the subsequent management that will alter the outcome."

CEMACH 2003-05

Sepsis 'bundles'

- A bundle is a group of evidence-based care components for a given disease that, when executed together, may result in better outcomes than if implemented individually"

The sepsis six

1. Give high flow oxygen
2. Take blood cultures
3. Give IV antibiotics
4. Start IV fluid resuscitation
5. Check haemoglobin and lactate
6. Monitor accurate hourly urine output

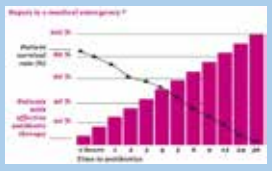
Daniels et al
Emergency Medicine Journal, 2010

Antibiotic timing - *does it really matter?*

- Importance of rapid antibiotic administration in sepsis long been recognised
- 'A recurring feature ….is a delay in starting intravenous antibiotics'

CEMACH 2003-5

Antibiotic timing - *does it really matter?*



'Every additional hour without effective antibiotic therapy can increase risk of death in patients with hypotensive sepsis by 7.6% during the first 6 hours'

Kumar et al
Crit Care Med, 2006

Antibiotic – other considerations

Strategy	Which drug(s)
• Start Urgently • Adequate doses, IV NOT oral • Senior micro input • Daily review • Don't wait for micro results • Don't stop too soon	• Difficult! • Lamont et al, BJOG, 2011 • CMACE – Augmentin + metronidazole – Severe sepsis • Piperacillin–tazobactam plus gentamicin

Fluid balance in obstetrics

Additional challenges in the parturient

- Physiology
- Pathology – co-existing disease
- Pharmacology- syntocinon, prostaglandins
- Monitoring - 'or lack of'

Fluid balance in obstetrics

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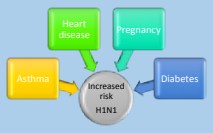
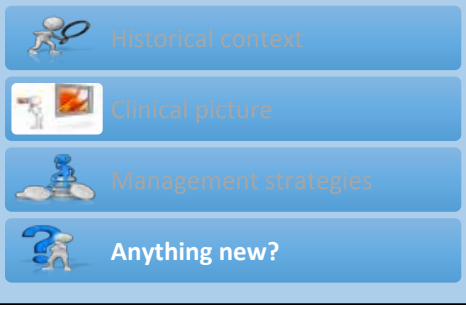
H1N1



- 2 messages
1) Vaccination
2) Use of neuraminidase inhibitors

- Little benefit in *general* population
- Studies *excluded* pregnant women
- Observational data continues to show evidence of benefit in pregnant women

Siston, Rasmussen, 2010
Pierce, Kurinczuk, 2011



BJA

Known knowns, known unknowns, and unknown unknowns: can systems medicine provide a new approach to sepsis?

'Mathematical modelling' & 'data mining' to augment the classical, hypothesis-driven approach that has largely failed to stem the tide of critical illness, including sepsis

ORIGINAL ARTICLE

Goal-Directed Resuscitation for Patients with Early Septic Shock

ORIGINAL ARTICLE

Trial of Early, Goal-Directed Resuscitation for Septic Shock

Surviving Sepsis Campaign

Updated Bundles in Response to New Evidence

TO BE COMPLETED WITHIN 6 HOURS OF TIME OF PRESENTATION:

1. Apply vasopressors [for hypotension that does not respond to initial fluid resuscitation] to maintain a mean arterial pressure [MAP] ≥65 mmHg.
5. In the event of persistent hypotension after initial fluid administration [MAP < 65 mm Hg] or if initial lactate was ≥4 mmol/L, re-assess volume status and tissue perfusion and document findings according to Table 1.
7. Re-measure lactate if initial lactate elevated.

- Mandatory rigorous annual training programme
- Computerised guidelines

The American Journal of Emergency Medicine

Implementation of a bundle of actions to improve adherence to the Surviving Sepsis Campaign guidelines at the ED

Effect of training on adherence to sepsis guidelines

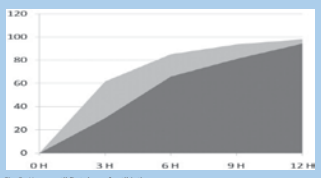


Fig. 5 Hours until first dose of antibiotics
(in light color, the improvement for the 2007 cohort).

Jos et al
Am J Em Med 2009

Take home messages

- Impact of morbidity
- Difficulties of diagnosis
- Timing of antibiotics
- Evolving role for anaesthesia

Title: Peripartum Sepsis: Updates from the Infectious Disease Perspective

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Disclosures: None

Objectives: The objectives of this presentation are to provide updates on:

1. The performance of sepsis prediction rules (risk scores) in pregnancy and the postpartum period
2. Current guidelines for the use of prophylactic and therapeutic antibiotics in the peripartum period

Summary: Sepsis is a leading cause of morbidity and mortality among obstetric patients in the United States.[1] The early identification of sepsis in pregnant and postpartum women is difficult, because signs and symptoms of sepsis overlap with normal pregnancy physiology.[2] As a result, substantial recent advances in the evaluation and management of sepsis in non-pregnant patients, with resulting reductions in morbidity and mortality, have not translated to obstetric patients.[3,4] There is a great need to improve the recognition and treatment of peripartum sepsis, in order to implement early treatment and appropriate escalation of care. Novel scoring systems can identify peripartum patients with sepsis and permit timely therapy, but they have important limitations in this population. The appropriate selection of antibiotics for prophylaxis during pregnancy termination or cesarean delivery, as well as for treatment of presumed or confirmed infection, is critical to improving outcomes related to peripartum sepsis.[5]

Key concepts:

Background information

This presentation is the second half of a session focused on peripartum sepsis. In the first half, Dr. Nuala Lucas will provide key background information, including definitions of the systemic inflammatory response syndrome (SIRS) and sepsis, history of puerperal sepsis, epidemiology of peripartum sepsis in developed and resource-limited settings, physiology of sepsis its relation to normal pregnancy physiology, and specific considerations for the anesthesiologist.

Peripartum sepsis

Peripartum sepsis, defined as sepsis in pregnancy or within 6 weeks after delivery, accounts for 14% of maternal deaths in the United States and 12% of maternal deaths worldwide.[1,6] The incidence of severe peripartum sepsis has increased more than 2-fold in the past decade, from 1 in 15,000 to 1 in 7,000 deliveries, likely attributable to increased maternal age and higher rates of comorbidities in women becoming pregnant.[7] Because normal pregnancy physiology can mimic early warning signs for sepsis, it is frequently misdiagnosed, leading to delays in appropriate initiation of antibiotics and escalation of care that adversely impact both mothers and infants.[2,7]

Challenges in identifying sepsis in pregnant and postpartum women

Approximately half of all sepsis-related deaths in pregnancy are preventable.[8] However, clinicians frequently miss the early warning signs of peripartum sepsis. Substantial overlap between SIRS physiology and normal pregnant/postpartum physiology makes the early identification of peripartum sepsis difficult. For example, heart rate, blood pressure, respiratory rate, and white blood cell count can often meet SIRS criteria in healthy pregnant women, especially during the third trimester, delivery, or postpartum periods.[2] Epidemiologic risk factors are present in as few as 6% of all patients, and thus also lack sensitivity for identifying patients at risk.[7]

Several scoring systems have been developed to predict risk of peripartum sepsis. These include the Sepsis in Obstetrics Score (SOS),[9] the Modified Early Obstetric Warning System (MEOWS),[10] and the Maternal Early Warning Criteria (MEWC),[11] which have been compared to scoring systems derived for non-pregnant adults, such as the Modified

Early Warning System (MEWS),[12,13] the Rapid Emergency Medicine Score (REMS),[14] and standard SIRS criteria. This presentation will review the performance of each algorithm, including sensitivity, specificity, and positive and negative predictive value. We will also highlight, however, that each scoring system has been used to predict different outcomes (e.g., sepsis vs. ICU admission vs. mortality), has been compared to different "gold standards," and has been studied in different populations, and few scoring systems have been prospectively validated.

Antibiotic selection to prevent and treat peripartum sepsis

The appropriate selection and timely administration of antibiotics are critical to improving sepsis-related outcomes.[5,15] Antibiotic selection includes both prophylaxis for women at risk for infection and treatment for women with suspected infection. Key issues in prophylaxis include timing and selection of antibiotics for prophylaxis during cesarean delivery or pregnancy termination.[16,17] Key issues in treatment include selection of empiric antibiotics for patients with fever or other warning signs of sepsis. Optimal empiric antibiotics should be chosen based on knowledge of likely or possible sites of infection (commonly chorioamniotitis/ endometritis, pyelonephritis, and pneumonia) and pathogens (importantly, Group B *streptococcus*, Group A *streptococcus*, *E. coli*, and other gram-negative bacteria).[18-20] Type and severity of infection may differ by antepartum, intrapartum, or postpartum status.[21] We will review key data to inform antibiotic selection during these time periods.

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Best Practice Panel - Case Report Review with the Experts

Moderator: Katherine W. Arendt, M.D.
Panelists: Katherine W. Arendt, M.D.; Brendan Carvalho, M.B.B.Ch., F.R.C.A., M.D.C.H.; Robert D'Angelo, M.D.; Roshan Fernando, M.B., Ch.B.

NOTES

Thursday, May 19, 2016

Abstract #:T-01

Maintaining a Malignant Hyperthermia Treatment Cart Within Labor and Delivery Suites is Not Cost-Effective

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Introduction: Dantrolene is known to be an effective treatment for Malignant Hyperthermia (MH), and the Malignant Hyperthermia Association of the United States (MHAUS) recommends dantrolene be administered within 10 minutes of the decision to treat for MH. However, MH-triggering agents are rarely used in obstetric suites. The goal of this analysis was to assess the economics of maintaining a MH cart in labor and delivery instead of relying on MH carts available in other areas of the hospital.

Methods: The predicted incidence of MH in women managed in an obstetric suite was computed by estimating the incidence of general anesthesia and MH from published literature and institutional data. The costs of maintaining a MH cart on labor and delivery were estimated by combining drugs, equipment, supplies and labor costs (pharmacist and nurse time for MH cart maintenance and preparedness training). A decision tree model with Monte Carlo simulations was used to evaluate the cost-effectiveness from society's perspective of having a MH cart on labor and delivery, facilitating treatment immediately within 10 minutes compared to using a MH cart from another area in the hospital with treatment within 40 minutes from decision to treat.

Results: Assuming a national cesarean delivery rate of 32.2%, with 5.6% of these receiving general anesthesia, the MH incidence in peripartum patients was estimated to be 1 in 170,968. The estimated annual cost of having dantrolene immediately available in all obstetric suites in the U.S. is $8,708,060, or $2,962 per suite. Having a MH cart immediately available in the obstetric suite compared to using a MH cart from another area in the hospital (e.g. the main operating room suite), would collectively save an additional 0.06 lives per year in the US; an incremental cost-effectiveness ratio of $150,646,468 per life saved. Applying the most favorable assumptions for having a MH cart in labor and delivery resulted in a cost-effectiveness ratio of $20,461,059 per life saved, which is significantly greater than what is commonly accepted as cost-effective.

Conclusion: The Joint Commission has set standards and elements of performance, which suggest all labor and delivery suites maintain their own MH carts. However, this is not cost-effective due to how few MH-triggering general anesthetics are given to parturients combined with the low incidence of MH. MHAUS recommendation for immediate dantrolene availability in the obstetric setting is not a cost-effective strategy. Findings suggest that having a MH cart close enough to a labor and delivery suite to initiate treatment within 40 minutes is a more appropriate policy.

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1. Malignant Hyperthermia Association of the United States http://www.mhaus.org/faqs/dantrolene
2. The Joint Commission Comprehensive Accreditation Manual for Hospitals (2013).
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Abstract #:T-02

Independent Risk Factors for Surgical Site Infection after Cesarean Delivery in a Rural Tertiary Academic Medical Center

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Introduction: We aimed to determine the incidence of surgical site infection (SSI) after cesarean delivery (CD) and identify risk factors for SSIs in a rural tertiary academic medical center.

Methods: After local institutional review board approval, we conducted a time matched, case control, quality assurance analysis. Over a 6.5 year period, 218 patients with a SSI were identified based on ICD code and matched to a control group of 3,131 parturients from the Integrated Data Repository quality assurance medical record database. Data is presented as mean ± SD with 95% CI, median with range in parenthesis, or percentage with Odds Ratio (OR) and analyzed using t-test or Chi-square. A $P < 0.05$ is significant.

Results: The overall incidence of SSI after CD was 7.0%. No differences were noted with respect to age, ethnicity, height, insurance, prenatal care visits, prior antibiotic use, prior CD, GBS colonization, steroid use, malpresentation, cervical incompetence, diagnosis of chorioamnionitis or maternal fever, history of diabetes, SLE, STD, or preeclampsia, use of Foley bulb, number of vaginal exams, vaginal bleeding during pregnancy, use of internal fetal monitor, need for amnioinfusion, presence of meconium at birth, emergency CD, STAT CD, time between admission and CD, intraoperative antibiotic use, gestational age, Apgar score, and child birth weight. Significant differences did occur in BMI 40.30 ± 10.60 kg/m2 SSI (95% CI: 38.73-41.87) vs. 34.05 ± 8.24 kg/m2 control (95% CI: 33.75-34.35, $P < 0.001$), highest level of education 13.28 ± 2.44 yr. SSI (95% CI: 12.9-13.66) vs. 14.07 ± 2.81 yr. control (95% CI: 13.96-14.18, $P < 0.001$), and prior births 2 (1-9) SSI vs. 1 (1-11) control ($P < 0.001$). Table 1 lists additional independent risk factors for SSI after CD.

Conclusions: In addition to higher BMI, lower education level, and history of higher parity, we found that tobacco use, a diagnosis of hypertension and gestational diabetes to be independent risk factors for SSI. Conversely, the presence of ruptured membranes, an elective or urgent CD, and a low transverse incision were protective against a SSI after CD.

Table 1. Independent risk factors for SSI post CD.

Variable	SSI (n=218)	Control (n=3131)	P-value	OR	95% CI
Tobacco use	42.18%	32.90%	0.021	1.49	1.06 - 2.09
Diagnosis of Hypertension	54.50%	39.92%	<0.001	1.80	1.34 -2.42
Gestational Diabetes	33.49%	24.08%	0.002	1.59	1.18 - 2.13
Ruptured Membranes	0.46%	6.55%	<0.001	0.07	0.01 - 0.47
Elective Procedure	27.52%	44.98%	<0.001	0.47	0.34 - 0.63
Urgent Procedure	3.67%	8.44%	<0.001	0.41	0.20 - 0.85
Low Transverse Incision	6.42%	13.68%	0.002	0.43	0.25 - 0.75

Abstract #:T-03

Socioeconomic disparities and utilization of anesthetic care during pregnancy and delivery. A French prospective, multicenter, cohort study

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Elie Kantor, Jean Guglielminotti, Candice Estellat, for the PreCARE study Group.
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Background: Socioeconomic (SE) disparities during pregnancy are associated with a lower utilization of prenatal care, and with an increased risk of adverse maternal and neonatal outcomes. Pre-anesthetic evaluation (PAE) during pregnancy aims to improve the quality and safety of anesthetic care provided during childbirth, especially neuraxial analgesic techniques (NAT) (Anesthesiol Res Pract 2010;2010). PAE and NAT are free of charge in France, and PAE is mandatory for all women during the last trimester of pregnancy. For patients without a health insurance, a temporary insurance is provided by the French state. This study aims to examine the association between maternal SE disparities and (i) the absence of PAE during pregnancy, and (ii) the non-utilization of NAT during labor.

Methods: Data came from a prospective cohort of 10,419 women who delivered in 4 academic public hospitals in Paris, France. Pre-anesthetic evaluation was defined absent if performed less than 48 hours before delivery; in France, a minimum delay of 48 hours is required before PAE and a planned surgical procedure. Multivariable logistic regression was used to examine the association between maternal SE characteristics (social isolation, poor housing condition, not work-related household income, or absence of a permanent health insurance), immigration characteristics (country of birth), low education level, substances abuse during pregnancy, and language barrier with the absence of PAE, and the non-utilization of NAT.

Results: PAE was absent in 482 (5.6%) of the 8,624 women analyzed. After multivariate adjustment, three risk factors for the absence of PAE were identified: absence of permanent health care insurance (adjusted odds ratio (aOR): 1.23; 95% confidence interval (CI): 1.10-1.37), low education level (aOR: 1.18; 95% CI: 1.06-1.32), and substances abuses (aOR: 1.67; 95% CI: 1.15-2.42]). NAT during labor was not utilized in 776 of the 6,834 women analyzed (8.4%). The only SE characteristic associated with the non-utilization of NAT was a low education level (aOR 1.28; 95% CI: 1.17-1.41).

Conclusions: SE disparities in a healthcare system providing charge-free anesthetic care are associated with an increased risk of the absence of PAE during pregnancy and non-utilization of NAT during labor. Interventions should be targeted to these populations to increase the realization of PAE during pregnancy and improve the quality and safety of anesthesia care during childbirth.

Abstract #:T-04

The Effect of a Culturally Sensitive Educational Intervention on Acceptance of Neuraxial Anesthesia in Hispanic and Caucasian Parturients: A Randomized Controlled Trial

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Introduction: Large disparities in access to medical care exist between Hispanic and non-Hispanic Americans. Hispanic women receive epidural labor analgesia much less frequently than their non-Hispanic counterparts despite studies repeatedly demonstrating that it offers the best pain control. We tested the hypothesis that an epidural-focused, language-appropriate educational intervention could dispel epidural-related myths and improve epidural usage rates.

Methods: In this single-blinded, randomized controlled trial Hispanic and non-Hispanic women were randomized upon arrival to labor and delivery to a pamphlet and video (intervention) targeting common myths about epidurals in the subject's home language (English or Spanish) or standard of care (control). Eligible women were ≥ 18 years, ASA I-III, gestation ≥ 24 weeks, on Medicaid, assigned to a M.D., and free to choose epidural analgesia. All women completed a short Beliefs About Epidurals Questionnaire (BAEQ) before (pre-test) and after (post-test) their randomized intervention. The BAEQ assessed subject agreement with commonly cited non-evidence-based reasons for avoiding epidural analgesia with points awarded for incorrect answers. The effect of the intervention on epidural usage rates (data presented as % that choose epidural in intervention vs. control) was compared with the Fisher's exact test and BAEQ scores (presented as median, IQR for pre-test vs. post-test) were compared with the Wilcoxon signed-rank test. Two-sided p-values < 0.05 were statistically significant.

Results: This is an interim analysis of 58 non-Hispanic (29 intervention and 29 control) and 26 Hispanic (9 intervention and 17 control) parturients out of a planned 176 subjects (44 per group). There was a non-significant trend towards a higher epidural usage rate in Hispanic women that received the intervention (100% vs. 76%, p = 0.26). Non-Hispanics receiving additional education did not elect epidural analgesia more often (93% vs. 97%, p = 0.62). Both Hispanic [(5, IQR 2,7) vs. (2, IQR 2,2), W = 2.5 < critical 3, N too small to calculate p-value) and non-Hispanic [(3, IQR 2,4) vs. (2, IQR 0,3), W = 26, p = 0.003] women that received the intervention achieved more correct answers on the BAEQ. Non-Hispanic women randomized to standard of care did not have improved BAEQ scores [(3, IQR 1.5,4) vs. (1, IQR 1,3), W = 42, p = 0.10]; however, Hispanic control subjects did [(5, IQR 4,6) vs. (3, IQR 2,3), W = 7.5, p = 0.005].

Conclusion: In this interim analysis, the educational intervention improved epidural analgesia knowledge and seemed to help dispel epidural-related myths for both Hispanic or non-Hispanic parturients; however, improved knowledge did not translate into a higher epidural usage rate. This suggests that the decision to choose epidural analgesia is multifactorial and improved peripartum knowledge about epidurals may not, by itself, be enough to effect epidural usage patterns.

Abstract #:T-05

Practical Guide for the Implementation of an Obstetric Hemorrhage Protocol

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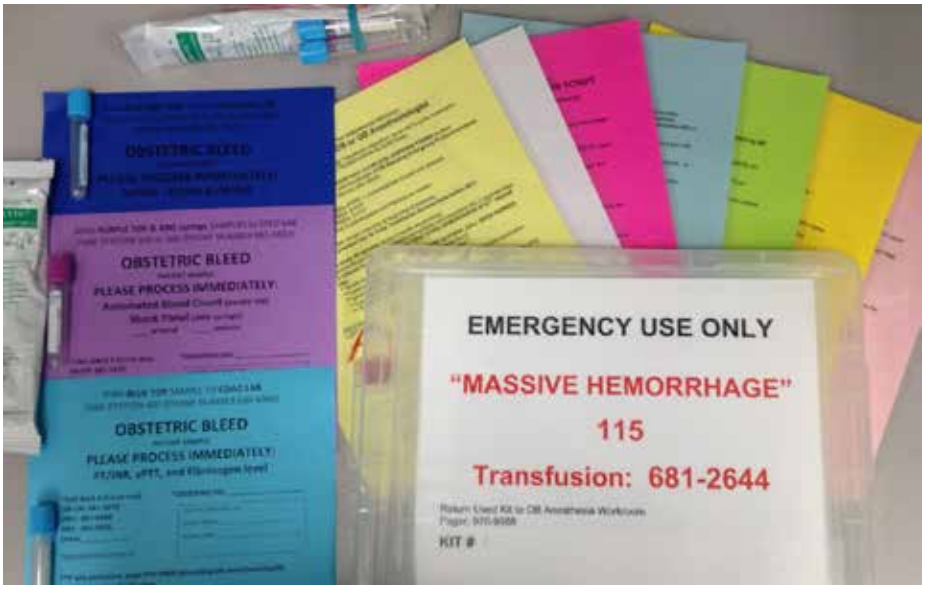
Introduction: Evidence supports improved outcomes with obstetric hemorrhage protocol (OHP).1 Resources, including toolkits, are available that describe implementation of an OHP.2 Challenges to implementation include system-issues and cultural barriers. We describe our 5 year experience with introduction and use of an OHP.

Description: Systems' issues during OHP implementation extended beyond labor & delivery (L&D)–such as lab, pharmacy, subspecialty consultants and perioperative resources. Like many, our L&D unit functioned in isolation. Cultural barriers to OHP included lack of: team engagement at local and health system's level; subspecialists' reluctance to relinquish territory; coordination in patient management; and acceptance of the need for new management approach.
A critical step was to establish and maintain a multidisciplinary team. Members ranged from patient aids to hospital administrators. Careful attention to processes identified opportunities to improve care. An example is use of color-coded lab slips for easy recognition of sample destination. A simple approach for assignment of roles was created by use of laminated cards with roles and designated tasks that are handed to individuals as they arrive to help. This enabled a culture of engagement. Cognitive aides and flow sheets facilitate adherence to OHP. Post-event debrief and team meeting have maintained engagement and ownership of the process.
Our OHP has been activated over 100 times. Successful launch and adherence to OHP occurs at all hours and days of week. Changes to OHP have included use of TXA, fibrinogen concentration, ROTEM and engagement of other personnel (eg. pharmacist to aid in obtaining and dosing adjuvants).

Conclusion: Recognizing each practice is unique our experience in implementing and refining an OHP may be useful to others struggling to apply published recommendations or tools.2 We highlight the value of protocol in engaging and inducing cultural change.



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Abstract #:T-06

Cost-Effectiveness Analysis of Intraoperative Cell Salvage for Cesarean Delivery

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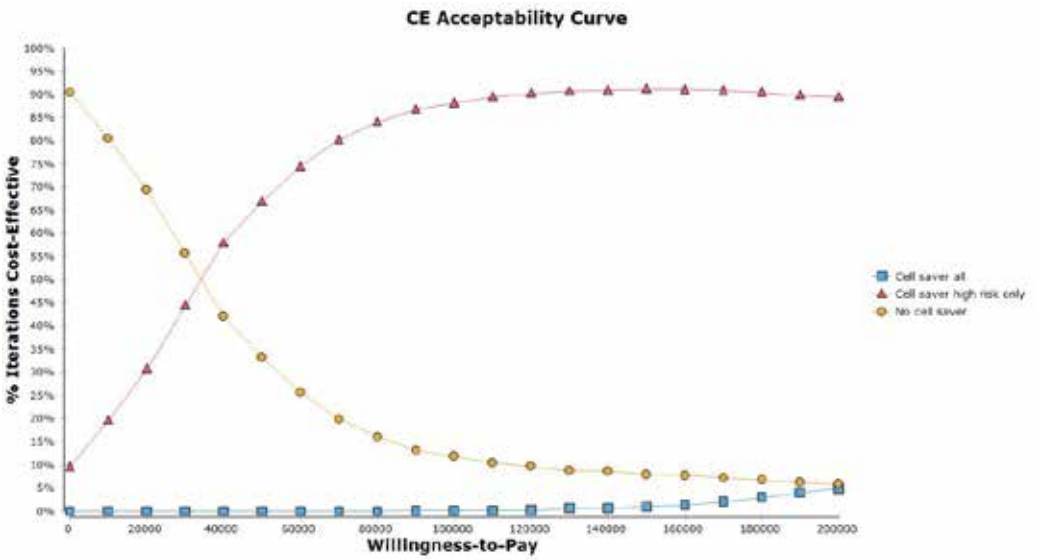
Background: Cell salvage for obstetric hemorrhage is effective in attenuating allogeneic blood product consumption, but uncertainty exists around optimal cost-effective strategies by which to implement cell salvage in obstetrics. Our objective was to determine the cost-effectiveness of cell salvage strategies in cesarean delivery using a societal perspective and lifetime horizon.

Methods: We used a Markov decision analysis model to compare the cost-effectiveness of three primary strategies: use of cell salvage for every cesarean delivery; cell salvage use for high-risk cases alone; and no cell salvage. We assumed a societal perspective and a lifetime horizon for the base case of a 26-year-old nulliparous woman presenting for cesarean delivery. For each strategy, the model integrated: 1) probabilities of hemorrhage, hysterectomy, transfusion reactions, emergency procedures, and cell salvage utilization; 2) utilities for quality of life (0=dead, 1=perfect health); and 3) costs at the societal level. One- and two-way sensitivity analyses as well as Monte Carlo probabilistic sensitivity analysis were performed. A threshold of $100,000 per quality-adjusted life-year (QALY) gained was utilized as a cost-effectiveness criterion.

Results: Cell salvage use for cases at high risk for hemorrhage (IOCS-HR) was cost-effective, with an incremental cost-effectiveness ratio (ICER) of $34,881 per QALY gained. Routine cell salvage use for all cesarean deliveries was not cost-effective, costing $415,488 per QALY gained. The utility of the health state associated with receiving any transfusion at which IOCS-HR exceeds the $100,000 per QALY threshold was 0.902 or greater (base case 0.8). Results were not sensitive to individual variation of other model parameters. The probabilistic sensitivity analysis showed that at the $100,000 per QALY gained threshold, there is >85% likelihood that IOCS-HR is favorable.



Conclusions: The use of cell salvage for cases at high risk for hemorrhage is economically reasonable; routine cell salvage use for all cesarean deliveries is not. Further investigations aimed at elucidating the utility of the health state associated with allogeneic transfusion in obstetric patients will be useful in further assessing the robustness of these findings.

References:

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Milne ME. Obstet Gynec. 2015;125:919-23.

Abstract #:T-07

Post-cesarean Section Opioid Use and Estimated Blood Loss in Patients Who Received Ketorolac and Epidural Morphine versus Epidural Morphine Alone

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Background: Prior studies have shown opioid-sparing effects of ketorolac and other non-steroidal anti-inflammatory drugs in post-surgical patients (1). Despite this, ketorolac is not widely used due to concern for hemorrhage, secondary to platelet dysfunction and uterine atony (2,3). Recent studies in surgical specialties have found no clinically significant difference in estimated blood loss with ketorolac use (4). No study examines the effect of both intraoperative and postoperative dosing of ketorolac on opioid use and estimated blood loss in patients who underwent cesarean section. We performed a retrospective cohort study that examined whether patients post-cesarean section receiving ketorolac and epidural morphine versus epidural morphine alone required any additional intravenous opioid for the treatment of pain in the first 24 hours. We further assessed if ketorolac use led to an increase in estimated blood loss.

Methods: We performed a retrospective review of all Quality Assurance data for patients undergoing cesarean section at University Hospitals Case Medical Center from August 2014 to January 2015 (n=630). After removal of patients with exclusion criteria, 204 patients remained in the cohort: 166 received both intraoperative and postoperative ketorolac and 38 patients received no ketorolac. A fitted logistic regression model was used to evaluate our primary outcome. Secondary outcomes were evaluated fitting logistic regression or linear regression model, as appropriate. Significant secondary outcomes included estimated blood loss, misoprostol doses, methylergonovine doses and promethazine doses.

Results: We determined there was a statistically significant reduction the use of any hydromorphone to treat post cesarean section pain in patients who received ketorolac (odds ratio=0.3133, 95% confidence interval=1506-.6515, p value=0.002). We also found that patients who received ketorolac had a lower estimated blood loss than those who did not; 813.3ml versus 1097.8ml, respectively (p value<0.001). Misoprostol doses and methylergonovine doses were lower in the ketorolac group (p=0.008 and p<0.001). Promethazine doses were also lower in the ketorolac group (p=0.006). There was no statistically significant difference in demographic data between either group.

Conclusions: The use of intraoperative and postoperative ketorolac significantly reduced the likelihood of receiving any hydromorphone in the first 24 hours to treat post cesarean section pain. Lower promethazine doses in the ketorolac group likely signify decreased side effects secondary to decreased opioid usage. Decreased estimated blood loss and use of uterotonics in the ketorolac group likely represents patient selection bias.

References:

1. Blackburn A. J Clin Anesth. 1995 Mar:103-8.
2. Elhakim M. Acta Anaesthesiol Scand. 2000 May: 555-9.
3. Diemunsch P. Eur J Obstet Gynecol Reprod Biol. 1997 Apr: 205-6.
4. Gobble RM. Plast Reconstr Surg. 2015 Jan 29: 741-755.

Abstract #:T-08

The Mozart Panacea: A Randomized Controlled Trial Of Music On Anxiety, Hemodynamic Changes, And Patient Satisfaction During Cesarean Delivery

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Introduction: Anxiety prior to cesarean delivery (CD) has been associated with hypotension after spinal anesthesia (1). Because music is a non-pharmacological method that may reduce anxiety (2), we sought to determine if it might be suitable for the obstetric setting. Our hypothesis was that music during CD would mitigate spinal induced hypotension by lowering patient anxiety, and that music would improve patient satisfaction.

Methods: After obtaining informed consent, parturients scheduled for CD were randomized to Mozart (pre-selected music), Pandora (patient-selected music), or control (no music). Music was broadcast through an iPod with an external amplified speaker starting 30 minutes prior to surgery and lasting until 30 minutes after surgery. Anxiety was measured using a verbal analog scale (0-10) at the time of enrollment, immediately preoperatively, and postoperatively. Noninvasive blood pressure was measured at baseline and every minute for 10 minutes after spinal anesthesia, and absolute percent change in systolic arterial pressure (%ΔSAP) was calculated. Patient satisfaction was evaluated using a previously validated survey (3). Student's t-test was used to analyze anxiety, %ΔSAP, and satisfaction scores, while the effect of anxiety on %ΔSAP was assessed by one-way ANOVA.

Results: Thirty-six of 60 patients have been recruited (Mozart N=13; Pandora N=14; control N=9), and patient characteristics were similar in all groups. The mean duration of music was 181.7 minutes. The anxiety levels preoperatively and the %ΔSAP after spinal anesthesia were no different between control and both music groups. However, the Mozart group experienced lower postoperative anxiety levels (p=0.039), higher patient satisfaction (p=0.007), and found the operating room atmosphere more comfortable (p=0.001) compared to controls (see Table).

Discussion: Perioperative music during CD does not improve preoperative anxiety or %ΔSAP, but Mozart music appears associated with lower postoperative anxiety and higher patient satisfaction. The most important factor for higher patient satisfaction was experiencing a comfortable operating room atmosphere. Because patient satisfaction has been linked to reimbursements via pay-for-performance metrics, further investigation is needed to determine if music during CD can be a panacea to patients who have high anxiety levels.

References:

1. Orbach-Zinger 2012
2. Conrad 2007
3. Morgan 1999

Table: Patient Outcomes Based On Randomization Group

	CONTROL	MOZART	PANDORA	*P* (Mozart)	*P* (Pandora)
Baseline anxiety, VAS (SD)	4.28 (1.95)	3.42 (3.0)	3.93 (2.62)	0.437	0.719
Preoperative anxiety, VAS (SD)	4.67 (2.14)	3.17 (2.95)	4.07 (2.61)	0.192	0.557
Postoperative anxiety,VAS (SD)	2.56 (2.58)	0.25 (0.45)	0.86 (1.1)	**0.039***	0.111
Satisfaction (9-63 pt scale)	45.9 (5.0)	53.7 (5.3)	50.2 (4.6)	**0.007***	0.085
Comfortable OR (1-9 pt scale)	5.33 (1.0)	6.92 (0.29)	6.14 (1.17)	**0.001***	0.092
Max % Δ SAP	31.5 (11.9)	34.2 (19.7)	56.4 (51.9)	0.724	0.134
Phenylephrine equivalents	560.3 (491.5)	599.9 (371.0)	402.2 (250.7)	0.843	0.391

VAS = visual analog scale; SD = standard deviation; OR = operating room; * = P <0.05; pt = point;
Max % Δ SAP = maximum percent change in systolic arterial pressure

Abstract #:T-09

Airway Examination during Labor and Delivery in Preeclamptic Compared to Healthy Parturients

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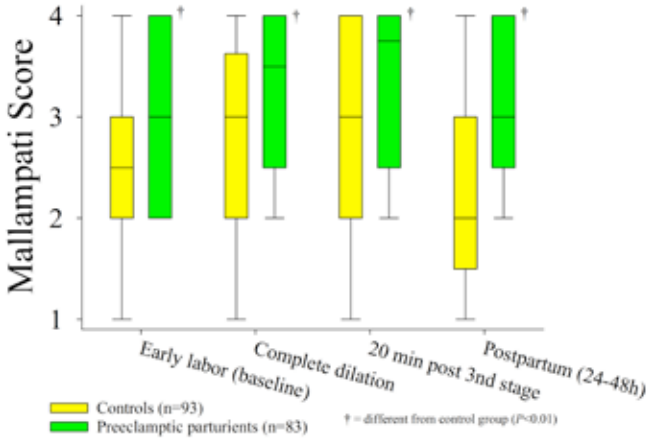
Introduction: The incidence of failed intubation is eight-times higher in pregnant patients than non-pregnant patients. Previous studies have shown there are changes in the Mallampati classification over the course of labor. It is unknown if preeclampsia is associated with worsening airway changes during labor due to fluid retention. We hypothesized that preeclamptic women would experience worse airway change during labor than healthy women.

Methods: Healthy and preeclamptic parturients with cervical dilation <5 cm admitted for planned vaginal delivery were recruited in this prospective observational cohort study. Airway photographs were taken with a digital SLR camera at four times: 1) study enrollment; 2) complete cervical dilation; 3) 20 min after delivery; and 4) 36-48 h postpartum. Two anesthesiologists, blinded to patient and timing of the photograph, graded the airways using the Samsoon modification of Mallampati classification. Change in modified Mallampati airway class, excluding women with a Mallampati class 4 airway at baseline, in preeclamptic and healthy parturients was evaluated with the preceding measurement interval using the sign test. Between group differences at the 4 assessment intervals was evaluated using the Mann Whitney U-test. Inter-rater reliability in assigning Mallampati classification was determined using Chronbach's alpha. A $P<0.01$ was required for between group assessments to control for multiple comparisons.

Results: One hundred twelve patients were recruited for each group. The control group had 93 subjects (83%) and the preeclampsia group had 83 subjects (74%) that had at least one evaluable pair of images. Reviewer agreement was 0.94. Mallampati scores were greater at all time intervals in preeclamptic women compared with the control group (Fig 1). There was no difference in the number of women that increased their Mallampati by 1 or more classification compared to the preceding assessment in either study group.

Conclusions: Preeclamptic women had worse Mallampati scores at initial and subsequent evaluations compared to healthy parturients during and after labor. There was no difference between the preeclamptic and healthy groups in the number of women that had increased Mallampati score. The four-point Mallampati classification may not be sensitive enough to detect smaller changes over time. These findings emphasize the importance of airway re-evaluation prior to operative procedures in the peripartum period.



Abstract #:T-10

Rapid sequence induction with videolaryngoscopy for category 1 caesarean delivery in parturients with anticipated difficult intubation: the use of decision analysis based on data from systematic reviews.

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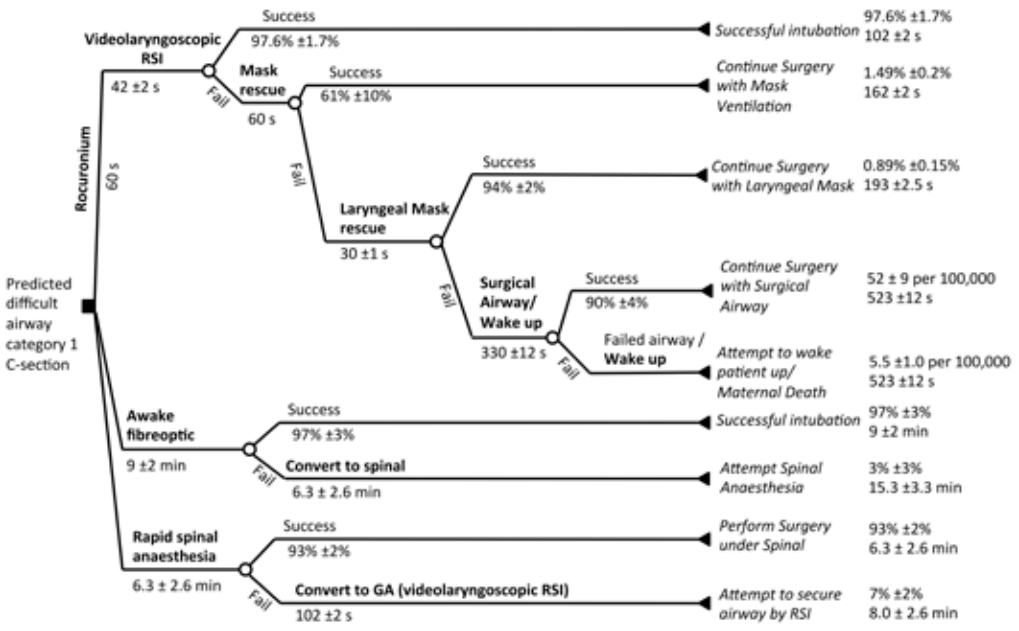
Introduction: Predicted difficult airway is considered by many to be an absolute contraindication for rapid sequence induction (RSI) even in category 1 caesarean deliveries. This risk may be diminished by using videolaryngoscopy (VL), but quantifying this risk is hampered by the rarity and urgency of these cases.

Methods: We used decision analysis, based on multiple systematic literature searches (Pubmed 1966-2015 and Cochrane Library), to quantify probability of failure and time to success of three management strategies: RSI with VL; awake fibreoptic intubation (FOI); and spinal anaesthesia. Studies were analysed that assessed either success rate (nominator and denominator), or time to success (reported in a way that allowed calculation of mean and standard error). Mean time for each node was the average of the times from each trial, weighted according to number of successes. Standard error for time was estimated pragmatically depending on how variation was presented in the relevant paper: 95% CI÷2; standard deviation/√(n-1);or interquartile range/1.35/√(n-1). Cumulative probabilities were calculated by multiplying the probabilities of each of the preceding nodes. Standard errors for cumulative probabilities were calculated by adding the relative errors in quadrature (square root of the sum of the squares) of probabilities for each of the preceding nodes. Cumulative pathway times were calculated by adding the times for each of the preceding nodes. Standard errors for cumulate times were calculated by adding absolute errors in quadrature. Numbers of accepted / rejected studies were: videolaryngoscopy 7/17, rescue mask ventilation 1/98, rescue LMA ventilation 16/241, surgical cricothyroidotomy 1/36, awake fibreoptic intubation 1/33, and spinal anaesthesia for category 1 caesarean delivery 2/294. Full list of accepted and rejected papers, including reasons for rejection, are available on request. Results for each node have been populated in the figure.

Results: There was a shorter time to induction using RSI-VL (102 ± 2 sec) compared with awake fiberoptic intubation (approximately 9 ± 2 min, p=0.0001) or spinal anaesthesia (6.3 ±2.6 min, p=0.038). The risk of ultimate failed airway after RSI-VL was 5.5 ± 1.0 per 100,000 cases.

Conclusion: Data from decision analysis may be used to inform clinical decision making. We suggest that many mothers would accept such a low additional risk in order to reduce delivery time and potentially reduce fetal harm.



Abstract #:T-11

Comparison of volumes of air delivered and peak airway pressures generated using maximal and normal bimanual compressions of an adult Ambu® bag through two lengths of Frova intubation bougies into a standard adult lung compliance simulator: a pilot study

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Introduction: Blade Assisted Bougie Cricothyroidotomy can be life saving in a "can't intubate, can't oxygenate" emergency1, 2.The Frova bougie (Cook medical) may be used as a temporizing device for oxygen delivery.
We aimed to demonstrate that it is possible to deliver significant volumes of air through a Frova bougie using bimanual compression of an Ambu® bag. We compared the volume of air delivered and the peak airway pressures generated using two lengths of Frova bougies. We hypothesized that there would be greater resistance to the flow of air through the longer Frova bougie resulting in smaller tidal volumes.

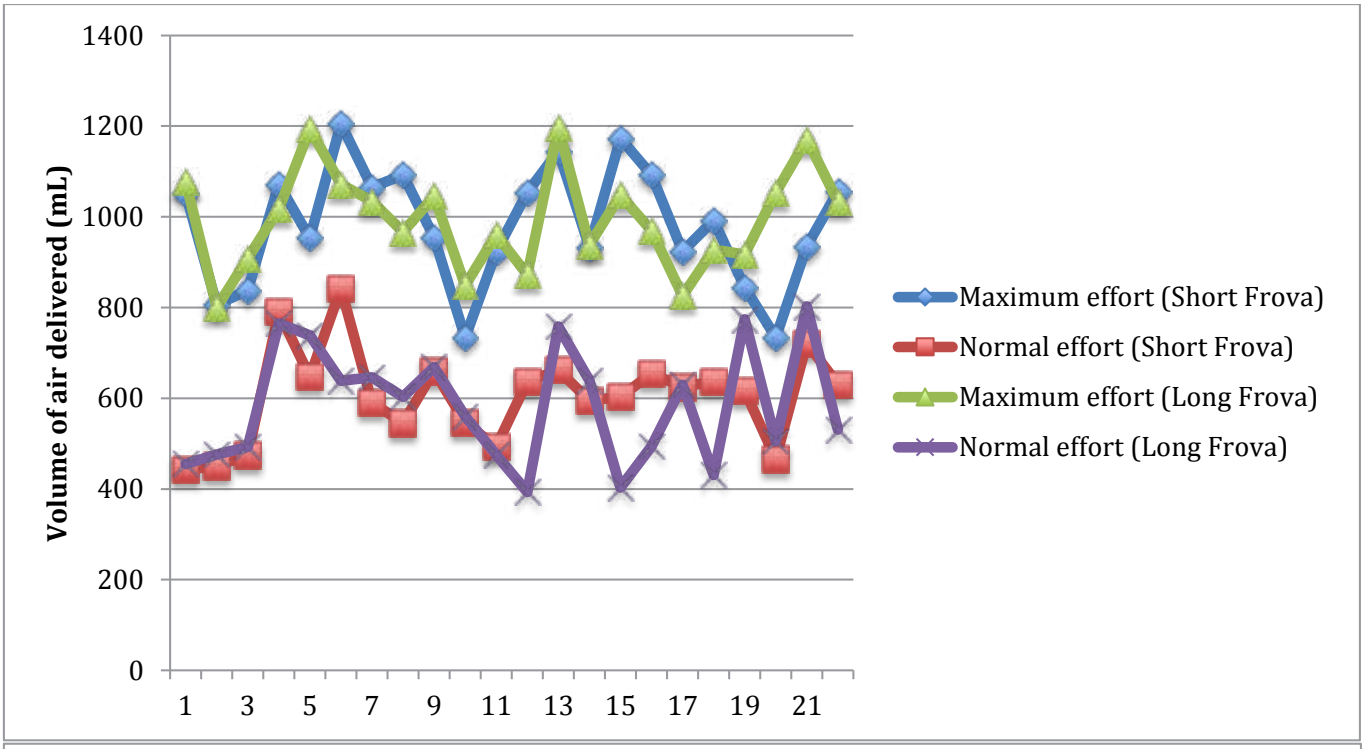
Methods: This prospective, randomized, and blinded observational study was conducted in the department of Anesthesia, BC Women's and Children's Hospital, Vancouver. Written informed consent was obtained from 22 anesthesiologists.
The proximal end of a Frova bougie was connected via a Rapi-fit® connector to an adult 2L Ambu® bag. The distal end was inserted via a universal adaptor into the measurement port of a flow analyser PF-300 fitted with a standard adult lung compliance simulator. The participants bimanually squeezed the Ambu® bag, connected to one of the Frova bougies (14G-70 cm; 14G-65 cm), with a maximum and a normal effort in a random order, using a computer generated randomisation table. Each participant was assessed three times per group, and the mean values were calculated. For each ventilatory effort, the volume of air delivered, the peak airway pressure generated, peak flow and inspiratory time were measured. Descriptive statistics were used for analysis.

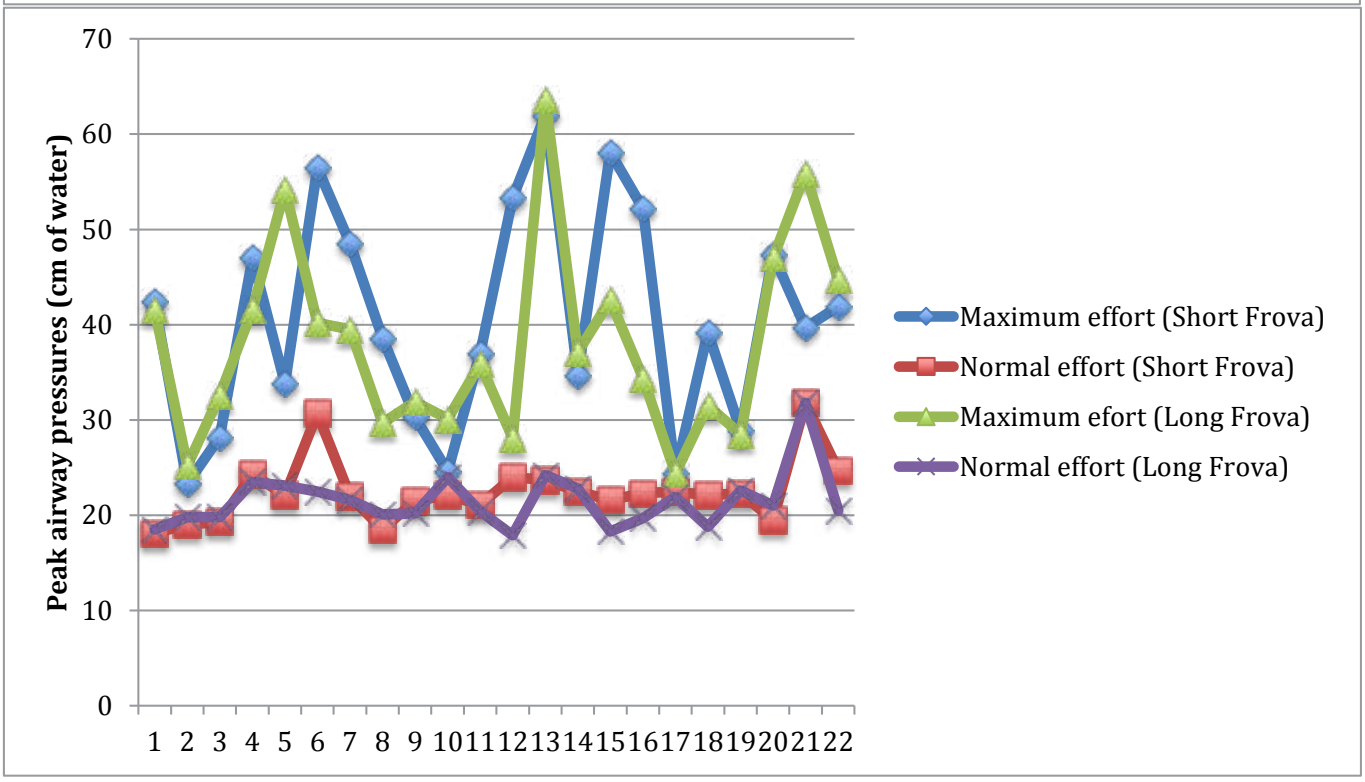
Results: The volume of air delivered with a maximum and a normal effort with the 65cm and the 70cm Frova bougie were 980.8ml±133.5ml and 605.9±103.4ml versus 980.2±111.9ml and 585.5±128.9ml. The peak airway pressures for the two groups with a maximum and a normal effort were 40.5±11.5cm of water and 22.5±3.4cm of water versus 38.2±10.3cm of water and 22±2.9cm of water respectively.

Conclusion: Clinically significant volumes of air can be delivered through a Frova. Significantly larger volumes and peak pressures were seen in the short Frova bougie group ($p<0.05$). There was a significant increase, in these measurements, when a maximum effort was used, compared to the normal effort ($p<0.05$). Further study and discussion are required prior to recommending this technique for oxygenation.

References:

1. Br. J. Anaesth. 2015; 115 (6): 827-848
2. Acad Emerg Med, 2012; 19 (7): 876–879


Volume of air delivered (mL)
1400
1200
1000
800
600
400
200
0
1 3 5 7 9 11 13 15 17 19 21
Maximum effort (Short Frova)
Normal effort (Short Frova)
Maximum effort (Long Frova)
Normal effort (Long Frova)


Peak airway pressures (cm of water)
70
60
50
40
30
20
10
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Maximum effort (Short Frova)
Normal effort (Short Frova)
Maximum efort (Long Frova)
Normal effort (Long Frova)

Abstract #:T-12

The Impact of NAP5 on Obstetric Anaesthesia: an OAA Approved UK Survey

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Introduction: The findings of the 5th National Audit Project (NAP5) conducted in the UK by the Royal College of Anaesthetists (RCOA) and the Association of Anaesthetists of Great Britain and Ireland (AAGBI) have recently been released.(1) This national project is the largest prospective study investigating accidental awareness under general anesthesia (AAGA). Obstetrics was the most markedly over-represented surgical specialty, with the incidence of AAGA found to be 1:670 when general anesthesia was used for cesarean delivery. The aim of this survey was to evaluate the impact of NAP5 findings on obstetric general anesthesia practice in the UK.

Methods: Following Obstetric Anaesthetists' Association (OAA) audit committee approval, all 1372 UK consultant members were invited to complete an electronic survey using the OAA online submission system. Questions explored obstetric general anesthesia practice before and after the release of NAP5, and examined if recommendations were being implemented into routine clinical practice. Results were analyzed using difference in proportions with 95% confidence intervals and exact two-sided mid-P values; $P<0.05$ was regarded as statistically significant.

Results: There were 540 responses (39.4% response rate). Key findings are summarized in the table. Following the NAP5 findings, 15% of respondents would increase the dose of induction agent used in obstetrics to reduce risk of AAGA. Nineteen percent would now increase the minimum alveolar concentration (MAC) of volatile used during cesarean delivery, with most of these respondents (63%) aiming to achieve this between induction of anesthesia and delivery. Approximately two- thirds (65%) of respondents now implement a strategy to reduce the risk of latent drug errors, the most common being to keep induction agents and antibiotics in separate locations.

Discussion: Our results show that obstetric general anesthesia practice is evolving in the UK following the release of NAP5. Traditional techniques of general anesthesia are being superseded by those previously considered controversial, most notably the use of propofol and opioids at induction. It is encouraging that recommendations from NAP5 are being implemented, however, the clinical impact for both mother and foetus has yet to be determined.

Reference:

1. NAP5: Accidental Awareness during General Anaesthesia in the UK and Ireland. http://www.nationalauditprojects.org.uk/NAP5_home.

Table showing the impact of NAP5 on obstetric practice for general anesthesia

	BEFORE NAP5 (%)	AFTER NAP5 (%)	Difference % (95% CI)	Exact mid-P value
Thiopentone as induction agent	89	73	-16 (-21 to -11)	<0.0001
Propofol as induction agent	11	27	16 (11 to 21)	<0.0001
Incorporation of opiate at induction	20	30	11 (6 to 16)	<0.0001
Preparation of an extra syringe of IV induction agent in the event of airway difficulty	19	37	18 (12 to 23)	<0.0001
Use of depth of anesthesia monitor routinely	1	11	9 (7 to 12)	<0.0001
Inclusion of AAGA **always** as part of consent	17	29	11 (6 to 16)	<0.0001

Abstract #:T-13

Efficacy of Surface Landmark Palpation for Identification of the Cricoid Cartilage in Obstetric Patients

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Introduction: Pregnant patients during labour are at increased risk of pulmonary aspiration of gastric contents when they have a general anesthetic1. Rapid sequence induction with the application of cricoid pressure, although controversial, is an accepted practice during induction of general anesthesia when there is potential risk for pulmonary aspiration2. Nevertheless, incorrect application of the maneuver may increase the risk of failed intubation. We conducted this observational study to assess the ability of caregivers in the obstetric care units (anesthesia consultants, residents, respiratory therapists, and nurses) in correctly identifying the location of the cricoid cartilage in an obstetric population. Our hypothesis was that consultant anesthesiologists would have the highest accuracy rate.

Methods: Institutional REB approval was obtained as was written informed consent from participants in the study. We are conducting a prospective observational study of 30 healthy parturients at term gestation having elective cesarean delivery, and 60 caregivers(15 anesthesia consultants, 15 anesthesia residents, 15 respiratory therapists, and 15 nurses). Using palpation, the participant is asked to mark the center of the cricoid cartilage with the patient in the sniffing position, using fluorescent "invisible" ink. An anesthesiologist with expertise in ultrasound uses ultrasound to mark the middle of the cricoid cartilage (figure1). Evaluation of the participant's assessment is considered accurate if it is within 5 mm from the ultrasound's measured line. The total time from the start of palpation until locating the cricoid cartilage is measured. The caregiver is asked to score the ease of cricoid cartilage palpation between 1 to 10 using a visual analog scoring (VAS) scale.

Results and discussion: To date, we have recruited 23 parturients and 46 caregivers. . The study is feasible - no refusals to participate and no missing data. Recruitment, data collection and entry are ongoing. We anticipate that we will be able to present our final results at the meeting. .

References:

1. Suresh M et al. Shnider and Levinson's anesthesia for obstetrics. 5th ed. 2013. pp. 462-83
2. Ting T et al. Trends Anesth Crtic Care. 4 (2014) 42-46

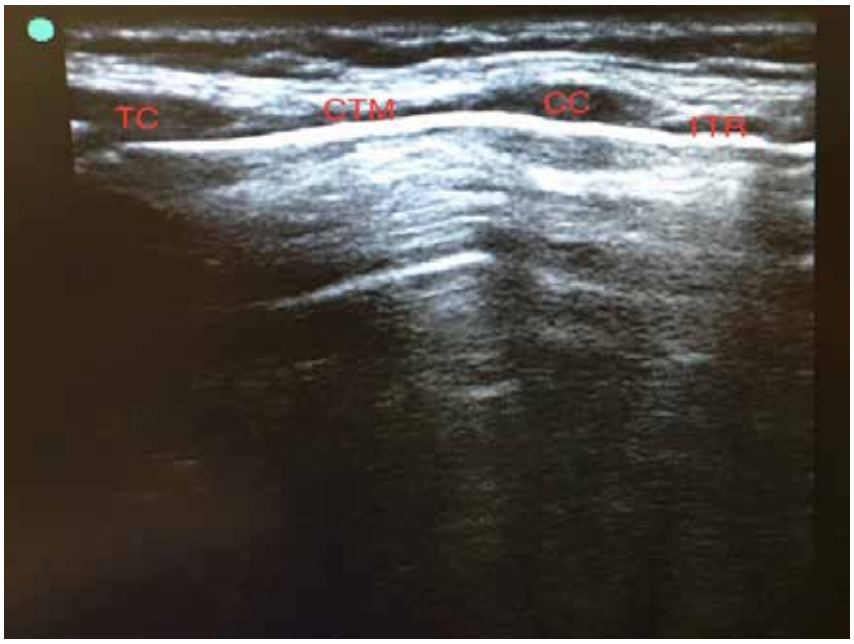

Figure Legend: TC= Thyroid Cartilage, CTM= Cricothyroid Membrane, CC= Cricoid Cartilage, 1TR= First Tracheal Ring

Abstract #:T-14

Concordance of Predicted Difficult Airway and Back Parameters with Difficult Labor Epidural Placements - A Prospective Observational Study

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Lawrence Tsen M.D. - Brigham and Women's Hospital - Boston, Massachusetts

Introduction: Pregnancy invokes significant anatomic and hormonal changes that have anesthetic implications. While clinicians, including anesthesiologists, often focus on features associated with a "difficult airway",[1] those associated with a "difficult back" (i.e., difficult neuraxial technique) are seldom evaluated systematically. The aims of this study were to determine the concordance rate between difficult airway and back features, and if airway parameters could be predictive of difficult labor epidural placements.

Methods: A list of parameters associated with a difficult airway and back were identified through a literature review; continuous variables were dichotomized according to published cut-off values. These parameters were prospectively collected in term parturients. An independent co-investigator recorded provider duration of epidural placement using standardized start and end times. Difficult epidural technique placement was defined as duration of placement greater than 4.2 minutes.[2] Concordance rate was determined using the number of patients with concordant difficult airway and back parameters. A logistic regression model was used to determine airway parameters associated with difficult epidural placements.

Results: To date, 192 of 400 patients have been recruited. Concordance rates for predicted difficult airway and back parameters are displayed in Fig 1. Patients with larger neck circumference (OR 1.1; 95% CI = 1.01-1.19; p=0.032) and higher BMI (OR 1.11; 95% CI =1.04-1.17; p=0.001) were associated with difficult epidural placements.

Discussion: In laboring parturients, larger neck circumference and elevated BMI are significantly associated with difficult epidural placements; these parameters have a high concordance rate with difficult back features. Our data suggest that these two simple physical assessments, which are quick to obtain and typically associated with difficult intubation, can be used to predict difficulty of epidural placements.

References:

1. Guglielminotti J et al. Reg Anesth Pain Med 2013
2. Clark A et al. IJOA 2015

Figure 1. Concordance rates of selected difficult airway parameters and difficult back parameters.

	Scoliosis	History of Back Surgery	Non-Palpable Spinous Process	Non-Palpable Interspace	Cannot Flex Back	Abdominal Circumference >= 105 cm	Difficult Epidural Placement
Body Mass Index >=30	8.3%	2.7%	44.4%	**63.8%**	13.9%	**86.1%**	**72.2%**
Thyromental Distance < 6 cm	5.4%	0%	10.9%	14.5%	10.9%	**54.5%**	43.6%
Upper Lip Bite Test Grade 3	14.2%	0%	14.2%	14.2%	14.2%	**71.4%**	28.6%
Modified Mallampati Class 3 or 4	4.7%	1.6%	19.0%	22.2%	12.6%	**79.4%**	47.6%
High arch palate	22.2%	0%	11.1%	11.1%	33.3%	**77.8%**	33.3%
Neck Circumference > 43 cm	0%	0%	**75.0%**	**100%**	25.0%	**75.0%**	**100%**
Poor C-spine Anteroflexion	0%	16.7%	16.7%	33.3%	33.3%	**66.7%**	**50.0%**
High Risk of OSA STOPBANG score ≥ 3	11.5%	7.7%	38.4%	**57.6%**	7.7%	**84.6%**	**65.4%**
Diagnosed OSA	0%	0%	33.3%	**66.7%**	0%	**66.7%**	**66.7%**

Abstract #:T-15

Association between OSA screening questions, OSA status, and Pregnancy Outcomes

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Co-Author: Mary Cooter M.S.c - Duke University Medical Center - Durham, NC
Ashraf S. Habib M.B.BCh, M.S.c, MHSc, FRCA - Duke University Medical Center - Durham, NC

Background: Recent studies have associated obstructive sleep apnea (OSA) with peripartum complications. However, identifying pregnant women with OSA is difficult given the poor reliability of available OSA screening tools. The purpose of this study is to develop a reliable screening tool to identify pregnant women at risk for OSA, and to study the peripartum outcomes of women with OSA.

Methods: Recruitment started in March 2015 and is ongoing. Adult, pregnant subjects, 24-30 weeks GA and BMI > 40 kg.m-2, are recruited. Non-English speaking subjects, those with known OSA or chronic opioid use are excluded. 4 OSA screening tools: the Berlin (BQ) and STOP-BANG; Epworth Sleepiness Scale (ESS); and ASA checklist (ASAC) are collected with demographics and neck circumference (NC). Subjects undergo home polysomnography using ApneaLink Air™(ResMed Corp, Poway, CA, USA). The device reports Apnea-Hypopnea Index (AHI), flow-limited breathing, and oxygen-desaturation index (ODI) among other data. Pregnancy and neonatal outcomes are followed. Descriptive statistics were calculated for each questionnaire's total score, as well as for each individual question in the study cohort and among those that experienced each event of interest [N (%), mean (SD), and median (Q1,Q3) for total scores].

Results: 41 subjects had responses and outcomes. 33/41 subjects had valid sleep studies. Invalid studies or less than 2 hrs were excluded. Mean(SD) age and GA for all subjects was 28.3(5.2) yrs and 29.2(5.2) wks. 27.3% of subjects were at-risk for OSA by home sleep study (AHI ≥ 5). Higher BMI was associated with AHI ≥ 5 (52.7 vs. 47.5 kg.m-2), but ages and GA were similar. Positive responses to OSA questions among women with AHI ≥ 5 vs. AHI < 5 are reported in Table 1. Women who endorsed loud snoring were more likely to develop PIH (25% vs. 13.8%). NC > 40 cm was associated with higher rates of PIH (83% vs. 37.9%). Loud snoring was more common in women with gestational diabetes mellitus (33.3% vs. 14.3%). Those who reported "falling asleep while driving" had a greater proportion of adverse fetal outcomes.

Conclusions: This small, observational, prospective study suggests that the incidence of OSA among obese, early third trimester gravidas may exceed 27%, as home studies tend to underestimate AHI. As suggested by others, while total scores may not predict OSA, elements of some of these questionnaires may be useful in predicting women at-risk for OSA, as well as pregnancy complications.

TABLE 1. Polysomnography data for subjects that had positive scores for individual OSA screening questions

Questionnaire	Question	No OSA (AHI<5) N=24 (72.7%)*	OSA (AHI≥5) N=9 (27.3%)*, **	Oxygen desaturation index		% Flow limited breathing with Snoring	
				Negative Response	Positive Response	Negative Response	Positive Response
Berlin¶	**Q1: Do you Snore?**	**18 (75.0)**	**8 (88.9)**	3 (2.7, 10.3)	4.2 (2.2, 9.3)	0 (0, 9)	0 (0, 3)
	Q2: How loud do you snore?	**2 (8.3)**	**2 (22.2)**	**3.8 (2.2, 8.7)**	**8.7 (2.8, 26)**	0 (0, 3)	0.5 (0, 2.5)
	Q3: How often do you snore?	**14 (58.3)**	**6 (66.7)**	**3.1 (2.5, 7)**	**4.9 (2.1, 11.2)**	0 (0, 0.5)	0 (0, 3.5)
	Q4: Snoring Bothered People?	**9 (37.5)**	**5 (55.6)**	3.8 (2.8, 8.7)	4.1 (1.3, 13.9)	0 (0, 1)	0.5 (0,3)
	Q5: Notice you quit breathing?	**1 (4.2)**	**3 (33.3)**	**3.2 (2.2, 6.1)**	**18.7 (9, 30.3)**	**0 (0, 2)**	**3.5 (2, 8)**
	Q6: How often tired/fatigued after sleeping?	12 (50.0)	5 (55.6)	4.2 (2.7, 8.7)	3.0 (1.3, 8.7)	0 (0, 1.5)	1 (0, 9)
	Q7: While awake tired/fatigued?	13 (54.2)	4 (44.4)	5 (3, 11.2)	2.9 (1.3, 8.7)	0 (0, 1.5)	1 (0, 9)
	Q8: Nodded off/fallen asleep driving	**4 (16.7)**	**3 (33.3)**	3.6 (2.2, 8.7)	4.9 (2.7, 10.3)	**0 (0, 3)**	**5.5 (0, 14)**
	Q10: High Blood pressure?	**4 (16.7)**	**3 (33.3)**	3.8 (2.7, 8.0)	3.2 (2.2, 14.4)	0 (0, 4.5)	0 (0, 3)
STOP-BANG^	**S: Do you snore loudly?**	5 (20.8)	4 (44.4)	**3.4 (1.3, 6.8)**	**6.1 (2.9, 14.4)**	0 (0, 5)	0 (0,3)
	T: Often feel tired/fatigued during day?	20 (83.3)	8 (88.9)	2.7 (2.2, 4.5)	3.8 (2.8, 9.8)	0 (0, 0)	0 (0, 3.5)
	O: Been observed to stop breathing?	6 (25.0)	4 (44.4)	3.7 (2.2, 8)	3.7 (2.9, 14.4)	0 (0, 7)	0.5 (0, 3)
	P: Do you have/being treated for HTN?	4 (16.7)	4 (44.4)	**3.7 (2.7, 6.1)**	**6.0 (2.6, 21.7)**	0 (0, 3)	0.5 (0, 2.5)
	N: Neck Circumference > 40 cm	**11 (45.8)**	**7 (77.8)**	**2.9 (2.7, 4.5)**	**5.9 (2.2, 10.3)**	0 (0, 1)	0.5 (0, 9)
ASA Checklist	**Awake with choking sensation?**	**7 (29.2)**	**4 (44.4)**	3.2 (2.7, 8.0)	3.8 (0.7, 22.9)	0 (0, 7)	0 (0, 3)
	Frequent arousals from sleep?	11 (45.8)	5 (55.6)	**3.4 (1.2, 8.7)**	**5.0 (2.8, 10.9)**	2 (0, 9)	0 (0, 0.5)

*N (%) of positive responses to each question, or median (Q1, Q3) for total scores.

**One patient had an initial recording of AHI = 4.8, but on formal, in-lab polysomnography had AHI≥5.

¶ Questions on the Berlin Questionnaire are considered positive if subjects endorse one of the two most severe or frequent responses on multiple-choice.

^ Age > 50 and male gender were not relevant for any subjects in this study

Abstract #:T-16

Cell Salvage for PPH after Vaginal Delivery: A Case Series Review

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Obstetrical hemorrhage is a leading cause of maternal morbidity and mortality. The increasing rate of cesarean sections, morbid obesity and excessive use of oxytocin augmentation place many women at high risk for postpartum hemorrhage (PPH). The use of intraoperative red cell salvage has been used by many surgical subspecialities to decrease the amount of allogeneic blood, and to decrease the risk of transfusion related morbidity. The use of intraoperative blood salvage has been integrated into protocols for treatment of massive obstetric bleeding, but has not been extensively utilized for PPH after vaginal delivery. Our case series studied 26 patients that had cell salvage available on standby for high risk maternal bleeding, or was set up and used by obstetricians during active hemorrhage after a vaginal delivery. These documented cases occurred from 2010-2015 at Magee-Womens Hospital of UPMC. 10 out of 26 patients received cell salvaged blood in this study. The average estimated blood loss was 1577 mL, the average amount of recovered blood was 359 mL. The average length of stay (LOS) was 3.7 days for patients not receiving salvaged blood and 3.4 days for patients who received salvaged blood. The preliminary data shows that all 10/26 patients who received cell salvaged blood did not have any documented complications subsequent to receiving the salvaged blood including: sepsis, wound healing, amniotic fluid embolus (AFE) or increased hospital stay. The reasons for blood recovery in our patients included: abruption (4/26), atony (11/26), uterine inversion (1/26), laceration (3/26), and undocumented causes (3/26), HELLP (1/26) , retained placenta (1/26), Jehovah's Witness (1/26), and prior history of severe PPH (1/26).

References:

Waters J et al. Amniotic fluid removal during cell salvage in the Cesarean Section patient. Anesthesiology 2000; 92 (6): 1531-1536.

Milne ME et al. Red Blood Cell Salvage During Obstetric Hemorrhage. Obstet Gyne 2015; 125 (4): 919-923.

Abstract #:T-17

Estimated Blood Loss During Dilation and Extraction by Anesthetic Type

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Introduction: Dilation and evacuation (D&E) account for 10-15% of the 42 million abortions that are performed worldwide1. These procedures are commonly performed in the 2nd trimester with either a general anesthetic, a neuraxial technique, or monitored anesthetic care (MAC)2. Bleeding is a serious complication of these procedures3, resulting in greater risk of transfusion, morbidity and mortality4. Volatile anesthetics are known to cause uterine relaxation and may increase this risk. This retrospective study investigates differences in estimated blood loss (EBL) between D&Es performed under GA vs MAC.

Materials and Methods: A chart review from 2008 to 2014 was performed utilizing the D&E CPT code to identify cases for the study. Anesthetic and operative reports (n = 298) for D&E's performed at UWMC in the OR were reviewed. Cases were analyzed by anesthesia type and EBL as reported by the anesthesia team and OB provider. Cases without a numerical EBL or performed under neuraxial anesthesia or TIVA were excluded from the statistical analysis. The primary outcome was EBL at the time of procedure, while secondary outcomes included aspiration, gynecological complications, EBL greater than 500cc, need for transfusion, and use of uterotonic medications.

Results: 298 cases were included in the analysis; gestational age range was 14 weeks to 25 weeks. 121 procedures were performed under GA and 178 under MAC. Mean EBL for D&Es performed under GA was 332 mL, versus 123 mL for the procedures performed under MAC ($p<0.001$). Carboprost, methylergonovine, and misoprostol were more commonly used for D&Es performed under GA versus MAC (17.5% vs 6.7%, $p<0.001$). Complications, as defined above, were higher for GA versus MAC (22.5% vs 3.4%, $p < 0.001$). Differences remained statistically significant when controlling for gestational age and indication for D&E.

Conclusions: There was a highly significant difference in mean EBL for D&E procedures performed under MAC compared to those under GA with volatile anesthetics. It should be noted that the choice of a GA over MAC in the anesthetic care of these patients may be due to already perceived increased risk of hemorrhage. Also of note, there were no aspiration events recorded in the anesthetic record of any of the MAC group. Randomized control trials are needed to elucidate the effects of anesthetic agents on blood loss during D&Es.

References:

1. ACOG Practice bulletin No 135. 2nd trimester abortion.
2. Dalton VK, et al. Patient preferences, satisfaction, and resource use in office evacuation of early pregnancy failure. Obstet Gynecol. 2006 Jul;108(1):103-10.
3. Pauli E, et al Morbidity of dilatation and evacuation in the second trimester: An analysis. Gynakol Geburtshilfliche Rundsch. 2005 Apr;45(2):107-15.
4. Gutierrez MC,, et al Postpartum hemorrhage treated with a massive transfusion protocol at a tertiary obstetric center: A retrospective study. International Journal of Obstetric Anesthesia. 2012 7;21(3):230-5.

Abstract #:T-18

Obstetric Interventions And Maternal Morbidity Among Women Who Experience Severe Postpartum Hemorrhage During Pre-labor Cesarean Delivery

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Introduction: Postpartum hemorrhage (PPH) is recognized as a leading cause of obstetric morbidity.(1,2) Although women who undergo cesarean delivery are at increased risk of PPH,(3) management practices and PPH-related morbidities among women who experience severe PPH during pre-labor CD are poorly described.

Methods: We performed a secondary analysis of data from a cohort of women who experienced severe PPH during pre-labor CD at a tertiary US obstetric center between 2002-2012. Inclusion criteria were women undergoing cesarean delivery without prior active labor or induction of labor. Severe PPH was defined as an EBL≥1500ml &/or red blood cell (RBC) transfusion within 48 hr of delivery. We performed descriptive analyses to assess rates of medical intervention (uterotonic use, bakri balloon, interventional radiology), surgical intervention (vessel ligation, hysterectomy), and transfusion utilization. We compared rates of medical/surgical intervention between women with and without severe PPH (EBL<1500 ml and no transfusion), matched by year of delivery. Data are presented as n (%), mean (SD), median [IQR]; $P<0.05$ as statistically significant.

Results: We identified 269 women with severe PPH and 550 matched controls. Women with severe PPH had a higher EBL compared to controls (1600 [1500-2000] ml vs. 800 [600-900] ml; $P<0.001$). Compared to controls, medical and surgical interventions for blood loss control were more common among women with severe PPH (Table 1). The majority (82%) of patients with severe PPH were transferred to the postpartum floor. For those admitted to the ICU, patients with severe PPH had a greater likelihood of experiencing pulmonary edema and requiring ventilation compared to controls. Intraoperative and postoperative blood product utilization data are presented in Table 2. One third of women with severe PPH received RBC transfusion intraoperatively and postoperatively.

Conclusion: Our findings provide important insight on contemporary practices for managing severe PPH during prelabor CD. As 1 in 6 women with severe PPH required postpartum care on the ICU, comparative effectiveness studies are urgently needed to determine best medical, surgical and transfusion practices for managing severe PPH during elective CD.

References:

1. Obstet Gynecol 2012; 120: 1029-36
2. Obstet Gynecol 2015;125:5-12.
3. Anesth Analg 2010; 110:1368-73.

Table 1. Pharmacologic Treatment and Medical and Surgical Interventions for Patients with and without severe Postpartum Hemorrhage during Pre-Labor Cesarean Delivery

	Control (n=550)	Case (n=269)	P value
Pharmacologic treatment			
Oxytocin dose (U)	30 [30-30][a]	30 [30-32][b]	0.02
Methergine given	28 (5.1%)	89 (33.1%)	<0.001
Hemabate given	8 (1.4%)	58 (21.6%)	<0.001
Misoprostol given	9 (1.6%)	52 (19.3%)	<0.001
Medical/Surgical intervention			
B-lynch brace suture	1 (0.2%)	8 (2.9%)	0.001
Bakri balloon	1 (0.2%)	22 (8.2%)	<0.001
Uterine artery ligation	1 (0.2%)	5 (1.9%)	0.02
Hypogastric artery ligation	0	2 (0.7%)	0.11
Hysterectomy	0	47 (17.5%)	<0.001
Interventional Radiology:			
UA embolization	0	8 (2.9%)	<0.001
UA or IA balloon catheterization	0	10 (3.7%)	<0.001
Disposition Post-CD			<0.001
ICU	1 (0.2%)	43 (16.1%)	
Monitored bed	1 (0.2%)	5 (1.9%)	
Routine postpartum bed	547 (99.6%)	219 (82%)	
ICU-related morbidity			
Respiratory failure requiring ventilation	1 (0.2%)	22 (8.2%)	<0.001
Pulmonary edema	0	8 (2.9%)	<0.001
ARDS	1 (0.2%)	1 (0.4%)	0.54
Renal failure	0	1 (0.4%)	0.33

Data presented as n (%), median [IQR]
IA = internal iliac artery; UA = uterine artery
[a] = Missing data for 32 patients
[b] = Missing data for 17 patients

Table 2. Intraoperative and Postoperative Transfusion Data on Patients with Severe Postpartum Hemorrhage during Pre-Labor Cesarean Delivery

	n=269
Intraoperative transfusion	
RBC	91 (33.8%)
Number of units transfused	3 [2-6]
Plasma	46 (17.1%)
Number of units transfused	4 [2-6]
PLTs	26 (9.7%)
Number of units transfused	2 [1-4]
Cryoprecipitate	9 (3.3%)
Number of pools transfused	1 [1-2]
Postoperative transfusion (in first 48 hrs postpartum)	
RBC	90 (33.5%)
Number of units transfused	2 [2-3]
Plasma	21 (7.8%)
Number of units transfused	2 [2-5]
PLTs	26 (9.6%)
Number of units transfused	2 [1-6]
Cryoprecipitate	9 (3.3%)
Number of pools transfused	4 [2-6]

PLTs = platelets; RBC = red blood cells
Data presented as n (%), median [IQR]

Abstract #:T-19

ROTEM-Guided Resuscitation of Suspected Amniotic Fluid Embolism During Dilation and Evacuation for Fetal Anomalies

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Introduction: Amniotic fluid embolism (AFE) is a rare and enigmatic obstetric complication associated with hypoxia, hemodynamic instability, and coagulopathy. Rotational thromboelastometry (ROTEM) is a point-of-care test that assesses multiple pathways of hemostasis including the intrinsic and extrinsic coagulation systems, fibrinogen function, and fibrinolysis. We report a case of suspected AFE in which ROTEM facilitated rapid diagnosis and correction of severe coagulopathy.

Case Presentation: A 31 year-old gravida 3, para 1 patient at 16 weeks gestation was scheduled for an elective dilation and evacuation (D&E) for fetal anomalies, performed under moderate sedation and a paracervical nerve block. Shortly after amniotic membrane rupture, the patient developed cyanosis, agitation, and oxygen desaturation followed by tachycardia and hypotension. She was intubated for airway protection and became pulseless. Cardiopulmonary resuscitation and epinephrine administration resulted in prompt return of spontaneous circulation. Oozing was noted from her existing peripheral intravenous line as well as from rapidly obtained arterial and central venous access sites. The first laboratory evidence of coagulopathy was obtained from ROTEM which demonstrated no measurable clotting time or maximal clot formation from the intrinsic (INTEM) and extrinsic (EXTEM) systems; fibrinogen function (FIBTEM) was immeasurable and hyperfibrinolysis (APTEM) was noted (Figure). Subsequently reported laboratory results were significant for PT 39.8 s, PTT 108.5 s, INR 4.3, platelet 185x10^9/L (previously 297x10^9/L), and fibrinogen <38 mg/dL. Continuation of the D&E was completed approximately one hour later, after the patient underwent partial correction of the coagulopathy, guided by serial ROTEM analyses, with cryoprecipitate, fresh frozen plasma, and tranexamic acid. No significant hemorrhage occurred. The patient was extubated on post-operative day one with significant short-term memory impairment that subsequently improved by discharge on hospital day six.

Discussion: AFE complicates 1/10,000 – 1/100,000 pregnancies with a mortality rate approaching 50% or higher. One of the major sequelae of AFE is the development of a rapid and profound consumptive coagulopathy, often leading to post-partum hemorrhage. ROTEM is a point-of-care test that can quickly diagnose and guide management of coagulopathy.

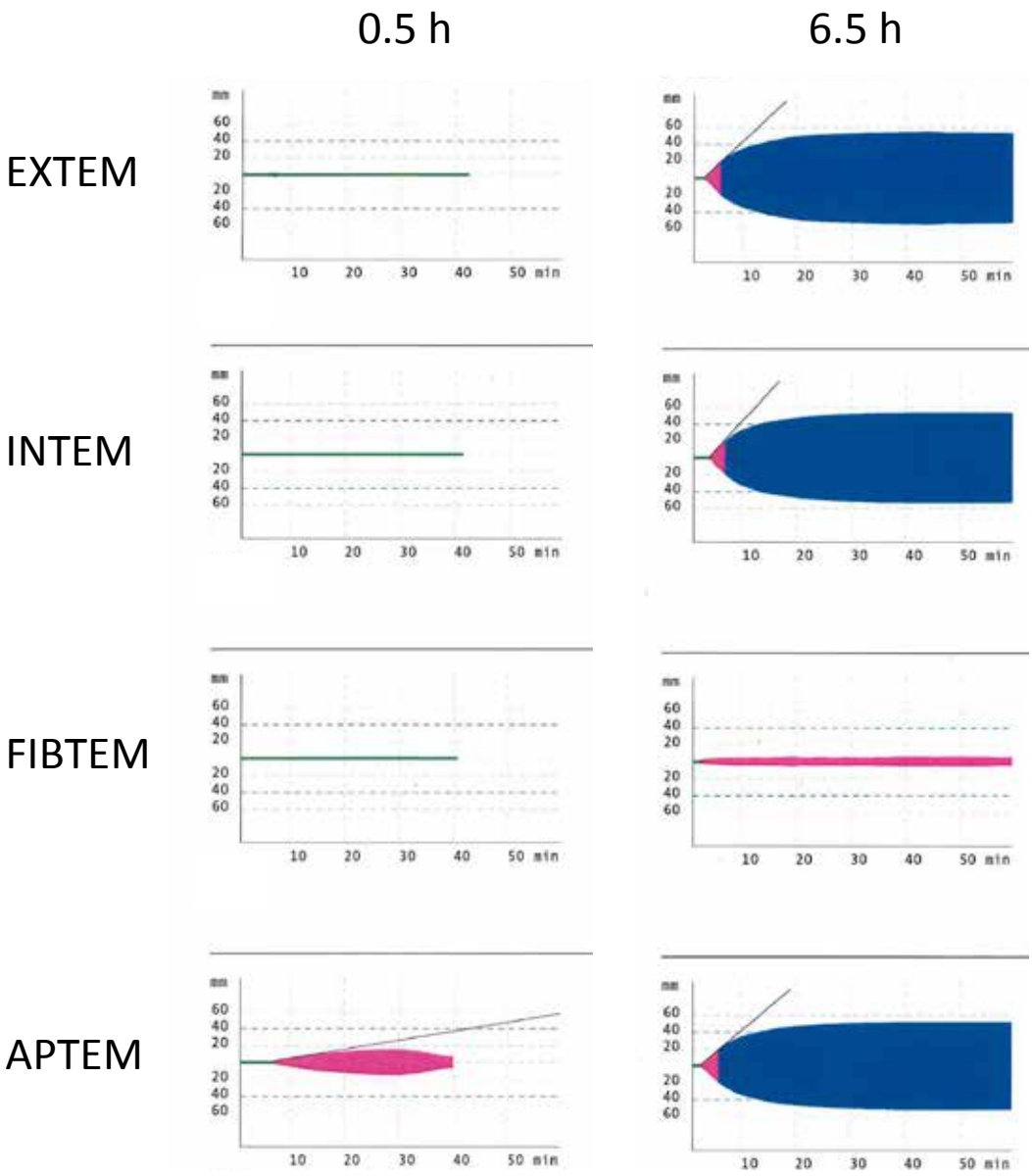

Figure. Rotational thromboelastometry (ROTEM) analysis of suspected AFE. Citrated peripheral blood was analyzed by ROTEM 0.5 hours (left column) after the initial hypoxic/hypotensive event and demonstrated deficiencies of the extrinsic and intrinsic coagulation systems, reduced fibrinogen function, and hyperfibrinolysis. Six hours later (right column), ROTEM analysis showed partial correction of the coagulopathy. EXTEM, extrinsic coagulation system; INTEM, intrinsic coagulation system; FIBTEM, fibrinogen function; APTEM, fibrinolysis.

Abstract #:T-20

The Association between Thromboelastographic Parameters and Total Estimated Blood Loss in Patients undergoing Intrapartum Cesarean Delivery

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Introduction: Women who undergo intrapartum Cesarean delivery (CD) are at high risk for severe PPH (1,2). However, it is unclear whether maternal coagulation disturbance influences the degree of blood loss during intrapartum CD. In this prospective observational study, we sought to examine the relationship between maternal coagulation parameters using kaolin-activated thromboelastography (TEG) and total estimated blood loss among women undergoing intrapartum CD.

Methods: After gaining IRB approval, we recruited 33 healthy women who required intrapartum CD for failure to progress or arrest of descent. TEG parameters (split point (SP), reaction (r time), k time, α angle, and maximum amplitude (MA)) were recorded immediately before and after CD. Correlation analyses were performed to assess the associations between baseline TEG indices and EBL, and the percentage change for each TEG parameter and EBL. Secondary analysis included comparisons of pre-CD vs. post-CD TEG parameters. $P<0.05$ was considered as statistically significant.

Results: EBL was not correlated with any baseline TEG parameter nor with percentage change for any TEG parameter (Table). The reaction (r) times and k times were significantly higher pre-CD compared to post-CD; mean (SD) pre-CD vs. post-CD r times = 7.0 (3.0) vs. 5.6 (2.6) respectively, P=0.005; median [IQR] pre-CD vs post-CD k times = 2.1 [1.8-2.8] vs. 1.9 [1.5-2.6] respectively, P=0.03.

Conclusions: We found no evidence of an association between indices of clot formation (using TEG) and EBL in patients undergoing intrapartum CD. Although these data suggest that coagulation disturbance is not associated with the degree of blood loss that occurs during intrapartum CD, we did observe a modest reduction in the degree of maternal hypercoagulability in the early period after intrapartum CD.

References:

1. Am J Obstet Gynecol 2009;201:273.e1-9
2. BJOG 2008;115:1265-72.

Table 4. Bivariate Spearman Correlations between Thromboelastographic Indices and Total Estimated Blood Loss.

	Bivariate Spearman Correlations[1]	P value	Bivariate Spearman Correlations[2]	P value
SP	0.16	0.4	0.23	0.2
R	0.13	0.5	0.3	0.1
K	0.12	0.5	0.09	0.6
Alpha Angle	-0.08	0.6	-0.04	0.8
MA	-0.17	0.35	0.23	0.2
CL30	-0.16	0.4	0.03	0.9
LY30	-0.04	0.8	-0.18	0.7
MRTG	-0.15	0.4	0.08	0.7
TMRTG	0.12	0.5	0.3	0.1
TG	-0.12	0.5	0.26	0.2

[1] Spearman correlations between baseline (precesarean) Thromboelastographic values and total estimated blood loss.

[2] Spearman correlations between the percentage change in Thromboelastographic values (accounting for pre-cesarean and post-cesarean values) and total estimated blood loss.

SP= split point, R=reaction time; MA = maximum amplitude; CL=clot lysis (amplitude relative to MA [30 min after MA measurement]); LY=percentage decrease in amplitude 30 min post-MA; MRTG=maximum rate of thrombus generation; TMRTG=time to maximum rate of thrombus generation; TG=thrombin generation

Abstract #:T-21

Risk Factors for Severe Postpartum Hemorrhage among Women undergoing Prelabor Cesarean Delivery

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Introduction: Compared to vaginal delivery, women who undergo cesarean delivery (CD) are at increased risk of postpartum hemorrhage (PPH).(1,2) Because key differences exist in the characteristics of women who undergo prelabor CD compared to intrapartum CD, the risk profile of women who experience PPH likely differs across each CD population. The aim of this study was to examine risk factors for severe PPH among women undergoing prelabor CD.

Methods: After IRB approval, we performed a nested case-control study within a cohort of 819 women who underwent intrapartum CD at large US obstetric center between 2002 and 2012. Data were abstracted from medical records for clinical, obstetric, and laboratory information. Maternal and obstetric characteristics were compared for 269 women who experienced severe PPH and 550 matched controls (no severe PPH). Severe PPH was classified by an EBL ≥1500 mL or RBC transfusion within 48 hr post-CD. Multivariate logistic regression analyses was performed to identify independent risk factors for severe PPH, which included variables with a P value<0.1 in the univariate analyses.

Results: Among all cases, 223 (82.9%) women had at least 1500 ml EBL, 91 (33.8%) women received RBC intraoperatively, and 90 (33.5%) women received RBC within 48 hr post-CD. Clinical factors independently associated with severe PPH are presented in Table 1. Clinical factors with the highest adjusted odds of severe PPH were general anesthesia (aOR=19.9), multiple pregnancy (aOR=8.0), and previa (aOR=6.5). In a sensitivity analysis excluding women with abnormal placentation (n=51), we observed only modest changes in the point estimates in our final logistic model (data not presented).

Conclusion: Our findings indicate that women with previa, multiple pregnancy or those who undergo general anesthesia are at highest risk for severe PPH during prelabor CD. These findings may assist providers in triaging patients for severe PPH prior to prelabor CD and may optimize preoperative blood ordering practices.

References:

1. Anesth Analg 2010; 110:1368-73.
2. BJOG 2008;115: 1265-72

Table 1. Main Risk Factors for Severe Postpartum Hemorrhage during Prelabor Cesarean Delivery*

	Adjusted Odds Ratio (95% CI)*
Maternal Age (y)[a]	
Less than 34	Reference
34-37	1.19 (0.73 – 1.96)
38 or greater	1.17 (0.71 – 1.91)
Insurance	
Private	Reference
Government-assisted or other	0.67 (0.39 – 1.17)
Race	
Caucasian	Reference
African-American	**2.45 (1.06 – 5.64)**
Asian	**1.81 (1.1 – 2.99)**
Other	1.99 (0.89 – 4.45)
Ethnicity	
Non-Hispanic	Reference
Hispanic	**2.27 (1.27 – 4.06)**
Chronic hypertension	1.57 (0.69 – 3.57)
Gestational Age (weeks)	
38 or greater	Reference
34 – 37	1.08 (0.66 – 1.76)
33 or less	**2.42 (1.11 – 5.26)**
Type of pregnancy:	
Singleton	Reference
Multiple pregnancy	**7.99 (4.27 – 14.95)**
Number of prior CS	
0	Reference
1	0.68 (0.43 – 1.09)
2	0.71 (0.38 – 1.31)
3 or more	0.52 (0.15 – 1.76)
Placenta Previa	**6.52 (3.52 – 12.07)**
Prior D&C or D&E	**1.78 (1.11 – 2.84)**
Pre-delivery hemoglobin (g/dl)	
≥11	Reference
10 – 10.9	1.05 (0.59 – 1.89)
≤9.9	**2.78 (1.25 – 6.2)**
Time of Delivery	
Weekday daytime	Reference
Weekday nighttime	0.96 (0.46 – 1.97)
Weekend	1.54 (0.88 – 2.69)
Primary mode of anesthesia	
Spinal	Reference
CSE	**2.96 (1.91 – 4.6)**
Epidural	**3.42 (1.17 – 10.05)**
General Anesthesia	**19.88 (5.04 – 78.4)**
Uterine Incision	
Transverse	Reference
Other	**4.44 (2.24 – 8.81)**

D&C = dilatation and curettage; D&E = Dilatation and evacuation.
[a] Categories created according to the relationship between log odds of the variable with the outcome, based on cubic spline function models.
* Statistically significant associations are denoted by bold text
Hosmer-Lemeshow Test: χ^2=12.2; P=0.14
AUROC=0.85

Abstract #:T-22

Report on 5-year Experience with Obstetric Hemorrhage Protocol

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Introduction: Obstetric hemorrhage continues to be a leading cause of maternal death worldwide. In our practice the incidence of significant maternal hemorrhage is less than 1%. Recent publications suggest use of protocols, checklists, and cognitive aids improve team performance and outcome in critical events.1 We developed an obstetric hemorrhage protocol (OHP) to guide management for these life-threatening situations. The following describes our experience with an OHP in our practice.

Results: Quality improvement data collected from 2010-2015 from OHP implementation to present was reviewed. The OHP was activated 121 times in setting of approximately 16,000 deliveries in that period. Results are summarized in table 1.

Discussion: Since critical hemorrhage events can evolve rapidly, management requires coordination of personnel, supplies and blood products. Consistent with recommendations of organizations such as WHO,2 the goals of our OHP included organizing staff and systems, as well as providing guidance for lab-based decisions for treatment of hemorrhage and coagulopathy. In response to emerging trends in the management of massive transfusion periodic updates were made in the OHP. The introduction of tranexamic acid and fibrinogen concentrate to the OHP addressed inhibition of fibrinolysis and rapid treatment of hypofibrinogenemia. Point-of-care coagulation testing allowed for detection of coagulopathy, facilitating goal-directed therapy. Interval analysis following process improvement changes suggest they led to improved hemorrhage management as measured by reduced RBC transfusion. Indicators of severe maternal morbidity associated with maternal hemorrhage, ICU admission or transfusion of 4 or more blood products, were also reduced.3 We recognize factors not recorded in our data could also have significant influence such as concurrent changes in organization of our approach and changes in work culture facilitated by the OHP.

Conclusion: Our analysis suggests that OHP refinements since implementation have led to changes in our transfusion practices.

References:

1. Hilton G et al.Checklists and multidisciplinary team performance during simulated obstetric hemorrhage.IJOA(2016),25:9-16
2. World Health Organization."WHO recommendations for the prevention and treatment or postpartum haemorrhage:evidence base."(2012)
3. Comprehensive Accreditation Manual for Hospitals Update, January 2015; https://www.jcrinc.com/assets/1/14/CAH15_Sample_Pages.pdf

Table 1 – Results of Obstetric Hemorrhage Protocol 2010 - 2015

	Overall	Interval 1	Interval 2 (TXA+Fib Conc)	Interval 3 (TXA+Fib Conc+ROTEM)
n	121	50	71	39
Median EBL (ml)		2,500	2,500	2,500
EBL range (ml)		800–25,000	750 - 6,000	600 – 5,000
PRBCs total units	584	405	179	76
PRBC: 4 or more, n(%)	45 (37%)	26 (52%)	19 (27%)	10 (26%)
PRBC: 10 or more, n(%)	13 (10%)	8 (16%)	5 (7%)	0
Cryo: 10+ units, n(%)	44 (36%)	21 (42%)	13 (18%)	3 (8.3%)
ICU Admission, n(%)	39 (32%)	18 (36%)	21 (30%)	10 (26%)
4+ blood products, n(%)	69 (57%)	38 (76%)	31 (44%)	13 (33%)
TXA, n(%)		NA	22 (31%)	15 (38%)
Fib Conc, n(%)		NA	5 (7%)	3 (7.7%)

*includes one maternal death; NA – not applicable; PRBC – packed red blood cells; Cryo-cryoprecipitate; Fib Conc – fibrinogen concentrate; TXA—tranexamic acid

Abstract #:T-23

Obstetric Interventions and Maternal Morbidity among Women who experience Severe Postpartum Hemorrhage during Intrapartum Cesarean Delivery

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Introduction: Women who undergo intrapartum Cesarean delivery (CD) are at the highest risk for postpartum hemorrhage (PPH) compared to those undergoing prelabor CD or vaginal delivery.(1,2) Rates of hemorrhage-related morbidity among women who experience severe PPH during intrapartum CD are uncertain. We performed a retrospective study to assess rates of medical/surgical intervention and transfusion among women undergoing intrapartum CD.

Methods: We performed a secondary analysis of data from a cohort of women who experienced severe PPH during intrapartum CD at a tertiary US obstetric center from 2002-2012. Inclusion criteria were women undergoing cesarean delivery with prior active labor or induction of labor. Severe PPH was defined as an EBL≥1500ml &/or red blood cell (RBC) transfusion within 48 hr of delivery. Matched controls were identified (women with an EBL<1500 ml and no RBC transfusion). We compared rates of medical intervention (uterotonic use, bakri balloon, interventional radiology), surgical intervention (vessel ligation, hysterectomy) between women with severe PPH vs. controls. Transfusion data were analyzed in women with severe PPH. Data are presented as n (%), mean (SD), median [IQR]; P<0.05 as statistically significant.

Results: We identified 278 women with severe PPH and 572 matched controls. The mean EBL values were significantly higher among women with severe PPH compared to controls (1685 (665) ml vs. 781 (202) ml; P<0.001). Medical/surgical interventions are presented in Table 1. Compared to controls, patients with severe PPH had a greater likelihood of requiring 2nd line uterotonics and medical/surgical intervention (excluding hypogastric artery ligation). Major morbidity among women with severe PPH included respiratory failure (6.1%) and renal failure (1%). Intraoperative and postoperative blood product utilization data are presented in Table 2. Among those with severe PPH, the rate of RBC transfusion was higher post-CD compared to during CD (43.9% vs. 18.3%; P=0.05).

Conclusion: Our findings suggest that, among women with severe PPH during intrapartum CD, second line uterotonic use is high and the B-lynch brace suture is the most common surgical intervention. With 10% patients requiring ICU admission post-PPH, cost-effectiveness studies are needed to determine the best environment for monitoring patients after an episode of severe PPH.

References:

1. BJOG 2008; 115: 1265-72
2. Anesth Analg 2010;110:1368-73

Table 1. Pharmacologic Treatment and Medical and Surgical Interventions for Patients with and without Severe Postpartum Hemorrhage during Intrapartum Cesarean Delivery

	No Severe PPH (n=572)	Severe PPH (n=278)	P value
Pharmacologic treatment			
Oxytocin dose (U)	30 (10)[a]	37 (18)[a]	<0.001
Methergine given	71 (12.4%)	120 (43.2%)	<0.001
Methergine dose (mg)	0.2 [0.2 – 0.2]	0.2 [0.2 – 0.4][b]	0.002
Hemabate given	20 (3.5%)	78 (28.1%)	<0.001
Hemabate dose (mg)	0.25 [0.25 – 0.25][c]	0.25 [0.25 – 0.5][d]	0.28
Misoprostol given	24 (4.2%)	63 (22.7%)	<0.001
Misoprostol dose (mcg)	800 [600 – 1000]	800 [600 – 1000][e]	0.44
Medical/Surgical intervention			
B-lynch brace suture	0	19 (6.83%)	<0.001
Bakri balloon	0	10 (3.6%)	<0.001
Uterine artery ligation	1 (0.2%)	8 (2.9%)	0.001
Hypogastric artery ligation	0	0	
Hysterectomy	0	11 (4%)	<0.001
Interventional Radiology:			
UA embolization	0	2	0.11
UA or IA balloon catheterization	0	0	
Disposition Post-CD			<0.001
ICU	0	28 (10.1%)	
Monitored bed	1 (0.2%)	9 (3.2%)	
Routine postpartum bed	569 (99.5%)	237 (85.3%)	
Not documented	2 (0.3%)	4 (1.4%)	
Severe morbidity			
Respiratory failure requiring ventilation	0	17 (6.1%)	<0.001
Pulmonary edema	2 (0.4%)	16 (5.8%)	<0.001
ARDS	0	4 (1.4%)	0.01
Renal failure	0	3 (1.1%)	0.04

Data presented as mean (SD), median [IQR], n (%)

[a] Data missing for 19 patients

[b] Data available for 119 patients

[c] Data available for 19 patients

[d] Data available for 77 patients

[e] Data available for 62 patients

IA=internal iliac artery; ICU=Intensive care unit; PPH = Postpartum hemorrhage; UA = uterine artery

Table 2. Intraoperative and Postoperative Transfusion Data among Women with Severe Postpartum Hemorrhage during Intrapartum Cesarean Delivery

	N (%)
Intraoperative transfusion	
RBC	51 (18.3%)
Number of units transfused	2 [2 -4]
Plasma	28 (10.1%)
Number of units transfused	2 [2 – 4]
PLTs transfusion	12 (4.3%)
Number of PLT units transfused	1 [1 – 2]
Cryoprecipitate transfused	5 (1.8%)
Number of pools transfused	1 [1 -1]
Postoperative transfusion (in first 48 postpartum)	
RBC	122 (43.9%)
Number of units transfused	2 [2 – 2]
Plasma	36 (12.9%)
Number of units transfused	2 [2 – 4.5]
PLTs transfusion	11 (4%)
Number of units transfused	1 [1 – 5]
Cryoprecipitate transfusion	12 (4.3%)
Number of pools transfused	1.5 [1 – 3]

PLTs = platelets; RBC = red blood cells

Data presented as n (%), median [IQR]

Abstract #:T-24

A survey of intravenous remifentanil use for labor analgesia at academic medical centers in the United States

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Background: Intravenous (IV) remifentanil is one of few moderately effective alternatives to neuraxial labor analgesia, most commonly offered in the US to women for whom neuraxial analgesia is contraindicated. There remains a lack of consensus regarding the optimal mode of administration (bolus versus continuous or combination of both), dosing strategy, as well as requirements for maternal monitoring when remifentanil is used. We designed this survey to evaluate current practices at academic medical centers in the US that are using remifentanil for labor analgesia.

Methods: A list of all academic medical centers with anesthesiology residency programs was established (N=126) and a survey link (SurveyMonkey) made available online from May 28, 2015 - July 13, 2015. The survey consisted of 16 questions sent by email to the obstetric anesthesia directors of these programs.

Results: The response rate was 67% (84/126); 30/84 (36%) reported that remifentanil is used at their center. There were differences in administration (PCA only, PCA & infusion, infusion only), as well as maternal monitoring across centers (Table 1). No center used remifentanil more than 20 times in the prior year. Based on the responses, one can estimate that there were no more than 340 women receiving remifentanil during labor across the 84 centers in the last 12 months (<5 cases in 15 centers, 5-10 cases in 11 centers, 10-20 cases in 4 centers; Table 1). There were 9 cases of maternal respiratory complications reported in 7 centers (one of which occurred after the pharmacy prepared a 100-fold more concentrated solution), and 5 cases of neonatal respiratory complications. All cases of neonatal complications were reported at centers where maternal complications occurred, and 4/5 occurred in centers using remifentanil < 5 times in the previous year. There were no complications at the 4 centers that used remifentanil 10 – 20 times in the last year.

Conclusions: Only 36% of academic centers in the US use IV remifentanil for labor analgesia, most of which use it less than 5 times yearly. Reported complications were rare; however, 9 cases of maternal and 5 cases of neonatal respiratory depression were reported. Perhaps significantly, these complications occurred in centers where remifentanil is used infrequently. If centers intend to use remifentanil for labor analgesia, clinical protocols and adequate monitoring seem crucial to ensure maternal and neonatal safety.

Table 1. Remifentanil use and general analgesic practice

CHARACTERISTICS OF LABOR ANALGESIA PRACTICE	N=84
Do you use IV remifentanil for labor analgesia?	**30 (36%)**
Do you use any other IV analgesics for labor analgesia?	67 (81%)
Is nitrous oxide available in your labor rooms?	12 (14%)
The rate of neuraxial analgesia in your unit is	
< 50%	5 (6%)
50-80%	31 (37%)
>80%	48 (57%)
The annual delivery rate in your unit is	
< 5,000	59 (70%)
5,000-10,000	21 (25%)
>10,000	4 (5%)
REMIFENTANIL USE	**N=30**
IV remifentanil was used in the last 12 months	
< 5 times	15 (30%)
5-10 times	11 (37%)
10-20 times	4 (13%)
> 20 times	0
Which women are eligible for remifentanil	
All (women's preference)	4 (13%)
Women with a contraindication to neuraxial analgesia	26 (87%)
What is your standard way for administering remifentanil	
Continuous infusion only	4 (13%)
Bolus (PCA) only	16 (53%)
Continuous infusion & bolus	10 (33%)
When is remifentanil discontinued	
Prior to the start of 2nd stage	2 (7%)
After the start of 2nd stage but before delivery	13 (43%)
After the delivery of the neonate	14 (47%)
Is one-to-one nursing care required for women using remifentanil	19 (63%)
Is oxygen routinely given to women using remifentanil	15 (50%)
Which parameters are recorded for women using remifentanil	
Sedation	19 (63%)
Oxygen saturation	30 (100%)
Pulse	28 (93%)
ET-CO2	3 (10%)
Blood pressure	26 (87%)
Pain score	26 (87%)
Instances of maternal respiratory depression (9 cases)	7 centers
Center with < 5000 deliveries (6 cases)	5
Using remifentanil < 5 times a year	3
Using remifentanil 5-10 times a year	2
Center with 5-10,000 deliveries (3 cases)	2
Using remifentanil < 5 times a year	2
Instances of neonatal respiratory depression (5 cases)	3 centers

There were no maternal or neonatal complications in centers were remifentanil use was 10-20 times in the last year (N=4), and no complication occurred in the centers (N=4) that use continuous remifentanil only.

All neonatal complications (N=5) occurred in cases where there had been maternal respiratory issues, and 4/5 occurred in centers using remifentanil < 5 times in the last year

Abstract #:T-25

Utilization and Predictors of Efficacy of Nitrous Oxide for Labor Analgesia

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Introduction: Nitrous oxide (N2O), a widely used labor analgesia outside the United States, has recently gained popularity in the United States.(1,2) We examined the characteristics of women who choose N2O for labor pain management, efficacy of analgesia, and factors that predicted conversion to labor epidural analgesia.

Methods: After IRB approval, we reviewed the medical records of all women who used N2O between September 2014 and September 2015 after it was introduced at a US tertiary obstetric center. We collected maternal demographic and obstetric data, analgesic endpoints, and neonatal outcomes. Bivariate correlations of maternal characteristics and labor epidural use were determined. Multivariate logistic regression was performed to determine factors that predicted conversion to labor epidural among women who used N2O. Data is presented as n (%), median [IQR], adjusted relative risk (aRR), and 95% confidence intervals (CI) as appropriate.

Results: 148 (3.2%) of the 4698 women who delivered vaginally within the study period received N2O. The characteristics of these women are outlined in Table 1. The median duration of use was 80 min [38-143]. Median verbal pain score immediately prior to N2O initiation was 8 [6-9], and median pain score change after N2O use was 0 [-2 to 1]. Labor epidural analgesia was used by 60% of women using N2O, which is significantly different than the 74% institutional epidural rate ($p=0.0001$). Bivariate analysis for association with conversion to neuraxial analgesia revealed several candidate variables: language ($p=0.17$), nulliparity ($p=0.005$), labor type ($p<0.0005$), birth plan ($p=0.03$), pain score prior to nitrous oxide ($p=0.0005$), and cervical dilation ($p<0.00005$). In the multivariate model, compared to spontaneous labor, labor induction (aRR=2.0, CI 1.2-3.3) and augmentation (aRR=1.7, CI 1.0-2.9) were associated with epidural use.

Conclusion: Our findings suggest that only a small proportion of women chose to use N2O, analgesia was modest, and duration of use was limited. Although the majority converted to neuraxial analgesia, the epidural rate was lower than women who did not use N2O. Labor induction and augmentation predicted epidural use. Future studies are needed to further delineate laboring women who most benefit from N2O.

References:

1. Anesth Analg 2014;118:153-67.
2. Am J Obstet Gynecol 2002;186:S110-26.

Table 1

Variable	n (%)
Age* (y)	30.3 (5.9)
Ethnicity/Race	
Caucasian	55 (37.9)
Hispanic	44 (30.3)
Asian	27 (18.4)
Other	19 (12.9)
Preferred Language	
English	119 (82.1)
Non-English	26 (17.9)
BMI+ (kg/m2)	28.1 (25.2-31.2)
Insurance	
Private	90 (61.6)
Government/None	56 (38.4)
Nulliparity	105 (71.9)
EGA+ (w)	39.7 (38.7-40.4)
Type of labor	
Spontaneous	49 (33.6)
Augmented	56 (38.4)
Induced	41 (28.1)
Delivery type	
Vaginal	119 (81.5)
Operative vaginal	5 (3.4)
Cesarean	22 (15.1)
Apgar+	
1min	8 (8-9)
5min	9 (9-9)
Initial birth plan	
Nonmedical	67/129 (51.9)
Medicated (iv, epidural, nitrous)	40/129 (31.0)
Undecided	17/129 (13.2)
Dilation at initiation of nitrous oxide+ (cm)	5 (3-7)
Stage of labor at initiation of nitrous oxide	
1	139 (95.2)
2	4 (2.7)
3	3 (2.1)
Changed to neuraxial	
Yes	88 (60.3)
No	58 (39.7)
Pain score prior to initiation of nitrous+	8 (6-9)
Pain score change with use of nitrous+	0 (-2 to 1)

*mean (std dev)

+median (IQR)

Abstract #:T-26

Labor Analgesia When Neuraxial Anesthesia Is Relatively Contraindicated: Comparison Of I.V. Fentanyl PCA And Intermittent I.V. Nalbuphine Boluses.

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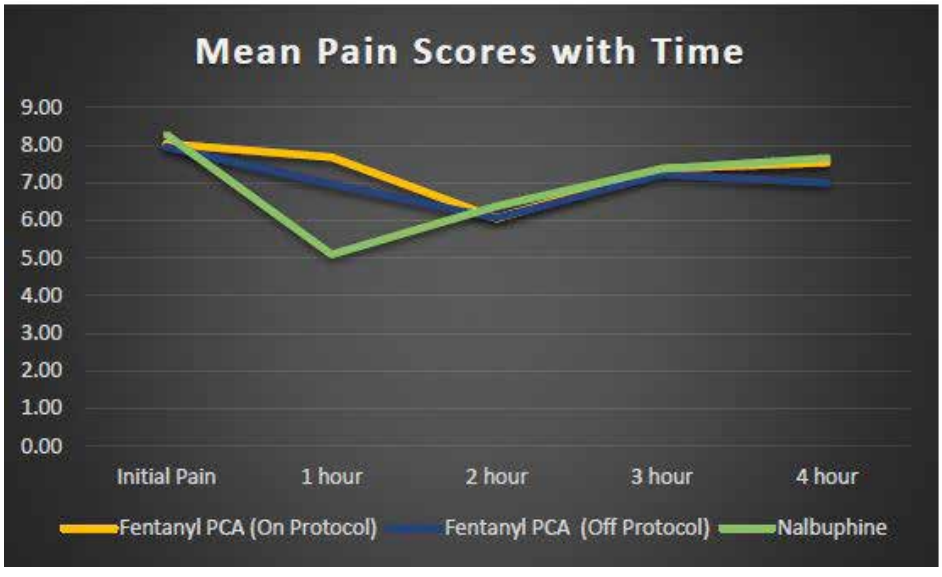
Background: In 2009, we implemented an I.V. Fentanyl PCA protocol (initial 250 mcg per hour limit) to be used for those parturients that had relative contraindications to neuraxial anesthesia. Nurse administered IV Nalbuphine boluses are routinely used at our institution for patients not receiving epidural analgesia.

Objectives: The primary objective of this study is to compare the effectiveness of I.V. Fentanyl PCA to Nalbuphine boluses for management of labor pain. The secondary goals are to examine adherence to the protocol over time and compare maternal and fetal adverse events associated with IV Fentanyl PCA versus I.V. Nalbuphine boluses.

Methods: We identified all patients at our institution utilizing IV Fentanyl PCA for labor from August 2009 though August 2015. We then performed a chart review to determine pain control and maternal/fetal adverse events experienced throughout labor for patients receiving IV Fentanyl PCA. We compared this cohort of patients with similar patients in labor during this time period that received IV Nalbuphine boluses.

Results: There were no significant differences in pain scores between the IV Fentanyl PCA and Nalbuphine bolus groups (p=0.43) (Figure 1). Following an initial modest decline, all groups showed a significant increase in pain scores with time (p <.0001). Adherence to the fentanyl protocol progressively decreased with each ensuing year from 2009 -2015 (80%, 59%, 56%, 50%, 33%, 25%, 0%) with the obstetric team usually requesting a much lower fentanyl dose than recommended by protocol. There were no maternal complications (maternal desaturations, Narcan, bag mask ventilation, intubation) observed in any group. Fetal adverse events were not significantly different between the Fentanyl vs. Nalbuphine groups: fetal bag/mask ventilation 3/42 vs. 2/44, intubation 2/42 vs. 0/44, and NICU admissions 2/42 vs. 2/44 for gestation >35 weeks.

Discussion: Parturients continued to have high pain scores with both Fentanyl PCA and Nalbuphine boluses during labor. We could not detect improvement in pain scores with use of the Fentanyl PCA compared to Nalbuphine boluses. Adherence to the protocol progressively decreased with time suggesting the need for ongoing education of both the obstetric and anesthesia staffs regarding the details of the Fentanyl PCA protocol. Maternal and fetal adverse events were very uncommon and not significantly different between the Fentanyl PCA and Nalbuphine groups.



Abstract #:T-27

Intravenous Acetaminophen As An Adjunct To Patient-Controlled Epidural Analgesia With Levobupivacaine And Fentanyl In Labor: A Randomized Controlled Study

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Background: To evaluate the effect of intravenous infusion of acetaminophen on the average hourly consumption of levobupivacaine and fentanyl combination given as patient-controlled epidural analgesia (PCEA) in laboring parturients.

Methods: In this randomized, double-blind, placebo-controlled clinical trial conducted in a tertiary care hospital, 80 parturients were randomly assigned to two groups of 40 each to receive either 1000mg (100ml) i.v. acetaminophen or 100ml normal saline as placebo 30min before the procedure. After insertion of the epidural catheter all patients received 10ml of levobupivacaine 0.1% with 2µg/ml fentanyl, followed by continuous background epidural infusion of 6ml/h of with a provision of patient-controlled bolus 5ml of same drug with a lock-out interval of 12min.
The primary outcome was hourly average consumption of levobupivacaine and fentanyl mixture. Secondary outcomes included pain score, sensory and motor block characteristics, hemodynamic parameters of mother, duration of second stage of labor, mode of delivery, Apgar scores, fetal heart rate and adverse effects.

Results: The average hourly drug consumption in the Acetaminophen group was significantly lower as compared to Placebo group (7.035 ± 0.83 ml/h vs. 8.124 ± 1.34 ml/h; $p<0.05$). The number of boluses taken were also significantly less in Acetaminophen group (1.00 ± 0.93 vs. 1.43 ± 0.90; $p<0.05$).

Conclusion: Use of 1000mg i.v. acetaminophen 30min before the procedure significantly decreases the average hourly drug consumption as well as number of boluses taken through the epidural route. Thus i.v. acetaminophen is a safe and effective adjunct to PCEA in labor analgesia.

Abstract #:T-28

Survey of Attitudes and Perceptions of Nulliparous Parturients Regarding Labor Epidural Analgesia

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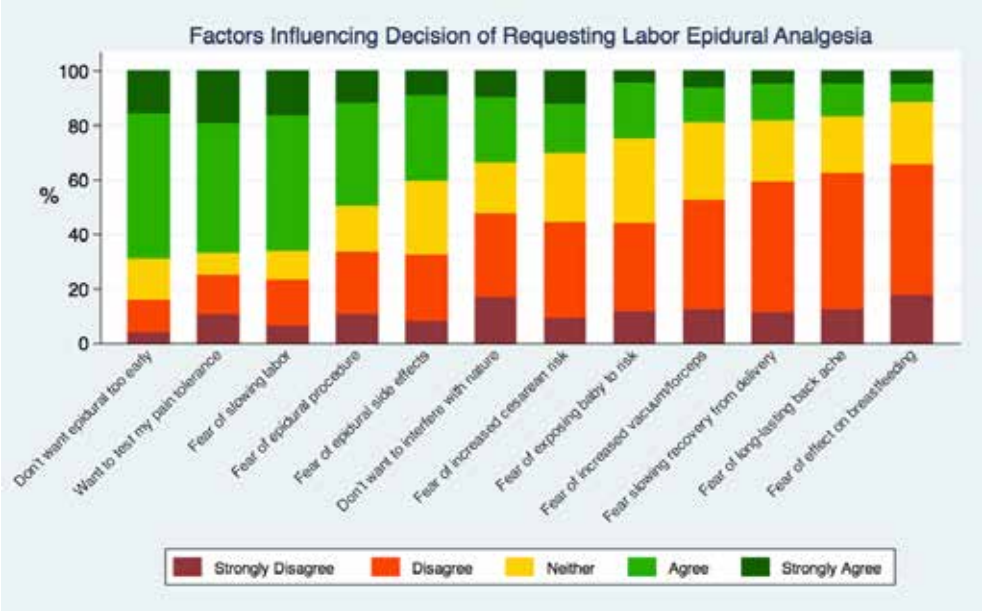
Intro: At our hospital, more than 90% of nulliparous parturients receive labor epidurals, but we have noticed that many women experience considerable pain before requesting their epidural. We posited a link between this delay and misconceptions about epidurals. We therefore conducted a survey to probe parturient attitudes and perceptions.

Methods: Laboring nulliparous women with epidurals were enrolled. Questions included pain (VAS; 0 - 10) before and after the epidural, the influence of painful contractions on the parturient's decision to plan for an epidural, attendance at a childbirth education class, and perception of class bias regarding epidurals. We also assessed 12 specific factors (listed on the x axis in the figure below) that may have influenced the decision to request an epidural.

Results: 150 surveys were completed. Although we did not track response rate for the first 100 surveys completed, we did so for the next 50 completed (response rate = 96%). Pain VAS declined from 7.1 (2.1 SD) before to 0.7 (1.0 SD) after epidural ($p<0.01$ Wilcoxon signed rank test). Intention to plan for epidural before and after painful contractions began increased from 72% to 89.3% ($p <0.01$; McNemar's test). 67.3% of respondents attended a childbirth class. Perception of class bias was 15.4% pro-epidural, 51.2% neutral, and 27.5% anti-epidural. See figure 1 for breakdown of the 12 specific factors probed. The most common factors driving decision-making about epidurals were that the epidural should not be taken too early (68.6%), that it would slow labor (66%) and that parturients wanted to test their pain tolerance (66.6%). 49.3% of women were fearful of the epidural procedure. 30% and 18.7% thought that epidurals would increase their risk of cesarean and vacuum/forceps, respectively. Childbirth class attendance increased the odds of thinking that the epidural should not be taken too early (OR=2.5; 95% CI: 1.2 to 5.1; $p=0.013$) and that the epidural would slow down labor (OR=2.3; 95% CI: 1.1 to 4.7; $p=0.02$).

Discussion: We found that many nulliparous women harbor misconceptions about epidural analgesia, which are not supported by evidence-based medicine. Attending childbirth class appears to encourage women to delay their request for epidural analgesia. We suggest that efforts be directed towards providing mothers-to-be with accurate evidence-based information, so that they will better able to decide if and when to request epidural analgesia for their labor.



Abstract #:T-29

The Angle Labor Pain Questionnaire: Reliability of Pain Recall Following Initiation of Epidural Analgesia

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Introduction: Severe pain is extremely difficult to assess during labor, making it desirable to conduct assessments after women have received pain relief. The reliability of retrospective pain assessments following epidural drug administration, however, is unknown. This study assessed the reliability of pain recall using the Angle Labor Pain Questionnaire (A-LPQ) following initiation of labor epidural analgesia.

Methods: After REB approval and written informed consent, 44 women in early active labor were recruited. Women were fluent in English, >18 years of age, ≤6cm cervical dilatation and contracting ≥3 minutes apart without pain relief. The same trained interviewer administered the A-LPQ in mixed versus standard question order format during 2 test sessions. Test session 1 was administered just prior to epidural insertion; Test session 2 was initiated 20 minutes following the epidural test dose. Overall changes in pain were assessed using the Patient Global Impression of Change Scale (PGICS). Concurrent validity was assessed with overall pain intensity ratings based on an 11-point Numeric Rating Scale (NRS) and a Verbal Rating Scale (VRS) and for coping using the Pain Mastery Scale (PMS) for both test sessions.

Results: Forty women were analysed; the majority (90%) reported moderate (21/39) or severe (14/39) pain at baseline. Most women (73%, 29/40) reported very much improved pain following epidural drug administration during Test 2. Recall reliability for A-LPQ summary scores was excellent (ICC 0.98, 95% CI 0.97, 0.99) and very good to excellent for subscales (Table 1). Cronbach's alphas were ≥0.95 for A-LPQ summary scores and ranged from 0.72 to 0.95 subscales. Paired t-tests were insignificant for all comparisons except for The Enormity of the Pain subscale (p=0.03). Intraclass correlation coefficients (ICC) were high (>0.95) for this subscale regardless of parity. Correlations between A-LPQ summary and subscale scores with overall pain intensity scores on the NRS and VRS and with the PMS for pain coping supported concurrent and construct validity.

Conclusion: The study demonstrated that recall reliability of prior pain experiences is high in women of mixed parity during early active labor. Findings suggest that the A-LPQ can be used to asses severe or extreme labor pain in women after epidural analgesia has been established.

Table 1. Recall Reliability Based on the Intraclass Correlation Coefficient (ICC)

Scale		ICC (95% CI)	p value
A-LPQ Summary Score		0.98 (0.97, 0.99)	<0.001
Subscale	Uterine Contraction Pain	0.92 (0.85, 0.96)	<0.001
	Birthing Pain	0.91 (0.84, 0.95)	<0.001
	Back Pain/Long Haul	0.95 (0.91, 0.98)	<0.001
	Enormity of the Pain	0.98 (0.97,0 .99)	<0.001
	Fear/Anxiety	0.97 (0 .95, 0.99)	<0.001

Abstract #:T-30

Epidural catheter functional assessment with high concentration local anesthetics

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Background: Women who receive labor epidural analgesia (LEA) often require a supplemental bolus for pain control. In some cases the anesthesia provider may question if breakthrough pain is due to excessive labor pain or a failing catheter. This distinction can be diagnosed by injecting a volume (5 to 10ml) of a high concentration local anesthetics (HCLA) such as bupivacaine (Bupiv) or lidocaine (Lido). Lido might provide faster onset and a quicker determination, while Bupiv would allow for a longer effect if the epidural catheter is functioning. We investigated which high concentration of lidocaine or bupivacaine was superior for the assessment of a failed epidural catheter in women during LEA.

Methods: IRB approval was obtained for this observational cohort study. Consecutive charts of women who had a LEA were reviewed for the use of lidocaine (≥1%) or bupivacaine (≥0.25%). Cases where the HCLA was administered within 30 minutes of either placement or of delivery, when used for assisted delivery or cesarean, or specifically identified catheter issues, were eliminated. The time from HCLA administration to the next pain control intervention, and the number of subsequent interventions required for that patient were recorded. Chi-square and t-test were used for comparison. $P<0.05$ considered significant.

Results: 3116 women received LEA over a 12 month period, of which 146 (4.7%) received HCLA. We eliminated 41 for use immediately prior to delivery (n=30) or within 30 min of initiation (n=3), assisted delivery (n=7) or catheter disconnection (n=1). Of the remaining 105, 56 received Lido and 49 Bupiv. There was no difference in demographic or obstetric characteristics between groups. There was no difference in the duration of epidural analgesia between groups. Women who received Bupiv were less likely to require a second intervention (24% vs. 51%; p=0.004), had a longer time to the next intervention (93 ± 40 minutes vs. 63 ± 42 minutes; p=0.04), and required fewer additional interventions after HCLA (0.4 ± 0.8 vs. 0.9 ± 1.1; p=0.01; (55% reduction, 95%CI: 14% to 97%)). There was no difference in complications between groups.

Discussion: Assessment of breakthrough pain during labor epidural analgesia must include an evaluation of whether the epidural catheter has failed. In some cases it can be difficult to determine if the epidural catheter is functioning correctly, high concentration local anesthetic are often used to make this assessment. Women who received Bupivacaine (≥0.25%) were less likely to need a second intervention, had a 48% longer time before the next intervention when necessary, and needed half as many subsequent interventions. The use of lidocaine (≥1%) results in more repeated requests for analgesia in the mother and a greater workload for the anesthesia provider.

Abstract #:T-31

A case-series of Programmed Intermittent Epidural Boluses (PIEB) using High-Flow Delivery for Labor Analgesia

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Background: Epidural bolus injections for labor analgesia have been proven to provide superior pain relief and maternal satisfaction compared with continuous infusions. In 2014, the FDA approved commercially available pumps (CADD®) that deliver programmed intermittent bolus (PIEB) along with patient-controlled epidural analgesia (PCEA). These pumps can be programmed to deliver the boluses at different flows ranging from 150ml/h to 500ml/h, however the default flow is usually programmed at 250 ml/h, because higher flows require specific tubing (high-flow tubing). Currently, there is no available data on PIEB delivered at the maximum high-flow of 500ml/h for labor analgesia. It has been reported that occlusions may be occurring which may counteract the possible advantages of high flow delivery. We report here on our case-series of 25 cases using a CADD®-Solis PIB Ambulatory Infusion System with high flow tubing.

Methods: Data from 25 women receiving a combined-spinal epidural (CSE) for labor analgesia using a CADD® Solis PIEB pump with high-flow tubing cases were collected from July to November 2015. PIEB protocol was as reported previously (1): 10ml PIEB bolus every 45minutes (bupivacaine 0.0625%-fentanyl 2mcg/ml), 5ml PCEA bolus, 10min lock-out for both boluses, delivered at high-flow of 500ml/h. Demographics, anesthetic interventions (time to 1st physician-administered top-up, number of top-ups) and obstetric data (duration of 2nd stage, time to delivery, delivery mode) were recorded.

Results: Among 25 women, only 5 (20%) requested a physician top-up, with a median time from CSE to 1st top-up of 235 minutes (IQR 81-227). No episodes of hypotension requiring physician intervention were recorded. There were no cases of tubing occlusion and no technical issues were reported by nursing or providers.

Conclusions: Use of PIEB with PCEA set-up to deliver boluses at 500ml/h with high-flow tubing appears to be providing effective analgesia without any technical problems requiring any troubleshooting during labor and delivery. With only 20% of women requesting a physician top-up, which is somewhat lower than expected, our experience with this novel delivery mode is extremely promising. However, because of the higher cost of the high-flow tubing, randomized clinical trials are needed to evaluate whether this additional cost is justified by substantial advantages in analgesia parameters, motor block, and possibly obstetric outcomes.

References

1. Delgado,C.GM-02,SOAP.2015.

Table. Demographic characteristics and obstetric/anesthetic outcomes. Data presented as, means (SD), or proportions for demographics. Times are represented as medians with (IQR).

Age (years)	32 (5)	
Weight (kg)	82 (15)	
Height (cm)	163 (5)	
Mode of delivery	*Vaginal*	92%
	Cesarean	8%
Time from CSE until delivery (min)	428 (230-539)	
Cervical dilatation @ CSE (cm)	4.3 (1.5)	
Gestational age (weeks)	38 (3)	
Nulliparity	32%	
Time from CSE to 1st physician top-up (min) **(in women requesting a top-up)**	235 (81-227) (n=5)	
Duration of 2nd stage (min) **(cesarean cases excluded)**	41 (14-96) (n=23)	

Abstract #:T-32

Epidemiology of Severe Postpartum Anemia after Cesarean Section.

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Background: Although postpartum anemia is associated with important maternal and perinatal morbidity, the epidemiology of severe postpartum anemia has not been well described.

Objective: Our objective was to describe the epidemiology of severe postpartum anemia after cesarean section. We characterized the incidence of severe postpartum anemia and identified key risk factors for severe postpartum anemia.

Study Design: We studied women who underwent cesarean section at Kaiser Permanente Northern California facilities, between 2005 and 2013. Data were collected on 84,025 cesarean sections. Severe postpartum anemia was defined as a maternal hemoglobin < 8 g/dl at the time of hospital discharge. Using multivariate logistic regression, we assessed the presence and strength of associations between key risk factors - predelivery anemia and postpartum hemorrhage (PPH) - with severe postpartum anemia. We estimated the distribution of these risk factors among women with severe postpartum anemia.

Results: The overall rate of severe postpartum anemia was 7.3%. Severe postpartum anemia was strongly associated with a predelivery hemoglobin between 10 and 10.9 g/dl (adjusted odds ratio (aOR)=5.4; 95% confidence interval (CI) 4.91-5.93), predelivery hemoglobin <10 g/dl (aOR 30.74; 95% CI=27.21-34.73, and PPH (aOR=8.35; 95% CI=7.71-9.06). The proportions of women with severe postpartum anemia were highest for those experiencing PPH but no predelivery anemia (12.2%; 95% CI=11.0 to 13.6), and those with neither PPH nor predelivery anemia (10.7%; 95% CI=9.6 to 12.0).

Conclusion: Although predelivery maternal anemia and PPH are strong risk factors for severe anemia after cesarean section, more than 1 in 10 women with severe postpartum anemia lack both risk factors.

Table. Associations between Severe Postpartum Anemia with Predelivery Hemoglobin and Postpartum Hemorrhage.

	Model 1[a]	Model 2[b]	Model 3[c]	Model 4[d]
	OR (95% CI)	aOR (95% CI)	aOR (95% CI)	aOR (95% CI)
PPH	9.57 (8.85 – 10.34)	9.82 (9.08 – 10.62)	9.57 (8.85 – 10.36)	8.35 (7.71 – 9.06)
Prepartum Hb level (g/dl):				
> 11	Reference	Reference	Reference	Reference
10 -10.9	5.05 (4.61 – 5.54)	5.06 (4.61 – 5.54)	5.10 (4.65 – 5.60)	5.40 (4.91 – 5.93)
< 10	26.7 (23.75 – 30.0)	26.9 (23.92 – 30.23)	27.06 (24.03 – 30.46)	30.74 (27.21 – 34.73)
Missing Hb	1.16 (1.08 – 1.25)	1.16 (1.07 – 1.25)	1.19 (1.10 – 1.28)	1.54 (1.41 – 1.67)

[a] unadjusted model
[b] adjusted for year of birth as a fixed effect, and individual hospital as a random effect.
[c] adjusted for year of birth, maternal age, and race/ethnicity as fixed effects, and individual hospital as a random effect.
[d] adjusted for year of birth, maternal age, race/ethnicity, grand multiparity, hereditary or acquired coagulation disorders, gestational age at delivery, number of prior cesarean deliveries, obesity, thrombocytopenia, pre-eclampsia, labor, placenta previa, antepartum hemorrhage as fixed effects, and individual hospital as a random effect.
aOR = adjusted odds ratio; CI = confidence interval; Hb = hemoglobin; PPH = postpartum hemorrhage

Abstract #:T-33

A Simulation Study of Noise Levels in the Obstetric Operating Room

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Noise in the operating room (OR) can distract the anesthesiologist and increase patient anxiety. (1) This is of particular importance during Cesarean delivery, when patients are awake and support people are present. High noise levels are associated with surgical site infections; (2) thus, decreasing noise levels is critical for safety. We performed this study to determine the intensity of sound created by common noises in the OR.

The SoundMeter app by Faber Acoustical was used to take measurements at the center of an empty obstetric OR. (3) Each session was measured for 10 seconds and A-weighted, which takes into account the logarithmic scale with which the human ear interprets changes in loudness. The average and maximum A-weighted decibel (dBA) levels were determined.

Ten sessions were recorded with these noise sources: baseline; 1, 2, and 3 suctions; 3 suctions and pulse oximeter at 60% or 100% volume; suctions and pulse oximeter with crinkling of glove paper; suctions and pulse oximeter with two people talking; suctions and pulse oximeter with two people talking and crinkling of glove paper simultaneously; suctions and pulse oximeter with throwing sharps away. Baseline dBA level was 54.3. The loudest reading occurred with 3 suctions, pulse oximeter at 100%, people talking, and crinkling of paper simultaneously, with an average 81.6 dBA.

The sensation of loudness is not proportional to the decibel level but is a logarithmic function, such that an increase of 10 dBA is perceived as twice as loud, an increase of 20 dBA is perceived as four times as loud, and so forth. Compared to a library (30 dBA), the OR baseline dBA level was 54.3 (perceived as 5.4x louder than the library) due to background humming noises. The maximum sound intensity observed in this study was 85.1 dBA, which is perceived as 8.5x louder than baseline. Noise is distracting to both patients and clinicians, and can lead to increased complications. Awareness of this issue is critical to a multidisciplinary effort to maintain a culture of quiet and safety in the obstetric OR.

References:

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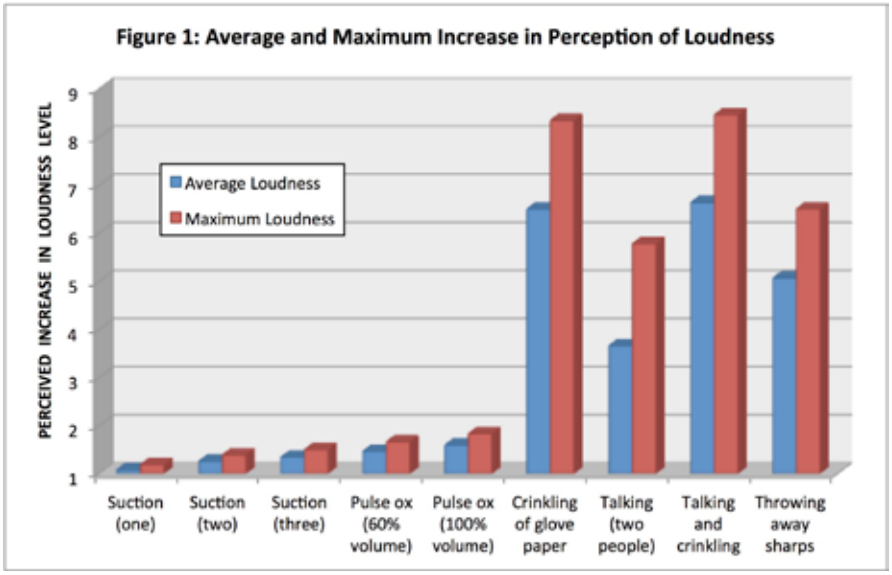
2. Dholakia et al. The association of noise and surgical-site infection in day-case hernia repairs. Surgery 2015;157(6).
3. Kardous et al. Evaluation of smartphone sound measurement applications. J Acoust Soc Am 2014;135(4).



Abstract #:T-34

Barriers to collaborative anesthetic care between Anesthesiologists and Nurses on Labour and Delivery: A multicenter study using the Delphi method.

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Introduction: The practice of obstetrical anesthesia relies on the collaborative efforts between anesthesiologists and nurses. Teamwork, however, remains a challenge in health care (1). While the reasons for this are varied (1,2), it is known that interventions to improve inter-professional collaboration may improve patient care (3). We sought to identify barriers to collaborative care between anesthesiologists and nurses in a busy Canadian tertiary labor and delivery (L&D) unit and to validate these findings in other units across Canada and the United States.

Methods: This double-blind cross-sectional consensus building study was based on the Delphi technique(4)and carried out in two phases. The first phase was completed at our institution where a panel of obstetric anesthesiologists and nurses responded to four parallel sequential rounds of questionnaires. Round 1 comprised of a set of three open-ended questions: "What are the barriers to collaborative care between anesthesiologists and nurses that affect patient care during the provision of anesthetic care on the L&D unit? What are the reasons they exist? What are some interventions that may address them?" Round 2 sought consensus (defined as >70% of agreement) on the responses within each professional group and these would proceed to Round 3. Round 3 (cross-over) sought consensus (>70% of agreement) on items submitted by the opposite profession. In Round 4 (ranking), both groups were asked to rank the top ten barriers to collaboration out of a list originated at the completion of Round 3. The second phase of the study will be a multicenter (10 L&D units across Canada and the United States) validation inquiry seeking consensus on the top ten barriers found in the first phase.

Results: For the first phase, 22 anesthesia providers and 18 nurses were recruited. During Round 1, the open-ended questions revealed 56 and 30 barriers/corresponding reasons/suggested interventions from the anesthesia and nursing group, respectively. Identified barriers included themes such as professionalism, availability, dissonance, role clarity, team coordination, communication environment, organizational structure and knowledge gaps. Preliminary findings from Round 2 are presented in Table 1, with final results expected by the SOAP conference.

References:

1. Nurs Inq 2008 15: 1-2;
2. Medsurg Nurs 2008 17: 35;
3. Cochrane Database Syst Rev 2009: 3;
4. J Adv Nurs 2003 41: 376-82

Table 1. Within group consensus of barriers to collaboration (Round 2 results)

Barriers identified by Anesthesia providers (N=21)	Barriers identified by Nursing (N=15)
Professionalism	
• Lack of respect for anesthesia trainees among nurse e.g., communication breakdowns, bypassing residents through staff, Questioning medical decisions, addressing providers as "anesthesia" instead of their names. • Bypassing anesthesia residents through staff for some epidural requests • Requesting epidurals at the convenience of the nurse i.e., after breaks/report	
Availability	
• There is a lack of understanding of competing interests of anesthesiologist's time. Not being immediately available for non-urgent requests can be perceived as a lack of interest in a patient's needs • Multiple interruptions during conduct of patient care i.e., simultaneous requests for epidurals, top-ups, C/s etc.	• Patients having to wait for an epidural during handover periods • Not enough anesthesia staff to deal with epidurals during other busy times (i.e., C-sections, teaching sessions or other emergencies) • Time pressures that prevent the anesthesiologist from providing the level of collaborative care with the nurse for the patient that is ideal
Dissonance	
• Conflicting priorities during emergency situations • Computer documentation seems to be a priority vs patient care	
Role Clarity	
• Anesthesiologist are not consulted with making plans, we are seen as the facilitator of other people's plans • Nurses and physicians have a poor understanding of each others job, pressures, and expectations	
Team Coordination	
• A lack of nursing assistance for anesthesia during emergencies and/or Cesarean section when RT/AA are unavailable • Some nurses do not know the patient history nor have they completed an assessment when they call you for an issue.	• Unclear communication during crash C-section • Some staff anaesthesiologist rely too much on their residents and fellows to do the epidurals, even when it's busy
Communication	
• Unclear communication regarding the plan for certain patients • Communicating the urgency of a situation • Delays in moving high risk patients to the OR once emergency C/S is requested	• Communication breakdowns i.e., multiple requests simultaneously and changes in care plans not shared • Nursing often acts as the middle person communicating between anesthesia and obstetrics.
Organizational Structure	
• Handover issues: nurses are not included so they don't know what our plans are and handover time is also often interrupted by nursing requests	
Knowledge Gaps	
• Lack of knowledge where to access anesthetic equipment, particularly when the AA is busy • Management of patients that feel some degree of pain when they already have an epidural anesthesia	• Lack of interprofessional development - nurses and anaesthesia rarely get an opportunity to learn outside of the unit.

Abstract #:T-35

Assessing Leadership Development in Obstetric Anesthesia Fellowship Programs

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Introduction: Clinical leadership has been shown to directly correlate with overall improved healthcare delivery and outcomes and reduction in preventable mortality.1 Therefore, leadership training may be warranted to both improve patient outcomes and prepare trainees for their future roles. Graduates of Obstetric Anesthesiology Fellowship programs may assume various leadership roles in their future careers. It is unknown whether current obstetric anesthesiology fellowship programs provide training in leadership competencies. This study was designed to examine the leadership training being offered to current obstetric anesthesiology fellows.

Methods: As no known standardized leadership competencies exist for medical education, the authors synthesized a list of 8 common competencies regarding leadership from current literature. A survey to assess the current leadership curricula, both formal and informal, offered by obstetric fellowships in the United States was generated and beta tested with resident volunteers at the University of Illinois at Chicago to ensure understandability. After IRB approval, an electronic survey was distributed (via SurveyMonkey) to current obstetric anesthesiology fellows via the SOAP fellowship directory over the period of one month with weekly reminders. Descriptive statistics were used to categorize survey responses.

Results: The survey was administered to 84 fellows, of which 28 participants responded (33.3%). Only 28.57% of respondents had any prior leadership training. Of the 8 leadership competencies surveyed, only two competencies, Managerial Skills and Systems Based Practice, demonstrated greater than 50% prevalence of any form of training with the majority of training being in an informal setting.

Discussion: With the rapidly changing landscape of medicine, it is vitally important for physicians to be positioned to take key leadership roles to guide change. Our data indicate that the majority of respondents were not receiving leadership training, either formal or informal, during their fellowship. However the majority of respondents (64.29%) reported that they did feel prepared to take on a leadership role in their future career. Future efforts may be needed to create a formal leadership curriculum to target the skills obstetric fellows may require for their future careers.

References

1. Blumenthal DM. Acad Med. 2012;87(4):513-522.

Competency	% Respondants Receiving Training	Type of training		
		Formal	Informal	Both
Communication Skills	42.86%	7.14%	21.43%	14.29%
Financial Skills *	32.14%	14.29%	7.14%	7.14%
Managerial Skills	64.29%	7.14%	42.86%	14.29%
Systems Based Practice	55.56%	7.41%	29.63%	18.52%
Organizational Orientation	37.03%	11.11%	18.52%	7.41%
Emotional Intelligence	40.74%	7.41%	22.22%	11.11%
Change Management	18.52%	3.70%	14.81%	0.00%
Strategic Vision	14.81%	0.00%	7.41%	7.41%

*** One respondant selected "None" as type of training received**

Abstract #:T-36

Identifying Perceived Barriers for Implementation of the National Consensus Safety Bundle on Obstetric Hemorrhage: Utilization of the Delphi Method

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Introduction: The most preventable cause of maternal death, postpartum hemorrhage (PPH), has an increasing incidence within the United States (US).(1) In response, the National Partnership for Maternal Safety (NPMS) developed an obstetric hemorrhage consensus bundle to provide every US birthing facility consistent, validated practice guidelines.(1) With the Delphi method, we sought to identify items from the bundle at our institution that could be improved, had perceived barriers to implementation, and had solutions with high feasibility and impact on patient care.

Methods: After IRB exemption, we conducted a prospective consensus-building study based on the Delphi method. Experts (≥ five years of experience on the labor and delivery floor) comprised of anesthesiologists, obstetricians, nurses, and surgical technicians were asked to participate in four sequential questionnaires on the implementation of the obstetric hemorrhage safety bundle. The first round identified bundle components that experts perceived as not currently adequate and the perceived barriers to implementation. The second round established agreement on important components within each specialty, and the third round ranked the elements (with ≥ 60% agreement) on feasibility of implementation and impact on patient care. The final round shared insights across all four specialties for a final consensus. Descriptive statistics were performed.

Results: A total of (39) experts have completed two rounds at this time: (11) anesthesiologists, (11) obstetricians, (11) registered nurses, and (6) surgical technicians. Results describing areas for improvement are shown in the table. Other areas were deemed to be sufficiently adequate or lacked strong consensus.

Conclusion: The NPMS obstetric hemorrhage bundle was created to help guide practice and system improvement for every US birthing facility. For successful implementation, each center needs to create quality improvement mechanisms that identify deficiencies and build a culture of change, through group consensus. Our preliminary findings have identified several urgent areas for improvement including assessment of hemorrhage risk and a support program for staff, patients, and families. The Delphi method is a useful method to build consensus among expert providers and create a structured, purposeful program to deliver tangible quality improvement. Future studies will evaluate the long-term success of this initiative.

References

1. Main EK et al, A&A 2015

Component of Bundle for Improvement	Specialties in Agreement				Solutions with ≥ 60% Consensus
	AN	OB	RN	ST	
Readiness (Every Unit)					
Immediate access to hemorrhage medications (kit or equivalent)	■	■		■	Medications (including those requiring refrigeration) should be readily available in the OR for quicker access.
Unit education on protocols, unit-based drills with post drill debriefs		■	■	■	Drills should occur more frequently, with multidisciplinary staff and all work shifts
Recognition and Prevention (Every Patient)					
Assessment of hemorrhage risk	■	■	■	■	A formal checklist/scoring system should be created to identify all patients at high risk for hemorrhage
Response (Every Hemorrhage)					
Unit-standard, stage-based OB hemorrhage emergency plan with checklists	■	■	■		A formalized hemorrhage response checklist should be visible and known to all members of staff
Support program for patients, families, and staff for all significant hemorrhages	■	■	■	■	A support program should be created for better communication with families. This element should be defined at the beginning of an event
Reporting and Systems Learning (Every Unit)					
Establish a culture of huddles for high-risk patients and post event debriefs to identify successes and opportunities	■		■	■	Multidisciplinary huddles should be performed consistently and comprehensively for all high risk patients, not only those going to the OR

*Adapted from Main et al; AN=Anesthesiologists, OB=Obstetricians, RN=Registered Nurses, ST=Surgical Technicians

Abstract #:T-38

Communication of critical information following implementation of a standardized format for multidisciplinary rounds on labor and delivery

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Introduction: Communication errors are involved in 85% of hospital sentinel events; however, multidisciplinary rounds using various cognitive aids (i.e. checklists, flowsheets) have been shown to reduce errors in a variety of hospital settings (1-3). We hypothesized that developing and incorporating a standardized 6-item checklist into nurse-led multidisciplinary rounds on labor and delivery would result in more frequent communication of critical information.

Methods: A six-item checklist was developed using Delphi methodology with a multidisciplinary group of anesthesiologists, obstetricians, and nurses. (Table) Nurse educators and leaders were engaged through face to face meetings and agreed to educate and implement the new format. Implementation included posters, laminated cards, emails and in-person reminders from nurse leaders to use the new format. The 6-item format for rounds was incorporated into RN workflow by placing the new format on their SBAR sheet. A total of 28 multidisciplinary rounds were recorded, 14 pre-implementation (PRE) and 14 post-implementation (POST). Audiotapes were transcribed verbatim. Two reviewers, blinded to timing (PRE vs POST), evaluated the number of critical items addressed during each patient's discussion. Inter-rater reliability was determined using Cronbach's alpha. Fisher's exact and Mann-Whitney U tests were used for analysis.

Results: A total of 133 patients were discussed in the PRE period and 83 discussed in The POST period. Reviewer agreement was 0.84. Median number of checklist items addressed were not different between PRE (2 (IQR 1.5 to 3)) and POST (2 (IQR 2 to 3.5) groups (P = 0.07). Maternal health issues were discussed more frequently post-implementation. (Table) No other item was significantly more likely to be discussed following implementation.

Discussion: Checklist implementation did not result in an increased number of items being discussed; however, main maternal medical issues were discussed more frequently. Reluctance to change the traditionally-unstructured format of multidisciplinary rounds and the perception that the format would not improve communication may have contributed to these findings. Continued efforts to facilitate and encourage explicit discussion of patient information and intrapartum plans using standardized formats or other methods are warranted.

References

1. JCAHO. Sentinel event statistics. March 31,2006
2. Crit Care Med 2013;41:2015–2029
3. J Trauma Acute Care Surg 2012;73:S75–S82

Table: 6-item checklist and percentage of patient discussions containing checklist items

	PRE (N=266)[a]	POST (N=166)[b]	*P*
1. STATE patient's name and age	49%	57%	0.11
2. DISCUSS patient's main *medical* issues	28%	43%	0.002
3. DISCUSS patient's *pregnancy-related* issues	31%	35%	0.46
4. DISCUSS *fetal* issues	18%	17%	0.90
5. DISCUSS *labor* issues	87%	89%	0.76
6. SUMMARIZE THE PLAN	27%	32%	0.33

[a] represents 133 patient discussions, evaluated by 2 reviewers
[b] represents 83 patient discussions, evaluated by 2 reviewers

Abstract #:T-39

Variability in routine nursing involvement relating to labor epidurals- Does practice setting dictate nursing practice?

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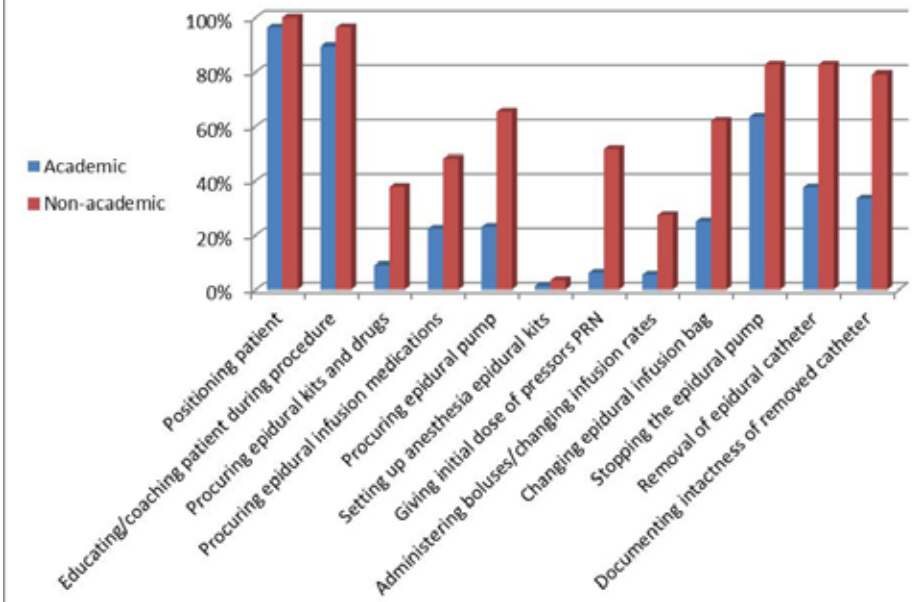
Objective: To understand the variability in routine nursing practice as it relates to labor epidurals across different practice settings, especially between academic and non-academic environments.

Methods: All the U.S. members of the Society for Obstetric Anesthesia and Perinatology (SOAP) were sent a link to an anonymous 17-question survey relating to typical labor and delivery nursing practices observed by the SOAP members in their respective practice settings. The survey was administered via Qualtrics. A reminder was sent to the participants at the end of 4 weeks. At the end of the 8 weeks, the survey was closed and the results analyzed. The details of the questions answered in the survey are in Table 1.

Results: Of the 795 members who were sent the survey, 237 began the survey and 223 finished it, for a completion rate of 28%. The survey focused on 12 areas in which nurses might be involved with respect to labor epidurals, and not surprisingly found that nurses did significantly more tasks (7.4/12 vs 4.1/12, $p < 0.001$) in non-academic settings compared to academic settings. These included obtaining epidural kits and drugs, administering boluses and changing infusion rates. In fact, every one of the 12 areas analyzed had higher nursing involvement in non-academic areas. Some of the differences were striking, for instance, in only 6.3% of academic settings, nurses give the initial dose of pressors; whereas nurses give the initial dose of pressors in 52% of non-academic settings. Along the same lines, the study found that nurses did significantly more in private hospital settings compared to public (6.2/12 vs 4.1/12, $p = 0.001$). The study also found that nurses were likely to do more tasks if the hospital had a policy on the extent of nursing involvement ($p < 0.01$).

Conclusion: Nursing practice varies significantly between academic and non-academic settings with respect to labor epidurals, with nurses in non-academic settings having a greater scope of practice. This may be due in part to the increased role of residents in academic settings and a greater reliance on nursing staff in the private practice environment.

Table 1: Items for which nursing staff provide assistance



Abstract #:T-40

Teamwork Assessment Tools in Obstetric Emergencies: A Systematic Review

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Introduction: The management of obstetric emergencies requires a multidisciplinary team. Lack of communication and inadequate care are frequent factors in poor maternal and fetal outcomes [1]. The Institute of Medicine identifies team-based training and simulation as methods to improve patient safety [2]. Many teamwork assessment tools exist to try to quantify the adequacy of teamworking in various scenarios, but whether or not a specific tool is better adapted to teamwork assessment in obstetric emergencies is unclear, and no general consensus exists. The purpose of this systematic review was to determine the best teamwork assessment tool, in terms of ease of use, reliability and validity, for use in obstetric emergencies.

Methods: Prospective studies evaluating multidisciplinary team non-technical skills in obstetric emergencies, using a specific tool, were included. The search was conducted in Embase, Medline, Pubmed, Web of Science, PsycINFO, CINAHL and Google Scholar using the search string: 'group processes', 'team', 'non-technical skills', 'nontechnical skills', 'obstetrics' and 'pregnancy'. The search was conducted from 1944 to January 11, 2016. Abstracts and non-English studies were excluded. Data on study intervention, outcomes assessed, reliability and validity were collected and a descriptive analysis performed.

Results: A total of 15,333 records were identified, 6,168 were screened after removal of duplicates and non-English studies. Seventy full text articles were assessed for eligibility with 57 excluded for not meeting the inclusion criteria. Thirteen studies were included in the qualitative synthesis and assessed simulation scenarios. Nine looked at team training and scenario implementation and one looked at patient safety. One evaluated teamwork scales using validity measures, six using reliability measures and one used both (Table 1). Only 6 of the 13 studies included anesthetists in the simulations.

Discussion: Five scales had the greatest reliability with the CTS also displaying construct validity. Only the GAOTP and GRS were evaluated with anesthetist involvement in the team scenario. More work needs to be done to establish the validity of teamwork scales for non-technical skills. Further studies are required to assess how outcomes, such as performance and patient safety, are influenced when using these scales.

References:

1. MBRRACE-UK 2011-13
2. Institute of Medicine 2000

Reference	Tool	Domains	Reliability	Validity	Study conclusion
Morgan (2015) J Interprof Care	SAGAT	Perception of elements in current situation Comprehension of current situation Projection of future status	Interrater agreement - Kappa < 0.4 for most scenarios	No validity measures used	High degree of feasibility of use of SAGAT with interprofessional obstetrical teams and high fidelity simulation.
Fransen (2012) BJOG	CTS	Communication Decision making Role responsibility Situational awareness/resource management Patient-friendliness	Interrater agreement - Kappa statistic 0.78, Kendall coefficient 0.95 Interrater reliability - ICC 0.98	No validity measures used	Team performance and medical technical skills may be significantly improved after multiprofessional obstetric team training in a medical simulation centre
Morgan (2012) BMJ Qual Saf	AOTP GAOTP	Communication with patient/partner Task/case management Teamwork Situational awareness Communication with team members Environment of the room	Internal consistency - Cronbach's α for AOTP was 0.96, and for GAOTP was 0.91. Cronbach's α for combined scales was 0.97, Interrater reliability - Eight-rater α for GAOTP was 0.81 (single-rater ICC 0.34). Moderate test-retest reliability - Pearson product moment correlation total score across scenarios 0.47.	No validity measures used	High correlation between AOTP and GAOTP. GAOTP sufficient assessment tool for obstetrical team simulation performance when used with at least eight raters.
Posmontier (2012) J Nurs Educ	TAQ	Structure Leadership Situation monitoring Mutual support Communication	Internal consistency - Pre-test Cronbach's α were 0.71 for team structure, 0.83 for leadership, 0.81 for situation monitoring, 0.72 for mutual support and 0.52 for communication. Post-test Cronbach's α were 0.85 for team structure, 0.93 for leadership, 0.93 for situation monitoring, 0.71 for mutual support and 0.63 for communication.	No validity measures used	Trans-disciplinary simulation experiences among women's health students may enhance mutual support and communication and promote better patient outcomes
Siassakos (2011) BJOG	Untitled	Leadership Team communication Team-member language/behavior Situational awareness Decision making	No reliability measures used	Construct validity - global situational awareness: general correlation with 'overall' GTS - Kendall's τ_b 0.38 - supportive language: significant correlation with 'behaviour' GTS Kendall's τ_b 0.44	Using administration of an essential drug (magnesium for eclampsia) as a valid surrogate of team efficiency and patient outcome after a simulated emergency, found more efficient teams more likely to exhibit certain team behaviours relating to better handover and task allocation
Guise (2008) Simul Healthc	CTS	Communication Decision-making Role responsibility (leader/helper) Situational awareness/resource management Patient-friendliness	Interrater reliability - ICC 0.98 Interrater agreement - Kappa statistic 0.78 Concordance - Kendall coefficient 0.95 Correlation - Pearson coefficient of scored ratings 0.94-0.96	Construct validity – Rater scores corresponded with a priori designed teamwork level for each scenario: Scenario 1 80-82%, scenario 2 60-80%, scenario 3 73-80%	CTS easy to use, reliable and has construct validity
Morgan (2007) Anesthesiology	HFRS GRS	Leadership-structure Confidence-assertion Information sharing Teamwork Error Communication Patient safety	**HFRS** Internal consistency - Nine-rater Cronbach's α 0.823 Interrater reliability - Single rater ICC 0.34 Self-assessment single rater ICC 0.12 Pearson correlation (external vs self evaluation) 0.24 **GRS** Internal consistency - Nine-rater Cronbach's α 0.88 Interrater reliability - Single rater ICC 0.45 Self-assessment single rater ICC 0.74 Pearson correlation (external vs self evaluation) 0.44 Correlation between HFRS & GRS 0.93	No validity measures used	Does not support HFRS for assessment of obstetric teams. GRS "shows promise as a summative but not a formative assessment tool."

Table 1: Reliability and validity of teamwork tools for obstetric emergencies.

Key: SAGAT = Situation Awareness Global Assessment Technique, CTS = Clinical Teamwork Scale, ICC = intraclass correlation coefficient, AOTP = Assessment of Obstetric Team Performance, GAOTP = Global Assessment of Obstetric Team Performance, TAQ = Team Attitudes Questionnaire, GTS = Generic Teamwork Scores, HFRS = Human Factors Rating Scale, GRS = Global Rating Scale

Abstract #:T-41

Bedside Ultrasound Assessment of Gastric Volume in Pregnant Women at Term: Development of a Predictive Model

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Introduction: Pulmonary aspiration of gastric content is one of the most feared complications in obstetric anesthesia. Bedside gastric ultrasonography (US) is a feasible imaging tool that can be reliably performed by anesthesiologists to assess gastric content in the perioperative period.1,2 We studied the relationship between the gastric antral area assessed by US and the volume of clear fluids ingested aiming to develop a predictive model to estimate gastric volume.

Methods: We conducted this randomized single-blinded study in non-laboring pregnant women at term. A standardized scanning protocol of the gastric antrum was carried out using a 2-5 MHz curvilinear array transducer in a sagittal to right parasagittal plane on the epigastric area by one of two anesthesiologists. Subjects were on a 45-degree semi-recumbent position. Firstly, we performed a baseline qualitative assessment of the gastric content after an 8-hour fasting period in supine and in right lateral decubitus (RLD). Women were classified following a 3-point grading system (grade 0: no fluid; grade 1: fluid seen in RLD only; grade 2: fluid seen in both positions). Secondly, subjects were randomized to ingest one of 6 predetermined volumes of apple juice (0-50-100-200-300-400 ml). A quantitative assessment was performed through a series of sonographic measurements of the cross-sectional area of the antrum (CSA) at baseline and after the volume ingestion. The anesthesiologist performing the US examinations was blinded to the volume allocation. Primary outcome: the relationship between antrum CSA and volume ingested were analyzed through Pearson correlation coefficients. Secondary outcome: multiple regression analysis was used to create a mathematical model to estimate gastric volume.

Results: We have examined 56 out of 60 subjects. Preliminary results show that the CSA in RLD correlated well with volumes ingested (Pearson's correlation r=0.65). Various mathematical models were tested statistically significant, which incorporate CSA in RLD and demographics such as age, gestational age, height and BMI (Coefficient of determination R2=0.42 to 0.7)

Discussion: Bedside gastric US is a feasible tool in the assessment of pregnant women. The antrum CSA correlates well with the volume ingested. We developed a predictive model to estimate gastric volumes based on antral CSA and patient demographics. The quantitative measurement of antral CSA is a promising tool. Further research is warranted to identify the best use of this point-of-care diagnostic modality.

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Abstract #:T-42

Can lumbar ultrasound guidance facilitate lateral labor epidural placement by anesthesiology residents? A randomized controlled trial of placement duration and ultrasound reproducibility

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Introduction: Mastery of the lumbar epidural technique with the patient in lateral position can be a challenge for anesthesiology residents and fellows. However, lateral epidural placement may enhance patient comfort and lower the risk of intravascular catheter placement (1,2). Lumbar ultrasound (LUS) has been shown to improve the learning curve of epidural placement in trainees (3). However, LUS is typically performed immediately before epidural placement, which is inconvenient for a woman in active labor. We evaluated the impact of LUS on the success and efficiency of lateral epidural placement by residents and fellows as well as the reproducibility of LUS measurements when performed in the lateral position at two time points: early labor vs. active labor.

Methods: Healthy patients in early labor (VAS <3 and/or cervical dilation <3 cm) anticipating epidural placements were randomized to control or study group. Following a baseline lateral LUS, the L3-4 midline insertion point, vertebral level, and lateral positioning in the bed were identified but marked only in the study group. Measurements were repeated for the study group immediately before epidural placement by an independent operator and re-marked if different from baseline. Residents or fellows performed all epidural placements; duration of placement was recorded using standardized start and end times. The primary outcome was duration of placement. Secondary outcomes included epidural placement success indices (number of attempts, need for staff intervention, procedural complications), and reproducibility of LUS measurements (midline, vertebral level and distance to ligamentum flavum [LF]). The primary outcome was analyzed using student's t-test and secondary outcomes were analyzed using Fisher's exact test.

Results: To date, 34 of 60 patients have been recruited (19 control, 15 study). The mean duration of epidural placements was similar between groups ($p = 0.968$). However, reproducibility of LUS measurements in early compared to active labor was 100% for midline insertion point and 87% for vertebral level. Distance to LF measurements by LUS during early and active labor were similar ($p=0.76$) but significantly underestimated the actual depth by 0.86 cm ($p = 0.03$). There were no significant differences in other outcomes.

Conclusion: Our preliminary findings suggest that although the duration of lateral epidural placement was similar with and without LUS immediately before placement by anesthesiology residents or fellows, there was excellent reproducibility of LUS midline, vertebral level, and LF depth between early and active labor. We propose that in selected patients where LUS may be useful, it could be done during early labor rather than active labor so that the LUS is not a source of delay for analgesia.

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2) Bahar M. Can J Anesth 2004
3) Grau T. Can J Anesth 2003

Abstract #:T-43

Comparison of ultrasound measured posterior longitudinal ligament length in parturients in the standard sitting and crossed leg positions: A Case Series

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Introduction: Neuraxial anesthesia is routinely used in parturients for labor analgesia and cesarean delivery. Ultrasound (US) facilitates the performance of neuraxial blocks1. US has demonstrated the effect of patient position on the visualized length of posterior longitudinal ligament (PLL) 2,3. Improved visualization of the PLL suggests an 'open acoustic window', or unobstructed path to the dura between the laminae of the lumbar spine 4.In our experience, having parturients sit in crossed leg position (CLP) compared to standard sitting position (SP) facilitates placement of spinals and epidurals. There are no prospective studies evaluating the role of CLP for neuraxial anesthesia in parturients. We conducted a case series in term pregnant patients to compare the length of PLL, ligamentum flavum (LF) and interlaminar distance (ILD) visualized using US longitudinal paramedian view in CLP and SP.

Methods: Five healthy term gestation patients gave written informed consent to participate. In the CLP, patients sat on the bed with their legs crossed, neck and back flexed. In the SP, patients sat on the bed with their feet supported by a chair, neck and back flexed. US was performed in both positions sequentially to measure the best visualized length of PLL, LF and ILD at L3-4 level in longitudinal paramedian view by Investigator 1. Measurements were recorded by Investigator 2 using intrinsic caliper software. Investigator 1 was not informed of the measurements. The patient's comfort score was also noted in both positions.

Results: Mean±SD measurements in cm (SP, CLP) - PLL (0.94±0.3, 1.37±0.6), LF (0.9±0.2, 1.1±0.4) and ILD (2.8±0.6, 3.2±0.5). Details provided in table 1. Conclusion: This series demonstrated the feasibility of using ultrasonography to visualize PLL, LF, and ILD at L3-4 intervertebral space using longitudinal paramedian view in term pregnant women in both CLP and SP. Measurements were found to be longer in CLP which may suggest improved lumbar neuraxial access. All women were comfortable in both positions.

References:

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Table 1: Details of ultrasound measurements and comfort score

	Patient 1		Patient 2		Patient 3		Patient 4		Patient 5	
	SP	CLP	SP	CLP	SP	CLP	SP	CLP	SP	CLP
PLL (cm)	0.78	1.08	1.47	2.08	0.81	0.89	0.77	0.94	0.85	1.87
LF (cm)	1.09	1.10	0.85	1.52	0.78	0.75	0.72	0.74	1.06	1.38
ILD (cm)	3.52	3.60	3.38	3.59	2.41	3.07	2.11	2.42	2.82	3.34
CS	5	3	3	5	4	4	4	5	4	3

SP- standard sitting position, CLP – cross legged position, PLL – Posterior longitudinal ligament, LF - ligamentum flavum, ILD - interlaminar distance, CS – Comfort score in Likert scale (1-extremely uncomfortable, 2-uncomfortable, 3-neutral, 4-comfortable,5-extremely comfortable)

Abstract #:T-44

Accuracy of Intervertebral Level Determination for Obstetric Neuraxial Anesthetic Procedures

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Background: Using palpation of the iliac crest for identification of Tuffier's line may result in inaccurate level determination for neuraxial anesthetic procedures.1 Anatomic changes associated with pregnancy may further distort the anatomy.2 Improper identification of interspaces has safety concerns given the variability of conus medullaris ending often beyond the level of L1.3 Ultrasound (US) use may increase accuracy,2 yet routine use of US to identify level is not the standard of care. Previous investigators have documented poor accuracy of level determination by palpation in an experimental environment.1 We undertook this study to determine accuracy of vertebral level identification in the obstetric anesthesia clinical environment.

Methods: In this IRB-approved study we identified and consented patients who had neuraxial labor analgesia and performed US examination of their back on postpartum day 1 or 2. We determined level of neuraxial anesthetic placement by noting the US-determined level of the puncture mark on the skin and after US was completed, compared that to the level documented in the electronic medical record (EMR). We noted BMI and relevant details of the anesthetic procedure, including whether placement had been US-guided. The examiner recorded ease of visualization of US (easy, moderate, difficult) based on time spent and image quality.

Results: Of 95 patients studied, level could not be determined by US in 1 and level was not documented in the EMR in 2. US-determined level correlated with EMR-documented level in 32/92 (35%) of cases, was 2 segments higher in 8/92 (9%), was 1 segment higher in 34/92 (37%), and was 1 segment lower in 18/92 (21%) of patients. BMI was 33 SD±7.4. 79/95 (83%) of anesthetics were CSE or IT procedures, and only 4/95 (4%) of procedures were US-guided. 68/95 (72%) of US exams were judged to be easy.

Conclusions: Consistent with studies under experimental conditions1 accuracy of identification of intervertebral level by palpation in clinical settings is poor and most errors result in placement of neuraxial anesthetic higher than estimated. A large portion of our blocks intentionally entered the IT space arguing for a greater need for accuracy. Visualization of intervertebral level using US is easy in most parturients, including in an obese population of patients, and may improve accuracy.

US-determined (y-axis) vs EMR-documented (x-axis) intervertebral level

		Documented level			
		L1-2	L2-3	L3-4	L4-5
US level	L1-2		2	6	
	L2-3	1	9	21	2
	L3-4		8	23	11
	L4-5			8	
	L5-S1				1

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Abstract #:T-45

Investigation on the Corresponding Relationship and Influencing Factors between T Line and Lumbar Spine of Chinese Pregnant and Non-pregnant Women

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Objective: To assess the corresponding relationship between iliac crest connection and lumbar spinous gap and the accuracy rate of lumbar spinous process gap positioning by anesthesiologists through ultrasound for pregnant and non-pregnant women in China.

Method :1763 patients undergoing obstetric (Group O, N=905) and gynecological (Group G, N=858) surgeries were recruited. Before anesthesia, patients maintained their back vertical to the bed surface in the lateral position. They bowed their head, and bent their hip and knees for maximum flexion of the spine. The bilateral iliac crest apogee was palpated, and a line connecting them was drawn as the Tuffier's-line (T line). In clinic, anesthesiologist usually drew a perpendicular line to ground based on the above lateral iliac crest apogee (actually the line was T', rather than T). Anesthesiologists in different seniority were chosen randomly to locate the L2-3 interspace, and ultrasound was applied to determine accuracy rate.

Results: 1. In group O (N=858), the percentage of the T line in the L3or L3-4 interspacewas 5.19% and 19.01% respectively, which were higher than those in the group G (N=905) (3.03% and 12.00% respectively)($P < 0.01$).2. In group O (N=798), the percentage (5.01%) of T line in the L3 was significantly lower than that (56.77%) of T' line in the L3 ($P < 0.01$). And there was no significant difference in the probability of T or T' line located at the L3-4 interspace ($P > 0.05$). Meanwhile, in group G (N=212), the percentage of the T line in the L3 was 4.72%, and in the L3-4 interspace was 11.79%,which were lower than thoseof the T' line in the L3or L3-4interspace (37.26% and 23.11% respectively)($P < 0.01$). 3. The positioning accuracy rate by anesthesiologists' palpation was 70.93%.Positioning of 20.30% patients was higher than the actual position, and 8.77% was lower than the actual position.

Conclusion: T line of pregnant women was higher than that of non-pregnant women; in clinic, the positioned connection by anesthesiologists' palpation was not the actual T line. Palpation positioned interspace was usually higher, and puncturing had the potential risk of damaging spinal cord; ultrasound could provide reliable evidence for spinous gap positioning.

【Keywords】 Ultrasound; Iliac crest connection; Spinous gap; Location

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Abstract #:T-46

Abnormal Diastolic Filling Patterns Identified in Preeclampsia with Severe Features

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Objective: Preeclampsia (PEC) is a hyperdynamic cardiovascular state with increased systemic vascular resistance. Preliminary studies suggest that PEC is associated with diastolic dysfunction (DD) in the absence of concomitant cardiovascular comorbidities; however, this remains poorly defined. We sought to determine whether PEC with severe features (PEC-SF) is associated with unique patterns of DD utilizing echocardiography (ECHO).

Study Design: Participants were recruited from the Johns Hopkins Health System. Inclusion criteria included singleton pregnancies > 23 weeks. Diagnosis of PEC-SF was per ACOG (Hypertension in Pregnancy, 2013). Exclusion criteria: multiple gestation, known valvular malformations, previous cardiac surgery, known pulmonary hypertension, history of pulmonary embolism, or interstitial lung disease. PEC participants were subdivided in 2 groups: PEC-SF and PEC superimposed on preexisting hypertension (SI-PEC). We further subdivided the PEC group into PEC with DD and PEC without DD. ECHO was performed at time of consent for controls, and at time of PEC diagnosis for women with PEC. DD was assessed using American Society of Echocardiography guidelines by measuring the ratio of early diastolic mitral inflow velocity (E) and late diastolic velocity (A), and comparing E to tissue Doppler septal velocity of the mitral annulus (e'). Septal E/e' ratio of >15 was defined as increased filling pressure. Statistical analyses were performed using Stata, version 14.

Results: Controls (n=36), PEC-SF (n=46), and SI-PEC (n=17) had similar demographic characteristics, except race with significantly more black participants in the preeclamptic groups when compared to controls. Mitral Septal E/e'and septal e' were significantly different in controls when compared to PEC-SF and SI-PEC: 7.35 (1.58) vs 10.6 (2.9) vs 11.4 (2.7) for E/e', $p<0.001$, respectively; and 11.6 (1.9) vs 9.8 (2.5) vs 8.9 (1.9), $p < 0.001$ for septal e', respectively. 29/61 (30%) of women with PEC had echocardiographic evidence of DD. When we compared preeclamptic women with and without DD to controls, the PEC w/DD had lower mitral e' when compared to controls and PEC w/o DD group (Table).

Conclusion: In this prospective cohort, we found increased LAA and septal E/e' in the PEC-SF and SI-PEC group. We also found that 30% of our cohort had echocardiographic evidence of DD with significantly decreased septal e' in the PEC w/DD group when compared to controls and PEC w/o DD. These data may help guide anti-hypertensive therapy and cardiac risk stratification after pregnancy.

Table : Clinical and Sonographic Cardiovascular Characteristics by DD

	Normal Values	Control (n=35)	PEC w/o DD (n=43)	PEC w/ DD (n=18)	p-value
Highest SBP (mmHg)	< 140	--	185 (16)	183 (18)	0.556
Highest DBP (mmHg)	< 180	--	102 (9)	104 (9)	0.451
LAA (mL/m^2)	< 20	16.6 [15-19]	19.8 [17.5-21.9]	20.8 [17.7-22.4]	0.002
LVEF (%)	> 55	61 (5)	64 (6)	64 (7)	0.033
Mitral Septal E (cm/s)	73 (19)	84.3 (17.9)	101.0 (18.3)	89.6 (29.6)	0.002
Mitral Septal A (msec)	**113 (17)**	**55.7 [49 -69]**	**73.3 [61-89]**	**66.0 [59-86]**	**<0.001***
Mitral Septal e'	**14.9 (2.31)**	**11.6 (1.8)**	**10.4 (2.2)**	**7.3 (0.88)**	**<0.001****
Mitral Septal E/A	1.88 (0.45)	1.4 [1.2-1.8]	1.3 [1.1 -1.6]	1.1 [0.9-1.6]	0.084
Mitral Septal E/e'	**6.7 (2.2)**	**7.5 [5 -9]**	**9.9 [8 -11]**	**12.1 [8-15]**	**<0.001***
DT (msec)	200 (40)	193 [170-232]	208 [172 – 219]	185 [159 – 194]	0.206
LV Posterior Wall Thickness (cm)	**0.6 – 0.9**	**0.85 (0.13)**	**1.00 (0.16)**	**1.01 (0.22)**	**<0.001***
LV Septal Wall Thickness (cm)	**0.6 – 0.9**	**0.81 (0.12)**	**1.00 (0.26)**	**1.01 (0.22)**	**<0.001***
Net Fluid Balance (mL)	--	--	10.0 [-118 – 99]	50.0 [-56 – 122]	0.445
BNP (pg/mL)	--	44.4 [20 -81]	50.6 [25 – 89]	79.7 [23 – 164]	0.230

Data are mean (SD).
SBP: Systolic blood pressure; DBP: Diastolic blood pressure; LAA: Left Atrial Area; LVEF: Left Ventricular Ejection Fraction; E: Mitral inflow velocity of early diastolic filling; A: Mitral inflow velocity of late diastolic filling; e': Mitral annular velocity of tissue Doppler imaging; S/D: Systolic/Diastolic; DT: Deceleration Time; BNP: Brain natriuretic peptide
* statistical difference between control and PEC groups; ** statistical difference among all three groups

Abstract #:T-47

Retrospective Review of Peri-induction Hypertension in 58 patients with Preeclampsia

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Background: Cerebrovascular complications are the most common cause of major disability and death in women with preeclampsia. Systolic blood pressure (SBP) of > 160 mm Hg is a risk factor for stroke in preeclampsia.[1]Spinal or epidural are preferred for cesarean delivery(CD),general anesthesia(GA) may become necessary for fetal or maternal indications. Laryngoscopy may be accompanied by an acute rise in blood pressure (BP) putting the patient at risk for intracerebral hemorrhage or pulmonary edema. Antihypertensive agents have been studied to blunt the hypertensive response to intubation. The goal should be to control the maternal blood pressure to 140/90 mm Hg prior to induction.[2] The 2005 CEMACH 2003-2005, UK) reported two deaths from intracranial hemorrhage that were attributed to the hypertensive response to tracheal intubation in preeclamptic patients.[3]
In preeclamptic patients undergoing GA, laryngoscopy and intubation have been noted to be associated with dangerous levels of hypertension. In a review of this subject by Pant,in 2014[1], adjuncts were reviewed to control the BP response to intubation. Recommended were esmolol, or nitroglycerin, labetalol and short acting opioids.Previous studies were performed with thiopental for induction agent,now propofol is the most widely used induction agent in the US.

Methods: The anesthesia records of all women with a diagnosis of preeclampsia, HELLP syndrome, and chronic HTN with superimposed preeclampsia, who underwent Cesarean delivery under general anesthesia from 2011-2014 were reviewed. A similar number of control patients without HTN who underwent Cesarean with GA were reviewed during the same time period were reviewed retrospectively. IRB approval was obtained. Basic demographics, age, parity, gestational age, APGAR scores were recorded. Heart rate HR, SBP, mean M.B.P, and diastolic blood pressure DBP were recorded as listed below:
T0: baseline
T1: highest BPin first 10 min after induction
T2: BP and HR at 20 min after induction
T3: BP and HR at extubation
58 cases with preeclampsia and 50 nonhypertensive cases having GA for CD were studied.

Results: Peri-induction beta blockers were given in 3 % and fentanyl in 22 %.Induction was with propofol in 91% and etomidate in 9%. SBP was >160 mm Hg in 57% of cases in the first ten min after intubation, but remained >160 at 20 min in only 3% of cases. Factors associated with increased SBP response to intubation were: baseline SBP > 160 and diagnosis of HELLP syndrome. Addition of fentanyl to propofol decreased SBP at all intervals, but failed to reach statistical significance. Two patients remained intubated post-op for pulmonary edema, four with PRES syndrome, and four had seizures including two post-delivery, and no CVA.

Discussion: SBP after intubation increased more with baseline SBP>160, and HELLP, and was largely back to baseline at 20 min.

References

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2. Chestnutt's Obstetric Anesthesia 2009:995
3. IJOA 2010;103:102

Abstract #:T-48

The Prone Position in Preeclampsia (P3) Study

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Introduction: The prone position, achieved using appropriate pillows, is a safe position for pregnant women. It is utilised in allied health fields & for relaxation & massage in pregnancy. In this position uterine compression of large abdominal vessels is significantly reduced. In non-pregnant critically ill adults respiratory mechanics are also improved. Despite these advantages, the prone position is rarely used in medical settings in pregnancy. There is little information about the position in pregnancy & no published information about the prone position in preeclampsia(PE). Recently a new unified theory of PE has been published.1 It proposes that hypertension in PE is an adaptive response to the demands of a growing fetus & is driven by an imbalance between maternal oxygen supply to the fetus (which may be caused by inadequate blood flow to the uteroplacental unit) & fetal oxygen demands. We hypothesise that placing a women with PE in the prone position will reduce her blood pressure(BP) by eliminating abdominal compression of blood vessels thereby reducing abdominal vascular resistance & improving blood flow. We aimed to test this hypothesis & assess feasibility of the prone position in pregnancy.

Method: After IRB approval, consent & trial registration (ACTRN:12615000160538) 62 women(50 healthy term pregnant(HP) & 12 PE) had their BP, heart rate(HR), oxygen saturation(SpO2), respiratory rate(RR), fetal HR(FHR) & comfort levels measured in 2 positions: left lateral, & prone. Measurements were after 5 minutes rest in each position. Sample size(12) PE group was based on a clinically important 10 mmHg change in systolic BP from lateral to prone position(power 80%,5% type 1 risk,two tailed t-test).

Results: 62 women completed the study. All found the prone position acceptable. Mean±SD age, gestation & body mass index for HP women was 33±4.1 years, 38±1.0 weeks and 27±3.2 kg.m-2 & for PE women was 31±3.7 years, 36±3.7 weeks, 32±5.9 kg.m-2 respectively. 44% HP & 50% PE women preferred the prone position to lateral. Hemodynamic & respiratory variables are shown in the table.

Group	Variable	Left Lateral	Prone
HP	SBP (mmHg)	112 ± 7.2	108 ± 12.9
n=50	DBP (mmHg)	70 ± 5.8	70 ± 10.8
	HR (BPM)	75 ± 8.6	85 ± 12.2
	SpO_2 (%)	98 ± 0.8	98 ± 0.7
	RR (BPM)	17 ± 2.9	17 ± 2.9
	FHR (BPM)	137 ± 10.0	138 ± 9.0
PE	SBP (mmHg)	149 ± 5.9	143 ± 9.7*
n=12	DBP (mmHg)	96 ± 6.9	94 ± 8.0
	HR (BPM)	80 ± 11.2	85 ± 13.5
	SpO_2 (%)	98 ± 0.9	98 ± 0.6
	RR (BPM)	18 ± 3.7	17 ± 3.1
	FHR (BPM)	139 ± 7.8	142 ± 10.5

*P=0.044 Data are mean ± SD, S= systolic, D=diastolic

Conclusions: The prone position is feasible & comfortable in pregnant women including those at term. The prone position may reduce SBP in women with PE without obvious adverse effects & may be an acute treatment for PE. Randomised controlled trials are needed. Pregnancy should not be a contraindication to the prone position.

Reference:

1. Dennis A,Castro J. Anaesthesia 2014;69:1183-1189

Abstract #:T-49

Retrospective Analysis of Thrombocytopenia in Pre-eclampsia with and without Severe Features

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Introduction: Currently, there is no evidence based method to define the timing of platelet assessment prior to neuraxial anesthesia in preeclamptic patients. Of concern to anesthesiologists is the potential for spinal hematoma formation in preeclamptic patients with thrombocytopenia. This retrospective study examines platelet assessments in preeclamptic patients to determine the potential time progression to clinically significant thrombocytopenia (<100K or <75K).

Methods: We performed a search of billing records at the University of Illinois Hospital (11-1-2011 to 12-9-2015) for patients with Delivery CPT codes and ICD-9 or 10 codes for the diagnosis of preeclampsia, HELLP, gestational hypertension, or cHTN . Charts were hand searched to verify inclusion criteria of age (13-49), a dx of preeclampsia at time of delivery, and viable pregnancy. Platelet values at admission , 6-12hrs, 12-18hrs, 18-24hrs, and 24 hours, clinical symptoms and vitals were recorded from charts if available.

Results: Of 598 patients, 266 patients met inclusion criteria. 62 were without severe features, 156 had severe features , 37 had superimposed preeclampsia, and 11 had HELLP.
The mean admission platelet counts were: 217K in preeclampsia without severe features, 224K with severe features, 241K in superimposed preeclampsia, and 174K in patients with HELLP.
Thirteen patients had platelets <100K, 6 had a value <75K, during their hospital course. Of the 62 without severe features, 0% became thrombocytopenic. In patients with severe feature preeclampsia 2% developed thrombocytopenia : 1.2% at admission, 0% at < 12 hours and 0.6% at >24h. Of the patients who had superimposed preeclampsia, 2.7% had platelets <100K at admission. Of those with HELLP 72% were thrombocytopenic at admission and 9% converted after 12 hrs. (Figure 1).

Discussion: Presently, there is no standard among anesthesiologists for the time frame of platelet assessment prior to neuraxial in preeclamptic patients. The limitations of our study include the small number of identified patients and retrospective data. Performing this study prospectively would be challenging given the rarity of clinically relevant thrombocytopenia in preeclamptic patients. Our study demonstrates it is unlikely for patients without severe features of preeclampsia to develop clinically significant thrombocytopenia within 12h of admission; those who present with thrombocytopenia or have severe features warrant more frequent lab evaluation.

Figure 1.

Percentage of patients becoming Thrombocytopenic and Time Points at Conversion

Platelets	Diagnosis	N	Admission-6h	6-12h	>12h
<100,000	Pre-e wo features	0	0%	0%	0%
	Pre-e w features	4	1.2%	0%	0.6%
	Superimposed pre-e	1	2.7%	0%	0%
	HELLP	8	72%	0%	9%
<75,000	Pre-e wo features	0	0%	0%	0%
	Pre-e w features	1	0.6%	0%	0%
	Superimposed pre-e	1	2.7%	0%	0%
	HELLP	4	36%	0%	0%

Abstract #:T-50

Prophylactic placement of internal iliac artery balloon catheters cannot improve outcomes of patients with abnormal invasive placenta

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Background: Prophylactic placement of internal iliac artery balloon catheters (IIABC) was initiated in our institute at November 2014. The objective of this study was to evaluate whether this procedure improved outcomes of women with abnormal invasive placenta (AIP).

Methods: From November 2013 to October 2014, all the patients with a prenatal diagnosis of AIP received prophylactic placement of IIABC and were identified as the study cohort (Group IIABC). Prenatally-diagnosed AIP patients in the preceding 12 months (from October 2012 to October 2013), who received the same standard treatment but no balloon catheters, were analyzed and served as a historic control (Group CON).

Results: Totally eligible 41 patients were identified in our database. 30 of the subjects received prophylactic balloon catheter and the balloons were inflated in 27 of the 30 cases. There were 11 subjects in group CON. Maternal demographic characteristics were similar between the two groups. There was no difference in estimated intraoperative blood loss (p = 0.636) or the incidence of intraoperative blood transfusion (p = 0.655) between the two groups. There was no difference in requirement of postoperative transfusion, either. Balloon catheter insertion failed to reduced cesarean hysterectomy (27.3% in group CON versus 43.3% in group IIABC, p = 0.478; RR = 2.039 [CI: 0.45-9.273]). However, balloon catheter insertion was associated with a slightly shortened hospital stay (5 [4-6] days versus 6 [5-7] days, p = 0.033, data were expressed as median [interquartile range]). No maternal or fetal complication was found with the insertion of balloon catheters.

Conclusions: Prophylactic balloon occlusion of internal iliac arteries was a safe procedure for both pregnant women and fetus. However, it had no effect on reducing intraoperative hemorrhage or cesarean hysterectomy in patients with AIP undergoing cesarean section. It seemed to reduce the length of postoperative hospital stay.

Table 1. Perioperative Blood Hemoglobin and Transfusion.

	CON (n=11)	IIABC (n=30)	p value
EBL intra (ml)	1100(800-2600)	1000(600-2512.5)	0.636
BT intra			
Patients received RBC (n, %)	6(54.5%)	14(46.7%)	0.655
RBC(U)	3(0-7.5)	0(0-6.125)	0.672
BTpost			
Patients received RBC (n, %)	3(27.3%)	5(16.7%)	0.658
RBC (U)	0(0-2)	0(0-0)	0.384
ΔHb (g/L)	11(2-24)	11(-1-22.5)	0.731

Data present as median (interquartile range) or n(%)
EBLintra = intraoperative Estimated Blood Loss; BTintra = intraoperative Blood Transfusion; EBLpost = postoperative Estimated Blood Loss; BTpost = postoperative Blood Transfusion; ΔHb = Preoperative Hb – Postoperative Hb

Abstract #:T-51

The anesthetic management of central versus marginal placenta previa

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Introduction: According to an Israeli survey of abnormal placentation (1), spinal anesthesia is the preferred anesthesia mode for uncomplicated placenta previa (PP), whereas general anesthesia is preferred for PP with suspected accreta. Sparse data are available regarding anesthetic management and outcome of central versus marginal PP.

Methods: We conducted a 5-year retrospective study in two tertiary Israeli medical centers. We identified PP cases via an electronic medical record in the Labor and Delivery, and manually reviewed each chart to identify maternal characteristics and anesthesia and obstetric outcomes. Outcomes for central versus marginal PP were compared using appropriate tests for continuous variables with and without normal distribution, and chi-square or Fisher's exact for categorical variables. Statistical significance was considered for p-value<0.05.

Results: We identified 452 cases of PP: 134 central and 318 marginal. Women with central PP had a significantly higher gravidity, parity number of prior cesarean delivery and prior abortions than marginal PP (p=0.011, p=0.013,p=0.002 respectively).
There was no difference between groups in preoperative ultrasound suspicion of accreta. Marginal PP presented more commonly with bleeding and required an emergency cesarean delivery, Table. General anesthesia was more commonly used for central PP. and central PP had a significantly longer surgical duration, required significantly more packed cells and blood products, and used invasive monitoring more frequently. Central PP required more frequent intraoperative conversion to general anesthesia, and had a higher frequency of peripartum hysterectomy. Women with central PP required more mechanical ventilation and intensive care admission and had longer duration of hospitalization. These differences were similar frequency of intraoperative placenta accreta for central versus marginal PP.

Conclusions: There was a significant difference in intraoperative blood loss, use of blood products, and need for invasive monitoring in central versus marginal PP in spite of the fact that the accreta rates did not differ. We believe that this information may help anesthesiologists preoperatively decide on anesthesia regimen.
(1)Ioscovich A et al. Acta Anaesthesiol Scand 2015

Table Maternal Intraoperative Anesthesia Management Strategies and Postoperative Outcomes

	Central Placenta Previa (n=134)	Marginal Placenta Previa (n=318)	P value
Preoperative ultrasound suspicion of placenta accreta #	26(19.4%)	53(16.7%)	0.49
Vaginal bleeding on presentation to hospital #	2(1.5%)	61(19.2%)	<0.001
Emergency cesarean delivery #	48(35.8%)	152 (47.8%)	0.019
GA as initial anesthesia mode #	37(27.6%)	54(17%)	0.017
GA as anesthesia mode at any point during surgery #	49(36.6%)	75(23.6%)	0.005
Duration of surgery(min)^	80.1±46.7	63.9±41.6	0.001
Estimated Blood Loss (EBL) (cc)^	1538.4±1625.5	1024.1±509.1	<0.001
EBL >1000 #			
Need for blood products (y/n) #	42(31.3%)	48(15.1%)	<0.0001
Need for > 2 units packed cells #	25(18.7%)	22(6.9%)	<0.0001
Fresh frozen plasma ^	1.2±3.2	0.4±1.6	0.01
PLT ^	1.7±5.4	0.3±1.7	<0.001
Cryoprecipitate^	1.5±5.9	0.3±1.7	0.024
Rapid infuser system used#	16(11.9%)	7(2.2%)	<0.0001
Arterial line placed#	41(30.6%)	32(10.1%)	<0.0001
Central line placed#	12(9.0%)	4(1.3%)	<0.0001
Placenta accreta confirmed intraoperatively#	24(17.4%)	38(11.9%)	0.093
Peripartum hysterectomy performed #	25(18.7%)	12(3.8%)	<0.0001
Time in PACU (minutes)*	120(90-300)	120(83-145)	0.02

Need for blood products #	25(18.7%)	28(8.8%)	0.003
Need for PC>2#	6(4.5%)	5(1.6%	0.067
Need for mechanical ventilation *	14(10.4%)	7(2.2%)	<0.001
Need for ICU *	11(8.2%)	6(1.9%)	<0.001
ICU time*	0(0-0)	0(0-0)	0.002
Hospitalization time *	6(5-8)	5(4-7)	<0.001

#- chi square, n(%)
^ - t-test, mean± standard deviation
*- Mann-Whitney test median (interquartile range)

Abstract #:T-52

Anesthesia and peripartum management of parturients with suspected accreta: neuraxial versus general anesthesia.

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Introduction: Concurrent to the rise in cesarean delivery rate, placenta accreta (PA) has become more prevalent. Anesthesia management of PA has been described in small case series (1; it is still unclear what anesthesia is preferable for these cases

Methods: We conducted a 5-year retrospective review in two tertiary medical centers with large annual delivery volumes. PA cases were identified through the hospital database and each chart was then reviewed individually.

Results: We identified 79 suspected PA cases from June 2010-2015; from onset. 35 women underwent general anesthesia (GA) and 44 underwent neuraxial anesthesia (NA) Demographic data is presented in Table. Women who underwent general anesthesia initially had higher gravidity, higher parity and had lower gestational week. Fifteen women in the initial NA group required conversion to GA (34.1%). There were no airway complications during conversion to GA. Intraoperatively women in GA group were more likely to have arrived with emergency cesarean section and with a central placenta previa . Women in the GA group had a higher estimated blood loss, required more invasive monitoring and needed more bladder repair and peripartum hysterectomy. This was in spite of the fact that there was no significant difference in actual accretas found intraoperatively. Babies in the GA group also had a significantly lower 1 minute and 5 minute Apgar. Postoperatively more women in the GA group required blood products but there was no difference in intensive care time and hospitalization time. Using a logistic regression model predicting which women were anesthetized with GA only emergency CS ($p<0.001$, OR 8.4) and central placenta previa ($p=0.03$, OR 3.57) were determinants.

Conclusion: In the women with suspected accreta who a priori were selected for NA the rate of conversion to GA was high as 34.1% but there were no significant adverse outcome reported.

	General anesthesia (n=35)	Regional anesthesia (n=44)	P value
Age ^	34.3±4.2	36.1±4.2	0.07
Weight ^	75.1±13.3	82.7±16.9	0.06
Gravida *	5(3-7)	3(3-5)	0.04
Parity *	3(2-5)	2(1-3)	0.02
Gestational Week^	35.0±2.6	36.8±2.4	0.002
s/p abortion^	0.9±0.9	0.7±1.0	0.48
s/p CS ^	2.2±1.1	1.8±1.5	0.20
Presented with Bleeding? (Y/N)#	2/35 (5.7%)	2/44 (4.5%)	0.81
Emergency CS(Y/N)#	11/35 (31.5%)	13/44 (29.5%)	<0.001
Length of surgery(min)^	95.6±39.0	82.4±62.9	0.26
EBL (cc)^	2490.0±1856.3	1635.2±1392.9	0.03
% Central previa#	16/35 (45.7%)	10/44(22.7%)	0.03
PC^	4.0±3.5	2.5±4.4	0.10
Use of Rapid Infuser System#	17/35 (48.5%)	4/44 (9.1%)	<0.0001
Use of cell saver#	11/35 (31.4%)	4/40 (10.0%)	<0.019
Use of arterial line#	29/35 (82.9%)	18/44 (40.9%)	0.001
Use of central line#	8/27 (29.6%)	3/44 (6.8%)	0.09
First HgB			
Lowest HgB^	10.0±1.3	9.7±1.3	0.19
Apgar 1 * (0-10)	7(5-9)	9(9-9)	<0.001
Apgar 5* (0-10)#	9(7.75-9.25)	10(9-10)	<0.001
Actual intraoperative diagnosis of accreta#	28/35 (80.0%)	30/44 (68.2%)	0.24
Peripartum hysterectomy #	20/35 (57.1%)	9/44 (20.5%)	0.001
Bladder repair #	5/35 (14.3%)	1/44 (2.3%)	0.04
Time in PACU (minutes)#	250(120-720)	140(90-300)	0.17
Need for blood products (y/n) #	32/35 (91.4%)	20/44 (45.5%)	<0.0001
Number of PC PC>2 #	19/35 (54.3%)	13/44 (29.5%)	0.03

Massive transfusion (pc>=7)#	4/35 (11.4%)	4/44(9.1%)	0.73
Mechanical ventilation hours *	0 (0-0)	0(0-0)	0.36
ICU days*	0(0-1)	0(0-0)	0.14
Need for ICU#	8/35(22.9%)	4/44 (9.1%)	0.09
Clinical DIC#	3/35 (11.4%)	3/44 (6.8%)	0.77
Need for meachanical ventilationY/N) #	10/35 (28.6%)	6/44 (13.6%)	0.1
Hospitalization time (days)#	7(5-9.25)	6(5-9.5)	0.09

#- chi square, n(%)
^ - t-test, mean± standard deviation
*- Mann-Whitney test median (interquartile range)

Abstract #:T-53

Study to investigate the association between placenta accreta subtype and red blood cell transfusion

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Objective: Women with abnormal placentation are at increased risk of massive transfusion. Determining red blood cell (RBC) requirements according to the degree of abnormal placentation may help tailor predelivery RBC ordering. This retrospective study investigated the association between number of transfused RBCs and placentation subtype.

Study Design: An institution-specific pathology database was searched for women delivered between 7/2009-7/2014 suspected of abnormal placentation based on documentation of radiologic evidence and/or clinical suspicion at the time of delivery. We abstracted clinical, laboratory and pathology data from medical records and the pathology database for all women with or without abnormal placentation. Based on the pathology report, placental subtypes were classified as: no accreta (NA), microscopic placenta accreta (MPA), non-microscopic placenta accreta (NMPA), placenta increta or placenta percreta (PIPP). We compared number of transfused RBCs between women with different placental subtypes using Kruskal-Wallis test. Multivariate linear regression was used to determine whether placental subtype was associated with the number of transfused RBCs, after adjusting for: maternal age, known placenta previa, and number of prior cesarean deliveries. P<0.05 considered as statistically significant.

Results: The study cohort comprised 136 women. Placental subtypes were: 42 (31%) NA, 39 (29%) MPA, 21 (15%) NMPA, and 34 (25%) PIPP. The median [IQR] number of RBCs transfused during the hospitalization period differed according to the degree of placentation: NA=0 [0-0] units; MPA=0 [0-2] units; NMPA=4 [0-11] units and PIPP=6 [2-6] units; P<0.001. In the adjusted model, the number of transfused RBCs was not independently associated with placental subtype (Table). However, compared to women with NA, RBC requirements were non-significantly higher for women with PA and PIPP.

Conclusion: Our study provides evidence that women with PA and PIPP have higher peripartum RBC requirements than women with NA. As our cohort size was limited, population-wide studies are needed to examine whether the degree of placentation is significantly associated with transfused RBC.

Table. Multivariate Linear Regression for the Total Number of Red Blood Cells Transfused

Variable	Coefficient	Standard Error	P value
Intercept	2.7	7.0	
No accreta	Reference group		
Microscopic placenta accreta	0.5	1.0	0.6
Non-microscopic placenta accreta	4.0	2.0	0.05
Placenta increta or Percreta	3.6	2.2	0.10

Outliers removed who had >40 units total RBC transfused
*Adjusted for the following covariates: maternal age, gestational age at delivery, known placenta previa, mode of delivery, number of prior cesarean deliveries.

Abstract #:T-54

Parturients on Magnesium infusion and its effectiveness as a post cesarean analgesic adjuvant- A retrospective analysis

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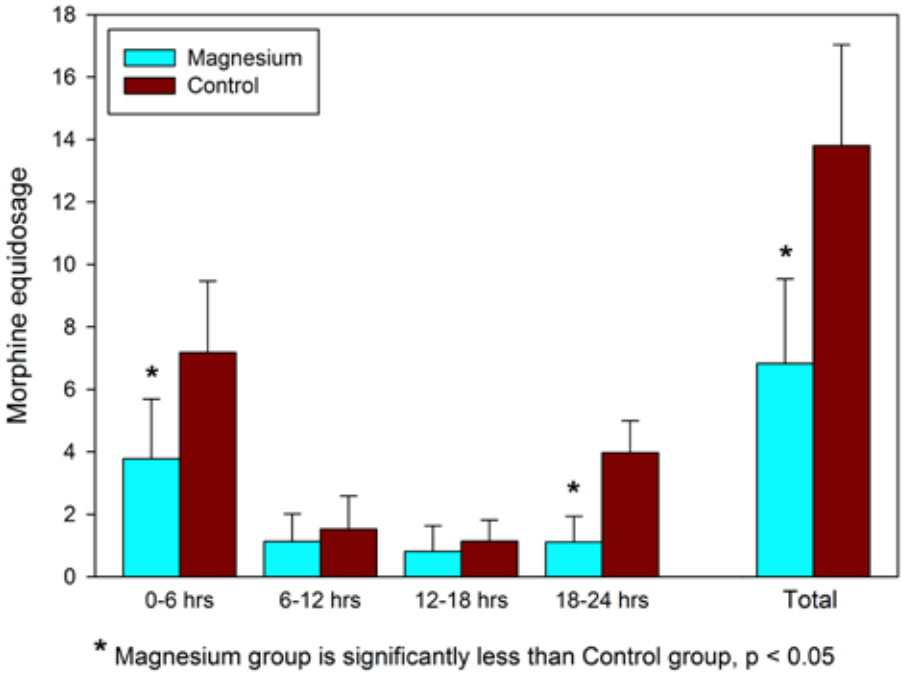
Introduction: Magnesium is known to reduce post-surgical analgesic requirement. We aimed to study if this was true with post cesarean patients. Study objective was to determine the effectiveness of intravenous(IV) magnesium sulfate infusion to lower analgesic requirement and Visual Analogue Scale(VAS) scores during the first 24-hour post-cesarean period.

Methods: This was an IRB approved retrospective analysis of 32 patients' medical records who received IV magnesium for preeclampsia during the first 24 hours after cesarean delivery and compared that data to 32 non-preeclamptic patients who did not receive post cesarean IV magnesium.

Results: The gestational age was significantly lower in the magnesium group (34.6 ± 3.6 weeks) compared to the control group (38.9 ± 5.4 weeks; P<0.05). The magnesium group received significantly less IV ketorolac, as the initial rescue analgesic, in the first 24 hours after cesarean delivery (79 ± 23 mg) compared to the control group (90 ± 0 mg; p = 0.0082). In addition, the number of patients receiving ketorolac between 6-12 hours (magnesium = 38%; control = 91%; p = 0.00040) & 12-18 hours (magnesium = 16%; control = 75%; p = 0.013) were significantly lower in the magnesium group. The magnesium group also had lower overall VAS scores (magnesium VAS = 1.8 ± 1.6; control VAS = 3.8 ± 1.9; p = 0.000033). Only 63% of the patients in the magnesium group required additional analgesics compared to 100% in the control group (p = 0.00015). Various opioid medications were prescribed as rescue analgesics when pain was not satisfactorily controlled with IV ketorolac. The amounts of these opioids were converted to morphine equivalents to determine the amounts administered for each group. Overall, the magnesium group received significantly less IV morphine or morphine equivalents than the control group (6.8 ± 7.8 mg vs 13.8 ± 9.3 mg, p = 0.0019).

Conclusion: In conclusion, this study demonstrates the effectiveness of IV magnesium sulfate infusion in reducing the total analgesic need and decreasing VAS score after cesarean delivery. We suggest that further studies be done using IV magnesium with intermittent dosing rather than as a continuous infusion to investigate its efficacy as an adjuvant analgesic in post cesarean patients.



Abstract #:T-55

Analgesic requirements and pain experience after cesarean section under neuraxial anesthesia women with preeclampsia

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Introduction: Cesarean section (CS) is a common mode of delivery in women with preeclampsia(PE). There is no literature concerning postoperative pain following CS in PE & little information on the safety/efficacy of analgesics used in PE. Non-steroidal anti-inflammatory drugs(NSAIDS) should be used with caution in other hypertensive adults & there are case reports of their use causing acute hypertension & subsequent death in PE. It is theorised that analgesics that reduce the seizure threshold(tramadol & pethidine) should not be administered in PE due to the risk of seizures in PE. Magnesium sulphate is used to treat & prevent seizures in PE & may also provide analgesia when administered systemically. Acute perioperative pain management guidelines fail to differentiate between healthy pregnant(HP) woman & PE.1 This means that clinicians either follow these guidelines which may not be appropriate in PE or undertake management with little clinical guidance. We hypothesised that women with PE have a different postoperative pain experience & different pain management compared to HP women. We aimed to determine the current practice of analgesic administration & pain experience after CS in PE & compare this with HP(ASA I) women.

Method: After IRB approval, we conducted a single centre (7400 births/year) one-year retrospective case control study to determine analgesic administration, pain experience & adherence to postoperative pain protocol (strict regular paracetamol/oxycodone slow release/NSAIDs + as required tramadol & immediate release oxycodone for 48 hours) after CS in PE compared with HP women. Inclusions for all women were; neuraxial anaesthesia, no labour, no prior abdominal surgery, having first CS, surgery ≤60 minutes.

Results: 62 women were included;21 cases(PE) & 41 controls(HP). The cases & control were matched for age, height, weight, gravidity, parity, duration of surgery & previous surgical history. Cases had shorter gestation compared with controls (31.7±3.0 vs 38.5±1.1 weeks $p<0.001$). Cases received more spinal bupivacaine (mean difference 0.4 mg) & in the first six-hours postoperatively received(mean ± SD, % or median (IQR)), less oxycodone (11.5±3.9mg versus 14.3± 5.1mg, $p<0.031$), less often received parecoxib (43% versus 100%, $p<0.001$), & reported less maximum pain scores (0(0,5) versus (4(3,6)) $p<0.005$). Pain management protocol was followed in 78% of HP women & 43% of PE ($p=0.023$).

Conclusions: This study suggests that PE women experience less pain in the first 6-hours after CS despite receiving less analgesia, & have a different postoperative pain experience & receive different pain management compared to HP women. Earlier gestation, different analgesia regimens & the use of $MgSO_4$ may explain these differences. Further research is needed to explore these novel findings.

Reference:

1. Macintyre PE et al. Acute Pain Management: Scientific Evidence (3rd edition) ISBN Online: 978-0-9775174-5-9

Abstract #:T-56

Incisional liposomal bupivacaine and its impact on post cesarean analgesia.

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Introduction: Appropriate postoperative pain control after cesarean delivery is very important as the mother attempts to recuperate postoperatively and provide care for her newborn. Existing analgesic modalities have effects lasting up to 24hrs. In addition, they have unwanted side effects such as nausea, vomiting, pruritis, urinary retention, sedation and respiratory depression, which are barriers in providing care for a newborn. Long acting local anesthetics such as liposomal bupivacaine may have prolonged analgesic effects lasting 72-96hours. Our goal is to investigate the effectiveness of incisional liposomal bupivacaine injection in reducing post-cesarean morphine use in women undergoing primary cesarean via a Pfannenstiel incision.

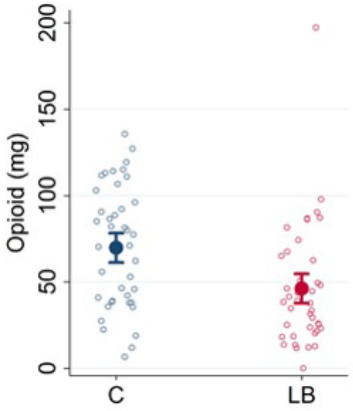
Methods: This is a retrospective, case-control study with a 1:1 allocation ratio of study cases to controls. All the cesarean deliveries at a community hospital in Mississippi spanning a 40-month period from 2011 to 2014 completed by a single physician were reviewed and 80 cases meet the inclusion criteria. Study group received an injection of 266mg of liposomal bupivacaine in the space between the rectus muscle and fascia, and at the level of the subcutaneous tissue; divided equally. None of the patients received intrathecal morphine. Data about type of anesthesia administered, opioid consumption, non-steroidal anti-inflammatory use, acetaminophen use, type of cesarean, reason for cesarean and length of post-operative stay were collected.

Results: A multiple linear regression model was used to determine the statistical significance. There is a significant difference of IV morphine use between the study and the control group; 26.52 milligrams (p=<0.001, 95% CI of 12.76mg to 40.28mg). Administration of intravenous ketorolac and acetaminophen was greater in treatment group compared to control group (p< 0.001, p<0.001), but this was controlled for in the final analysis. Post-operative length of stay was similar between groups (p=0.475). The indication for cesarean, number of classical surgeries, type of anesthesia (GETA, spinal, epidural) were not different between groups (p=0.583).

Conclusions: This study supports the injection of liposomal bupivacaine into Pfannenstiel incisions as an analgesic adjunct in reducing post-operative opioid usage, in patients undergoing primary cesarean delivery. Further study is recommended in the form of a prospective trial that includes pain scores and return of bowel function.

Figure 1

Estimated mean opioid consumption by group (control vs. liposomal bupivacaine), with 95% confidence interval bars.



Abstract #:T-57

A Randomized Controlled Trial of the Impact of Ropivacaine Concentration Used for Transversus Abdominis Plane (TAP) Blockade on Post-Cesarean Analgesia

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Introduction: A multimodal approach to post-cesarean analgesia may include transversus abdominus plane (TAP) blockade (1), particularly in parturients with contraindication to neuraxial morphine such as those at risk for sleep-disordered breathing. The optimal technique for administering post-cesarean TAP blockade has not been defined. The aim of this study was to compare the effect of TAP blockade ropivacaine concentration on 24-hour post-cesarean delivery opioid consumption.

Table: Opioid consumption and pain burden.

	Saline (n=33)	Ropivacaine 0.2% (n=30)	Ropivacaine 0.5% (n=25)	Ropivacaine 0.75% (n=27)	*P*
Morphine equivalents 0-24h	54 (37 to 70)	38 (22 to 46)†	32 (18 to 54)†	45 (29 to 75)	0.005
Morphine equivalents 0-72h	120 (90 to 158)	96 (57 to 117)	98 (82 to 129)	112 (82 to 182)	0.05
Pain burden at rest	129 (84 to 195)	79 (33 to 130)‡	79 (48 to 133)	151 (68 to 243)	0.01
Pain burden with movement	265 (221 to 320)	202 (120 to 278)‡	233 (202 to 289)	327 (217 to 417)	0.001

Morphine equivalents calculated as the mg i.v. equivalent of morphine. Pain burden calculated as area under the pain score (0-10)*time (hr) curve. † = different from saline, P<0.05 (Bonferroni corrected), ‡ = different from ropivacaine 0.75%, P<0.05 (Bonferroni corrected)

Methods: Obese parturients (BMI > 40 kg/m2) undergoing scheduled cesarean delivery were recruited and received spinal or combined spinal-epidural anesthesia (IT bupivacaine 12mg, fentanyl 15mcg). Patients were randomized to post-operative, ultrasound-guided, bilateral TAP blockade with 15mL per side of either saline, or ropivacaine 0.2, 0.5, or 0.75% by one of 5 investigators. Patients received hydromorphone by PCA and scheduled IV ketorolac (30 mg q 6 hours) for 24h, followed by oral hydrocodone-acetaminophen and ibuprofen. The primary outcome was 24-hour morphine-equivalent opioid consumption. Secondary outcomes included total opioid consumption, NSAID consumption, and VAS pain scores at 2, 6, 24, and 72 hours post-TAP blockade.

Results: 274 patients were approached and 120 enrolled and randomized. Data from 5 patients were excluded from analysis due to exclusion criteria discovered after randomization. There were no differences among groups in BMI, EGA, number of previous CDs, race, or investigator. Compared to saline, median 24h morphine-equivalent consumption was lower in patients who received TAP blockade with ropivacaine 0.2 or 0.5% (table). However, there was no significant difference in 24h morphine-equivalent consumption between the saline and 0.75% ropivacaine groups.

Discussion: Post-cesarean TAP blockade using ropivacaine 0.2% or 0.5% reduced opioid consumption in morbidly obese parturients who received spinal anesthesia for cesarean delivery without intrathecal morphine. However, our observation that ropivacaine 0.75% is no more efficacious than saline was unexpected and may represent the unreliability of TAP blockade in morbidly obese parturients. There were no clear differences in patient characteristics, or a bias toward a particular provider performing the blockade, suggesting that the wide confidence intervals in our data support the lack of reliability of TAP analgesia in this population.

References

1. McDonnell JG: Anesth Analg 2007;104:193

Abstract #:T-58

Transvesus abdominus plane block for postoperative analgesia after Cesarean delivery in patients taking buprenorphine.

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Introduction: Post-partum patients pose unique challenges in the immediate postoperative period in regards to pain control. They desire a balance between being comfortable and being awake enough to care for their newborn. Within this population, women who are on opiate replacement therapy pose an even greater challenge, as they often require much higher doses of opioids in order to obtain relief resulting in unwanted side effects. Transversus Abdominus Plane (TAP) blocks have been shown to be efficacious for postoperative pain control following abdominal surgery. There has been no specific research regarding this form of analgesia in opioid tolerant obstetric patients. We evaluated the effect of TAP blocks in patients on buprenorphine and postoperative opioid consumption as well as pain scores in the first 24 hours following Cesarean section.

Methods: Eight patients on buprenorphine for opiate addiction presenting for cesarean delivery were randomly assigned to one of two groups: post-operative TAP block or sham block. All patients received spinal anesthesia with 12 mg bupivacaine and 15 mcg fentanyl for primary anesthetic. After surgery patients either received TAP block with 20 cc 0.5% ropivacaine, 4 mg dexamethasone, 1:200K epinephrine bilaterally or a sham block. All caregivers were blinded to study group except the anesthesia team providing the block. The primary outcome was total amount of opiate pain medication at 24 hrs. Secondary outcomes were pain scores and maternal satisfaction.

Results: Maternal satisfaction at 6 and 24 hours, pain scores at 24 hours and total morphine equivalents were calculated among the two groups. At 6 hours, the maternal satisfaction scores were higher in patients who received a TAP block compared to those who did not (mean score 9.75 out of 10 vs 6 out of 10, p=0.015.) At 24 hours maternal satisfaction was equivalent in both groups (mean score 7 out of 10, p=1) pain scores at 24 hours were also lower in patients who received a TAP block vs those that did not (mean score 5.75 out of 10 vs 7 out of 10, p=0.36.) Mean total morphine equivalents were also lower in the group who received the block compared to those who did not (108.6 mg vs 78.1 mg, p=0.47.)

Discussion: Maternal satisfaction at 6 hours following TAP block in this patient population was increased. A trend of lower opiate consumption was seen, however larger studies are needed to determine if this is a significant effect.

	Assignment		p value
	Sham	TAP block	
Number of subjects	4	4	
Age (mean)	32	30	
BMI (mean)	30.7	31.7	
Parity (mean)	2.75	2.5	
6-hour satisfaction score (0-10, mean)	6	9.75	0.015
24-hour satisfaction score (0-10, mean)	7	7	1
Pain score at 24 hours (0-10, mean)	7	5.75	0.36
Total morphine equivalent (mg, mean)	108.6	78.1	0.47

Abstract #:T-59

High dose and low dose transversus abdominis plane block versus control for post-cesarean delivery analgesia - a meta-analysis

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Introduction: Transversus abdominis plane (TAP) blocks provide effective analgesia after cesarean delivery (CD) but risk of local anesthetic toxicity (LAT) with large doses may be high due to physiological changes in pregnancy.1 This meta-analysis reports pain scores and opioid consumption in high dose (HD) and low dose (LD) TAP blocks for elective CD.

Methods: Online literature search identified 16 eligible RCTs examining post-CD analgesia after TAP block compared to control; HD was defined >50 mg bupivacaine equivalents per side, LD was ≤50 mg per side. Primary outcome was 24 hr opioid consumption (morphine equivalents). Secondary outcomes included: 6 hr opioid consumption, post-operative pain scores at rest and movement at 6 and 24 hrs. Mean difference (MD) and 95% confidence intervals were calculated using random effects modeling, HD and LD subgroups were compared using a Q test.

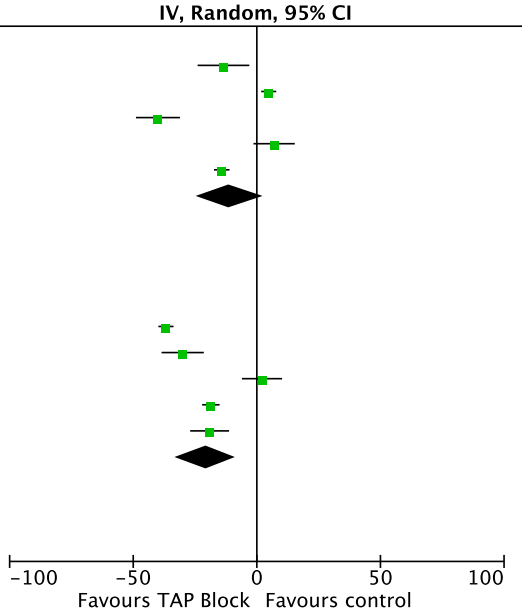
Results: 16 RCTs were included (1045 women; TAP group n=472; control group n=573). There was no difference in 24 hr opioid consumption between high and low dose groups (Figure 1). 6 hr pain scores were decreased compared with control in both TAP groups at rest (HD M.D. -11.11[-19.38, -2.84], p=0.008; LD M.D. -13.94[-25.88, -2.00], p=0.02) but were not different between HD and LD groups (p=0.70). 6 hr pain scores on movement were not statistically different in either TAP group compared with control (HD M.D. -12.53[-31.13, 6.07], p=0.19; LD M.D. -17.36[-38.41, 3.69], p=0.11), or between HD and LD groups (p=0.74). 24 hr pain scores at rest were not improved in HD or LD groups compared to control (HD M.D. -5.37[-14.74, 4.00], p=0.26; LD M.D. -4.63[-10.96, 1.69], p=0.15) and there was no difference between HD and LD groups (p=0.90). 24 hr pain scores on movement did not differ in both groups compared to control (HD M.D. -5.02[-21.46, 11.41], p=0.55; LD M.D. -13.21[-32.41, 5.99], p=0.18) and there was no difference between HD and LD groups (p=0.53).

Conclusion: This study demonstrates that LD TAP blocks provide equivalent analgesia and opioid sparing effects to HD blocks for CD. Findings suggest that lower doses (≤50mg bupivacaine equivalents per side) can be used to help reduce LAT risk without compromising analgesic efficacy.

Reference:

1. Br J Anaesth. 2013;110:996-1000

Study or Subgroup	TAP Block Mean	SD	Total	Control Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI
1.1.1 High Dose								
Belavy	18	15.6	23	31.5	20.7	24	18.9%	−13.50 [−23.95, −3.05]
Loanne	7.47	7.55	33	2.67	4.71	33	21.0%	4.80 [1.76, 7.84]
McDonnel	11	14.1	25	51	17.8	25	19.5%	−40.00 [−48.90, −31.10]
McMorrow	18.5	15.7	20	11.5	10.8	20	19.7%	7.00 [−1.35, 15.35]
Sriramka	17.6	5.09	25	31.8	6.18	25	21.0%	−14.20 [−17.34, −11.06]
Subtotal (95% CI)			**126**			**127**	**100.0%**	**−10.94 [−24.70, 2.83]**
Heterogeneity: Tau² = 232.62; Chi² = 142.15, df = 4 (P < 0.00001); I² = 97%								
Test for overall effect: Z = 1.56 (P = 0.12)								
1.1.2 Low Dose								
Baaj	25.79	5.14	20	62.55	4.72	20	20.9%	−36.76 [−39.82, −33.70]
Eslamian	15	7.5	24	45	20	24	19.3%	−30.00 [−38.55, −21.45]
McKeen	15.5	20.2	35	13.4	14.6	39	19.4%	2.10 [−6.01, 10.21]
Srivastava	15	4.4	31	33.6	9	31	20.8%	−18.60 [−22.13, −15.07]
Tan	12.3	11.5	20	31.4	13.8	20	19.5%	−19.10 [−26.97, −11.23]
Subtotal (95% CI)			**130**			**134**	**100.0%**	**−20.67 [−33.06, −8.28]**
Heterogeneity: Tau² = 188.37; Chi² = 114.28, df = 4 (P < 0.00001); I² = 96%								
Test for overall effect: Z = 3.27 (P = 0.001)								



Test for subgroup differences: Chi² = 1.06, df = 1 (P = 0.30), I² = 5.8%

Abstract #:T-60

Intrapartum Pain Improvement Is a Predictor for Postpartum Depression: The Importance of Labor Pain

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Background: Pain is a fundamental feature of childbirth, but little is known about the potential psychological ramifications of labor pain. We aimed to identify the association between intrapartum pain relief under labor epidural analgesia, defined by percent improvement in pain (PIP) [1,2], and postpartum depression symptoms.

Methods: 2491 medical records were reviewed. Women who received labor epidural analgesia, who had pain assessed during labor both before and during implementation of labor epidural analgesia by 0-10 numeric rating scores, and who had depression risk assessed by the Edinburgh Postnatal Depression Scale (EPDS) and documented at their six-week postpartum visit, were included in the final analysis. Simple and multiple linear regression was used to identify the best model for assessing the association between pain improvement and depression, after adjusting for history of anxiety or depression, other psychiatric history, abuse, trauma, mode of delivery, and other maternal or fetal co-morbid diseases.

Results: 201 patients received labor epidural analgesia, had intrapartum pain data available, and had the primary outcome of interest. A weak but significant relationship exists between PIP and EPDS (Spearman's $\sigma = -0.18$, $P = 0.012$). By simple linear regression, women with higher improvements in pain are associated with lower EPDS scores ($\beta = -0.023$, $F(1, 199)=12.43$, $P = 0.001$). There were no significant interactions between any a priori hypothesized interaction terms. There was no collinearity among variables. In support of the validity of the model, variables previously associated with depression were significantly correlated (body mass index, anxiety/depression, 3rd and 4th degree perineal lacerations, and anemia) and included in the final model. After adjusting for these covariates, PIP remained a significant predictor of EPDS ($\beta = -0.022$, $t = -2.70$, $P = 0.008$) (Table).

Conclusions: Improvement in pain during labor under epidural analgesia is a significant predictor in the development of postpartum depression symptoms. Labor pain, alongside other established risk factors, is important to the subsequent detection of postpartum depression symptoms. Research aimed at optimization of labor pain management strategies is warranted as part of a multimodal strategy to reduce risk for postpartum depression.

References

1. Max M.B., ed. New York: Raven Press: 1991, 55-95.
2. McQuay HJ, ed. Oxford University Press, 1998, 32-38.

Table. Summary of hierarchical regression analysis for variables predicting depression by Edinburgh Postnatal Depression Scale (N = 201)

	Model 1			Model 2			Model 3			Model 4			Model 5		
Variable	β	SE	*P-value*	β	SE	*P-value*	β	SE	*P-value*	β	SE	*P-value*	β	SE	*P-value*
PIP	-0.027	0.0086	0.002**	-0.026	0.0086	0.003**	-0.024	0.0083	0.004**	-0.022	0.0081	0.007**	-0.022	0.008	0.008**
BMI				0.12	0.06	0.046*	0.12	0.057	0.036*	0.12	0.056	0.027*	0.13	0.056	0.02*
Anxiety or depression							3.96	1.09	<0.001**	3.99	1.06	<0.001**	3.57	1.08	0.001**
Laceration 3º or 4º										6.14	2.05	0.003**	6.38	2.04	0.002**
Anemia													2.50	1.46	0.089
R^2		0.066			0.092			0.17			0.22			0.24	
F for change in R^2		10.12			7.19			9.58			9.82			8.55	

PIP, percent improvement in pain; BMI, body mass index

* p<0.05

** p<0.01

Abstract #:T-61

The effect of prelabor analgesic plan and actual analgesia during labor on postpartum depression and breast feeding outcome

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Introduction: Postpartum depression (PPD) is a common disorder with rates around 13%. A recent study showed epidural analgesia (EA) decreases PPD and increases breast feeding (BF) possibly due to decreased intrapartum pain.In this study we compared the patient's preconceived plan for labor analgesia with her actual labor analgesia. We assessed how this comparison was associated with labor satisfaction, BF, and rates of PPD.

Methods: The study was conducted at a tertiary hospital. Women completing a vaginal delivery for a healthy singleton at > 37 weeks were included. On postpartum day 1 women were given a questionnaire detailing demographic data, prelabor medical history, initial desire for EA , final decision for EA, adequacy of pain relief and satisfaction with labor (verbal numeric score (VNS) 0-10). Women were divided into 4 groups:
1. Initially wanted EA and received EA
2. Initially wanted EA and did not receive EA
3. Initially did not want EA and did receive EA
4. Initially did not want EA and did not receive EA

On both postpartum day 3 and 6 weeks postpartum, the parturient was called and assessed for signs of PPD using Edinburgh Postpartum Depression scale. She was also asked if her baby breastfed and if she breast fed exclusively.

Results: 1189 women completed the study: 607 in Group 1, 153 in Group 2, 230 in Group 3 and 199 in group 4. There were significant differences in groups in age, gravidity, parity, and intention to BF (Table). Groups 1 and 3 had significantly higher vacuum rates than groups 2 and 4 (Table). Women in groups 2 and 4 had much higher average pain during labor than the other two groups but in spite of this Group 4 had the highest satisfaction with labor. At 3 days postpartum, Group 1 had a significantly higher proportion of women having PPD. Women in Group 1 also had a significantly less BF rate than the other 3 groups. At 6 weeks postpartum, Group 1 had a significantly lower and Group 4 a significantly higher incidence of BF than other groups but no difference in incidence of PPD.
Using a logistic regression analysis to determine who would develop PPD at 3 days, only parity (p=0.005, OR 0.82) and instrumental delivery (p=0.012, OR 2.03). At 6 weeks, only previous history of depression (p=0.013, OR 4.5) and instrumental delivery (p=0.01, OR 2.1) were determinants.

Conclusion: There was no obvious association between the severity of intrapartum pain (or the use of epidural analgesia) with either the incidence of PPD or BF rate. This study is limited by the use of 4groups and by inability of an observational study to identify causation. While data like these may be useful for generating hypotheses, the reader is cautioned against over interpretation of the data.

Table- Demographic data and outcome measurements between groups

Table 1	Group 1	Group 2	Group 3	Group 4	P value
Age	31.3±5.0º	31.9 ±4.7&	29.4±4.6***	31.5±5.1	<0.001
Gravidity	2.7±1.8 º^	2.8±1.4& **	1.9±1.4***	3.2±1.9	<0.001
Parity	2.3±1.4 º^	2.4±1.0& **	1.6±1.0***	2.8±1.4	<0.001
Birth weight	3.3±0.5 º	3.2±0.4	3.2±0.4	3.3±0.6	0.18
Israeli born	91%	92.1%	86.5%	88.5%	0.26
History of depression	0.5%	0.5%	0.3%	0.4%	0.98
History of anxiety	0.9%	1.0%	1.6%	0.8%	0.69
Married	97.3%	96.6%	93.8%	96.6%	0.05
Primaparas	29.6% º *^	14.8% & **	61.6%***	18.3%	<0.001
Previous breast feeding	55.1% º *^	74.4%	31.1%&	71.4%	<0.001
Intention to breast feed after labor	86.8% º^	90.6%	94.4%	92.3%	<0.001
Cannot breast feed	1.0%	0.5%	1.0%	1.9%	0.5
Received previous epidural	65.2% º *^	74.4%& **	29.8%***	44.3%	<0.001
Labor Satisfaction (0-10)	8.4±2.3*	7.8±2.5 &	8.3±2.3***	9.0±1.8**	<0.001
Average pain during labor (0-10)	3.4±3.0 ^	8.4±1.6* &	4.0±3.1***	7.6±1.9**	<0.001
Instrumental delivery	14.5%*^	4.9% ~&	14.8%***	3.8%	<0.001
Breast feeding at 3 days	76.1% º ^	87.5%*	90.5%	90%	<0.001
Only breast feeding at 3 days	41.4% º ^	53.8%*	50.6%	58.7%	<0.001
Breast feeding at 6 weeks	63.2% º ^*	74.3%**	75.1%	81.3%	<0.001
Breast feeding only at 6 weeks	44.4% º ^*	54.7%	50.9% ***	60.7%	<0.001
3 day	17.8%^*	11.7%&	16%	9.9%	0.02

Abstract #:T-62

Successful neuraxial anesthesia for cesarean delivery in a patient with severe oral and neck arteriovenous malformations

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Introduction: Oral and neck arteriovenous malformations (AVMs) can pose significant risks for airway compromise during neuraxial or general anesthesia. AVMs are highflow lesions and have a propensity to bleed, which may be life-threatening. Accelerated growth of these lesions occurs during pregnancy from elevated hormonal levels. Here we present the case of a 24-year-old female with severe oral and neck AVMs who underwent a successful cesarean delivery under neuraxial anesthesia.

Case: A 24-year-old G3P2002 (5'2", 195 lbs, BMI 35.73 kg/m2) with an estimated gestational age of 39 weeks presented to the labor and delivery unit for a repeat cesarean section. Her past medical history was significant for endoscopic sinus surgery and tracheostomy, with subsequent decannulation. On exam, the patient was obese with a large neck diameter, short thyromental distance, and a Mallampati score of IV. She had significant lingual and lower lip, as well as bilateral neck AVMs. Her most recent MRI demonstrated multifocal airway stenosis at the oropharynx and the larynx secondary to her AVMs.

The patient was taken to the operating room with plans for a combined spinal and epidural (CSE) placement. The difficult airway cart, video laryngoscope and additional anesthesia personnel were present. An otolaryngologist was on standby for an emergent tracheostomy if needed. The CSE was performed without difficulty and the patient underwent a cesarean delivery without complications. A healthy baby girl was delivered. The patient's postoperative course was uneventful and she was discharged home two days later.

Discussion: Our case demonstrates that a repeat cesarean delivery can be performed safely under combined spinal epidural anesthesia in a patient with severe oral and neck AVMs. Anesthesiologists should be prepared for alternative techniques and emergent airway equipment and personnel should be made available. Accelerated growth of AVMs during pregnancy can put them at risk for ulceration, rupture or hemorrhage. A vascular surgery or otolaryngology consult is essential early in pregnancy, to evaluate lesions and to determine if devascularization or removal of AVMs are necessary. Preoperative imaging and an elective tracheostomy prior to cesarean delivery may be warranted in patients with unstable AVMs or in patients with signs of airway obstruction.

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Abstract #:T-64

Anesthetic Considerations in a Parturient with Freeman Sheldon Syndrome

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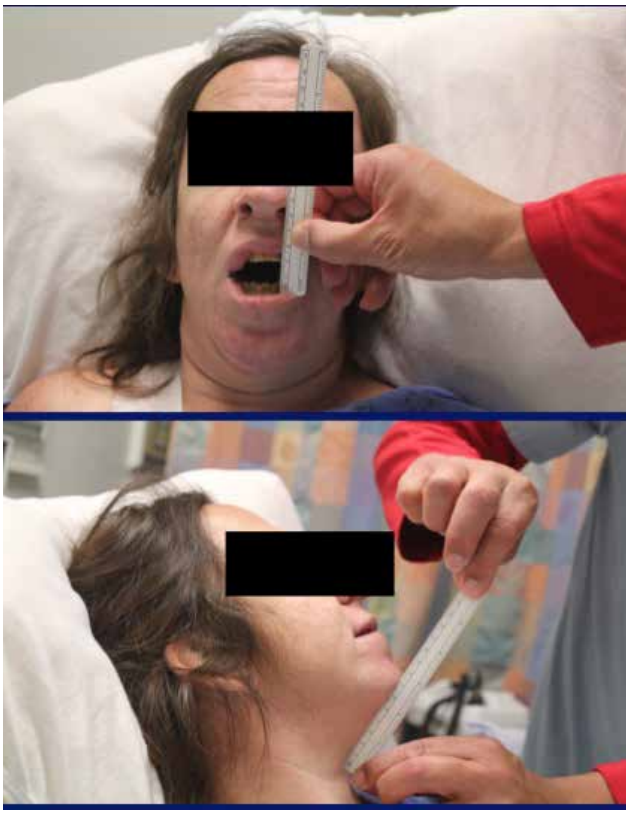
Introduction: Freeman Sheldon Syndrome (FSS) is a rare genetic disorder characterized by malformations of the face, oral cavity, and musculoskeletal system. Complications during anesthesia have been reported in individuals with this disorder. The most common complication is difficult intubation. Malignant hyperthermia, muscle rigidity and pyrexia have been reported in patients receiving MH triggering anesthesia1-4. We present the anesthetic management of a pregnant patient with FSS undergoing an elective cesarean delivery.



Case Report: A 36-year-old pregnant woman at 36 weeks gestation with past medical history of FSS and cannabis use, was booked for elective cesarean delivery due to concerns about hip dislocation if a vaginal birth was attempted. She had numerous orthopedic and maxillofacial procedures as a child that were uneventful. Her past medical history also included pacemaker insertion for arrhythmias from chronic methamphetamine use, spontaneous abortion that did not require any intervention and gestational diabetes during this pregnancy that is controlled on diet. Physical findings were camptodactyly, contractures in distal extremities, small nose, lengthened philtrum, and masked facies. She had severely limited mouth opening of approximately 2cm. (figure). She had a Mallampati III score, poor dentition and shortened thyromental distance of 3cm. We concluded that intubation would be difficult, but that bag mask ventilation was possible. She also had a mild lumbar kyphoscoliosis with curvature to her left side. Intravenous cannula insertion was successful after 3rd attempt using Ultrasound. Combined spinal epidural was attempted. Epidural space was detected but spinal needle placed through the epidural needle failed to enter the subarachnoid space, so spinal component was abandoned. Adequate block was achieved via epidural top up. The rest of the procedure was uneventful. Post-operative pain was well controlled with oral medications, and the patient was discharged two days post operatively.

Discussion: Challenges and complications faced by anesthesiologists in managing a patient with FSS can be numerous. As these patients progress into adulthood and become pregnant, anesthetic care will be required.

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Abstract #:T-65

How Low Can the Hemoglobin Go? Hyperhemolysis in a Pregnant Patient with Sickle Cell Disease

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Introduction: Hyperhemolysis is a rare, life-threatening transfusion reaction characterized by destruction of donor and recipient red blood cells resulting in severe anemia below pre-transfusion levels [1]. It is usually associated with sickle cell disease (SCD) or a history of pregnancy [1] but very rarely reported in parturients. It differs from delayed hemolytic transfusion reaction as it is more severe, often no new antibodies are found, and it is associated with reticulocytopenia [1,2,3]. Following an initial episode there is increased risk of hemolysis during future transfusions. Severe anemia and hemodynamic instability affect parturient and fetal well-being [4], and may complicate the anesthetic plan.

Case: We present a 22year old G1P0 parturient at 28 weeks gestation with SCD, a history of transfusions with development of alloantibodies who presented with sickle-like pain, fever, and severe anemia. Seven days prior, during an acute pain crisis, the patient received 1 unit of PRBCs. At the current admission the Hbg had fallen to 4.4g/dl with no source of bleeding. A diagnosis of hyperhemolysis was made with assessments of lab values including; LDH, bilirubin, Coombs test, and Hgb fractionation studies. Obstetrics, anesthesiology, and hematology services met to discuss the treatment and delivery plan. Hematology recommended delaying delivery as hgb was likely to improve, while MFM and anesthesiology services were concerned about fetal status and need for emergent delivery without the ability to transfuse. IVIG, methylprednisolone, and 2 units of antigen negative blood were given with a rise in hgb to 6.5g/dl. Hgb remained stable, darbopoetin was started and the patient was discharged to home. At 33+5 wga she re-presented with a sickle cell crisis (hgb = 6.1g/dl). Prolonged decelerations, severe IUGR and abnormal umbilical artery dopplers necessitated an urgent delivery. An epidural catheter was placed in the lateral position and slowly titrated with stable maternal and fetal hemodynamic profile. An uncomplicated primary low transverse cesarean section was performed with BTL and EBL of 600mL. Apgar scores were 9/9. No blood transfusions or plasma exchange were needed.

Discussion: Hyperhemolysis occurring in a pregnant patient places both the patient and the fetus at risk for life-threatening complications, mandating a multi-disciplinary approach. Key decisions include whether to transfuse, choice of treatment, timing of delivery, and the anesthetic plan. Providers must be aware how to coordinate and provide appropriate blood therapy during the peripartum period. Anesthetics provided during delivery should minimize the risk of post-partum hemorrhage and hemodynamic instability to decrease the risk of blood transfusion or fetal compromise.

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Abstract #:T-66

Anesthetic Management of Labor and Intrapartum Cesarean Delivery in a Patient with Conversion Disorder

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Introduction: Conversion disorder is a psychiatric disorder involving altered sensory and/or motor function that cannot be explained by organic mechanisms. Conversion events occur in 4 to 12 of 100,000 patients yearly, with the overwhelming majority occurring in young adult females during times of stress.1 Pregnant women with conversion disorder can pose a challenge for an obstetrical anesthesiologist. A concomitant episode of conversion disorder while undergoing a neuraxial anesthesia may present a confusing clinical picture, considering that neuraxial anesthesia, its complications, and conversion episodes may manifest with overlapping and dramatic motor and sensory elements.

Case Description: Our patient had a history of conversion disorder, which manifested as loss of consciousness. She presented for induction of labor for pre-eclampsia. A labor epidural catheter was placed at the patient's request after confirmation of normal hematological laboratory values. After an extended period of no cervical change, the decision was made to proceed with an intrapartum cesarean delivery. At that time, epidural analgesia was found to be ineffective. 45 minutes were allowed to elapse to permit local anesthetic resorption from the neuroaxis, and then a spinal anesthetic was performed in the operating room. One minute after induction of the subarachnoid block, she complained of leg weakness and her eyes closed. Her lid response was absent and she was unresponsive to verbal or painful stimuli to her extremities. Her ventilation was infrequent, but vital signs were stable with no evidence of bradycardia or significant hypotension. Spontaneous ventilation was maintained with supplemental oxygen by facemask. A conversion episode was diagnosed and a high spinal block was ruled out based on the lack of apnea or hemodynamic perturbations. Given her lack of return in mental status, inability to assess the adequacy of spinal anesthesia, and apparent inability to cope with psychologically stressful situations, a decision was made to proceed with cesarean delivery under general anesthesia.

Discussion: We highlight the challenges surrounding obstetric and anesthetic management of a parturient with conversion disorder. Stringent avoidance of general anesthesia in these cases may not always be warranted, and a balanced view of all anesthetic options is preferred.

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Table 1. Comparison of conversion disorder symptomology vs. manifestations and complications of neuraxial anesthesia.

Primary Disorder	Symptom									
		Onset	***Mental Status***	***Heart Rate***	***ECG Changes***	***Blood Pressure***	***Ventilatory Status***	***Motor***	***Sensory***	***Treatment***
	Conversion Disorder	Variable	Variable, changes are temporary	Not affected	None	Not affected	Not affected	May be affected	May be affected	Counseling, eliminating triggering stressors, anxiolytics
	Normal Neuraxial Anesthetic	Fast	Not effected	Elevated due to hypotension	None/Sinus Tachycardia	Hypotension	Not affected	Yes, lower extremity weakness	Yes, correlates to block	Vasopressors, intravenous fluids
	High Neuraxial Block	Fast	Variable depending on cerebral perfusion	Bradycardia	Sinus Bradycardia	Hypotension	Possible apnea	Yes, may include upper and lower extremity weakness	Yes	Supportive treatment, including respiratory and cardiac support
	Local Anesthetic Systemic Toxicity	Variable	May be affected: increased agitation, seizures, coma	Bradycardia, possible arrest	Possible widened QRS or prolonged PR interval	Hypotension	Possible dyspnea, tachypnea, apnea	May be affected-muscle twitching	Yes	Supportive treatment, lipid emulsion therapy, cardiopulmonary bypass Avoid vasopression, calcium channel- and beta-blockers
	Epidural Hematoma/ Space-Occupying Lesion	Variable	Not affected	Not affected	None	Not affected	Not affected	May be affected, lower extremity weakness	May be affected	Surgical evaluation, decompression
	Peripheral Nerve Palsy	Variable	Not affected	Not affected	None	Not affected	Not affected	Weakness corresponding to innervation	Numbness or paresthesia correlating to nerve distribution	Supportive, evaluation for physical therapy
	Nerve root/ Spinal Cord Trauma after Neuraxial Block	Fast	Not affected	Not affected	None	Not affected	Not affected	Foot drop or urinary incontinence may occur	Pain or paresthesia during insertion; Residual numbness	Supportive
	Chemical Injury	Fast	Not affected	May be affected depending on substance administered	Possible changes depending on substance administered	May have hypertension if vasopressors administered	Not affected	May be affected, depending on substance administered	May be affected, depending on substance administered	Supportive
	Postpartum Headache	Variable	Not affected	None	None	None	Not affected	Not affected	Cephalic, neck or shoulder pain	Variable, depending on etiology; supportive or treat underlying disorder

Abstract #:T-67

Neuroaxial anestheisa in obstetric patient with congenital insensitivity to pain

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Introduction: Congenital insensitivity to pain (CIP) is a group of rare genetic disorders characterized by varying degrees of sensory loss including nociceptive hyposensitivity and varying degrees of autonomic dysfunction1. It can be further categorized into five different types of hereditary sensory and autonomic neuropathies (HSANs I-V) 2. This case report describes the anesthetic management of a parturient with congenital insensitivity to pain presenting for cesarean delivery.

Case report: A 27-year-old G3T1P1A0L2 pregnant female at 32 weeks gestation with a past medical history of CIP presented to obstetric anesthesia clinic for assessment for her upcoming elective cesarean section. Her two previous deliveries were complicated because the patient was unaware of her labor. The decision was made to schedule her for cesarean section at 39 weeks to avoid this from occurring again. She denied symptoms of gastroesophygeal reflux. She described multiple injuries in the past, including a fractured tibia as a child that she was unaware of. She ha previously undergone general anesthetic without difficulties. Her physical findings showed that temperature sensation was preserved throughout all dermatomes, although sharp touch distinction was not appreciated. With respect to anesthetic technique, the patient was given the option between general anesthesia and neuraxial anesthesia. The patient was advised that a neuraxial technique for cesarean section in a patient with CIP had not previously been described in the literature. The patient requested spinal anesthesia for delivery. On the day of surgery, no local anesthetic was injected prior to insertion of a 20 Gauge introducer needle. Insertion of the needle did not provoke pain. A 25 Gauge Whitacre needle was used to locate the intrathecal space on the first attempt. 10.5 mg of 0.75% Bupivicaine was injected intrathecally. The level of neuraxial blockade was assessed by two modalities: temperature and fine touch. The block was estimated to be at the T4 level bilaterally according to loss of temperature sensation. The patient was unable to delineate the loss of fine touch sensation. Her blood pressure remained stable. The remainder of the anesthetic care was uneventful.

Discussion: CIPA and the spectrum of HSAN disorders present numerous challenges to the anesthesiologist. Although our patient underwent neuraxial anesthesia for caesarean delivery and experienced no complications, there are many important anesthetic considerations to be aware of when formulating an anesthetic plan. We recommend a thorough a perioperative evaluation, as HSAN patients experience different degrees of pain perception and sensation. Anesthetic considerations must also include potential hemodynamic instability secondary to autonomic dysfunction, prevention of aspiration, and maintenance of body temperature.

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Abstract #:T-68

Anesthesia for cesarean delivery with a dilated aortic root, severe pre-eclampsia, and acquired von Willebrand disease: a case report.

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We describe the management of a parturient with a dilated aortic root, severe pre-eclampsia (PE), and acquired von Willebrand (vW) disease who underwent a general anesthetic for urgent cesarean delivery (CD).

Case: A 35 yr G2P1 patient at 30 weeks presented with a history of a bicuspid aortic valve status post Ross procedure at age 18. She had a screening echocardiogram and was newly diagnosed with a dilated aortic root (4.8 cm TTE; 5 cm on follow-up MRI).

At 33 weeks + 4 days, she was diagnosed with severe PE. She was started on magnesium and her systolic BPs were maintained below 140. On the third night following admission, she developed recurrent severe range BPs. Given a recent diagnosis of acquired vW disease, one unit of platelets and vW concentrate (Humate-P) were transfused in anticipation of an urgent CD. Post transfusion platelet function testing was consistent with a continued coagulopathy (>300 CollagenADP/EPI).

Arterial line, central line, and large-bore peripheral IVs were established, and cross-matched blood and uterotonics were immediately available. Pre-induction BP management included IV labetalol 5 mg x 2, nitroprusside (0.2-1 mcg/kg/min), and esmolol 50 mcg/kg/min. General anesthesia was induced with rapid sequence induction of propofol 60 mg, etomidate 6 mg, succinylcholine 90 mg, and remifentanil 100 mcgs. She was intubated with glidescope laryngoscopy, and anesthesia was maintained with a mixture of sevofluorane and 50% nitrous/oxygen with a remifentanil infusion (0.05-0.15 mcg/kg/min). Following induction, she became hypotensive requiring down-titration of anti-hypertensives and initiation of a phenylephrine infusion. Delivery of the neonate occurred 16 minutes after intubation and estimated blood loss was 600 ml. Prior to extubation, 15 mg of IV morphine was titrated for post-operative analgesia. Nitroprusside was restarted for BP control 10 minutes before extubation and the remifentanil infusion was continued to minimize stimulus at emergence. She was extubated awake and transferred to the intensive care unit. In the ICU, she was successfully transitioned to oral labetalol, transferred to the floor on postpartum day 2, and discharged to home 4 days postpartum.

Discussion: Screening of the aortic root should be routinely performed in patients with a history of congenital cardiac repair prior to conception.1 Aortic diameter >40 mm among Marfan patients is considered particularly high risk, and maternal survival in the event of aortic rupture or dissection is dismal.2 The patient's dilated aortic root and concurrent severe PE necessitated urgent CD and meticulous peripartum BP control. Her vW and associated coagulopathy with limited response to vW factor and platelet transfusions precluded a neuraxial anesthetic technique, however hemodynamic stability during her CD was obtained with remifentanil and appropriate anti-hypertensives.

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Abstract #:T-69

Neuraxial Anesthetic Management In A Pregnant Patient With Repaired Tethered Cord Syndrome

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Introduction: Tethered cord syndrome[TCS] is a rare disorder caused by restriction of the normal mobility of the spinal cord. Neuraxial procedures for patients with repaired TCS present challenges. Inadvertent dural puncture is more common given post-surgical changes[PSC] affecting technique while a low-lying conus medullaris increases risk of neurologic damage. This case offers insight into decision-making necessary to create an anesthetic plan for pregnant patients with repaired TCS undergoing neuraxial management for labor.

Case: A 28 year old G1P0 at 36'5 weeks with history of repaired TCS presented for anesthesia consultation. Sacral dimpling and imaging during childhood confirmed TCS without concurrent neurologic deficiencies. Surgery was performed at age two. She remained asymptomatic with normal development and was released from specialty follow-up at age twelve. During prenatal evaluation, her obstetrician recommended consultation to assess safety of epidural placement. Exam revealed extensive scarring from L2–L5 without neurologic deficits. Given limited records and potential for underlying pathology, a MRI was ordered. Results demonstrated a low-lying conus medullaris at L3 without cord retethering. Significant PSC from L2-S1 and L5-disc bulging were also noted. Utilizing ultrasound, PSC were most minimal at L4-5. The devised anesthetic plan entailed having a senior anesthesiologist attempt [ideally L4-5] epidural placement for labor.
She was admitted for ruptured membranes at 38'1 weeks. Labor was augmented and epidural placement was soon requested. The epidural space was easily accessed at L4-5 and later L3-4 with failure to thread the catheter at both locations. A new provider attempted needle advancement at L3-4 resulting in dural puncture, abandonment of the procedure and an adjusted plan for serial spinal injections as needed. An hour later, cesarean-section was performed for failure to progress. A single-shot spinal consisting of 12mg 0.75% bupivacaine, 10mcg fentanyl and 0.2mg morphine was smoothly performed at L3-4.
Her course was complicated by a post-dural puncture headache which initially responded to conservative management, but ultimately required a blood patch.

Conclusion: Compared to intravenous medication, neuraxial anesthesia is preferred in labor to limit maternal and fetal risk. Complication and failure rates are elevated in patients with repaired TCS. Preop management with MRI imaging allows identification of the optimal interspace for procedures. For patients with PSC, consider epidural placement outside the affected region or serial spinal injections throughout labor to minimize complications. This case demonstrates how advanced planning, clinical judgement of anatomical barriers and careful technique are essential to managing patients with lumbosacral anomalies.

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Abstract #:T-70

Sequential Spinal for a Cesarean Delivery in a Patient with Aortic Stenosis

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Background: Spinal anesthesia for cesarean delivery is usually contraindicated in aortic stenosis due to concerns for hemodynamic instability (1). We report a case where a spinal anesthetic was dosed sequentially in a patient with moderate aortic stenosis with minimal hemodynamic changes.

Clinical Features: A 36 year-old primigravida with known congenital aortic stenosis and dilated aortic root presented for elective cesarean delivery at 37 6/7 weeks gestation. The patient noted a history of being "resistant to local anesthetics" as she always required more local anesthetic at dental visits. Her preoperative transthoracic echocardiogram (TTE) demonstrated an ejection fraction of 60-65% with a mean aortic gradient of 46mmHg and a peak of 80 mmHg.

On the day of surgery, after an arterial line and an 18-gauge IV were placed, an epidural catheter was easily placed after dural puncture confirmed cerebrospinal fluid (CSF) (dural puncture epidural) but no spinal medication was administered. A total of 27 ml 2% lidocaine was administered in divided doses with only a patchy T12 level and minimal motor block obtained. A combined spinal-epidural (CSE) procedure was then performed, with 1.25 mg isobaric bupivacaine and 0.2 mg morphine given spinally. After dosing 10 ml 2% lidocaine epidurally, an adequate level of anesthesia still could not be obtained. After extensive discussion with the patient, we decided to attempt a sequential spinal in the right lateral decubitus position. Free flow of CSF was confirmed with a 25G Whitacre needle and incremental, sequential doses of 0.4 ml 0.75% hyperbaric (3 mg) bupivacaine were given through the spinal needle. A total of 12mg was given over the course of 15 minutes as the patient remained in the lateral position with the spinal needle in place. A phenylephrine infusion was titrated to maintain arterial pressure near baseline. Another provider tested the level of anesthesia to pinprick bilaterally at frequent intervals to monitor the rise of the anesthetic level to T4. Once a good surgical level was achieved, the Whitacre needle was removed, and the patient was placed supine with left tilt.

The surgery proceeded uneventfully. The baby was delivered with Apgars of 9 and 9, and the patient did not develop a dural puncture headache.

Conclusions: This case demonstrates that a spinal anesthetic for cesarean delivery is possible and can be done safely in a patient with moderate to severe aortic stenosis when appropriate preoperative, intraoperative, and postoperative management is used. A continuous spinal anesthetic using a catheter technique could have been chosen (2), but that would have necessitated the puncture of the dura and arachnoid with a much larger needle than a 25G Whitacre, increasing the risk of a post-dural puncture headache.

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Abstract #:T-71

Epidural Blood Patch and PRES Syndrome-Are they related?

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Posterior Reversible Encephalopathy Syndrome (PRES) is a clinico-radiological diagnosis. Incidence and etiology of this disease is unclear. PRES has been described in patients with hypertensive encephalopathy,eclampsia and with the use of cytotoxic and immunosuppressent drugs. We are presenting a case series of two parturients with PRES syndrome manifesting after receiving blood patch for treatment of post dural puncture headache (PDPH).

Case 1
45 years female,P9009,s/p spontaneous vaginal delivery under CSE analgesia,complained of positional headache of two days duration. On evaluation, blood pressure (BP) was noted to be elevated and primary team notified. OB team attributed elevated BP to headache. Blood patch was performed uneventfully and successfully and patient went home. Patient returned to the hospital 48 hours later, after having a seizure episode at home. BP was noted to be 150/74 and patient was started on nifedipine and labetalol for BP control and Magnesium (Mg) infusion for seizure prophylaxis.
MRI of the brain was consistent with PRES. MRI showed bilateral parasagittal foci of increased T2 signal in the cortex and white matter and pneumocephalus compatible with recent dural puncture. MRA showed stenosis of the ACA, MCA and PCA. Patient's condition improved and was discharged home 7 days later.

Case 2
20 years female P1001 with history of migraine headaches, seen for positional headache on postpartum day 3, not responding to conservative management. Epidural blood patch was performed. 16 ml of autologus blood administered with minimal relief of headache. Decided to obtain neurology consult. However, patient elected to leave against medical advise. She was brought to the ED 48 hours later after having a tonic clinic seizure and the BP was recorded to be 150/90.
The patient was started on Mg and nicardipine infusion and admitted to MICU. MRI of the brain showed global cerebral edema and evidence of PRES as well as dural thickening consistent with intracranial hypotension. MRA showed no evidence of cerebral vasospasm.
Three days later patient was discharged home.

Discussion: Cases of concurrent PRES and PDPHA are rare in medical practice. In a setting of HTN, PRES has not been generally associated with PDPHA and this unique combination is scarcely described in literature. The opposing pathophysiologic features of the two conditions - decreased intracranial pressure (ICP) and increased intraparenchymal pressure (IPP) - pose an exclusive diagnostic and management challenge. Additionally, MRI is only performed on patients with seizure, which confirms the diagnosis of PRES.
Questions which need to be answered are: Could PRES be one of the manifestations of severe pre-eclampsia since it is a systemic disease affecting all the vasculature? Is there any association between epidural blood patch and onset of PRES?

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Abstract #:T-72

Anesthesia for a cesarean section for a diastrophic dwarf

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Introduction: Diastrophic Dysplasia (DTD) is a rare autosomal recessive disorder characterized by dwarfism, limb deformities, cervical kyphosis, and scoliosis.1 Pregnancy in patients with DTD is not well described; only 3 case reports have been published in the literature.1-3 Anesthetic challenges include respiratory compromise during pregnancy, difficult IV access, difficult airway, and challenges with placement and dosing of neuraxial anesthesia (NA).

Case: A 34 year old 145 cm G2P1 with DTD presented for anesthetic consultation at 30 weeks gestation. Her past medical history included concern for malignant hyperthermia (MH) and failed intubation at the time of her prior cesarean delivery (CD). At the time of consultation, the patient refused NA. Her airway exam revealed an immobile cervical spine and mallampati 4 view with a large tongue and small mouth opening. The plan was made for an elective CD at >37 weeks under general anesthesia (GA) with an awake fiberoptic intubation (FOI). However, she presented with labile blood pressures at 37 weeks and the decision was made to proceed with CD prior to the scheduled date. The patient was admitted in the evening hours and an 18 gauge IV was placed. ENT was consulted and performed a bedside nasal flexible laryngoscopy revealing normal laryngeal anatomy. The next morning she was premedicated with midazolam and glycopyrrolate. She was taken to the OR where the OB team as well as the ENT team (with a rigid bronchoscope and a tracheostomy kit) were present. She was topicalized with 4% nebulized lidocaine and a remifentanyl infusion was begun. A Williams airway, lubricated with 2% lidocaine, was inserted and a flexible pediatric bronchoscope was used to secure a glottic view. She was intubated with a 6.0 ETT and GA was induced. Anesthesia was maintained with a non-triggering anesthetic. A male fetus was delivered with Apgars of 2,1, 7. At the conclusion of surgery, she was extubated. Her postoperative course was uncomplicated and she was discharged on postpartum day 4.

Discussion: A patient with DTD presents complex anesthetic challenges for both GA and neuraxial techniques. Prior case reports of CD in patients with DTD reveal two cases utilizing a similar anesthetic technique described above with FOI and GA as well as a single case report under MRI guided epidural anesthesia.1-3 Optimal care requires careful consideration of the patient's specific risk factors and a multidisciplinary approach. Obtaining an early anesthesia and ENT consult allowed us to formulate a safe anesthetic plan. In our case, the patient refused NA and with a history of difficult airway, an awake FOI was deemed to be appropriate. Regardless of the anesthetic technique selected, a thorough preoperative assessment, multidisciplinary team approach, and ongoing communication is crucial to safe and appropriate peripartum management.

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Abstract #:T-73

Post-Partum Transfusion Related Blood Stream Infection and Septic Shock

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In recent years the precautions that protect patients against infected blood products has improved drastically. In addition the thresholds for transfusing have been modified to err on the side of caution, and therefore transfuse less product. Furthermore, bacteria are very rarely transmitted during blood component transfusion, but if they are, they usually cause severe, life-threatening adverse reactions, with the mortality rate of 20 – 30%. Bacteria transmission during transfusion is the second (just after "administrative error") most common cause of fatal transfusion-associated reactions.

We present a case of a 30-year-old G3P4 female patient who developed rapid, life-threatening septic shock with disseminated intravascular coagulation (DIC) and multiple organ failure after receiving a blood transfusion.

The patient had undergone an uneventful cesarean section for twins. On post-operative day 2 she received two units of packed red blood cells for a hemoglobin of 6.7. The first unit transfused uneventfully. Shortly after the second unit was started, the patient presented with sudden chills, muscle pain and cramping in the low back and bilateral legs, fever, hypertension, and tachycardia. Blood cultures from the patient initially showed the presence of gram-negative rods, which, later were revealed to be Pseudomonas fluorescens. Cultures from the second unit of blood confirmed that it was contaminated with the same gram-negative bacterium, Pseudomonas fluorescens.

The patient had a complicated hospital course including septic shock with multi-organ failure requiring dialysis, mechanical ventilation for respiratory failure, and multiple operations due to intraabdominal hemorrhage. This case demonstrates a rare complication of a transfusion reaction as well as the management of of sepsis in a post-partum patient.

Abstract #:T-74

Perils of Delivery in a Multiparous Parturient with BMI of 71

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Introduction: Obesity confers significant risk during pregnancy to both the mother and fetus. We report herein the complicated delivery and postpartum course of a parturient with BMI of 71.

Case report: A 40 year old G6P3 female at 39 4/7 weeks EGA presented to our labor and delivery unit for scheduled induction of labor. Her pregnancy had been complicated by chronic hypertension, advanced maternal age, class III obesity (BMI 71), and obstructive sleep apnea. She had 3 prior vaginal deliveries without complication. On admission, airway exam revealed a Mallampati IV that did not improve with phonation. Epidural was placed early in her labor without complication (LOR 9.5 cm) and worked well during her 24 hour induction. She eventually required cesarean delivery due to arrest of descent, chorioamnionitis, and recurrent late fetal decelerations. Time to prepare the patient in the operating room as well as skin to uterine incision were prolonged due to her extreme obesity. A female neonate with Apgars of 0, 5, and 5 was delivered to the awaiting NICU team and was placed on cooling protocol upon arrival to the NICU. After delivery the patient experienced a postpartum hemorrhage, with inability to exteriorize the uterus due to the patient's body habitus, eventually requiring hysterectomy. Additional peripheral IV access and radial arterial access were gained with ultrasound guidance. She was intubated for airway protection easily with the Glidescope (grade I view) due to ongoing hemorrhage and transfusion requirements. Estimated blood loss was 4000mL. On POD 1 she was extubated and required emergent reintubation due to acute airway obstruction and negative pressure pulmonary edema. On POD 2 she began to complain of R posterior calf pain. Lower extremity Doppler ultrasound was negative for DVT and the patient was continued on lovenox for prophylaxis. On POD 3 she was extubated without incident. She was discharged to home on POD 8. At 8 month follow up the patient was doing well; her infant was meeting milestones with no pathology noted on MRI and EEG.

Discussion: Although our patient had a history of multiple prior uneventful vaginal births, she remained at high risk for peripartum complications due to her high BMI.(1) A low threshold for expectation and management of labor complications, including arrest of descent, dystocia due to macrosomia and pelvic adiposity, and cesarean delivery should be present. Although evidence is conflicting,(2) postpartum hemorrhage requiring eventual hysterectomy was attributed to patient habitus and inability to exteriorize the uterus for optimal visualization. Postpartum complications, including respiratory complications and venous thromboembolism, are more frequent in the obese population as was seen in our patient. Lastly, perioperative care for the morbidly obese parturient represents a significant cost burden to the healthcare system.(3)

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Abstract #:T-75

Difficult ventilation management in spina bifida parturient presenting for an urgent cesarian delivery

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A 17 year old white nullipara at 37 weeks required urgent cesarean delivery for non-reassuring fetal status. She was not a candidate for neuraxial blockade due to spina bifida, repaired L1 myelomeningocele, scoliosis with thoracolumbar vertebral fusion, paraplegia, hydrocephalus and VP shunt, and short stature (151 cms). Pre-pregnancy MRI revealed a Chiari 2 malformation, thoracic syrinx T7-8 with diastematomyelia, which reconstituted above the conus at L3. Pre-pregnancy pulmonary function testing documented moderate restrictive dysfunction. Airway management was anticipated to be straightforward, given a BMI 21.7kg/m2, Mallampatti 2 examination, and normal teeth, neck extension and mouth opening. She refused face mask preoxygenation in preparation for general anesthesia, despite midazolam anxiolysis. Modified rapid sequence induction of anesthesia with propofol, rocuronium, cricoid pressure and mask ventilation resulted in grade I laryngoscopy with endobronchial intubation followed by profound oxygen desaturation. Withdrawal of the endotracheal tube to 16 cm, 5 cm PEEP, and lung recruitment maneuvers gradually restored oxygenation. However, surgical abdominal wall compression precipitated subsequent episodes of hypoxemia, particularly during abdominal muscle retraction and fetal extraction. Despite administering 100% oxygen by manual ventilation with lung expansion maneuvers and a head up position, the oxygen saturation remained between 80-90% until after delivery of the 3.2 kg neonate (APGAR scores of 2/3/5 at 1/5/10 minutes).Thenceforth, oxygenation was excellent (≥95% on FiO2≤0.8%), but she required 35 minutes of post-operative sedation and mechanical ventilation to facilitate safe reversal of the neuromuscular blockade and extubation in the operating room. Subsequent recovery was uneventful.

Discussion: In this patient with spinal dysraphism, diastematomyelia, kyphosoliosis, short stature & Arnold chiari malformartion, neuraxial blockade was felt to be both unsafe and unreliable. During general anesthesia for cesarean delivery, ventilation was compromised for three major reasons. First, as an adolescent survivor of a childhood illness, she refused pre-oxygenation despite both verbal and pharmacologic anxiolysis. Second, her scolioisis and short stature resulted in an unusually short distance between her mouth and carina. Third, the combination of kyphoscoliosis, uterine enlargement, and diaphragmatic relaxation during general anesthesia resulted in profound V/Q mismatch; surgical compression of the abdominal wall further compromised ventilation resulting in hypoxemia.
Third trimester pulmonary function testing and pre-anesthetic counselling may have better prepared the patient to cooperate with preoxygenation. Care during endotracheal intubation to insert the cuff balloon just through the vocal cords could help avoid endobronchial intubation. Finally, a head up position and vacuum extraction could improve ventilation during delivery

Abstract #:T-76

Corrected Transposition of the Great Vessels and Scoliosis in an Obstetric Patient

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Corrected transposition of the great vessels places pregnant women at higher risk of premature delivery, spontaneous miscarriage, fetal mortality, as well as right ventricular (RV) dysfunction and tricuspid regurgitation (TR) while pregnant without return to baseline.

A 26 year old G20010 at 30 and 3/7 weeks with corrected transposition of the great vessels and scoliosis presented for primary Cesarean section and bilateral tubal ligation. Previously she had a balloon atrial septoplasty at 1 day and Sennig procedure at 6 months old. Prior to and during her pregnancy she was followed regularly by cardiology. A pre-partum echo showed mild pulmonary stenosis and TR with low normal to mildly depressed RV (systemic) function normal left ventricular (pulmonary) function. At 10 weeks the patient developed mild dyspnea but unchanged echo. ECG showed sinus rhythm and right axis deviation. At 23 weeks, mild MVP with mild MR developed and RV function was moderate to severely depressed. She was now a NYHA class 2-3 and furesomide was started. Holter monitor findings were insignificant. At 26 weeks she had mild improvement in dyspnea with unchanged echo. At 28 weeks she had increasing fatigue but again the echo was unchanged. A multidisciplinary plan was developed with early scheduled delivery at 30 weeks or earlier, early epidural placement, CVICU recovery, adult cardiology follow-up, and cardiac anesthesia availability. The plan was modified to include delivery via Cesarean section to avoid prolonged labor. Prior to the procedure, two large bore IVs and an epidural were placed without difficulty. A radial arterial line was placed with ultrasound. Chloroprocaine 3% was given in divided doses to a T5 sensory level. MAP was maintained >75 mmHg with ephedrine and phenylephrine as deemed necessary. APGARs were 7 and 8. Oxytocin was given after placental delivery. Chloroprocaine was redosed and IV fentanyl and epidural morphine were given post-delivery. The patient was transported to the CVICU, had an uneventful hospital course, and was discharged POD 2.

Hemodynamic changes in pregnancy include a 40-50% increase in blood volume, 30-50% increase in cardiac output, a decrease in SVR and PVR, and 10-20 beat increase in heart rate. These changes may increase RV size and result in worsening of RV function in women with corrected transposition of the great vessels. Asymptomatic women with normal or near normal right ventricular function, good functional class, and good exercise capacity at baseline can successfully navigate pregnancy albeit at higher risk. Anesthetic management plays an important role and should include consideration of early neuraxial techniques with titration of dosing, hemodynamic monitoring, and avoidance of increased demand on the myocardium.

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Abstract #:T-77

Intrapartum Management of a Patient with HOCM Complicated by Chordal SAM

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Introduction: Patients with hypertrophic cardiomyopathy (HOCM) are at increased risk for dynamic LVOT obstruction due to systolic anterior motion (SAM) of the anterior mitral valve leaflet and subvalvular apparatus. Patients with preexisting SAM warrant close hemodynamic monitoring intrapartum as hemodynamic changes common in labor can provoke LVOT obstruction. We present the management of a recent case, which was also complicated by ICD lead malfunction during pregnancy.

Case: A 34 year old G1 with a history of HOCM confirmed by genetic testing was referred to a multidisciplinary team consisting of congenital cardiologists, maternal fetal medicine specialists, cardiac and obstetric anesthesiologists for delivery planning. History was significant for septal thickness of 2.3cm, mid-LV pressure gradient of 21mmHg with chordal SAM, syncope, and ICD for primary prevention of sudden cardiac death. Unfortunately, at 19 weeks gestation she was discovered to have a fractured RV lead and was instructed to wear a LifeVest for the remainder of her pregnancy. She was admitted for induction of labor at 39w5d with telemetry monitoring intrapartum and for 12 hours postpartum with an external defibrillator immediately available in case of ventricular arrhythmia. Prior to epidural placement, one liter of normal saline was administered to support preload, and a right radial arterial line was inserted for close hemodynamic monitoring. Labor epidural was placed at L3-4. 5ml of bupivacaine 0.125% with fentanyl 2mcg/ml was bolused, followed by an infusion of bupivacaine 0.0625% with fentanyl 2mcg/ml at 12ml/h. Six hours after epidural placement the patient delivered utilizing vacuum-assisted second stage. APGAR scores were 6 and 9 at 1 and 5 minutes, respectively. She was transferred to the postpartum unit wearing her LifeVest without additional monitoring. She wore the LifeVest until 6 weeks postpartum when the fractured RV lead was extracted and subcutaneous ICD placed.

Discussion: Patients with significant LVOT gradients on echocardiography at rest are at increased risk for LVOT obstruction with hemodynamic alterations known to provoke SAM. During delivery, LVOT obstruction may be exacerbated by tachycardia associated with sympathetic stimulation and hypovolemia secondary to blood loss. Preload is intermittently decreased during Valsalva, which can be minimized by assisting the second stage of labor. Neuraxial anesthesia attenuates pain associated with labor that may lead to tachycardia; however, avoiding sudden decreases in systemic vascular resistance is imperative. Physiologic changes of pregnancy such as increased intravascular volume may decrease LVOT obstruction, so serial echocardiography is helpful for delivery planning. Maintaining adequate preload, avoiding tachycardia, and assisting the second stage of labor may avoid complications and improve patient safety.

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Abstract #:T-78

Management of Accidental Dural Puncture (ADP) complicating Combined Spinal Epidural (CSE) for Caesarean Section (CS) in a patient with severe kyphoscoliosis

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Background: We report successful anaesthetic management for CS in a patient with severe kyphoscoliosis and associated respiratory failure where attempted CSE was complicated by ADP. We could not find a similar case report in the published literature.

Case report: A wheel chair bound 36 years old primigravida was planned for a CS at 28 weeks of gestation. She was hospitalized with recurrent chest infections and progressive dyspnea requiring supplemental oxygen for the preceding 4 months. She had corrective surgery for idiopathic kyphoscoliosis 20 years ago, however it continued to deteriorate slowly. Old case notes were not available.

She failed respiratory functions assessment due to dyspnea; cardiology assessment was unremarkable. Chest X-Ray revealed sigmoid shaped tracheal deformity predicting difficult intubation. Cobb's angle appeared high degree; however the lumbar vertebrae were obscured by the abdominal shield placed to protect the fetus from radiation. Old operation scar extended from upper thoracic to lower lumbar region, with significant lordosis; featuring technical difficulty with RA. Bedside ultrasound scan revealed lower pole of the Harrington rod at L1-2 interspace, and acoustic windows and good dural signal were noted at L2-3, L3-4 and L4-5.

The patient declined GA, so CSE was planned, with CS under Local Anaesthesia as the backup. A respiratory technician remained present throughout with a CPAP machine to provide respiratory support if needed. Arterial line was inserted, and CSE was attempted with Portex® CSEcure® 18G/27G kit after Ultrasound assisted pre-puncture marking of the skin. ADP occurred; epidural catheter was placed in the subarachanoid space and epidural needle removed, with a view to use it for continuous spinal anaesthesia. The patient was positioned according to her comfort. Fentanyl 15 mcg and small aliquots of Bupivacaine Heavy 0.5% were administered intrathecally (total 20 mg), with careful assessment of block progression to T6 bilaterally.

CS completed uneventfully, intrathecal catheter removed, and patient monitored in ICU. She was discharged home on Day 7. No complications of ADP were noted.

Discussion: Anaesthetic management for CS with severe kyphoscoliosis and respiratory failure presents unique challenges whereby both Regional Anaesthesia (RA) and General Anaesthesia (GA) are potentially associated with life threatening complications. There is paucity of evidence guiding choice of anaesthetic technique for this scenario. Combined Spinal Epidural (CSE) could potentially offer controlled progression and duration of RA while avoiding hypotension and respiratory morbidity.

Learning point
CSE may be complicated with ADP; epidural catheter placement in the subarachanoid space may facilitate successful anaesthetic management of patients with severe kyphoscoliosis and respiratory failure.

Abstract #:T-79

There's a Fungus Among Us - Peripartum Management of a Patient with Disseminated Blastomycosis

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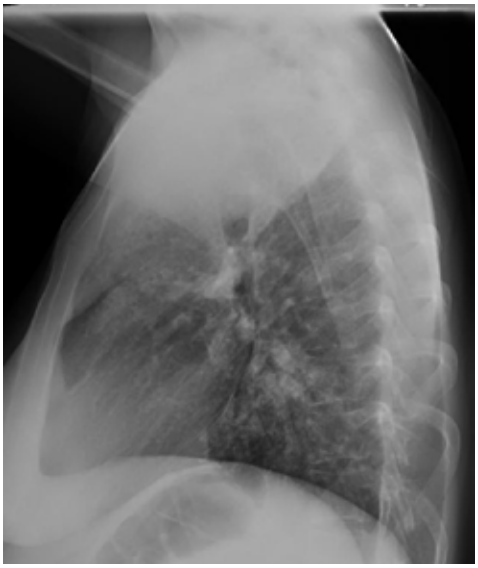
Introduction: Blastomycosis is a systemic disease caused by the fungus Blastomyces dermatitidis that is endemic in the Ohio and Mississippi River valley and Canadian regions that border the Great Lakes. Infection occurs by inhalation of spores from soil, and the disease presents as an acute or chronic pneumonia. The presentation of blastomycosis varies; immunocompromised patients may present with disseminated disease involving skin, bones, genitourinary, and central nervous system. In severe cases, vertical transmission can occur.



Case report: The patient is a healthy 35 year-old G2P1 who presented at 38 weeks' gestation with night sweats, weight loss, and cutaneous lesions on her arm, forehead, and right buttock. CXR revealed multifocal lesions and a RUL consolidation. Biopsy of the skin lesions confirmed a diagnosis of blastomycosis. The patient was started on amphotericin B 5 mg/kg daily at the recommendation of the infectious disease team. The following day she developed a headache and uterine contractions. The infectious disease team recommended brain MRI, as well as CSF sampling to rule out CNS involvement. Brain MRI, however, was deferred due to concern for imminent labor in the setting of uterine contractions, and CSF sampling was deferred for concern of creating a CSF leak that could lead to postdural puncture headache. Two days later, the patient went into spontaneous labor. A combined spinal epidural (CSE) was performed for labor analgesia. 5 ml of CSF was collected via 27G Whitacre during CSE placement and sent for evaluation. The patient subsequently underwent NSVD with APGARS 9/9. Her post-partum course was uncomplicated, and she was discharged to home on post-partum day #2. The CSF was negative for blastomycosis.

Discussion: There are only a handful of case reports on the management of blastomycosis in pregnancy, none of which address the safety of neuraxial analgesia in patients with disseminated disease. Neuraxial labor analgesia was used in this case, as the patient did not show signs of increased intracranial pressure (ICP) and had been on antibiotic therapy for three days prior. It also allowed for CSF evaluation to rule out CNS involvement. Neuraxial techniques appear to be safe in patients with disseminated blastomycosis without evidence of increased ICP.

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Abstract #:T-80

Intracerebral Hemorrhage in a Pregnant Patient

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Introduction: We present the case of a third trimester patient with elevated ICP due to intraparenchymal hemorrhage who underwent emergent craniotomy for AVM resection.

Case: A healthy 32yo G2P1 at 29 weeks 6 days noted sudden severe headache. CT showed large left parieto-occipital hemorrhage with concern for underlying vascular malformation. On transfer to our center, GCS was E3V4M6 with mild aphasia and right-sided weakness. Repeat CT showed enlarging hematoma and edema with 1cm midline shift. She was given hypertonic saline, betamethasone for fetal lung maturity, and magnesium for tocolysis. Continuous fetal monitoring showed normal heart rate and moderate variability. Cerebral angiogram was attempted under sedation but aborted due to intractable nausea.

On day 2, her exam worsened, thus she underwent angiogram under GA with rapid sequence induction and intubation with a Glidescope. Anesthesia was maintained with sevoflurane, N2O, and remifentanil. Angiogram revealed a 1.5cm left parietal AVM. On conclusion of the angiogram, pupils were dilated and became non-reactive over several minutes. She was given 23% saline, mannitol, furosemide, dexamethasone, and midazolam. Hyperventilation and mild hypothermia were initiated. She went emergently to the OR for left frontoparietal craniotomy for evacuation of hematoma and AVM resection. She was initially positioned supine with LUD, but as this hindered surgical access, she was repositioned in right lateral decubitus. EFM showed normal fetal heart rate with no decelerations despite minimal variability. Due to poor responsiveness to phenylephrine, MAP was maintained at 70-80 with norepinephrine. ABG showed hyperchloremic acidosis likely from hypertonic saline.

She was extubated on POD 1. Neurologic exam improved with patient following simple commands but showed right neglect.

Discussion: ICH occurs in about 5:10,000 pregnancies and has a mortality of 40% [1]. Pregnancy is a risk factor for AVM hemorrhage with a rate of 8.1% per pregnancy [2]. There may be conflicting goals to optimize both mother and fetus, but data to guide management are sparse. We used a multidisciplinary approach to determine ideal blood pressure goals; EFM provided reassurance throughout periods of relative hypotension. Hyperventilation is controversial due to risk of uterine artery vasoconstriction and left shift of the maternal oxyhemoglobin dissociation curve but was used in this case to prevent impending brain herniation. A case series showed no fetal complications with hyperventilation to $PaCO_2$ of 28 [2]. Similarly there are concerns with use of osmotic diuretics due to possible fetal hyperosmolality and intrauterine volume reduction, but case reports have shown safe use of mannitol up to doses of 1.7 g/kg [3,4]. Overall, management should be tailored to the individual patient.

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Friday, May 20, 2016

Abstract #:F-01

Impact of the Electronic Medical Record on Nurse's Time Allocation During Cesarean Delivery

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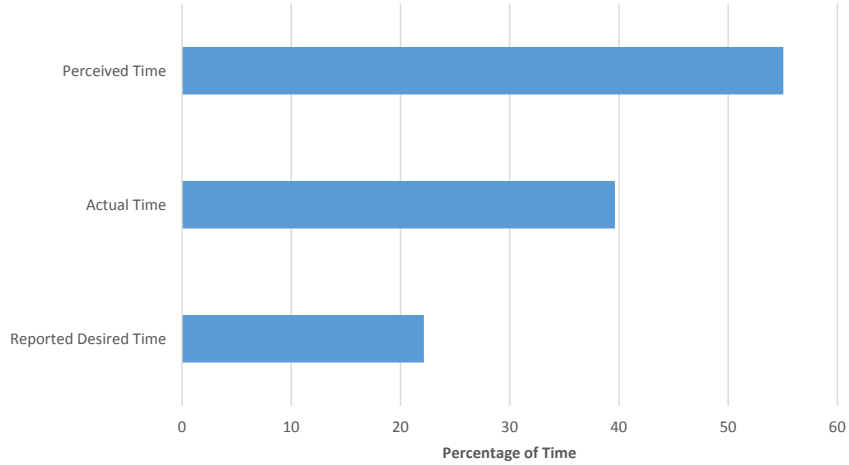
Introduction: Potential benefits of the Electronic Medical Record (EMR) include serving as a centralized hub for legible patient data, a platform for interdisciplinary communication, and a medium to store and transfer information. However, the impacts on provider workflow are poorly studied and less understood. The objective of this study was to collect data on the time that nurses spend on the EMR in the operating room during cesarean deliveries.

Methods: This prospective, observational study was conducted at Lucile Packard Children's Hospital at Stanford (Palo Alto, California). From June-July 2015, 20 scheduled cesarean deliveries were observed in the Labor and Delivery operating rooms. An observer timed how long the circulating nurse spent on the EMR during the case. The nurse was not aware they were being observed or timed. Immediately after the cesarean delivery, the nurse completed a questionnaire to determine their perception of time utilization in the operating room on direct patient care, assisting the healthcare team, EMR usage, and other activities. They were also asked about their perceived time allocation to the EMR pre- and post-operatively, and their desired time allocation for EMR. Data presented as mean ± standard deviation and percentage.

Results: The time spent on the EMR by the circulating nurse was 36 ± 12 minutes per cesarean delivery; 40% of the duration of the cesarean deliveries observed (Figure 1). The nurses perceived the proportion of time spent on the EMR during the case as greater than the actual time spent; (55% compared to 40%, p=0.020; Figure 1). There was no difference in the nurse's reported average time spent on EMR pre-, intra- and postoperatively (p=0.511). Nurse's reported desired proportion of time spent on the EMR during cesarean delivery was 22 ± 15%, significantly less than both actual and perceived intraoperative time spent on the EMR (p = 0.007).

Figure 1. Nurses Perceived Time, Actual Time, and Reported Desired Time on the EMR in the Operating Room



Conclusion: To our knowledge, this is the first study that demonstrates nurses spend 40% of their intra-operative time during cesarean delivery on the EMR; nearly twice the amount of time nurses desire to spend on EMR. A large proportion of time is also spent on the EMR pre- and post-operatively. Future studies are needed to better understand the impact of time spent with EMR on patient safety, and how the EMR can be optimized to limit time requirements.

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Abstract #:F-02

Variability in assignment of ASA grading for obstetric patients

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Introduction: In 1941, ASA introduced a six-part 'fitness for surgery' grading system(1), which was later developed into the five-part ASA Physical Status Classification in 1961(2). Its application in obstetric anaesthesia has always been point of controversy due to the physiological changes associated with pregnancy(3). ASA grading is used worldwide and is recognised as part of the WHO checklist. We designed and circulated an international survey to anaesthetists and obstetricians in the UK and in the USA aimed to investigate the level of consistency with ASA grading in obstetric population.

Methods: A survey was circulated online to several hospitals in UK and USA. Participants were asked to assign an ASA grade to the following cases: A) A 30 year old primiparous woman has no past medical history and takes no regular medicines. In her 34th week of pregnancy she develops high blood pressure, proteinuria, severe headache and visual disturbances; B) A 25 year old multiparous woman has a past medical history of asthma. She normally takes inhalers when needed. She has attended hospital once with her asthma, but has had no HDU or ITU admissions; C) A 23 primiparous woman has no past medical history and takes no regular medicines. She has had no problems in this pregnancy; D) A 40 year old multiparous woman has no past medical history and normally takes no medicines. She is currently on antibiotics for the treatment of an urinary tract infection; E) A 29 year old multiparous woman has had a vaginal delivery. Her estimated blood loss in the room is 1L and she continues to bleed. She is taken to theatre for an exploration. She loses a further 1L and receives 2 units of red blood cells. She is tachycardic and hypotensive.

Results: 100 survey responses were collected:90 responders were anaesthetist and 10 obstetricians. 61% of responders were senior anaesthetists and 21% were trainees. Amongst senior anaesthetists, 64% were obstetric anaesthetists. 62% of responders had more than 5 years experience in obstetrics. A great variety in the assignment of ASA grades to different scenarios was observed. The ASA grade assigned to the same scenario varied from 1 to 5 according to different responders.

Discussion: Our survey showed wide range of variability between clinicians in assigning ASA grades in obstetric patients and reluctance to assign ASA 2 grade to healthy pregnant patients. There was even greater variability in assigning ASA grading to pregnant patients with acute medical problems. These results suggest a need for further education and clarification in the ASA grading system, or a revision of the ASA system itself, including introduction of modifier such as "G"(3) or "P"(4).

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Abstract #:F-03

Anesthesiologists' Preferences Towards Visitor Presence During Placement Of Neuraxial Labor Analgesia: A Survey

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Introduction: Labor pain relief with neuraxial blocks has become an integral part of modern anesthesia practice. Visitor presence during placement may be beneficial to the patient but is not without risk. With no specific guidelines existing, we sent a nationwide survey to anesthesiologists to determine views on this subject.

Methods: An IRB approved survey was sent out to anesthesiologists practicing obstetric anesthesia via SOAP , several state anesthesia societies and to all anesthesiology residency programs. Over 1500 respondents were represented in the following categories:
--Neuraxial procedures per wk: <2; 2-5; 6-10; >10
--Years in practice: <2 years; 2-5 years; 6-15 years; >15 years
--Qualifications: Board Eligible (BE); Board Certified (BC); Board Eligible & OB Anesthesia Fellowship Trained (BE&F); Board Certified & OB Anesthesia Fellowship Trained (BC&F)
--Region: Northeast; Midwest; South; West
--Setting: Rural; Suburban; Urban
--Organization: Academic; Private; Government

Results: Questions And Responses (Results are statistically significant; Chi square in SPSS.)

1. Preferred neuraxial technique? Epidural; Combined spinal epidural -For all physician categories except "Qualification," there was a 2:1 or greater favor for epidural analgesia. For "Qualification," BE&F chose both options -equally.
2. Does the hospital have written policy regarding visitor presence during neuraxial procedure? Yes; No; I do not know.- Physicians most knowledgeable of the policy by category were: "> 5 procedures/wk;" ">15 yrs. practice;" "BC&F;" and "Rural practice."
3. In the absence of a policy would you allow a visitor? Yes; No. All categories favored allowing a visitor by at least 2.5:1.
4. 4) Favored visitor position: Sitting; Standing; Does not matter - For all categories, combined "Sitting" and "Does not matter" responses were >85%.
5. Favored visitor view: No view; Partial view; Does not matter - For all categories, "No view" was favored over either "Partial view" or "Does not matter" by 1.5:1 or greater.
6. Reason for allowing a visitor: Reduce patient anxiety; Reduce visitor anxiety; Visitor's assistance needed; Fulfil patient's request - For all categories, combined "Reduce patient anxiety" and "Fulfil patient request" responses were 85% or greater.
7. Frequency of non-anesthesia influence on decision for visitor: Rarely; Occasionally; Often - Except for "BE&F," all categories recorded "Rarely" by 3:1 over other choices.

Discussion: The ASA Task Force on Obstetric Anesthesia supports a multidisciplinary approach to create favorable maternal and fetal outcomes (Anesthesiology 2007;106:843-863). The majority of anesthesiologists agreed to have a visitor in the room during placement of neuraxial labor analgesia, but this may risk interference. Epidural analgesia and no view of the procedure as well as responses to most of the other survey questions showed statistically significant preferences.

Abstract #:F-04

Are We Done Yet? A Study of Factors Influencing Cesarean Delivery Times

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Introduction: One of the most commonly asked questions by our patients is: "how long will surgery take?," a question we sometimes ask ourselves in the midst of a case. We have previously reported the surgical time required for a primary (C1), secondary (C2), tertiary (C3) and quaternary or more (C4) CD.1 We now incorporate surgical factors (e.g., level of surgical training, details of the surgical procedure) into the analysis. Others have reported on factors affecting CD times 2,3, but these may differ by country/region and the nature of the institution.

Methods: This is a retrospective study of 1348 CDs performed from January to December 2011. Data was gathered from our electronic anesthesia records and EMR. We examined the effect of the number of previous CDs, age, gestational age (GA), BMI, trial of labor, urgency status, the anesthetic performed, the number of surgeons and surgeons' experience, the layers and type of surgical closure, and the performance of tubal ligation (BTL) on skin to closure time. The effect of previous CDs was compared by ANOVA, with Scheffe's post hoc test. A regression model was used to assess the combined effect of all independent variables, retaining those with $p<0.05$.

Results: There was a statistical difference between C1, C2 , C3, and C4 CDs when looking at skin to closure times (Table 1). Linear regression demonstrated that factors that affect surgical time were: BMI, GA, surgeons' experience, number of layers closed, urgency status, and BTL. Results showed that having a PGY 1 or 2 level surgeon and an attending operate instead of two attending surgeons operate adds 14 min to the surgical time. These independent factors account for about 18% of the variance (Table 2).

Conclusion: There was a statistical difference in surgical time between a primary CD and repeat CD. C1 and C2 CDs are completed in mean times of 56 and 60 min, respectively. A single-shot spinal is an adequate anesthetic option for these cases. C3 and C4 CD mean times are 7 0 and 82 min, respectively; these cases may require prolonged neuraxial anesthesia. When taking in consideration the time for onset of anesthesia and surgical prepping, it is not unreasonable to perform a CSE for C3 and C4 CDs, especially if some of the factors shown to have a moderate impact on surgical times are present.

References:

1. Abstract F22, SOAP 2013
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Table 1. Effect of Cesarean Delivery Number on Delivery Time

CD	Skin to closure time
C1	56.0
C2	59.9
C3	69.3
C4	81.7

C1= Primary CD; C2= secondary CD; C3= tertiary CD; C4 = quaternary or more CD

Table 2. Linear Regression on Skin to Closure Time (Rsquared = 0.18)

Independent Variables	Coeff.	Std. Err.	pValue	95% CI
BMI	0.23	0.08	0.01	0.07-0.38
BTL	6.73	1.84	0.00	3.13-10.34
Gestational age	-0.79	0.19	0.00	-1.17-(-0.42)
Most Junior Surgeon (PGY1 or PGY2)	14	1.46	0.00	11.1-16.8
Most Junior Surgeon (PGY3 or PGY 4)	4.8	1.5	0.00	1.78-7.72
Emergency	-2.9	1.25	0.02	-5.31-(-0.39)
Closing of Camper's/Scarpa's fascia	7.06	1.07	0.00	5.0-9.2
Constant	69.6	7.8	0.00	54.3-84.9

Abstract #:F-05

Noise and Distraction in the Obstetric Operating Room

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Background: Anesthesiology was the first medical specialty to focus on patient safety and outcomes. Physical or auditory interferences may lead to medical errors and patient harm. Noise >77 decibels (dB) in the OR causes distractions, reducing mental efficiency and short-term memory of anesthesia residents [1]. Cesarean delivery (CD) is a unique OR environment with additional noise and physical activity from an awake patient, crying newborn, visitors, pediatrics, and increased OR traffic. An observational quality improvement (QI) study to evaluate the frequency and severity of noise and interferences during CDs will help determine ways to minimize distractions and improve patient safety.

Methods: This IRB-waived departmental QI project included 50 prospective CD observations from 9/2015-1/2016 at Cedars-Sinai Medical Center. A sound meter continuously measured dB with major events (e.g. spinal, incision, delivery) recorded. The number of physical interferences violating the anesthesia workspace were noted. Interruptions distracting the anesthesiologist were scored using a modified Healy score [2]. The primary outcomes of noise levels and interferences are described by mean, range, and standard deviation. A single-factor ANOVA test compared dB of major events for all CDs. The secondary outcomes compared maternal/fetal characteristics, presence of pediatricians, or music with dB levels and modified Healy scores using t-tests and Chi-squared or Fisher's Exact tests.

Results: The average noise level of 50 CDs was 65.9dB (range 50.2-107.3, SD 5.6) for the case. Significant differences existed between major events in each CD with maximum dB occurring at delivery time, ANOVA ($p < 0.0001$). Nursing caused the most physical interferences into the anesthesia workspace (mean 48.8, range 25-102, SD 15.7), followed by the patient's visitor (mean 4.3, range 1-15, SD 2.7). Unscheduled CDs were associated with modified Healy score sum ≥50, Fisher's Exact ($p<0.05$). In addition, presence of pediatrics significantly impacted the modified Healy scores involving the anesthesia team, Chi-squared ($p<0.0001$). The dB exceeded recognized levels of distraction (77dB) in 98% of cases. This safety limit was exceeded in 16/50 cases for ≥30% of the entire CD time and 7/50 cases for ≥50% of the entire CD time.

Discussion: Patient safety remains paramount in the OR. This QI study identified several areas for possible improvement in noise level and distraction of anesthesiologists. Noise routinely exceeds dB levels associated with distraction and memory impairment of anesthesiologists [1]. Redesigning the OR workflow including limiting noise, number of visitors, and OR traffic to protect the anesthesia workspace from interferences may lead to less distractions to the anesthesiologist and improve patient care.

References:

1. Can J Anaesth,1995,42:7,608-11
2. Qual Saf Health Care,2007,16:2,135-9

Abstract #:F-06

Randomized Controlled Simulation Trial Comparing Procedures to Transfer Patients to the Operating Room for Emergency Cesarean Delivery

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Background: To reduce the risk of line entanglement, medication error and IV dislodgment during transfer to the OR for emergency cesarean delivery, the SOAP Patient Safety Committee has proposed a new procedure to cap all intravenous and epidural lines and to separate the infusion pump from the patient during transport.1

Methods: This in situ simulation study randomized 14 clinical teams to transfer a live patient actor to the operating room utilizing this new "cap and run" procedure or usual transfer procedures. We hypothesized that capping all lines, placing the main IV in the bed next to the patient, and pushing the IV pole separated from the bed would reduce total time to both transfer to the OR, and to prepare for emergency general anesthesia. Immediately prior to the simulation, each bedside nurse randomized to the "cap and run" procedure was introduced to the procedure and allowed to practice briefly. All others remained naïve to the change in procedure. The scenarios started with in utero resuscitation of recurrent FHR decelerations that necessitated position changes and led to line entanglement. The primary outcome measure was the time from decision in the labor room until the anesthesia resident had completed all necessary tasks to prepare for induction of general anesthesia.2 Secondary outcomes included intermediate times and qualitative observations.

Results: 12 simulations have been completed, 8 canceled due to unit workload or staff availability, and at least 2 more scheduled. The following best practices appeared to improve efficiency during transport and preparation for general anesthesia: 1) raise the labor bed prior to disconnecting the power cord, 2) disconnect all labor room monitors prior to transfer, and 3) standardize the location of equipment (e.g., drape clips in the OR). In the most efficient teams, nurses were skilled in managing the steer function on the labor bed and applying the arm board in the OR. For the anesthesiologist, airway examination, bicitra administration, and application of the facemask should be completed first, followed by connecting and cycling the blood pressure cuff. The sequence of other activities did not appear to change preparation times.

Conclusions: Quantitative analysis was deferred until all simulations have been completed, likely in the next week. Qualitative analysis has identified a number of practice changes to optimize efficiency during transfer for emergency cesarean delivery and preparation for general anesthesia.

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2. Scavone BM, Anesthesiology 2006;105(2):260-6.

Abstract #:F-07

Labor Units of the Future: Physical Design and Standardization of Labor and Delivery Suites

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Introduction: Standardization of equipment and processes are fundamental to safety in high stakes industries like aviation, aeronautics, nuclear power, and the military (1). Medicine has embraced standardization in the form of algorithms and checklists (2) but has yet to standardize equipment or physical layout of clinical areas. Facilities factors contribute to mortality in the high stakes, dynamic, multidisciplinary area of labor and delivery (3), but heterogeneity of physical design has not been previously studied. Therefore, the "optimal design" of a labor and delivery unit is unknown.

Methods: Between July 2015 and April 2016, academic and private labor and delivery units were measured in this prospective, observational, IRB-approved, pilot study. Researchers included a design expert, mechanical engineer, and clinicians who toured facilities and acquired direct measurements of labor rooms, OR's, and other clinical areas. Configurations of medical equipment in rooms, square footage, and distances between resources were measured. When available, facility maps were combined with measurements using Computer-Aided-Design (CAD) software to facilitate data collection.

Results: Data from the first four labor units is presented in Figure 1.Of note, multiple configurations of labor rooms and operating rooms existed within every institution measured. Clinical volume did not appear to correlate with labor room or operating room count. The distance between labor rooms and operating rooms varied within each institution The hospital in which patients recovered in their labor room had longer distances. Data from additional institutions will be presented at SOAP.

Conclusion: To our knowledge, this is the first pilot study demonstrating physical factor heterogeneity among labor and delivery units. Lack of standardization within an institution may contribute to provider, equipment, and patient safety issues. Lack of standardization across facilities may contribute to variation in practice and disparities in care. Further research is needed to determine the gold standard design for labor and delivery that maximizes efficiency, utilizes standardization to improve patient safety, and is tailored to the unique needs of individual units.

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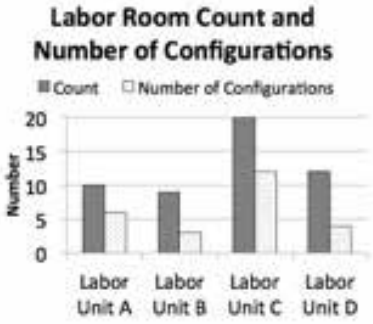
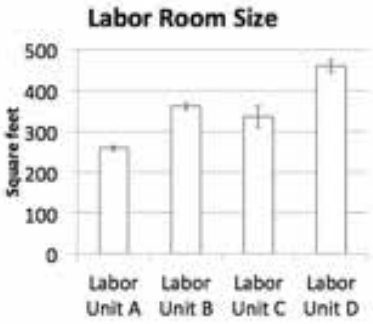
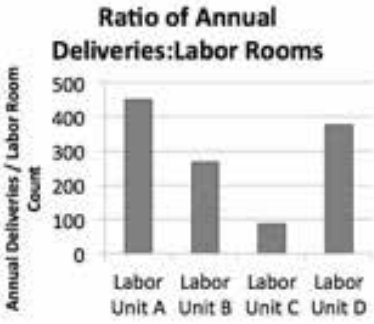
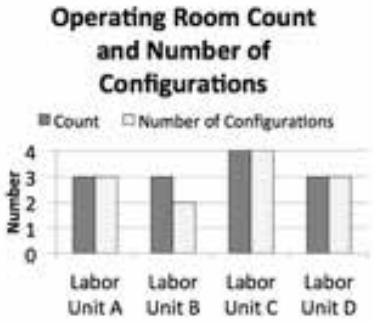
2. N Engl J Med 2013;368:246-253
3. CA-PAMR: 2002-2003 Maternal Death Reviews, 2011:47–9.

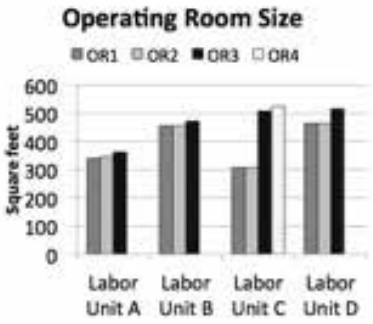

Labor Room Count and Number of Configurations
Count
Number of Configurations
Number
20
15
10
5
0
Labor Unit A
Labor Unit B
Labor Unit C
Labor Unit D

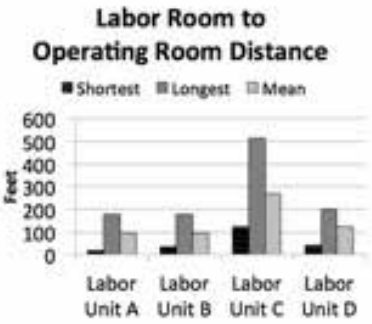

Labor Room Size
Square feet
500
400
300
200
100
0
Labor Unit A
Labor Unit B
Labor Unit C
Labor Unit D

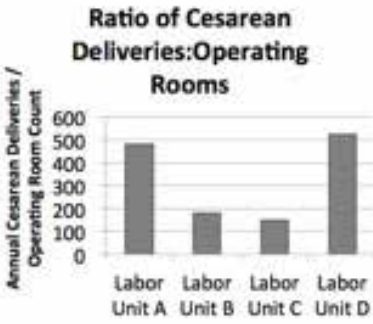

Annual Deliveries
Annual Deliveries
5000
4000
3000
2000
1000
0
Labor Unit A
Labor Unit B
Labor Unit C
Labor Unit D


Ratio of Annual Deliveries:Labor Rooms
Annual Deliveries / Labor Room Count
500
400
300
200
100
0
Labor Unit A
Labor Unit B
Labor Unit C
Labor Unit D


Operating Room Count and Number of Configurations
Count
Number of Configurations
Number
4
3
2
1
0
Labor Unit A
Labor Unit B
Labor Unit C
Labor Unit D


Operating Room Size
OR1
OR2
OR3
OR4
Square feet
600
500
400
300
200
100
0
Labor Unit A
Labor Unit B
Labor Unit C
Labor Unit D


Labor Room to Operating Room Distance
Shortest
Longest
Mean
Feet
600
500
400
300
200
100
0
Labor Unit A
Labor Unit B
Labor Unit C
Labor Unit D


Ratio of Cesarean Deliveries:Operating Rooms
Annual Cesarean Deliveries / Operating Room Count
600
500
400
300
200
100
0
Labor Unit A
Labor Unit B
Labor Unit C
Labor Unit D

Abstract #:F-08

Electronic Obstetric Anesthesia Documentation for Better or Worse - Review of Epic Implementation at the Brigham and Women's Hospital

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Background: Electronic health record (EHR) systems have been shown to enhance patient safety. The obstetrical anesthesia group at Brigham and Women's Hospital has adopted Epic electronic anesthesia record system on May 30, 2015. The purpose of this study is to evaluate the implementation and transition of the electronic anesthesia record system.

Methods: We randomly selected 80 obstetric anesthesia records for review, including 40 labor deliveries and 40 cesarean delivery cases, among which half of the cases were from the 1st month of Epic implementation and the other half were from the 7th month of implementation, respectively. All the records were reviewed based on four different data entry categories: Patient Demographic Data, Pre-Anesthetic Evaluation, Anesthesia Management Data, and Patient Follow-Up Data. Missing data points and errors were recorded. Fisher's exact test was used for data analysis.

Results: There was a trend of reduction for patients' demographic. (Table 1) Significant improvements were seen in three categories: patient follow-up in labor analgesia, pre-anesthetic evaluation for cesarean delivery and anesthesia management for cesarean delivery. (Table 2)

Discussion: Obstetric module is a relatively new component within the Epic system. Our study indicates that the Epic system does carry numbers of correctable flaws that requires constant system level maintenance and update of software. However, the fact of the slow reduction of missing or erroneous data points in patient demographic data partially implies shortage of informatics support. The comparison of the difference in the reduction of missing data in pre-anesthetic evaluations between labor analgesia and cesarean delivery patients could be attributed to the differences in the settings and mechanisms of how patients were evaluated. These data implies that the pre-anesthetics evaluations for labor analgesia, which were often performed by residents, were not as thorough as those of for cesarean deliveries. Closer fellow or attending supervision is indicated. The improvement of patient follow-up for labor analgesia patients indicates that anesthesiologists were better trained in using the electronic follow-up tool over the period. On the contrary, the persistent missing data in the follow-up for cesarean deliveries suggested potential system level problems might exist.

Table 1. Comparison of Completeness of Anesthesia Records for Labor Analgesia

Labor Analgesia Missing/Erroneous Data	June 2015 (20 cases)	December 2015 (20 cases)	Total Data Points	P-value
Patient Demographic Data	30	27	120	0.762
Pre-Anesthetic Evaluation	56	44	460	0.244
Anesthesia Management Data	209	181	600	0.096
Patient Follow-Up Data	106	51	460	<0.001
Total Missing/Erroneous Data	401	303	1640	<0.001

Table 2. Comparison of Completeness of Anesthesia Records for Cesarean Delivery

Cesarean Delivery Missing/Erroneous Data	June 2015 (20 cases)	December 2015 (20 cases)	Total Data Points	P-value
Patient Demographic Data	36	24	120	0.101
Pre-Anesthetic Evaluation	32	13	520	0.006
Anesthesia Management Data	103	138	600	0.014
Patient Follow-Up Data	23	30	460	0.396
Total Missing/Erroneous Data	194	205	1700	0.594

References:

1. Peterfreund RA, et al. 2011.
2. Riley JB, et al. 2015.
3. Steffens TG, et al. 2015.

Abstract #:F-09

Effect of magnesium sulphate pre-exposure on oxytocin-induced contractility in desensitized human myometrium – an in vitro study

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Introduction: Women with oxytocin-augmented labors are at higher risk for postpartum hemorrhage (PPH), possibly due to desensitization of oxytocin receptors (OTR) [1]. Magnesium sulphate ($MgSO_4$) is used for preeclampsia, eclampsia, fetal neuroprotection and as a tocolytic. There are suggestions $MgSO_4$ may lead to increased oxytocin requirements or PPH in preeclampsia [2]. It is known to reduce myometrial contractions in vitro [3], however, its effect on oxytocin-induced contractility in desensitized myometrium is unknown. The objective of this study was to determine oxytocin-induced myometrial contractility, in desensitized and control samples exposed to $MgSO_4$.

Methods: This prospective in vitro study was conducted with institutional REB approval and the informed consent of women undergoing elective Cesarean section, with no PPH risk factors. A myometrial sample was divided into 6 strips and mounted in separate organ baths with physiological salt solution (PSS) under homeostatic conditions. Samples were allocated to one of 3 pretreatment groups: $MgSO_4$ 3.5mM (Mg group), $MgSO_4$ 3.5mM + oxytocin 10-5M (Mg-Oxy group) and PSS (control group). Strips were then subjected to dose-response testing with oxytocin (10-10M to 10-5M). The primary outcome was motility index (MI, amplitude x frequency), presented as a % of baseline contractility.

Results: So far we have completed 23 experiments: Mg n=6, Mg-Oxy n=9, control n=8 (required sample size 96 strips, 32/group). We plan to complete the study by March 2016. Results so far indicate MI was higher in the Mg group (489%) and lower in the Mg-Oxy group (202%) as compared to the control group (227%).

Discussion: Pre-treatment with $MgSO_4$ itself does not seem to affect myometrial contractions. The attenuated contractions in the Mg-Oxy group could possibly be due to the desensitization mechanism, as a result of oxytocin pre-treatment. Nonetheless, further samples and experiments are yet to be conducted. Final discussion and conclusion will be presented at the meeting.

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2. AJOG 1997;176:623-7
3. AJOG 2006;194:1384-90

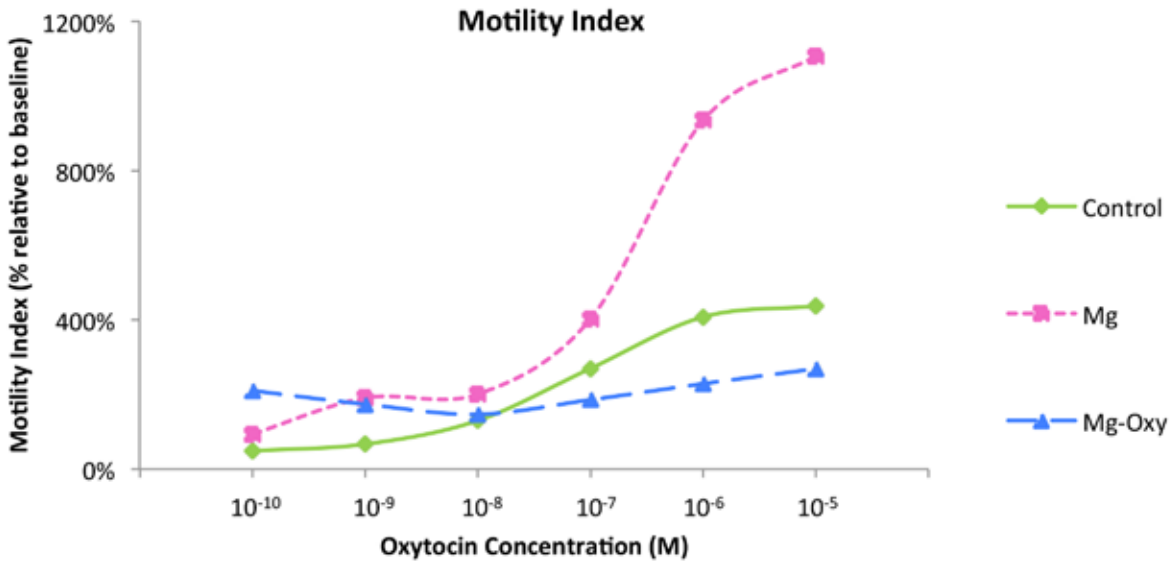

Figure 1. The dose-response curves for motility index of the myometrial strips stimulated with oxytocin after pretreatment with magnesium (Mg), magnesium and oxytocin 10^{-5} M (Mg-Oxy) or no pretreatment (Control) for 2 hours.

Abstract #:F-10

In-vitro intermittent exposure to oxytocin preserves myometrial responsiveness to oxytocin

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Introduction: Postpartum hemorrhage (PPH) secondary to uterine atony is a leading cause of maternal morbidity. Prolonged continuous infusion of oxytocin during labor may induce oxytocin receptor desensitization,[1] which attenuates the response of the myometrium to further oxytocin. The literature comparing pulsatile (intermittent) vs continuous oxytocin administration for labor augmentation is inconsistent with regards to maternal outcomes.[2,3] Furthermore, PPH has not been investigated as a primary outcome. We aimed to determine the effect of intermittent vs continuous oxytocin exposure on the extent of myometrial desensitization.

Methods: Following written informed consent from patients undergoing elective cesarean deliveries, this in-vitro study was undertaken using myometrium dissected into 6 strips. Each strip was mounted in a single organ bath with physiological salt solution (PSS) under homeostatic conditions and allocated to one of 3 groups 1) control (no pretreatment); 2) continuous (oxytocin 10-5M pretreatment for 2h [3]); or 3) intermittent (pretreatment with oxytocin 10-5M and PSS alternating every 15min for 2h). After pretreatment, a dose-response to oxytocin 10-10M to 10-5M was performed and contractile parameters measured. The primary outcome was motility index (MI, frequency x amplitude).

Results: Eighteen women were recruited and 86 successful experiments performed (control n=29, continuous n=28, intermittent n=29). The mean (SE) MI (√g.contractions/10min) in the control, continuous and intermittent groups were 2.34 (0.09), 1.78 (0.09) and 2.13 (0.11), respectively (Fig 1). The MI was significantly reduced in the continuous group when compared to the control ($p<0.01$) and intermittent group ($p=0.01$). There were no significant differences in MI in the intermittent vs control group ($p=0.17$).

Discussion: Human myometrium remains more responsive to subsequent oxytocin following intermittent exposure to oxytocin, compared to continuous exposure. Intermittent exposure to oxytocin may preserve oxytocin responsiveness by minimizing oxytocin receptor desensitization, or by facilitating receptor resensitization. These results suggest that pulsatile (intermittent) oxytocin administration for labor augmentation may prevent uterine atony and PPH. Further clinical trials should be considered.

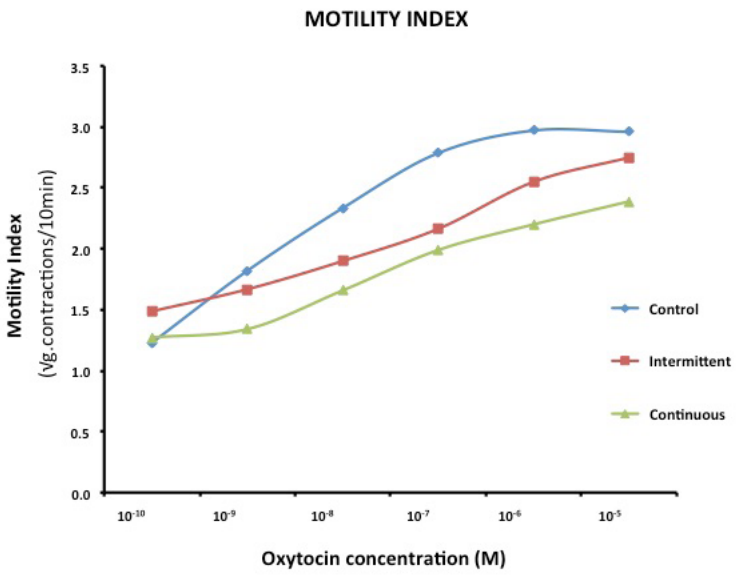

Figure 1: The dose-response curves for motility index

References:

1. AJOG 2003;188:497-502
2. Clin Exp Obstet Gynecol 2000;27:21-3
3. AJOG 2012; 206:230.e1-8
4. Anesthesiology 2013;119:552-61

Abstract #:F-11

Myometrial contractility after oxytocin pre-exposure in women with advanced maternal age and morbid obesity

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Introduction: Women with advanced maternal age (AMA) and morbid obesity (MO) are at a greater risk for postpartum hemorrhage (PPH). Oxytocin is the first line drug in the treatment of PPH. Prolonged exposure to oxytocin can result in desensitization of the oxytocin receptors [1], which may result in poor uterine tone after delivery with attenuated response to oxytocin. It is not known if the higher incidence of PPH seen in these women is due to poor uterine contractility. Further it is not known if oxytocin desensitization specifically affects contractility in AMA and MO women when compared to younger or normal weight women. We aimed to investigate the effect of oxytocin on myometrial strips of AMA and MO women in-vitro.

Methods: The in-vitro study was conducted after REB approval and written informed consent from women undergoing elective cesarean deliveries. Three groups of patients were studied: control (≤35 yr, BMI 20–24.9 kg/m2), AMA (≥40 yr, BMI 20–24.9 kg/m2), and MO (≤35 yr, BMI≥40 kg/m2). Myometrial tissue obtained from the uterine incision was dissected into six strips. Each strip was mounted in a single organ bath with physiological salt solution (PSS) and then pretreated with oxytocin 10-5M (desensitization model[2]) or left in PSS (untreated) for 2 hours. This was followed by a dose-response testing to oxytocin 10-10M to 10-5M. The primary outcome was motility index (MI; amplitude x frequency) of myometrial contractions. Data was analyzed using the % response during the dose response relative to the baseline contractions.

Results: So far 126 experiments have been performed (required n=168) with samples from 33 women: control (n=56), AMA (n=48), MO (n=22). The MI, calculated as a cumulative dose-response average, was higher in the control group (457%) compared to the AMA (414%) and MO (321%) groups in samples not pretreated with oxytocin. In the oxytocin-pretreated samples, the MI was lower in the control group (111%) compared to the AMA (158%) and MO (281%) groups (Fig 1). We plan to complete this study by March 15, following recruitment of 7 more patients.

Discussion
Our results suggest that women with AMA and particularly those with MO may exhibit poor intrinsic uterine contractility as compared to younger and normal weight women. Furthermore their uterine contractility is further impaired by pre-exposure to oxytocin.

References:

1. Am J Obstet Gynecol 2003; 188:497-502;
2. Anesthesiology 2013; 119: 552-561

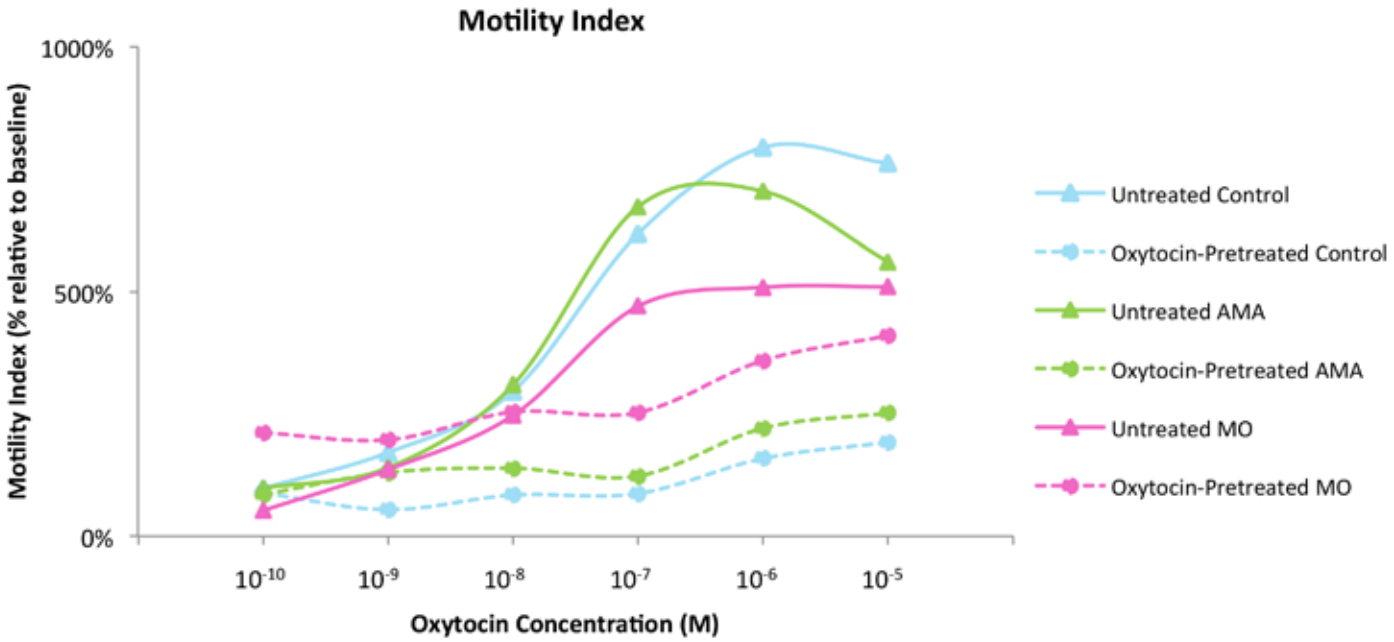

Figure 1. The dose-response curves for motility index of the myometrial strips stimulated with oxytocin after pretreatment with oxytocin 10^{-5} M (Oxytocin-Pretreated) or no pretreatment (Untreated) for 2 hours.

Abstract #:F-12

Association between recovery time (oxytocin discontinuation to delivery) and blood loss during cesarean deliveries following oxytocin augmented labor - A retrospective cohort study

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Introduction: Induction and augmentation of labor with oxytocin (OT) is currently a common obstetric practice. However, prolonged OT exposure during labor has been shown to be associated with uterine atony and postpartum hemorrhage (PPH) [1] due to OT receptor desensitization. In theory, discontinuation of OT following labor augmentation may facilitate a time-dependent recovery of OT receptor function [2] that can restore myometrial contractility, and thus decrease blood loss at cesarean delivery (CD). The purpose of this study was to examine the association between the time interval from discontinuation of OT to delivery (recovery time) and blood loss at CD for labor arrest.

Methods: This retrospective chart review included women who underwent CD for labor arrest following OT augmented labor from July 2013 to July 2015. Data on patient demographics, labor/delivery characteristics, amount and duration of OT exposure, recovery time and PPH risk factors were collected. Recovery time and PPH risk factors were included in a multiple linear regression model with estimated blood loss (EBL) as the primary outcome. EBL was calculated based on the hematocrit variation method.

Results: Data from 490 women were analyzed. The mean (SD) EBL was 1341 (577) mL. Duration and amount of OT infusion during labor were 619 (355) min and 6447 (6868) mU, respectively, while recovery time was 99 (65) min (range=0-367 min). There was an inverse correlation between recovery time and EBL that was significant after controlling for PPH risk factors (p=0.01). Every 10 min increase in recovery time was associated with a decrease in EBL on average by 10.3 mL. The EBL for recovery time < 1h was significantly higher than for ≥ 1h [1438 (586) ml vs. 1298 (569) mL; p=0.01]. Recovery time was not associated with the need for additional uterotonics or surgical interventions to control bleeding. There was a significant correlation between the total amount and duration of OT with the need for additional uterotonics (p<0.01) and surgical interventions (p≤0.01), but not with EBL.

Discussion: Our results suggest that OT should be stopped as soon as labor arrest is declared, and a longer interval between OT cessation and CD can help reduce blood loss. This could be due to OT receptor resensitization during the recovery time that possibly helps to restore myometrial responsiveness to prophylactic OT at CD.

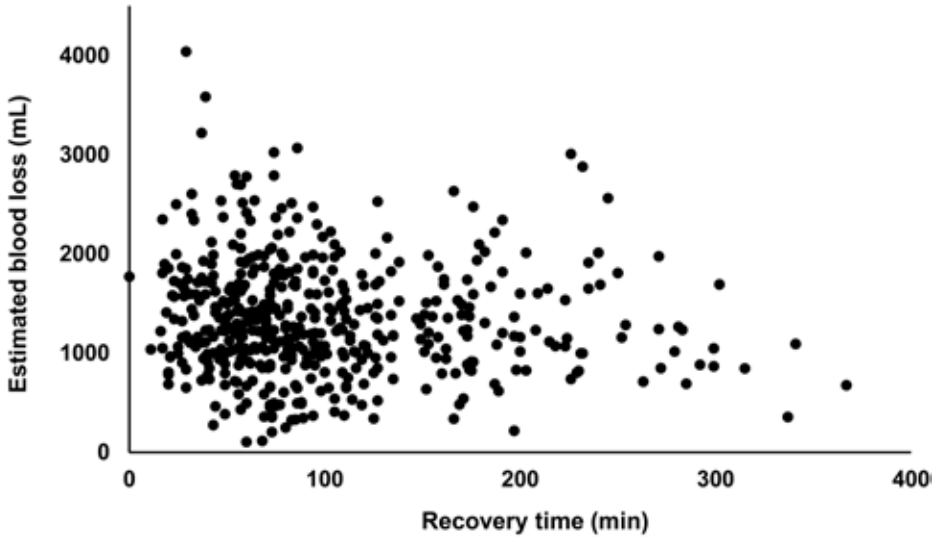

Figure 1. Correlation of recovery time and estimated blood loss in women with labor arrest

References:

1. AJOG 2011;204:56.e1-6;
2. Am J Physiol Endocrinol Metab 2009;296:E532-42

Abstract #:F-13

Carbetocin versus oxytocin on the need for second-line uterotonics in parturients requiring cesarean delivery for labor dystocia

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Background: Oxytocin is the most often used uterotonic agent for active management of 3rd stage of labor. However, in 2009, the Society of Obstetricians and Gynaecologists of Canada (SOGC) recommended carbetocin as the first-line agent for elective cesarean delivery (CD) for the prevention of postpartum hemorrhage (PPH) [1]. We hypothesized that carbetocin would be superior to oxytocin in preventing the need for second-line uterotonics in parturients who underwent CD for labor dystocia and were previously exposed to intrapartum oxytocin.

Methods: We conducted a retrospective study. Inclusion criteria were parturients undergoing CD for labor dystocia with BMI ≤ 40 kg/m2 and ASA PS 2. Medical records from 2004-2009 were reviewed and 894 parturients were included. Parturients who received variable doses of IV oxytocin (20-60 IU) were compared with parturients who received IV carbetocin (100 mcg) both during CD. The primary outcome was the need for additional uterotonics during CD. Secondary outcomes included estimated blood loss, perioperative hemoglobin variations, durations of intrapartum oxytocin exposure and time of discontinuation of oxytocin before CD.

Results: 478 and 416 parturients were included in the oxytocin and the carbetocin groups, respectively. No difference was found between the 2 groups regarding demographics, obstetric history and risk factors for uterine atony. There was no difference in the perioperative use of second-line uterotonics between oxytocin and carbetocin (8.4% vs 8.2%; P > 0.99). The mean (± SD) estimated blood loss was 857 ± 222 and 899 ± 211 mL in the carbetocin and oxytocin groups, respectively (P = 0.001), but the difference between the post and pre-op hemoglobin levels in the 2 groups were not significant (24 ± 10 vs 26 ± 10 g/L; P = 0.08). Using a logistic regression analysis, duration of intrapartum oxytocin exposure >10 hours presented a higher risk to receive a second-line uterotonic compared to an exposure of < 3 h (OR 4.64, 95% CI 1.43-15.12; P = 0.01). The presence of chorioamnionitis was also a risk factor for second-line uterotonics use (OR 1.65, 95% CI 1.02-2.68; P = 0.04). A 90-min or greater interval between oxytocin discontinuation and delivery compared to < 30 min was not associated with a lower risk of second-line uterotonic use in women who received intrapartum oxytocin for > 3 h (OR 1.39, 95% CI 0.42-4.55; P = 0.59).

Conclusions: Carbetocin (100 mcg IV) does not reduce the need for second-line uterotonics compared to variable doses of oxytocin (20-60 IU IV) during 3rd stage of labor in parturients undergoing a CD for labor dystocia previously exposed to intrapartum oxytocin. These results do not support the hypothesis, but are consistent with a recent study comparing the in vitro effect of carbetocin and oxytocin in pregnant human myometrium [2].

References

1. Leduc D. Obstet Gynaecol Can 2009
2. Cole NM. Anesthesiology 2016

Abstract #:F-14

Dosing of Oxytocin in Patients Undergoing Cesarean Delivery After a Period of Labor

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Kenneth Nunes M.D. - University of Chicago - Chicago, IL
Barbara Scavone M.D. - University of Chicago - Chicago, IL

Introduction: Experts recommend postpartum oxytocin to prevent uterine atony and hemorrhage.1 Its published ED90 is 17(95% CI 9.0-25.8) IU/hr.2 Based on this ED90 we adopted a protocol that calls for 1) routine administration of oxytocin 18 IU/hr; 2) administration at 36 IU/hr for uterine atony; and 3) administration of other uterotonic agents for persistent atony.3 A more recent study determined an ED90 of 44.2 (95% CI 33.8-55.6) IU/hr in patients exposed to oxytocin prior to cesarean delivery (CD).4 To determine the clinical relevance of these data, we undertook this study to compare postpartum oxytocin/other uterotonic requirements in patients exposed to oxytocin prior to CD (OXY+) versus those not exposed (OXY-) in order to assess adequacy of our current protocol.

Methods: In this IRB-approved study we reviewed medical records of patients who delivered via CD under neuraxial anesthesia during one year. Data collected included gravidity, parity, EGA, neonatal weight, intrapartum exposure to oxytocin/dose/duration, and relevant co-morbidities. Note was made of maximum postpartum oxytocin dose (18 vs 36 IU/hr) and use of other uterotonic drugs, uterostatic procedures, EBL, transfusion, and pre- and post-delivery Hgb. Nominal data were compared with the Chi-square or Fisher's Exact test; continuous data with the Mann-Whitney U test.

Results: OXY+ patients had higher EGA and neonatal weight and were more likely to be nulliparous and have chorioamnionitis and less likely to have multiple gestation than OXY- patients (table). Other comorbidities did not differ. OXY+ patients required high dose (36 IU/hr) postpartum oxytocin and other uterotonic agents more often than OXY- patients. EBL, hemorrhage rates and transfusion rates did not differ but OXY+ patients had a bigger drop in hemoglobin after delivery.

Conclusion: Differences in the ED90 of postpartum oxytocin appear to be clinically significant and we therefore plan to alter our current protocol so that women pre-exposed to oxytocin will receive higher oxytocin doses routinely.

References:

1. ACOG Practice Bulletin No. 76. Obset Gynecol 2006;108:1039
2. George: Can J Anesth 2010;57:578
3. DeGraca: Int J Obste Anes 2013;22:194
4. Lavoie: Anesth Analg 2015;121:159

	Oxy+ (n=140)	Oxy- (n=262)
EGA (weeks)	39 (38-40)*	37 (34-39)
Neonatal weight (g)	3293 (2685-3624)*	2978 (2140-3490)
Nullips	91 (65)*	60 (23)
Chorioamninitis	34 (24)*	9 (3)
Multiple gestation	2 (1)*	26 (10)
High dose oxy	90 (64)*	105 (40)
Other uterotonics	33 (24)*	28 (11)
EBL (mL)	750 (650-1000)	750 (600-1000)
Hemorrhage	41 (29)	67 (26)
Transfusion	8 (6)	8 (3)
Drop in Hgb (g/dL)	2.0 (1.5-2.6)*	1.7 (1.0-2.6)

Data expressed as median (IQR) or n (%); * P<0.05 compared to Oxy-

Abstract #:F-15

15-Year Analysis of Second-Line Uterotonic Use at A Large Teaching Hospital in The United States

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Background: Uterine atony has been recognized as the main cause of postpartum hemorrhage (PPH). For PPH due to uterine atony, second-line uterotonic agents, such as methylergonovine, carboprost, and misoprostol, have been highly recommended by the American College of Obstetricians and Gynecologists (ACOG) since 2006. Bateman et al demonstrated that an increased use of second-line uterotonic agents in the recent years. In this study, we investigated the use of second-line uterotonic agents at a large teaching hospital.

Methods: We conducted electronic database search at the Brigham and Woman's hospital (BWH). Patients who underwent cesarean delivery or cesarean hysterectomy were retrieved from 1999 to 2014. The medication usage data of methylergonovine, carboprost, misoprostol were analyzed.

Results: The overall usage of all second-line uterotonic agents increased in the past 15 years. (Figure 1a, 2a, 3a) After adjusting with patient volume, our data indicated the usage of methylergonovine and misoprostol decreased significantly in the recent years. (Figure 1b, 3b) On the other hand, there was a steady increase of carboprost use. (Figure 2b) Obstetric providers' usage pattern change between 2004 and 2014 was shown in Figure 4 and 5. While the usage of carboprost increased across all providers, we are continuing data process for a much thorough analysis at the SOAP meeting.

Discussion: We observed an increased use of second-line uterotonic agents of methylergonovine and carboprost with an obvious favor towards carboprost at our institution over the past 15 years. We are exploring the potential underlining causes and speculated that providers' personal preferences could be one of the leading reasons. Recent review data suggested methylergonovine could be more effective which might also reduce PPH morbidity. Nevertheless, most of the providers may not aware of the cost associated with each of these different therapies. A more evidence based practice is likely the best approach.

References:

1. Potts M, et al. Lancet 2010;375:1762.
2. ACOG. ACOG Practice bulletin no. 76. Obstet Gynecol 2006;108:1039.
3. Bateman BT, et al. Anesth Analg 2014;119:1344.
4. Butwick AJ, et al. Am J Obstet Gynecol 2015;212(5):642.e1.

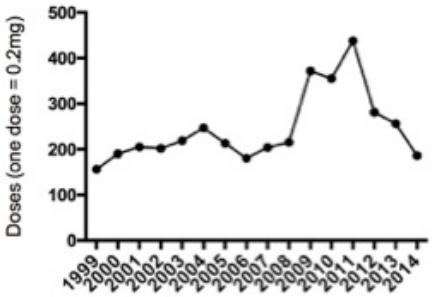

Figure 1a - Methylergonovine use per year

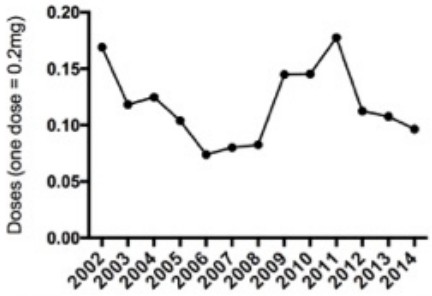

Figure 1b - Methylergonovine - Average use per delivery per year

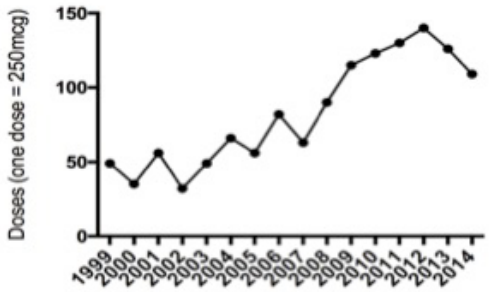

Figure 2a - Carboprost use per year

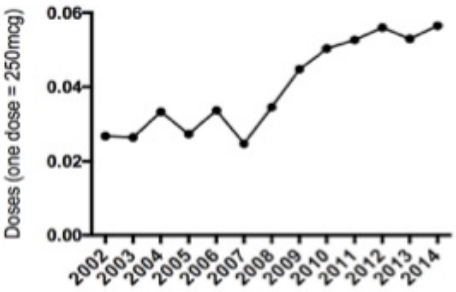

Figure 2b - Carboprost - Average use per delivery per year

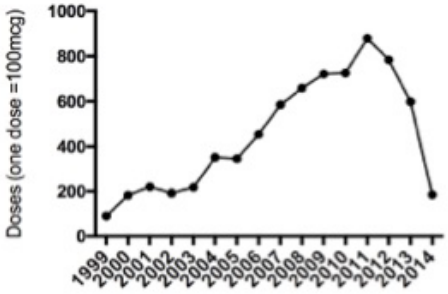

Figure 3a - Misoprostol use per year

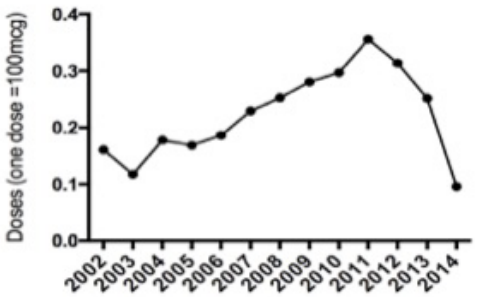

Figure 3b - Misoprostal - Average use per delivery per year

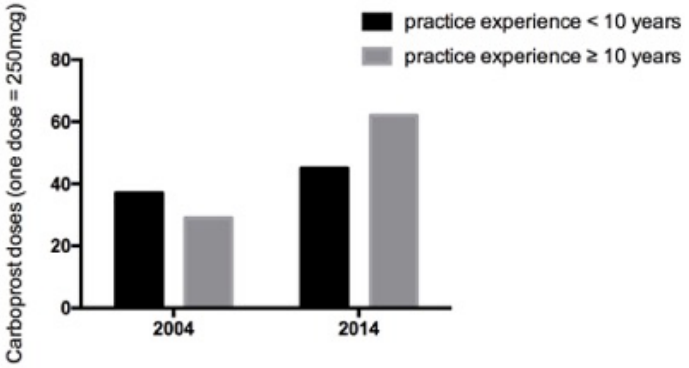

Figure 4 - Carboprost use based on different practice experience in 2004 and 2014

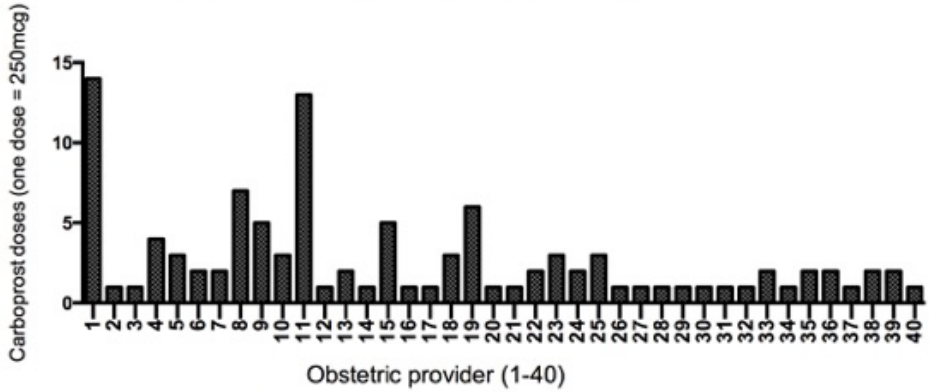

Figure 5 - Carboprost use based on different obstetric provider in 2014

Abstract #:F-16

Lumbar spine anatomy in women sustaining unintentional dural puncture during labor epidural placement: a descriptive study using magnetic resonance imaging and ultrasound

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Jose Carvalho M.D. Ph.D. - Department of Anesthesia, Mount Sinai Hospital, University of Toronto - Toronto, Ontario

Introduction: Unintentional dural puncture is one of the most frequent complications of the epidural technique. One previous study suggested that atypical sonoanatomy of the ligamentum flavum-dura mater unit may be a risk factor for this complication, however this study lacked confirmation by MRI(1). The objective of this study was to describe the sonoanatomy of the lumbar spine, as assessed by both MRI and ultrasound, in women sustaining unintentional dural puncture during epidural catheter placement for labor analgesia.

Methods: We approached women who sustained a recognized unintentional dural puncture during labor epidural placement. Those agreeing to participate had detailed documentation of the technical aspects of the epidural placement, including: pre-procedural ultrasound assessment or palpation, number of attempts, overall difficulty of placement, level of placement and operator experience. An MRI of the lumbar spine was performed in the immediate postpartum period to investigate for any spinal abnormalities, particularly those of the ligamentum flavum and dura mater. Additionally, all women had their lumbar spine scanned with ultrasound in both the transverse and longitudinal paramedian oblique views. Ultrasound images of the ligamentum flavum-dura mater unit in the transverse view were classified as typical, atypical or inconclusive. An atypical image was defined as that depicting all elements of the interspace, except for the ligamentun flavum-dura mater unit(1). All MRI images were reviewed by a neuroradiologist, who was blinded to the ultrasound images and to the level at which the unintentional dural puncture occurred.

Results: We included 10 women in the study. Half these punctures occurred despite experienced practitioners and no woman had an extremely low or high body mass index. The depth to loss of resistance was between 4 to 6 cm in all cases, 9 were at L3/4 and 1 at L2/3 level. Two women suffered two dural punctures each. Seven of the ten women developed postdural puncture headache and went on to have an epidural blood patch. Ultrasound imaging in the longitudinal paramedian oblique view produced typical images in all patients. However in the transverse view 7 of 10 women showed atypical or inconclusive scans, the atypical images being at either L4/5 or L5/S1 interspace. The MRI results for all women revealed no anatomical abnormalities, with the exception of 1 woman who had a ligamentum flavum gap left of midline at the L2/3 level (away from the puncture site).

Discussion: Our results suggest that unintentional dural punctures occur in likely anatomically normal women. Furthermore, the transverse ultrasound views may fail to demonstrate typical ligamentum flavum-dura mater unit at the lower lumbar levels despite its confirmed presence on MRI.

References:

1. Reg Anesth Pain Med 2008; 33: 266–270

Abstract #:F-17

The Risk of Post-dural Puncture Headache After Spinal and Combined Spinal-Epidural Compared to Epidural Anesthesia

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Pamela Flood M.D. - Stanford University - Stanford, CA
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Introduction: Post-dural puncture headache(PDPH) is a potentially serious complication associated with morbidity such as chronic headaches, seizures, cranial nerve palsies, and subdural hematoma(1). The comparative incidence of PDPH after spinal or combined spinal-epidural(CSE) compared to standard epidural is not well delineated. The study aim was to determine PDPH symptoms in a large cohort of women receiving these techniques for labor analgesia and cesarean anesthesia.

Methods: In this IRB-approved quality assurance analysis, we examined the records of women who received spinal, CSE or epidural for vaginal or cesarean delivery. The study was conducted from November 2014 to April 2015 at a large academic center. Data was derived from postpartum follow-up interviews conducted 24-48 hours after delivery. Detailed questions regarding postural headache and other PDPH-associated symptoms were obtained PDPH diagnosis was based on the international headache society criteria(2). A priori power analysis, based on historical institutional data, indicated 492 patients per group were needed to show a 3% difference in PDPH incidence between techniques.

Results: A total of 1276 records were examined. We excluded women who did not receive neuraxial anesthesia, and 7 women who had accidental dural punctures with the Touhy needle. There were 730 women in the spinal/CSE group and 521 women in the epidural group (Figure 1). The spinal/CSE group had a 2.7% (95% CI 1.8, 4.1) postural headache rate while the epidural group had a 1.5% (95% CI 0.8, 3.0) postural headache rate (95% CI of difference 0.06, 1.7; P=0.17). 1 of 8 patients with postural headache in the epidural group had other PDPH-associated symptoms and none required a blood patch. 10 of 20 spinal/CSE patients with postural headache had other PDPH-associated symptoms and 3 required a blood patch. Patients in the spinal/CSE group with postural headache had increased nausea and vomiting (28% vs 10% in the epidural group; P=0.01).

Conclusion: We did not find an increased risk of PDPH with spinal/CSE compared to epidural anesthesia. These results suggest that spinal/CSE and epidural techniques are equivalent with respect to postural headaches and PDPH syndrome. Future studies with larger sample sizes will be needed to determine if subtle difference between techniques exist, and if there are long term consequences of these differences.

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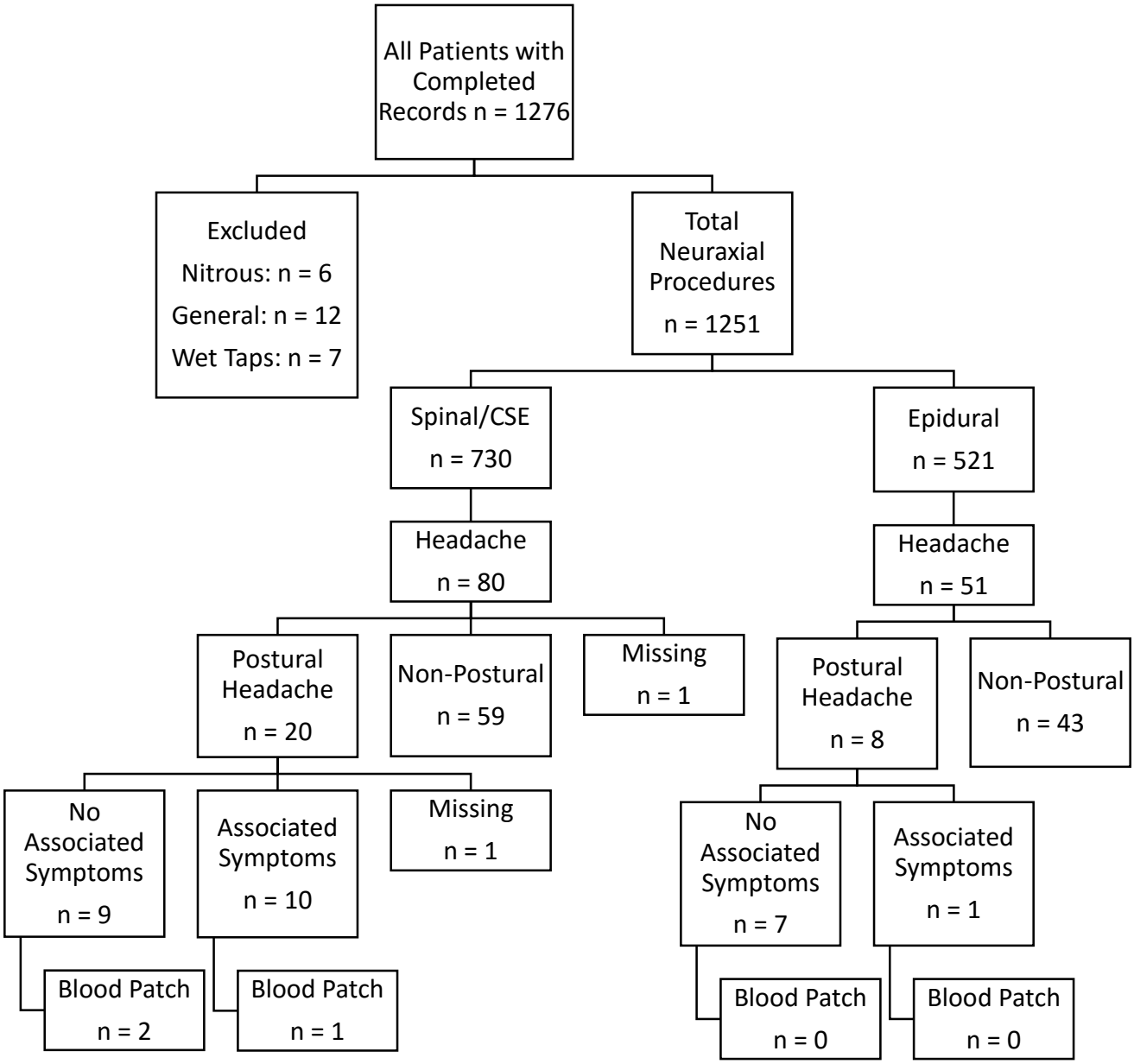
2. Cephalalgia 2013; 33(9):629-808


All Patients with Completed Records n = 1276
Excluded
Nitrous: n = 6
General: n = 12
Wet Taps: n = 7
Total Neuraxial Procedures
n = 1251
Spinal/CSE
n = 730
Epidural
n = 521
Headache
n = 80
Headache
n = 51
Postural Headache
n = 20
Non-Postural
n = 59
Missing
n = 1
Postural Headache
n = 8
Non-Postural
n = 43
No Associated Symptoms
n = 9
Associated Symptoms
n = 10
Missing
n = 1
No Associated Symptoms
n = 7
Associated Symptoms
n = 1
Blood Patch
n = 2
Blood Patch
n = 1
Blood Patch
n = 0
Blood Patch
n = 0

Abstract #:F-18

Subdural Hematoma Associated with Labor Epidural Analgesia and Post-Dural Puncture Headache: A Case Series

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Background: Subdural hematoma (SDH) after labor epidural analgesia is rare with a quoted incidence of 1:250,000 to 1:500,000.1 The proposed mechanism of SDH following labor epidural is low cerebrospinal pressure following unintentional dural puncture that leads to traction and tear of thin-walled meningeal blood vessels.2,3 We report a series of 11 obstetrical patients with subdural hematomas (SDH) that were associated with the use of labor epidural analgesia at a single, high-volume tertiary teaching hospital.

Description: All patients developed headaches consistent with post dural puncture headache (PDPH) prior to the diagnosis of SDH. 5 patients (50%) had a recognized unintentional dural puncture, 1 patient (10%) had a combined spinal and epidural with a 24 gauge pencil-point needle, and 5 patients (40%) had no recognized dural puncture. The SDH was diagnosed in 10 patients (91%) with radiologic studies an average 5.4 days (range 1-8 days) after performance of labor epidural analgesia. 3 patients were found to have small amount of intraventricular air at time of diagnosis. All patients without severe symptoms had a second hospital stay ranging from 2 to 4 days (average 2.8 days) for observation of the SDH. One patient experienced loss of consciousness and required neurosurgical intervention. Over the time period, 42,969 labor epidurals were placed and 437 inadvertent dural punctures were observed. Thus the observed institutional rate of labor neuraxial anesthesia-associated SDH was 0.026% (approximately 1:5000). The observed rate of SDH was 1.3% (approximately 1:100) if a recognized dural puncture occurred during labor epidural catheter placement.

Conclusions: We conclude that SDH as a result of dural puncture during placement of labor epidural is rare, but potentially more common than historically thought. SDH after unintentional dural puncture is likely underdiagnosed, and may be appropriately managed expectantly without surgical intervention if no other serious associated neurological signs are present. In fact, SDH associated with PDPH appears to be a frequently clinically incidental finding, the detection of which has the potential to increase healthcare utilization and cost.

References:

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3. Vaughan DJA. Br J Anaesth. 2000;84:518-20.

Case	*Age*	*G*	*P*	*Labor Analgesic*	*LOS 1*	*LOS 2*	*Recognized Dural Puncture*	*HA Hx*	*PreE*	*PDPH Hx*	*SDH Diagnosis*
1	28	2	1001	CSE	5	3	--	Yes	Yes	No	6
2	34	1	0000	Epidural	5	4	No	No	No	No	25
3	38	1	0000	Epidural	4	3	No	Yes	No	No	3
4	30	3	2002	Epidural	4	2	Yes	No	No	No	4
5	34	3	2012	Epidural	2	2	No	No	No	No	2
6	30	1	0000	Epidural	3	3	No	No	No	No	5
7	31	1	0000	Epidural	4	2	Yes	No	No	No	6
8	33	3	2002	Intrathecal Catheter	4	1	Yes	No	No	No	4
9	24	2	0010	Epidural	3	4	Yes	No	No	No	7
10	30	1	0000	Epidural	4	3	Yes	No	Yes	No	3
11	31	3	0020	Epidural	1	14	No	No	No	No	1

LOS1, length of stay for labor; LOS2, length of stay for SDH; HA Hx, headache history: PreE, pre-clampsia; PDPH Hx, post-dural puncture headache; SDH Diagnosis, number of days elapsed from time of neuraxial placement/dural puncture to subdural hemorrhage diagnosis

Abstract #:F-19

Identifying the True Incidence of PDPH after Accidental Dural Puncture in the Local Population

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Background: Accidental dural punctures (ADPs) during neuraxial techniques are infrequent – 0.16-1.3% incidence in non-obese and up to 4% in obese individuals— although when they occur the incidence of subsequent Post-dural puncture headache (PDPH) is estimated at 50-60%1,2. We have anecdotally observed a lower incidence of PDPH in our obese patients. This study examines the ADPs in the local patient population with the aim of determining whether an association exists between BMI and PDPH incidence.

Methods: We conducted a retrospective cohort study, searching our electronic medical records for patients that incurred an ADP during neuraxial techniques. All patients were parturients. All ADPs occurred with an 18g Tuohy needle, and the primary outcome was the PDPH incidence.

Results: Patients with ADPs (n=38) were assigned to either the obese group (BMI ≥ 30 kg/m^2, n=21) or the non-obese group (BMI <30 kg/m^2, n=17). The populations were compared with a chi-squared test with a P <0.05 considered significant. Total incidence of PDPH was 39.47% (15/38), with 9.5% of obese and 76.47% of non-obese patients developing a PDPH. Compared to the 50-60% rate of PDPH cited in literature, the rate demonstrated in our obese group was significantly different (P<0.001). No significant difference was observed between the non-obese group and the expected rate (P>0.05).

Discussion: Our results are consistent with other studies that suggest an inverse relationship between BMI and PDPH incidence. Peralta et al. used 17g Tuohy needles and reported a 39% incidence of PDPH in their high BMI group. The PDPH rate in our high BMI group was 9.5%, but with 18g Tuohy needles. Both studies found a lower incidence of PDPH in their respective high BMI groups as compared to the lower BMI groups. In the obese patients the purported protective mechanisms may be due to changes in the epidural/intrathecal spaces, with increased intra-abdominal and epidural pressures that ultimately reduce the CSF loss after ADP1,2. It is also possible that the magnitude of these protective mechanisms increases along with BMI, as 0/7 patients with a BMI ≥40 kg/m^2 developed a PDPH.

References:

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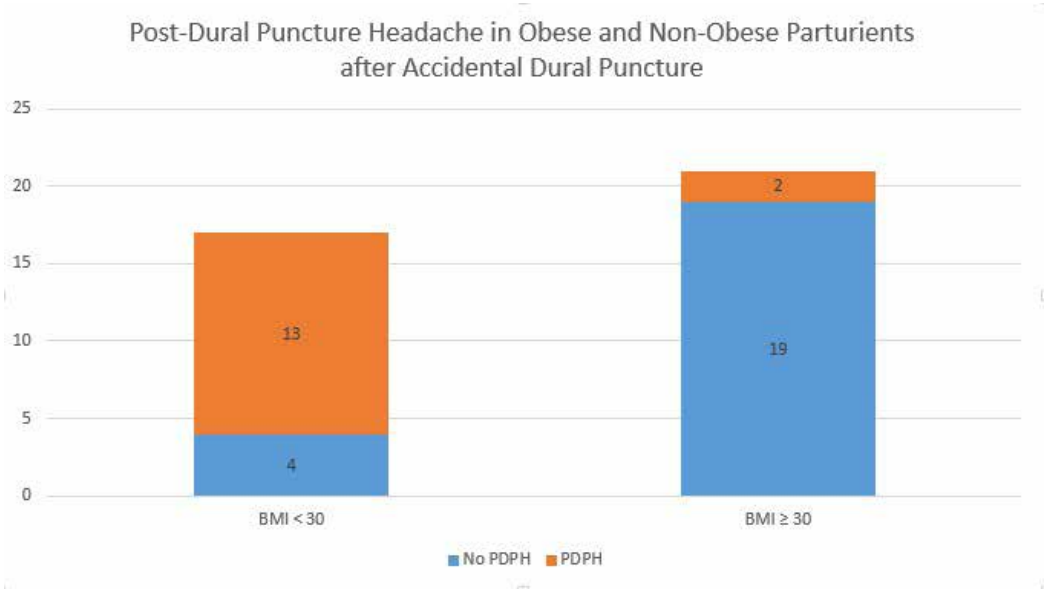
2. Peralta F, et al. The Relationship of body mass index with the incidence of postdural puncture headache in parturients. Anes and Analg 2015;121



Abstract #:F-20

Alkalinization of Local Anesthetics Increases Speed of Onset Through pH Stabilization at Physiologic Temperature: A Novel Mechanism

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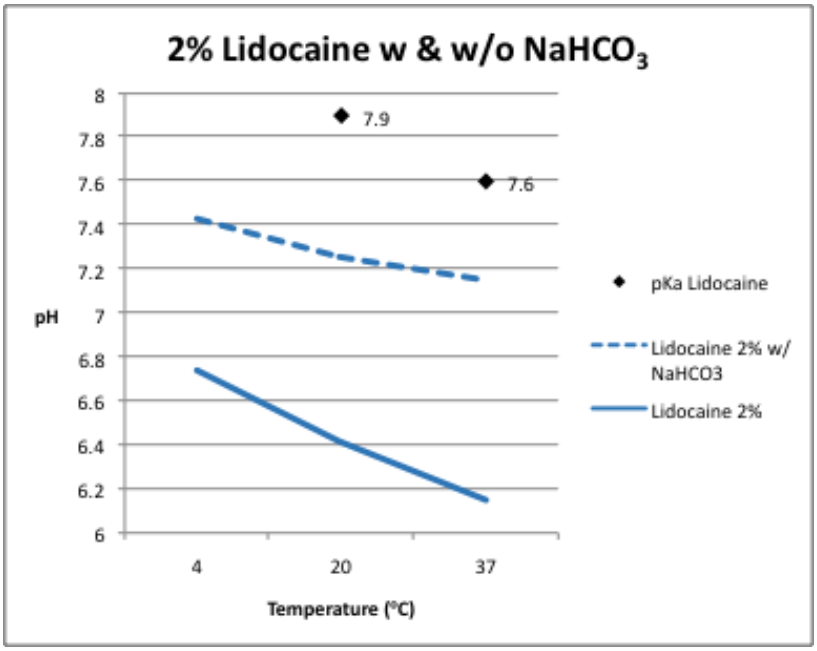
Introduction: The addition of sodium bicarbonate (NaHCO3) to local anesthetic (LA) has been shown in vitro and in vivo to increase the speed of onset of neuronal blockade. The increased speed of onset has been attributed to alkalinization of the local anesthetic closer to its pKa, which results in more unionized local anesthetic available to cross into the neuron.1 Temperature also affects the speed of onset, with increased speed of onset at physiologic temperature (PT) vs room temperature (RT).2 However, the potentiation of neuronal blockade by LA with bicarbonate is greater than expected when taking only pH change into consideration.1 We hypothesized that LA at PT would have a pH closer to its pKa, explaining the increased speed of onset, and that addition of NaHCO3 to the warm solution would result in an even larger increase in pH toward pKa.
Methods: The pH of 2% lidocaine was compared at RT (20C) and PT (37C) with and without NaHCO3 (10:1 mixture). The LA was placed in a water bath or ice bath set to the appropriate temperature. A Beckman 143800 200 pH meter was used to evaluate the pH of each solution. Each experiment was repeated in triplicate. The pH values were consistent for each temperature across the three measurements to within 0.01. Differences between the pH of the LA solution and the pKa of lidocaine at RT (7.9) and at PT (7.6) were calculated.3

Results: The pH of the LA decreases as the temperature increases to PT (Figure). With increasing temperature, the pH of the LA decreased 0.26 while the alkalinized LA decreased 0.1 At PT the difference between pH and pKa of the LA with and withouth NaHCO3 was 1.49 and 0.65 respectively. The difference at PT was 1.45 and 0.45 respectively.

Conclusions: The small improvement in the difference of pH to pKa in the plain LA (0.04) identifies the mechanism of the clinical difference in onset due to increased temperature. When we compare the LA with NaHCO3 to LA without, we see an exaggerated benefit to the warming. Though the pH of both solutions approach the pKa at PT, the pH of the alkalinized solution is less affected by temperature resulting in a significant improvement in pH toward pKa (0.2). We hypothesize a novel secondary mechanism by which addition of NaHCO3 increases the speed of onset of LA through the stabilization of pH as the LA warms in the physiologic environment.



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Abstract #:F-21

A retrospective audit comparing the effect of sodium bicarbonate on decision to delivery interval in patients receiving lidocaine and epinephrine epidural top ups

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Introduction: Epidural top up is a common method of anaesthesia for emergency lower segment caesarean section and there has been much debate about the best combination of drugs for this purpose, both in regards to speed of onset of block and quality of anaesthesia. In our institution we routinely use 2% lidocaine with 5 micrograms/ml epinephrine, with or without alkalinisation for such cases. Shortages of sodium bicarbonate in the past have necessitated the administration of epidural top ups without this addition. We have evaluated whether this has altered the decision to delivery interval (DDI).

Method: Three groups of 25 consecutive patients who had an epidural for labour and needed an emergency caesarean section were studied; the first group received an epidural top up mixture of 2% lidocaine, epinephrine 5 micrograms/ml and 2 ml 8.4% sodium bicarbonate (LBE1) in May 2013. The second group of patients received a mixture of 2% lidocaine and epinephrine 5 micrograms/ml (LE) in November to December 2013 and a third group received 2% lignocaine, epinephrine 5 micrograms/ml and 2 ml 8.4% sodium bicarbonate between November and December 2015 (LBE2). The number of patients in each group was determined using a power calculation.

A retrospective audit was performed. Category of lower segment caesarean section, adjuncts used intra operatively for pain, conversion to general anaesthesia and DDI were noted. Information was collected from patient notes and the E3 electronic maternity notes system.

Results: In the 75 patients, 1 patient from LBE1 and 1 patient from LBE2 were converted to general anaesthesia, following failure of top up with bicarbonate. The mean DDI in the LBE1 group was 40.8 min, in the LE group was 35.6 min and in the LBE2 group was 44.2 min.

Discussion: Lidocaine, bicarbonate and epinephrine and lidocaine and epinephrine mixture has been shown to be associated with a faster onset of anaesthesia for caesarean section than levobupivacaine (1). However the addition of bicarbonate to lidocaine mixture is controversial, it may introduce mixing errors and cause precipitation of lidocaine. A meta-analysis of published data suggested the use of ropivacaine as an alternative (2). Although there are theoretical reasons why onset of anaesthesia may be faster with the addition of bicarbonate this did not shorten decision to delivery time in this audit. We suggest a formal randomised controlled trial to examine this in more detail.

Conclusion: In this audit, addition of bicarbonate to lidocaine and epinephrine did not appear to reduce DDI in emergency section.

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Abstract #:F-22

Association between neuraxial analgesia and perineal trauma after vaginal delivery of patients with intra-uterine fetal demise (IUFD)

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Anna Palatnik M.D. - Northwestern University Feinberg School of Medicine - Chicago, IL
Robert J. McCarthy Pharm.D. - Northwestern University Feinberg School of Medicine - Chicago, IL

Introduction: Neuraxial analgesia has been cited as a risk factor for perineal trauma during vaginal delivery, although studies have shown conflicting results. Furthermore, the association between neuraxial analgesia and perineal trauma in patients with intrauterine fetal demise (IUFD) has not been carefully studied. The purpose of this study was to evaluate the incidence of perineal trauma with and without neuraxial analgesia and to model the relative risk of perineal laceration among risk factors in this patient population.

Methods: Patients with a diagnosis of IUFD from 2007 through 2016 were included in this retrospective study. The primary outcome was the incidence of perineal trauma in patients with IUFD in relation to the analgesic modality during labor and delivery. Secondary outcomes included the degree of laceration and the association of bupivacaine concentration with the incidence of laceration.

Results: A total of 442 patients met the definition of IUFD. There were 329 patients (78%) that received neuraxial analgesia. The incidence of perineal laceration was 20.2% (n=79); of those, 71 parturients received neuraxial analgesia compared to 8 patients in non-neuraxial group (23.1% vs. 9.5%, P<0.001). Among patients with perineal trauma in the neuraxial group, 38 patients (53.5%) received an infusion of bupivacaine 0.11% compared to 32 patients (45.1%) with bupivacaine 0.0625% (P=0.36). Multivariate logistic regression identified increased birth weight (OR=3.6, 95% CI [2.0, 6.6], P<0.001), lower BMI (OR=0.93, 95% CI [0.87, 0.99], P=0.014) and lower parity (OR=0.44, 95% CI [0.28, 0.69], P<0.001) as independent predictors of perineal laceration. The predictive accuracy (c-statistic) of the model was 0.91 (95% CI [0.87, 0.95]).

Conclusion: Neuraxial analgesia had a strong association with perineal injury. However, its causality is unclear due to selection bias from our clinical practice. Increased instrumental vaginal delivery related to neuraxial analgesia could play a role even though this technique is infrequently used in IUFD delivery at our institution. High birth weight was found to increase the incidence of perineal trauma significantly, while high BMI and increased parity appear to be protective.

References:

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		Neuraxial Group (329)	Non-Neuraxial Group (93)	Difference (95% CI)	*P* value
Incidence of Perineal Trauma		71 (23.1%)	8 (9.5%)	13.6 (5.4 to 21.8)	*P*<0.001
Laceration Degree	1	27 (9.1%)	4 (4.9%)	4.2 (1.9 to 10.3)	*P*=0.005
	2	28 (9.5%)	2 (2.4%)	7.1 (1.9 to 12.2)	
	3	5 (1.7%)	0	1.7 (-0.4 to 3.8)	
	Missing Data	14 (4.3%)	2 (2.4%)	1.8 (-2.6 to 6.4)	

Table 1. Incidence of perineal trauma and the degree of laceration in patients with and without neuraxial analgesia

	Patients with Perineal Trauma in Neuraxial Group (71)			*P* value
Bupivacaine Concentration in Epidural Infusion Bag	No Infusion Bag	Low (0.0625%)	High (0.11%)	
Patient Number	1 (1.4%)	32 (45.1%)	38 (53.5%)	*P*=0.364

Table 2. Association of bupivacaine concentration in patients with perineal trauma in neuraxial group

Abstract #:F-23

Intrathecal Morphine Administration for Spinal Anesthesia for Cesarean Delivery

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Background: Intrathecal morphine (ITM) provides optimal analgesia following cesarean delivery (CD). (1) Recent data from Israel suggest that ITM is frequently not administered. (2) We investigated factors associated with ITM administration for women undergoing CD under spinal anesthesia in a both a community and tertiary medical center in Jerusalem, Israel. Methods: Women who had CD from 02/2007 to 11/2015 were identified from an anesthesia information management system (AIMS) (Metavision, iMDsoft, Tel-Aviv, Israel). We identified all women who received spinal anesthesia including combined-spinal anesthesia, and women who underwent conversion to general anesthesia. We used logistic regression to identify factors associated with ITM administration for spinal anesthesia.

Results: Within the study cohort, 10,674 women had CD; 7, 686 (72%) received spinal anesthesia. ITM was administered to 5,909 (77%) of women in the study cohort. In our multivariate model, emergency surgery (aOR = 0.27; 95% CI = 0.25 – 0.29) was associated with decreased likelihood of ITM administration during spinal anesthesia for CD. CD in the tertiary center (aOR = 1.36, 95% CI = 1.25-1.48), and ASA 1 or 2 (aOR = 2.58; 95% CI = 1.91 – 3.49) were independently associated with increased likelihood of ITM administration during spinal anesthesia for CD. Maternal body weight above 70 kg (aOR 0.97, 95% CI = 0.89-1.07), resident only anesthesia provider (aOR = 1.26, 95% CI = 1.16-1.38), and CD during weekend shifts (aOR 1.10, 95% CI = 0.97 – 1.26) did not impact the likelihood of ITM administration.

Conclusion: In our study cohort, almost one-quarter of women who had spinal anesthesia for CD did not receive ITM. Findings provide an insight into factors associated with decreased likelihood of ITM administration, and will help facilitate strategies to help increase ITM use e.g. pre-made ITM for use during emergency CD; clinician education initiatives for non-obstetric anesthesia specialists in community practices. Our analysis also shows the utility of AIMS for quality improvement projects within and across medical institutions.

Table. Factors measured for association with intrathecal morphine administration for spinal anesthesia cesarean delivery

	N (%)	aOR	95% CI
Maternal weight			
Above 70 kg	7963 (74.6%)	0.97	0.89-1.07
Below 70 kg	2706 (25.4%)		
ASA			
1 or 2	10447 (97.9%)	2.58	1.91 – 3.49
3 or greater	222 (2.1%)		
Cesarean delivery			
Elective	5979 (56.0%)	0.27	0.25 – 0.29
Emergency	4701 (44.0%)		
Grade of Anesthesiologist			
Attending	5312 (49.7%)	1.26	1.16-1.38
Attending and resident	1847 (17.3%)		
Resident only	3515 (32.9%)		
Institution Hospital			
Community	6620 (62.0%)	1.36	1.25-1.48
Tertiary	4054 (38.0%)		
Workshift			
Weekday	9391 (88.0%)	1.10	0.97 – 1.26
Weekend	1283 (12.0%)		

Key: aOR = adjusted Odds Ration; CI = confidence interval

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Abstract #:F-24

Current prescribing practices in the UK for post-operative analgesia following caesarean section

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Background: Current controversies exist in the UK about safety of analgesic medication in postpartum women. The Medicines and Health Products Regulatory Agency (MHRA)(1) and European Medicines Agency (EMA)(2) recently recommended that codeine is avoided as post-operative analgesia in breastfeeding mothers due to fears about transmission to neonates and resulting respiratory depression(3,4). This survey aimed to establish how these recommendations have affected individual prescribing practices in the UK.

Methods: An Obstetric Anaesthetists' Association (OAA) survey on prescribing practices for post-operative analgesia following caesarean section (CS) was produced and sent to Consultant members of the OAA in 2015. 599 responded giving a response rate of 46%.

Results: 72% of respondents prescribe opiate based medication for women who have a CS under regional anesthesia (RA). 99% prescribe opiate based medication following a CS under general anesthesia (GA). 6% continue to prescribe codeine for CS under RA; 4% for CS under GA. Alternatives to codeine include dihydrocodiene, tramadol, oral morphine with the addition of IM, IV and PCAS morphine in the GA group. 39% routinely ask mothers about breastfeeding prior to prescribing analgesia. 76% would prescribe the same analgesia irrespective of whether patients were planning to breastfeed. Only 16% routinely counsel mothers on potential complications for her baby from post-operative analgesia. 61% of responders were aware of local hospital guidance which specifically mentions avoidance of codeine in breastfeeding mothers.

Discussion: This UK survey shows a low codeine prescribing rate suggesting MHRA and EMA recommendations are being followed. Combine this with a minority asking about breastfeeding and a majority not altering prescribing habits despite this and it suggests that an effective pain medication is under-utilised in the non-breastfeeding population.

Conclusion: Low post-operative analgesia counselling rates in this patient group could be seen as a missed opportunity to individualize patient medication. A patient information leaflet on analgesia side effects and implications for breastfeeding may be a way to open discussions and educate mothers about breastfeeding and post-operative analgesia.

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Abstract #:F-25

Patterns of opioid use following discharge after cesarean delivery

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Ruth Landau M.D. - Columbia University - New York, NY

Introduction: Prescription opioid abuse has emerged as a significant public health issue in the U.S.[1], with leftover medications representing a major source of misused or diverted opioids[2]. With over 1.3 million cesarean deliveries (CDs) performed annually in the U.S, it is imperative to align the amount of post-discharge opioids that are prescribed and consumed. Currently, the amount of opioids typically required following discharge from CD is not known. We therefore designed a study to evaluate patterns of oral opioid use after CD.

Methods: This study and its associated survey was conducted at 6 academic medical centers in the U.S. from 9/2014 to 1/2016. Women undergoing a CD were contacted by phone two weeks after discharge and answered a standardized interview about their use of oral opioids. Clinical variables were abstracted from the women's medical records.

Data were summarized as proportions or medians with interquartile ranges. Differences in proportions were compared across groups using chi-square and in continuous variables using the Kruskal-Wallis test. Independent predictors of the number of pills consumed were defined using negative binomial regression.

Results: A total of 667 women were enrolled; of these, 576(86.4%) filled an opioid prescription. Oxycodone was the most commonly prescribed opioid (85.4%), followed by hydrocodone (7.4%) and hydromorphone (7.2%).

The median number of dispensed tablets was 40 (IQR 30 to 40), the median number of consumed tablets was 20 (IQR 8 to 30), and median number of leftover tablets once the patient finished taking opioid was 15 (IQR 3 to 28). Of those with leftover opioids, 93.2% had not disposed of the excess medication at the time of the interview.

Tertiles were defined corresponding to the number of pills dispensed (≤30, 31 to 40, >40). The median number of pills consumed varied in these groups: the median for ≤30 was 15 (IQR 5 to 23), for 31 to 40 was 20 (IQR 10 to 36), and for >40 was 30 (IQR 10 to 50), $p<0.001$. However, the proportion of patients in each group who reported being very satisfied/ satisfied with their pain regimen was similar across the 3 groups (86%, 87%, and 86%, respectively; $p=0.99$).

Independent predictors for consuming higher numbers of pills included a pain score ≥4 at the time of hospital discharge ($p<0.05$) and increasing number of pills dispensed ($p<0.01$).

Conclusion: The amount of opioid prescribed following CD generally exceeds the amount consumed by a significant margin, leading to substantial amounts of leftover medication which patients generally retain. To minimize the risk of misuse or diversion from medication leftover after CD, strategies to reduce the amount of opioid medication prescribed should be pursued. Patients should be informed about the importance of properly disposing of leftover medication.

References

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Abstract #:F-26

Intrathecal Hydromorphone vs. Intrathecal Morphine: A study comparing efficacy, side-effect profiles and optimum dose of hydromorphone

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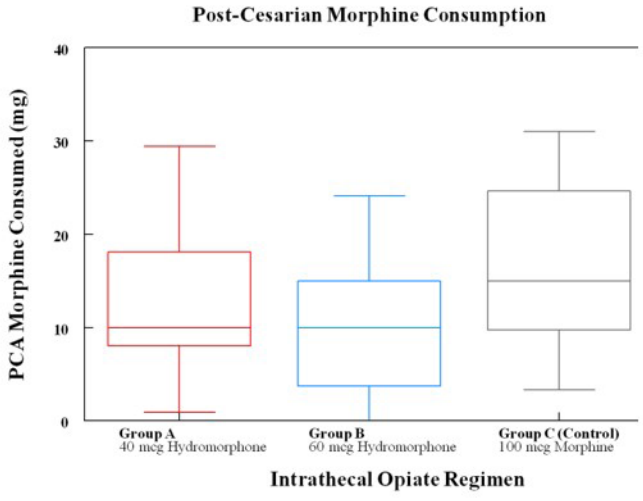
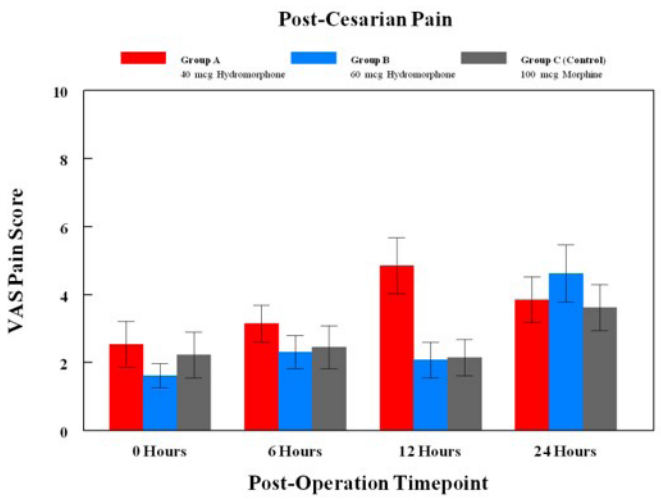
Introduction: Recent shortage of preservative free morphine forced anesthesiologists to use Hydromorphone as an alternative to provide comparable post-operative analgesia for cesarean section. This is the first prospective study to compare the efficacy and side effect profiles between intrathecal (IT) morphine and intrathecal hydromorphone and to determine the optimum dose of IT hydromorphone.

Method and Study Design: It is a prospective randomized double blinded study. After IRB approval and written informed consent, parturients scheduled for elective cesarean section under spinal anesthesia are randomly assigned as per protocol to receive IT hydromorphone 40 mcg (Group A), 60 mcg (Group B), or IT morphine 100 mcg (Group C) along with 12 mg of hyperbaric bupivacaine. Time of first opiate usage, postoperative opiate consumption, pain scores by VAS at 0,6,12 and 24hrs and the patient's satisfaction score, incidence of pruritus, nausea, vomiting, sedation and respiratory depression were collected. 42 participants (out of 105) had been enrolled so far.

Results: Preliminary statistical analysis using ANOVA for all three groups showed that both 40mcg and 60 mcg of IT hydromorphone is similar in efficacy compared to 100 mcg of IT morphine (Figure). Comparison of PCA morphine consumption between the groups was similar. However, the median consumption of PCA morphine in Group A (12.8 mg) and B (9.9 mg) was less than Group C (16.4 mg). Comparison of post-op pain scores (VAS) and patient satisfaction scores were similar between the three groups. None of the participants reported respiratory depression, hypoxemia, or decrease in sedation score. The other side effects like nausea, vomiting, urinary retention are similar in all groups, except itching, which is slightly more in group B recipients (0.4 vs 0.92 vs 0.38; p = 0.010). With continued patient enrollment, we hope to refine our analyses with greater statistical power.

Conclusion: This preliminary results showed IT hydromorphone in 40 mcg or 60 mcg has similar analgesic effect and is a safe alternative to IT morphine 100 mcg for post-operative analgesia for cesarean section.





Abstract #:F-27

Barriers to Discharge Following Scheduled Cesarean Delivery: Is Obstetrics Ready for Enhanced Recovery After Surgery?

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Background: As enhanced recovery after surgery (ERAS) programs increase in popularity and show improved outcomes for colorectal and other abdominal surgeries, institutions are expanding these evidence based practices to other surgical fields, optimizing post-operative pain control, length of hospital stay, return of bowel function and patient satisfaction. Given that cesarean delivery (CD) remains one of the most common surgical procedures in the United States, the implementation of ERAS protocols in this population could have a significant impact on healthcare resource utilization by improving patient outcomes and minimizing length of stay. The goal of this study was to demonstrate a need for an ERAS protocol for scheduled CD and to identify factors that could be barriers to discharge following CD.

Methods: After Institutional Review Board (IRB) approval, a chart review was conducted for scheduled CDs from November 2014 through November 2015 at the University of North Carolina Hospitals in Chapel Hill, North Carolina. Patient demographic data was evaluated to identify any apparent associations with length of stay. In addition, the most recent 38 patients were surveyed by telephone and asked if they preferred an earlier discharge, and what major factor they believed played a role in lengthening their hospital stay.

Results/Discussion: Of 328 cesarean sections, the mean length of stay was 3.1 days with a mean patient age of 31.9 years and body mass index (BMI) of 31.5. Increased parity and lower ASA scores were associated with decreased length of stay. BMI, age, race, surgical time, surgery day of the week and type of neuraxial anesthetic were not statistically significant with the corresponding length of stay, similar to the findings presented in an ERAS study by Wrench et al. In our telephone survey, 14/38 (36.7%) of the patients said they would have preferred to be discharged home one day earlier. More importantly, 17.1% of patients were discharged on POD 2, demonstrating the feasibility of early discharge. 26.7% of patients were discharged on POD 4, suggesting that a significant number of patients could reduce their length of stay. Barriers to discharge reported by survey participants included pain (39%), latching (21%), no issues (16%), problem with infant (13%), and other (11%). In the next phase of our project, we plan to address some of the issues identified in our survey by implementing a multi-disciplinary ERAS protocol that combines evidence-based standards of care for perioperative management to improve readiness for discharge after CD.

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Abstract #:F-28

An observational study of post-cesarean delivery respiratory patterns using a non-invasive minute ventilation monitor

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Background: Morphine is commonly injected neuraxially for post-cesarean delivery (CD) analgesia. We previously reported no respiratory depression (RD) in 5036 parturients who received neuraxial morphine (NM) despite a high incidence of obesity1. However, conventional intermittent monitoring could not exclude episodes of minor hypoventilation and the incidence of RD in high-risk parturients remains unknown. This has led some centers to withhold NM in some high-risk parturients. In this study, we monitor parturients who received NM using a non-invasive, continuous respiratory volume monitor (RVM) that measures respiratory rate, tidal volume, and minute ventilation (MV)

Methods: Continuous RVM (ExSpiron, Respiratory Motion, Waltham, MA) and opioid administration data were collected prior to and for 24 h following elective CD under neuraxial anesthesia with 150 mcg intrathecal or 3-mg epidural morphine. Demographics and co-morbidities were collected, and obstructive sleep apnea (OSA) screening tools were administered. Predicted MV (MVPRED, based on B.S.A) was calculated and Low MV (LMVe) was defined as MV < 40% MVPRED for > 1-min. LMVes were plotted over 24 h along with NM, intravenous and oral narcotics. Clinicians were blinded to the RVM measurements and followed routine care protocols.

Results: 13 parturients (mean (range) age, 32 yrs (18-81); BMI, 40.7 kg/m2 (26-57)) were included in this ongoing study. Only 2 patients (Figure 1, BMI 55 and 57 kg/m2) experienced repeated LMVe in the first 24 h following NM administration. Although neither had an OSA diagnosis, patient12 had numerous risk factors for OSA on screening questions. No abnormal vital signs were documented in either subject's chart surrounding these LMVe. Of note, 2 subjects in this sample with diagnosed OSA had no LMVe.

Conclusions: In this small observational study, only 2 parturients experienced repeated LMVe, but this did not result in adverse outcomes. Larger studies might identify clinically relevant adverse respiratory events. Current clinical practices, based on intermittent vital signs monitoring, may be incapable of identifying such events. Continuous RVM monitoring may prove useful for monitoring high-risk parturients receiving NM. More data are needed to quantify the true incidence of post-operative hypoventilation among parturients with NM and to identify patients who may benefit from additional monitoring.

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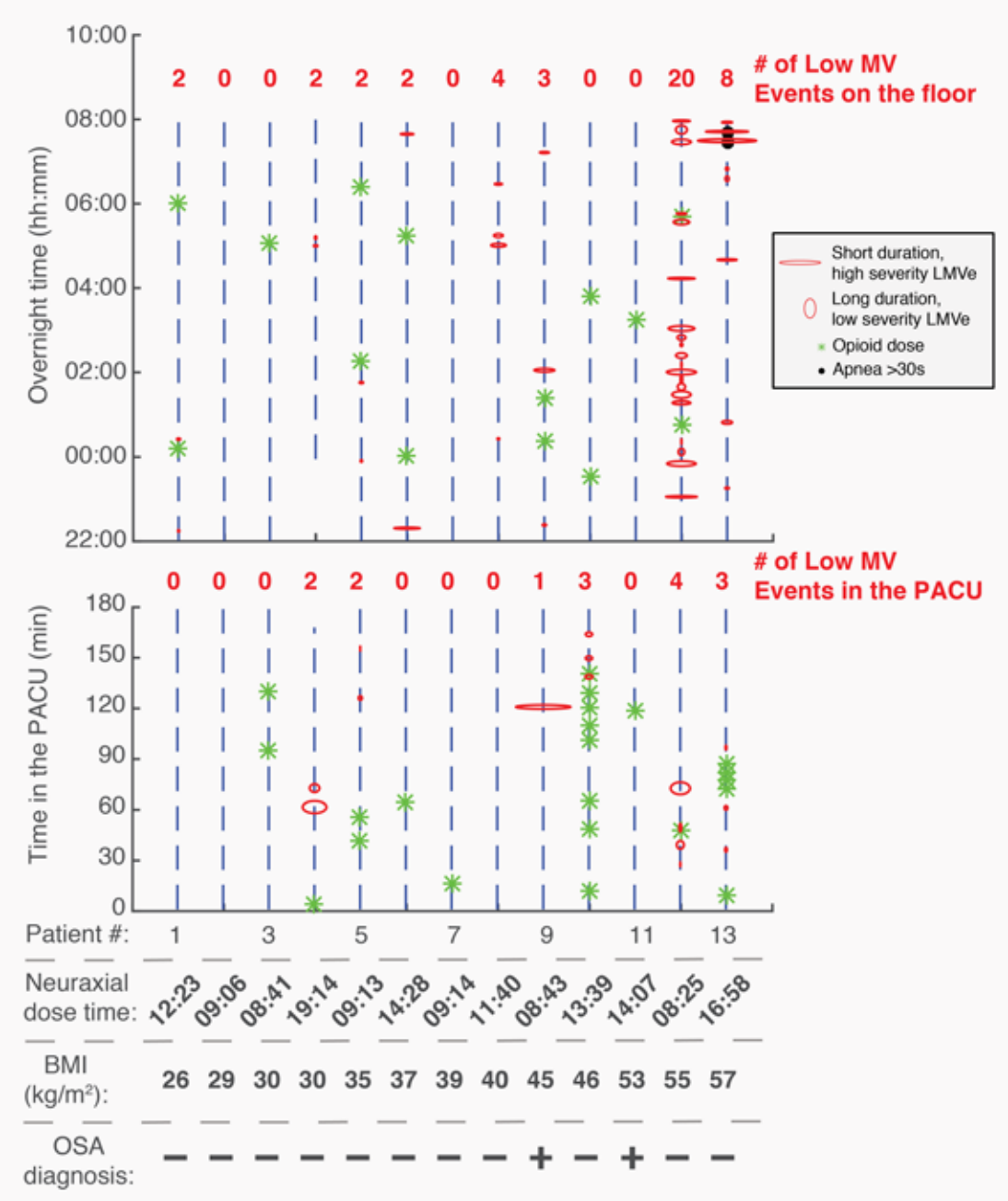
10:00
08:00
06:00
04:00
02:00
00:00
22:00
Overnight time (hh:mm)
2 0 0 2 2 2 0 4 3 0 0 20 8
# of Low MV Events on the floor
Short duration, high severity LMVe
Long duration, low severity LMVe
Opioid dose
Apnea >30s
180
150
120
90
60
30
0
Time in the PACU (min)
0 0 0 2 2 0 0 0 1 3 0 4 3
# of Low MV Events in the PACU
Patient #: 1 3 5 7 9 11 13
Neuraxial dose time: 12:23 09:06 08:41 19:14 09:13 14:28 09:14 11:40 08:43 13:39 14:07 08:25 16:58
BMI (kg/m²): 26 29 30 30 35 37 39 40 45 46 53 55 57
OSA diagnosis: – – – – – – – – + – + – –

Abstract #:F-29

A Randomized Controlled Trial Comparing Combined Spinal- Epidural Dosing Strategies for External Cephalic Version

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Introduction: Breech presentation is a leading cause of cesarean delivery (CD). ACOG recommends that external cephalic version (ECV) should be offered whenever possible to reposition the fetus to facilitate vertex vaginal delivery, thus avoiding the morbidity associated with CD. Anesthetic techniques for ECV range from no analgesia to systemic opioids to neuraxial techniques. Meta-analyses of RCTs suggest that neuraxial techniques employing higher doses of local anesthetic result in increased ECV success1.

Methods: We conducted a prospective, randomized trial to assess the impact of bupivacaine dose (2.5, 5, 7.5, 10 mg) with fentanyl 15 mcg as part of a combined spinal-epidural on the success rate of ECV for breech presentation. Patients and OBs were blinded to group assignment. Secondary outcomes included mode of delivery, patient pain scores and satisfaction, Obstetricians' perceived abdominal relaxation, length of stay, incidence of complications, and hypotension requiring vasopressor treatment.

Results: 240 subjects provided informed consent and 229 completed the study. ECVs were performed by 79 obstetricians with median performed 2 [1 to 18]. There was no difference among groups in ECV success (P=0.99). (Table) The mode of delivery and indication for CD were similar among groups. One emergent CD occurred in each group temporally related to the ECV procedure. Obstetrician perception of abdominal relaxation was similar among groups. Pain scores (VAS) for the procedure were low in all groups. Hypotension requiring treatment and time to discharge were increased with escalating bupivacaine doses.

Discussion: Our results do not support the hypothesis of a neuraxial dose-response effect on ECV success. Previous trials comparing neuraxial technique to nothing or to systemic opiate for ECV were limited by lack of patient and obstetrician blinding. Our overall ECV success rate of 51% was comparable to our previously published rates, but lower than other studies using high dose neuraxial techniques2. It is unclear why our success was relatively low, but this may be related to institutional practice (e.g., technique, number of attempts, threshold to abort procedure). We conclude that escalating bupivacaine dose does not confer an increase in ECV success or NSVD, but does incur an increase in hypotension and prolong length of stay.

References

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Table 1: Effect of intrathecal bupivacaine dose on external cephalic version outcomes

	Bupivacaine intrathecal dose (mg)				
	2.5 (n=58)	5mg (n=56)	7.5mg (n=58)	10mg (n=57)	*P*
Successful version n (%)	29 (50)	29 (52)	30 (52)	28 (49)	0.99
Vaginal delivery n (%)	24 (41)	21 (38)	27 (47)	21 (37)	0.70
Indication of cesarean delivery n (%)					
Malposition	27 (79)	26 (75)	25 (81)	26 (72)	
Arrest of labor	4 (12)	4 (11)	2 (6)	4 (11)	0.96
Non-reassuring fetal status	3 (9)	5 (14)	4 (13)	6 (17)	
Obstetrician rating of abdominal relaxation (0-100 scale)	78 (63 to 91)	83 (71 to 92)	84 (77 to 94)	87 (72 to 95)	0.16
Pain during procedure (0-100 scale)	12 (1 to 18)	5 (1 to 19)	4 (0 to 9)	5 (0 to 10)	0.005
Hypotension requiring treatment n (%)	27 (47)	43 (77)	53 (91)	49 (86)	<0.001
Patient satisfaction (0 to 10)	10 (9 to 10)	10 (9 to 10)	10 (8 to 10)	10 (8 to 10)	0.62
Time from anesthetic initiation to discharge (min)	209 (178 to 291)	230 (180 to 258)	286 (117 to 355)	315 (241 to 363)	<0.001

Data presented as n (%) or median (interquartile range)

Abstract #:F-30

Impact of prolonged second stage on epidural failure rate

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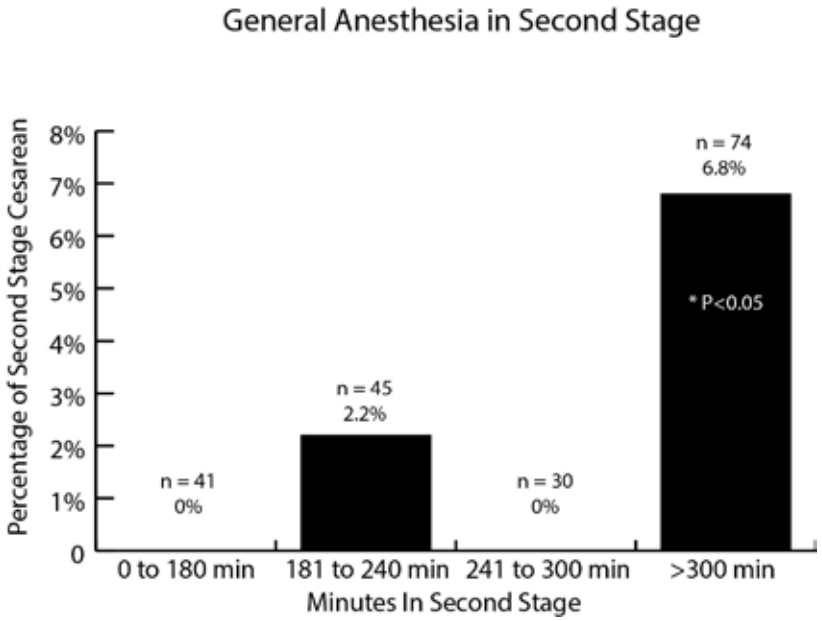
Yunping Li M.D. - Beth Israel Deaconess Medical Center - Boston, MA

Background: The American College of Obstetrics and Gynecology recently changed the recommendations for the length of labor and second stage (2ndSt) to continue as long as the fetus tolerates. Since this change we have seen more parturients with a 2ndSt of over 5 hours. We observed that it is more challenging to convert a labor analgesic to epidural anesthesia, and general anesthesia (GA) is frequently required. Previous research has not identified length of 2ndSt as a risk factor for GA.(1) We hypothesize this was because 2ndSt was uniformly short and terminated by time, not by fetal descent. The aim of this study was to determine if the need for GA is related to the length of 2ndSt.

Methods: Data for conversion of labor epidural analgesia to cesarean anesthesia was collected from two years prior to the guideline change (2011/2012: Period 1) and two years after (2014/2015: Period 2). Patient demographic data, labor course, obstetric and anesthetic factors, and anesthetic technique were recorded. We also determined if the catheter was replaced immediately prior to cesarean. We compared conversion success on non-STAT cesareans with cesarean done during 2ndSt. Rates of GA were compared in periods. To assess the impact of the change of practice for Period 2, we compared rates of GA by length of 2ndSt. Chi-square and trend analysis were used. $P<0.05$ considered significant.

Results: Total cesarean: 999, 41 were STAT (rate of GA was 4.6% and rate of supplementation 12.9%). 2ndSt cesarean 333 (GA: 4.8%, supplementation: 13.8%). There were no differences in the rates of supplementation between periods. The incidence of 2ndSt >300 min increased from Period 1 to 2 (12.4% to 38.7% $p<0.001$). During Period 1 (n=134 non-STAT) there was no difference in the rate of general anesthesia (P=0.55). During Period 2 (n=190 non-STAT) we found a statistically significant increase in GA rate by length of 2ndSt ($P<0.05$; Figure). Replacing the epidural catheter immediately before CS did not reduce the rate of GA (Not repl. 4.2% vs. 10.5% repl. P=0.22).

Conclusions: A parturient whose second stage is allowed to progress beyond five hours is at an increased risk of requiring GA for cesarean delivery. Our findings highlight the importance of preparedness for conversion failure. Replacement of the epidural catheter may not be the only solution, as we found no improvement in conversion.



Reference:
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Abstract #:F-31

Do Emergent Cesarean Deliveries Have Worse Neonatal Outcomes When Performed After "Normal" Business Hours?

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Our hypothesis was that neonates delivered via emergent Cesarean delivery after hours will have a higher proportion of low APGARs (5 or less), NICU admissions, and lower cord pH and BE, compared to neonates delivered between 7AM and 5PM. Our study methodology was a retrospective chart review (November 2012-January 2015) analyzing markers consistent with poor neonatal outcomes in patients who underwent an emergent Cesarean delivery. Other variables we considered included: time of delivery, maternal parity, gestational age, type of anesthesia, OB fellowship trained vs. generalist anesthesia staff, maternal BMI, interval between decision to actual delivery, indication for emergent delivery, and primary vs. repeat Cesarean. Our statistical methodology included chi-squared testing, t-test, ANOVA and regression analysis.

Our results included a sample size of 124 patients, 57 during business hours and 67 after business hours, to fulfill a power of 80%. The primary indication for emergent cesarean delivery was non-reassuring fetal heart tones (FHT's). Category 2 FHT's comprised 31.4% of deliveries, followed by Category 3 FHT's at 14.6% and terminal decelerations also at 14.6%. Other indications included placental abruption, cord prolapse, malpresentation and uterine rupture. Our primary outcome revealed that there was no statistical difference in outcomes during business hours compared to after hours when analyzing APGARs, cord pH, cord BE, and NICU admissions. The secondary results regarding anesthetic concerns include modality of anesthesia and staff training. The most used anesthetic for these patients was an epidural, which made up more than 50% in both arms of the study. This finding is most likely due to the high percentage of laboring patients receiving an epidural, that was then able to be converted to an anesthetic for surgery.

Our study revealed that fellowship training for anesthesiologists did not affect neonatal outcomes. Only the type of anesthetic showed a statistical difference. Patients that had general anesthesia or spinals for an emergent cesarean delivery had lower APGARS at 1 minute and more NICU admissions. This is likely due to the level of acuity of the presenting patient; for example, a uterine rupture presenting urgently to the hospital receiving a general anesthetic as compared to a category 2 FHT that is emergently brought to the OR with a working epidural.

This study shows that at our institution neonatal outcomes do not differ based on time or day of delivery. Our data have encouraged us to counsel patients that are at higher risk for emergent cesarean delivery to receive an epidural as neonates delivered with this anesthetic have better outcomes than if general or spinal anesthesia is induced.

Abstract #:F-32

Reaching a Decision to Incision Time Goal of 30 Minutes: Redefining Possibility in a High-Risk Academic Obstetric Practice

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Background: Reducing the time from decision for cesarean delivery (CD) in labor to incision (DTI) is an important obstetrical safety goal (1). The purpose of this quality improvement project was to identify strategies to reduce DTI at a large, academic hospital.

Methods: Mean DTI was assessed by a retrospective chart review of non-scheduled CDs over 3-months and providers were surveyed about their perspectives on DTI. These data were used to inform the improvement process. Lean A3 problem-solving methodology (2) including a multidisciplinary team of key stakeholders was used to address issues with DTI.

Results: Mean DTI for 91 non-scheduled CDs was 88 min with a standard deviation of 72 min. 107 providers (30 OB providers, 46 nurses and 31 anesthesiologists) responded to a survey about DTI (36% response rate). 60% of providers estimated actual mean DTI on the unit to be 30-60 min. However, 70% of OB providers, 61% of RNs and 32% of anesthesiologists responded that an appropriate DTI time was 0-30 minutes (p=0.02). 64% of providers felt that communication about DTI was poor or fair.
Using these data to inform the process, a multidisciplinary team including attending obstetricians, obstetric anesthesiologists, labor nurses, administrative nurses, residents and fellows from Obstetrics and Anesthesiology participated in development of an A3. The current processes for relocating a patient from a labor room to the operating room (OR) were described in detail by each provider type. With the current state clearly defined, various counter-measures were identified and an intervention designed.
The intervention involved identifying specific clinical conditions that frequently precede a decision for CD (e.g. pushing for 2 hours without progress) to trigger a pre-decision time ("PDT") huddle of all provider types to create situational awareness of the impending CD. Additionally, a "PDT" checklist was created to specify resources needed to move a patient to the OR and confirm that those resources are made available after a "PDT" huddle occurs. By completing these steps in advance, once the decision for CD is made, only the process of physically moving the patient to the OR remains.

Conclusions: Assessment of the current state of DTI on our unit identified a need for a multidisciplinary and systematic approach to reducing DTI. Lean improvement methodology was used to develop an intervention with buy-in from all of our Obstetrics-related disciplines. Further evaluation of DTI after implementation of the intervention will be used to assess the intervention and identify a need for further improvement.

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Abstract #:F-33

Delivery Outcomes in Subsequent Delivery Following Prior Breech Presentation

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Background: Breech presentation is a common indication for cesarean delivery (CD) (1). Alternatively, external cephalic version (ECV) may enable attempted vaginal delivery. We investigated delivery mode and maternal outcomes during subsequent deliveries following breech presentation, managed either by primary breech CD versus successful ECV.

Methods: We used the Labor and Delivery electronic medical record (EMR) to identify all women who underwent primary CD for breech presentation; and an ECV database to identify all women who had successful ECV for breech presentation, in one tertiary medical center, 2003-2013. The identified cases of primary breech CD and successful ECV were designated as the index delivery cohort (n=815); women with prior CD were excluded. We identified subsequent deliveries among the index delivery cohort. Multivariable analysis was used to report subsequent maternal delivery outcomes adjusted for maternal age and parity, comparing primary breech CD versus successful ECV at the index breech presentation. Outcomes include subsequent cesarean delivery, adverse maternal complication composite, placental complications, hemorrhage, infection, and complications associated with vaginal delivery or CD.

Results: We report 560 women with primary breech CD and 877 subsequent deliveries; and 255 women with successful ECV and 582 subsequent deliveries. Among the 1459 subsequent deliveries, women were significantly more likely to undergo subsequent CD following primary breech CD versus successful ECV during the index breech presentation, adjusted Odds Ratio (OR) 4.0; 95% Confidence interval (CI) 2.7-5.9. The adjusted adverse maternal complication composite was significantly more likely to occur among women undergoing subsequent delivery following primary breech CD versus successful ECV, OR 1.6; 95% CI 1.2-2.2. Subsequent delivery outcomes following index primary breech CD versus successful ECV are presented in the Table.

Conclusions: Delivery mode for breech presentation with no prior CD may affect maternal outcome for subsequent deliveries. Primary breech CD is associated with higher likelihood of subsequent CD, and is associated with higher likelihood of complications, including infection. ECV may be a suitable management strategy for women with breech presentation who are planning further pregnancies, in order to reduce the likelihood of subsequent CD and associated complications.

References

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Table. Mode of delivery and maternal outcomes in subsequent deliveries following index breech delivery: primary breech CD versus successful ECV

Outcome in Subsequent Deliveries	Index Delivery Group Primary Breech CD N=560	Index Delivery Group Successful ECV N=255	Odds Ratio	95% Confidence Interval
Cesarean delivery (n%)	295 (52.7%)	49 (19.2%)	4.0	2.7-5.9*
Composite adverse maternal complication (n%)	233 (41.6%)	78 (30.6%)	1.6 (1.6††)	1.2-2.2*
Placental complication (n%)	24(4.3%)	11(4.3%)	1.0	0.5-2.1
Hemorrhage (n%)	74(13.2%)	34(13.3%)	1.0	0.6-1.5
Infection (n%)	43(7.7%)	7(2.7%)	2.9	1.3-6.6*
Complication associated with VD (n%)	28(5.0%)	24(9.4%)	0.5	0.3-0.9*
Complication associated with CD (n%)	145(25.9%)	36(14.1%)	2.1	1.4-3.2*

CD=Cesarean delivery; VD = Vaginal delivery; ECV = External cephalic version; * = significant difference between the groups; †= adjusted OR for maternal age and parity; ††= adjusted OR for maternal age

Abstract #:F-34

Mode of delivery and anesthetic management outcomes in Patients with congenital and acquired cardiac disease (CACD)

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Background: It is well accepted that pregnant patients with congenital and acquired cardiac disease (CACD) have unique obstetric and anesthetic challenges. The optimal management of these patients during labor and delivery is not well understood. This study compares mode of delivery, obstetric outcomes, and type of intrapartum anesthesia for CACD and healthy controls.

Methods: We performed a retrospective cohort analysis of women with CACD who were managed by our multidisciplinary (PACT) team during 2008 to 2013. PACT team includes Maternal Fetal Medicine, Obstetric Anesthesia, and Congenital Cardiology. Our congenital cardiologist then categorized these patients as either complex congenital (C-CHD) or non-complex congenital (nonC-CHD) according to the ACC/AHA 2008 guidelines. NonC-CHD patients include both non-complex congenital and acquired HD. Controls consisted of all healthy nulliparous women with singleton, vertex pregnancies who delivered after 36 wks (GA) during the same time period.

Result: We identified 140 women with CACD who delivered at UCSF, including 43 (31%) with C-CHD and 97 (69%) with nonC-CHD. Our mean GA at delivery was 37.3 wks. 68% of C-CHD and 81% of nonC-CHD delivered at GA ≥36weeks. We analyzed 101 CACD patients who were either nulliparous or parous (without cesarean delivery (CD)). We found elective and non-elective CD rates were lower among CACD compared to our controls (14% vs 20%) and significantly more operative vaginal deliveries (VD) within the CACD group compared to controls (28% vs 12%). There was no significant difference for epidural analgesia use although controls used more nitrous oxide compared to CACD patients (18% vs. 9%). No maternal or neonatal deaths occurred with CACD patients. After delivery, only 8% of C-CHD and 10% of nonC-CHD were admitted to the ICU.

Conclusion: In this relatively large cohort of pregnant women with CACD, the majority were able to have VD with a low rate of maternal morbidity. Use of epidural anesthesia did not differ between the two groups, but controls had increased utilization of intrapartum nitrous oxide. Future analyses of our data will explore indications for operative VD and neonatal outcomes in the PACT patients.

Reference:

1. ACC/AHA 2008 guidelines for the management of adult with congenital heart disease. Circulation. 2008: 118:e714-e833

	Controls Cohort at UCSF		CACD Patients* N (101)					
			Noncomplex			Complex		
	N (5062)	%	N (66)	%	*P* Value	N (35)	%	*P* Value
Spontaneous Vaginal	3453	68%	44	67%	<.05	15	43%	<.05
Operative Vaginal	614	12%	15	23%		13	37%	
Cesarean delivery with Labor	895	18%	6	9%		5	14%	
Elective cesarean delivery	100	2%	1	2%		2	6%	
GA (37+ weeks)	4916	97%	60	91%	<.05	32	91%	<.05
GA (36.0 -36.6weeks)	146	3%	6	9%		3	9%	

Table 1. Mode of delivery and GA among control cohorts and CACD.
Control group consists of nulliparous, singleton, GA >=36 weeks, vertex deliveries.
*CACD patients in this analysis have singleton and (nulliparous, or multiparous) with no previous cesarean delivery.

Abstract #:F-35

The association between maternal size and outcomes for women undergoing for cesarean section: a multicentre prospective observational study (The MUM SIZE Study)

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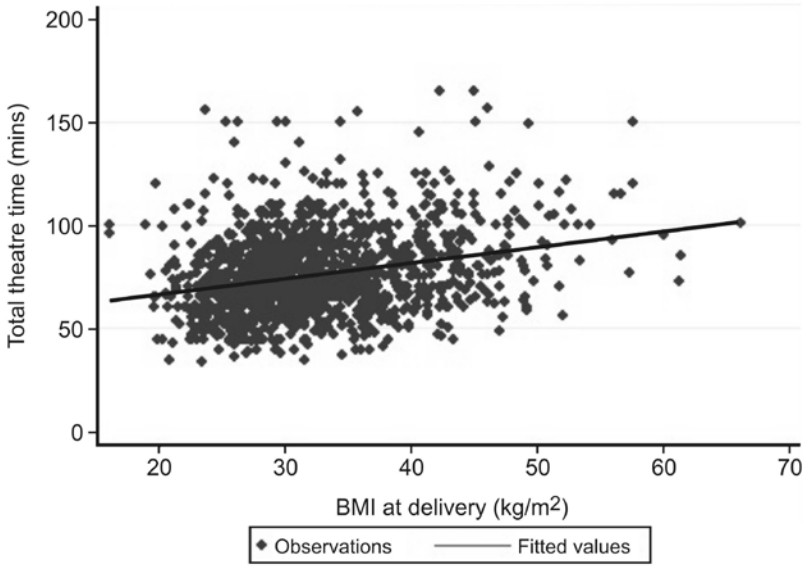
Introduction: Obesity is defined by World Health Organization(WHO) as a body mass index(BMI) of ≥30 kg.m-2. Obesity in childbearing age women is increasing. This is thought to contribute to adverse pregnancy outcomes. During pregnancy, however, BMI may naturally increase leading to incorrect classification of term women according to WHO BMI categories & a reluctance of clinicians & researchers to use WHO BMI categories at term. Also, the rate of cesarean section (CS) is increasing which, when combined with larger BMI, may lead to adverse maternal & neonatal events, increased theatre times & increased hospital costs. There is little research in this area. We aimed to investigate associations between maternal size (using term pregnancy specific BMI cut-off values which were 5 kg.m-2 higher in each WHO category), & clinical, theatre utilization & health economic outcomes for women having CS.

Method: Following IRB approval, consent & trial registration (ACTRN1261300060876) we undertook a prospective multicentre observational study in women undergoing CS. We recorded BMI at initial antenatal (booking) visit & delivery. Linear regression models accounting for clustering within hospitals & confounders, & health economic models analysed associations between delivery BMI & total theatre time, surgical & anesthesia times, maternal & neonatal adverse outcomes, total hospital costs, & theatre costs.

Results: 1457 women from 7 hospitals were included. Mean gestation was 38 weeks. Mean BMI increase (booking to delivery) was 4.0 kg.m-2. For each unit BMI increase total theatre time increased by 0.6 min(minutes)(p<0.001)(Figure 1). Super-obese (BMI ≥45 kg.m-2) women had 17 min longer total theatre time (p<0.001), 8 min longer surgical time (p<0.001) & 10 min longer anesthesia time (p<0.001) compared with normal BMI (23.5-<30 kg.m-2) women. Increased delivery BMI was associated with increased risk of maternal intensive care unit(ICU) admission (OR=1.07, p=0.046) but no increase in neonatal admission to higher acuity care(HDU). Total hospital, & theatre costs were increased by 15% (p=0.032) & 27% (p=0.001) respectively in super-obese compared to normal BMI women.

Conclusions: High BMI is associated with increased total theatre time, surgical & anesthesia time, increased maternal risk of ICU admission & increased total hospital & theatre costs. These clinical risks, time impacts & costs need to be considered in pregnant women. To do so we must record maternal BMI at term.



Abstract #:F-36

Amniotic fluid embolism: a multicenter ten year retrospective study

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Background: Amniotic fluid embolism (AFE) is an uncommon obstetric emergency, with considerable fetal and maternal morbidity and mortality. There is a paucity of data regarding clinical factors and management. In our study we aimed to delineate parturient characteristics and outcomes of women parturients suffering from an AFE.

Methods: This was a ten year multicenter, retrospective study conducted in 4 hospitals in Israel. The total combined delivery rate was 40,000 births a year. All parturients medical files with diagnosed cases of AFE identified according to the ICD guidelines were reviewed in the charts and then each chart reviewed individually to determine eligibility for AFE according to Clark's criteria. The institutional review board of every hospital approved the study.

Results: Sixteen cases of AFE were identified between the years 2005-2015. Nine cases occurred during vaginal delivery (56.%) , 5 cases occurred during a cesarean delivery (31.3%), 1 case in the emergency room (6.25%) and 1 women in the maternal fetal unit before labor (6.25%). Obstetric characteristics included; average age of women was 35.2 +/- 4.8 years, average parity was 2.3 +/-1.8, and average gestational week was 40.5+/-1.2 weeks. All women were healthy except for one women who had gestational diabetes. Three women had polyhydramnious (18.8%) and 2 women had macrosomia (12.5%). Three women had cervical ripening (18.8%), 3 women had prostaglandin induction (18.8%) ,6 women had artificial rupture of membranes (37.5%), and 10 women received oxytocin (62.5%). Presenting symptoms included : 3-doom (18.8%), 8 shortness of breath (50%), 2 (12.5%) cyanosis, 3 - cardiac arrest (18.8%), 9- fetal bradycardia (56.3%), 6- hypotension (37.5%), 9-loss of consciousness (64.3%), 4- seizure(25%), 1-headache (6.3%),2- bleeding (12.5%). Management included: Average packed cells given was 9.8+/-8.3, average fresh frozen plasma 11.5+/-7.3,cryoprecipitate 21.9+/-11.8, and platelets 14.7+/-10.8. Transesophageal echocardiography was used for diagnosis in 8 parturients (50%). Extracorporeal membrane oxygenation (ECMO) was used in 4 patients (25%) and cardiopulmonary bypass in 1(6.25%). Maternal outcomes included: Thirteen women survived (81.3%); of survivors 1 (8.3%) had major neurological disability, 3 (25%) had minor neurological morbidity. Average baby Apgar at one minute was 4.6+/- 3.4 and at 5 minutes 7.1+/- 3.2.

Conclusions: Amniotic fluid embolism has significant morbidity and mortality.

Abstract #:F-37

Antenatal Anesthesia Clinic for Women with Concurrent Cardiac Disease

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Background: Concurrent cardiac disease has become a major contributor to maternal mortality. Labor and delivery in this population has unique implications. We report deliveries among women with concurrent cardiac disease who were pre-assessed in the antenatal anesthesia clinic (2006-14).

Methods: The antenatal anesthesia clinic enables women with concurrent cardiac disease to receive an anesthesia plan contingent on their cardiac status. With IRB approval, we reviewed the electronic medical records (EMR) for planned and actual labor anesthesia management of women with concurrent cardiac disease who had visited the clinic prior to delivery.

Results: We identified 375 women with concurrent cardiac disease (2006-2014) from the EMR; 37(9.9%) visited the clinic since inception. We categorized the women who visited the clinic according to disease pathology: arrhythmia (n=7), congenital disease with (n=13) or without correction (n=4), valve disease (with or without pulmonary hypertension) (n=11) and cardiomyopathy (n=2). Women's ages ranged from 18-50, and for 4 women this was not their first delivery, (including 2 with cardiomyopathy). There were 23(57.5%) cesarean and 13(32.5%) vaginal deliveries; only one cesarean was performed under general anesthesia. Nine (24.3%) women had at least one further delivery; one woman (with a biological mitral valve) had 6 further deliveries.

Conclusion: The antenatal anesthesia plan for women with concurrent cardiac disease enabled us to plan prepare for these potentially complicated cases, however we identified a need to increase referrals, as less than 10% of women with concurrent cardiac disease were pre-assessed.

Table. Summary of characteristics of Pregnant Women with Concurrent Cardiac Disease seen in the Antenatal Anesthesia Clinic

Key: NYHA = New York Heart Classification of Disease; NB = Neuraxial Block; GA = General anesthesia; n = number

	Arrhythmia N = 7	Post Cardiac Surgery N =13	Unrepaired Congenital Heart Disease N = 4	Valvular Diseases / Pulmonary Hypertension N = 11	Peripartum Cardiomyopathy N = 2
Maternal Age at Clinic Visit (range)	30 - 40	18 - 37	29 - 50	27 - 38	32 - 36
Parity at clinic visit (range)	0 - 2	0 - 3	0	0 - 3	0 - 1
NYHA 1-2 (n%)	2(28.5%)	8(61.5%)	1(25%)	5(45.5%)	2(100%)
NYHA 3 (n%)	0	1(7.7%)	0	3(27.3%)	0
Planned delivery mode **Vaginal** **Cesarean**	 1 6	 7 5	 1 3	 6 5	 1 1
Actual delivery mode **Vaginal** **Cesarean**	 1 6	 5 5	 0 4	 5 6	 1 1
Monitors during delivery (n%)(not CS)	2(28.5%)	4(30.7%)	0	4(36.3%)	1(50%)
NB (n%)	7(100%)	7(54%)	3(75%)	11(100%)	1(50%)
GA (n%)	0	1(7.7%)	0	0	0

Abstract #:F-38

Anesthetic management and peripartum outcomes of parturients with Loeys-Dietz phenotype with and without mutations in the transforming growth factor-β signaling pathway.

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Introduction: Genetic mutations that alter transforming growth factor-β (TGF-β) signaling predispose individuals to cardiovascular, craniofacial and skeletal abnormalities. [1] These mutations are found in patients with Loeys-Dietz Syndrome (LDS), a connective tissue disease (CTD) first described in 2005. [2] Compared with Marfan syndrome, LDS patients have more aggressive vascular disease with dissection occurring at smaller aortic diameters and a mean age of death of 26.1. [1] During pregnancy, patients with LDS are at risk of progression of aortopathy and uterine rupture. [1] Some patients diagnosed with unspecified CTD are suspected to have LDS based on craniofacial and skeletal abnormalities but do not carry mutations in the TGF-β pathway. We sought to describe the anesthetic management and peripartum outcomes of parturients with unspecified CTD with LDS phenotype and those with genotype-confirmed LDS.

Methods: We retrospectively reviewed the medical records of all patients diagnosed with unspecified CTD having LDS phenotype with (LDS+) and without (LDS-) mutations affecting TGF-β signaling over a 7-year period (Nov 2007 to Jan 2015).

Results: Eleven pregnancies in nine parturients were analyzed. There were four LDS-, two LDS+, and three query LDS (qLDS) patients who not undergo genetic testing. Neither LDS+ patient had documented aggressive arterial disease, and three patients (1 LDS+, 2 LDS-) were on beta-blockers throughout gestation. The planned mode of delivery was vaginal for nine of eleven (82%) pregnancies. In the LDS- cases, three required vacuum or forceps assistance due to maternal fatigue and four cases ultimately required cesarean delivery (CD). A total of six CD's (55%) were performed, four in the LDS- group and two in the qLDS group; one was performed emergently due to placental abruption, three were performed urgently due to fetal intolerance of labor; two were performed electively. In the LDS+ cases, both had successful term vaginal deliveries. All deliveries were performed with a neuraxial technique. All cases were managed with serial echocardiograms, which indicated initial aortic root diameters of ≤ 38 mm during and after pregnancy. Arterial blood pressure monitoring and telemetry were not used in any cases. No maternal or neonatal complications were observed in this cohort.

Discussion: Parturients with unspecified CTD having LDS phenotype with or without mutations in the TGF-β pathway receiving care at our institution had good clinical outcomes. Despite being at high risk for anesthetic or obstetric complications, and encouraged to undergo early, elective CD [1], parturients with mutations in the TGF-β pathway without aggressive arterial disease can have successful term pregnancies, tolerate labor, and have vaginal and cesarean deliveries under neuraxial analgesia.

References:

1. MacCarrick G et al, Genet Med, 2014
2. Loeys BL et al, Nat Genet, 2005

Abstract #:F-39

Obstetrical Anesthesia and Dwarfism; a case series

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Introduction: Dwarfism is a catch all term for patients with acquired genetic mutations leading to short statures1. Cesarean section is the most recommended method of delivery in pregnant patients with dwarfism. There is no standard of care for the mode of anesthesia i.e. general anesthesia versus regional anesthesia during cesarean section in this group of patients. Acceptable outcomes have been reported by either of these methods, although general anesthesia has been used more frequently. GA has tended to be favored in the management2 of these cases due to cardiopulmonary issues and worries about spinal cord/column syndromes1. However, given the prevalence of obstructive sleep apnea, atlanto-axial instability, and airway management issues underlying both dwarfism and the pregnant state make a RA favored by some1,3. We report the details of anesthetic methods and relevant clinical outcomes in a cohort of patients with dwarfism who underwent c/s in our unit.

Materials and Methods: We reviewed the anesthetic charts of 7 patients with a number of known and unknown genetic mutations leading to dwarfism. These patients underwent c/s in our unit from Feb 2012 to July 2015. Demographic data, mode of anesthesia, comorbidities and other obstetrics parameters were reviewed.

Results: All patients were seen by a senior anesthesiologist with a detailed plan in place. All of the patients underwent c/s. Five of patients successfully received RA, 4 CSE technique and one single shot spinal anesthetic. Two patients underwent planned GA. Details and patients demographics are listed in table below.

Conclusion: This case series demonstrates that dose controlled RA is a safe mode of anesthesia for patients with dwarfism. A multi-disciplinary team of physicians and healthcare professional including maternal and fetal medicine group were involved in the decision-making and coordination of a cohesive plan for each patient. Pre-operative planning in certain cases were GA is required is of paramount importance.

References:

1. Berkowitz et al. Dwarfs: Pathophysiology and Anesthetic Implications. Anesthesiology. 73. 739-759
2. Walts LF, Finerman G, Wyatt GM. Anaesthesia for dwarfs and other patients of pathological small stature. Can Anaesth Soc J. 1975;22:703-9
3. Brimacombe JR, Caunt JA. Anaesthesia in a gravid achondroplastic dwarf. Anaesthesia. 1990;45: 132-4.

Table 1

	Anesthetic	Medications	Weight	Height	Comorbidites	
Case 1	Spinal	No local anesthetic noted; Fentanyl 10 mcg; Morphine 100 mcg	60 kg	134.9 cm	Achodroplasia; Thoracic rods; L2 - L3 laminectomy; Tonsil and adenoidectomy	
Case 2	CSE	Bupivicaine 7.5 mg; Fentanyl 10 mcg; Morphine 100 mcg; Clonidine 50 mcg	80.1 kg	147.3 cm	IMAGe syndrome; Pre-Eclampsia; SVT with WPW, Multiple previous abortions	
Case 3	CSE	Bupivicaine 12 mg; Fentanyl 25 mcg; Morphine 100 mcg	67.5 kg	153 cm	Hereditary Multiple Exostosis	
Case 4	CSE	Bupivicaine 5mg; Fentanyl 10 mcg	42 kg	91.9 cm	Osteogenesis Imperfecta type 3; Asthma; Scoliosis	
Case 5	CSE	Bupivicaine 3 mg; Fentanyl 10 mcg; Morphine 100 mcg	50 kg	120 cm	Achondroplasia; Central sleep apnea, Gestational diabetes, Atlanto-axial instability	
Case 6	GA	TIVA	50 kg	83.1 cm	Spondyloepiphyseal dysphasia congenita; Restrictive lung disease (unable to lie flat)	
Case 7	GA	Sevoflurane, Propofol, Remifentanil	36 kg	111 cm	Osteogenesis Imperfecta; Restrictive lung disease; Difficult airway; Scoliosis	

Abstract #:F-40

Parturients with Chiari Malformation – A 19-Year Review of Experience at the Brigham and Women's Hospital

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Background: In the recent years, we found an increased number of patients with Chiari Malformation (CM) coinciding pregnancy. Given the complexity of the condition, limited literature and potential impending neurological sequelae from potential complications of untoward neuraxial techniques, anesthetic approaches to these patients can be strenuous. We conducted a retrospective review of the anesthetic processes of parturient with CM at our institution.

Methods: Retrospective chart review of female patients who carried diagnoses of both pregnancy and CM at the Brigham and Women's Hospital from 1996 to 2015 have been performed.

Results: Ninety-four patients with CM diagnoses were identified from 1996 to 2014, who made total 108 deliveries. (We will complete the review of the data for the year of 2015 by the time of the SOAP meeting.) In 28 patients with 54 deliveries, first labor and delivery preceded the diagnosis of CM. The average size of cerebellar tonsil herniation was 9.6±4.9mm. For this group of patients, 8 spinals, 26 epidurals and 3 combined spinal epidurals (CSEs) were performed for 34 vaginal and 20 caesarean deliveries (CDs). Most common causes for CDs were failure to progress, non-reassuring fetal tracing and breech presentations. There were total 48 deliveries after the diagnoses of CM type I (CM-I) were made, among which 1 natural child birth (NCB), 8 spinals, 21 epidurals, 4 CSEs and 5 general anesthesia (GA) were performed for 30 vaginal and 18 CDs. GA was applied to patients with neurological symptoms or signs of hydrocephalus/syringomyelia. 8 patients who received decompression operations made 12 deliveries afterwards, for which 1 NCB, 1 accidental continuous spinal catheter, 1 spinal, 7 epidurals were performed for 9 vaginal and 3 CDs. No severe anesthesia related complication was found.

Discussion: This retrospective study provides a large case series of parturient with CM. CM is a complex neurological condition that requires case-by-case review before any specific anesthetic plan is chosen. Recent development on neuroimaging has provided more insights of this condition. Our data and practice support that parturient with asymptomatic CM-I condition are general safe to receive neuraxial technique for labor analgesia and anesthesia. An algorithm for clinical management of parturient with CM is proposed by the authors. Prenatal anesthesia consultation is a very practical method to form teamwork around complicated patient by linking anesthesiologists with obstetricians and neurosurgeons/ neurologists, from which a safe anesthetic and obstetric approach to individual patient can be developed.

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3. Agusti M, et al. Int J Obstet Anesth 2004;13(2):114
4. Meadows J, et al. J Neurosurg 2000; 92:920
5. Shaffer N, et al. J Biomech Eng 2014; 136(2):021012
6. Chantigian RC, et al. J Clin Anesth 2002;14(3):201

Abstract #:F-41

Pulmonary hypertension in pregnancy: A report of 49 cases

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Introduction: Pulmonary hypertension (PH) in pregnancy carries a mortality of 25%.1 If pregnancy occurs, termination is advised.2 No study of PH in pregnancy has examined outcomes according to the WHO PH classification.3 We hypothesized that outcomes vary depending on the WHO group and PH severity.

Methods: Electronic medical record at 3 North-American institutions were used to identify all pregnancies with PH (2001-2015), defined by mean PAP>25 (mild) and mean PAP≥50 or systolic PAP≥70 (severe). Demographics, clinical characteristics, management and outcomes were identified. Women were sorted by WHO PH classification: pulmonary arterial hypertension (PAH) (WHO Group 1); left heart disease (WHO Group 2); lung disease (WHO Group 3); thrombotic disease (WHO Group 4); and multifactorial etiologies (WHO Group 5).3 Severity and treatment of PH were identified. Fisher exact test (2-tailed p-values) was used to compare differences in outcomes between the groups.

Results: 49 women were included in the study (Table). Overall mortality (death within 1 year of delivery) was 16%; for women with PAH mortality was 23%, for thrombotic disease 14%, and for left heart and lung disease 0% (although the number in the later two groups were small). For women with Eisenmenger's syndrome (n=6) mortality was 50%. There was a non-significant trend toward higher mortality in women with severe PH versus mild PH (22% v 9%, p=0.4). Mortality was similar with vaginal (5%) or cesarean delivery (18%), p=0.44.

Neuraxial anesthesia was used in 20 of the CDs without anesthesia-related adverse events. Women with severe PH were more likely to receive advanced therapies (inotropes, pulmonary vasodilators, ECMO) than women with mild PH (65% v 32%, p=0.04). Preterm deliveries were more frequent with severe PH (82% v 47%, p=0.05). There was a 25 week IUFD, but no neonatal deaths.

Discussion: This is the largest contemporary case series of PH in pregnancy. Maternal PH-related morbidity remains high despite advanced therapies. The trend toward higher mortality and preterm delivery in women with severe PH and with PAH may guide preconception and early pregnancy counseling. Experts disagree regarding the safest mode of delivery for women with PH.2,4 Our data did not show a mortality difference associated with mode of delivery.

Other authors: R. Landau, R. Smiley

References

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3. Simonneau. JACC. 2013
4. Regitz-Zagrosek. Euro Heart J. 2011

	WHO classification of Pulmonary Hypertension			
	Group 1: Pulmonary arterial hypertension N = 30	Group 2: Left heart disease N = 11	Group 3: Lung disease N = 1	Group 4: Thrombotic disease N = 7
Age (years)	33 (3.37)	33.3 (5.29)	24 (0)	32.9 (5.1)
Nullipara women (N=)	16 (53%)	2 (18%)	1 (100%)	2 (29%)
Severe PH (N=)	19 (63%)	4 (36%)	0	4 (57%)
IUFD or termination (N=)	4 (13%) [1]	2 (18%)	0	0
Preterm delivery (N=)	17 (71%) [1]	2 (29%) [1]	1 (100%)	6 (86%)
Cesarean delivery (N=)	14 (56%)	4 (44%)	0	4 (67%) [2]
General anesthesia for cesarean (N=)	1 (7%)	0	0	1 (25%)
Women receiving advanced therapy (N=)	20 (67%)	2 (18%)	0	4 (57%)
Maternal deaths (N=)	7 (23%)	0	0	1 (14%)

Continuous values presented as mean ± standard deviation (SD)
Severe PH was defined as mean PAP≥50mmHg or systolic PAP≥70mmHg
IUFD = intrauterine fetal demise
Advanced therapy = inotrope, pulmonary vasodilator, ECMO
There were no women with a WHO Classification of PH group 5
[1] one case with missing data
[2] two cases with missing data

Abstract #:F-42

A Mouse Model of Acute Lung Injury in Pregnancy

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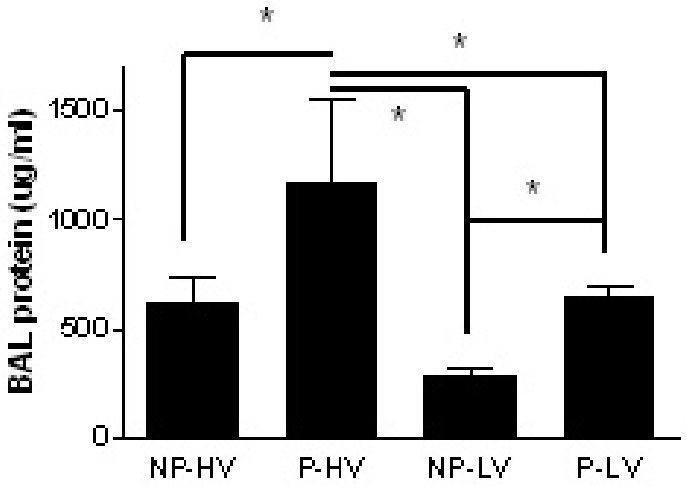
Rationale: Acute lung injury (ALI) is an under appreciated contributor to morbidity among pregnant women. It is estimated that 25% of pregnant women admitted to the ICU are there due to ALI secondary to infection. Acute respiratory distress syndrome (ARDS) has been found to complicate roughly one out of 6,000 deliveries, which is a shocking 10 times higher prevalence than what is seen in the general population. Some have suggested that pregnancy is a risk factor for severe ALI or ARDS, however, a mechanistic understanding of severe ALI and the increased incidence of ARDS during pregnancy is completely lacking. To better understand the nature of ALI in the parturient, we developed a mouse model of ventilator induced lung injury (VILI) in pregnancy.

Methods: 18+ days pregnant (P) or non-pregnant (NP) mice were subjected to either "protective" (LV) (TV 7ml/kg pre-pregnancy weight, RR 150/min, PEEP 3cm H2O) or "injurious" (HV) (TV 30ml/kg pre-pregnancy weight, RR 50/min, PEEP 0cm H2O) ventilation for 6 hours. Non-ventilated (NV) control animals are also included for comparison.

Results: When comparing the peak airway pressures generated before and after injurious ventilation, the peak airway pressures in non-pregnant mice increase by about 10% whereas the peak airway pressures in pregnant mice increase by nearly 25%. Bronchoalveolar levage (BAL) protein content was found to be twice as high in pregnant as compared to non-pregnant mice exposed to injurious ventilation (figure). BAL protein levels in pregnant mice exposed to protective ventilation were found to be elevated well above BAL protein levels seen in non-pregnant mice exposed to protective ventilation. On histology, we were able to identify both inflammatory cell infiltration into the alveolar space and alveolar protein infiltrates in the lungs of pregnant animals exposed to injurious ventilation, but not in non-pregnant animals exposed to high volume ventilation. Using staining against CD45, we have been able to positively identify increased numbers of immune cells in the injured pregnant lungs as compared to the injured non-pregnant lungs.

Conclusions: In response to injurious ventilation, lungs of pregnant mice, as compared to lungs of non-pregnant mice, display worsened injury as assessed by a number of indices. With further studies into the molecular mechanism of injury, this model of ALI in the parturient may hold a key to understanding the effects of pregnancy on acute lung injury.



Abstract #:F-43

Development of a Milestones Based Obstetric Anesthesia Curriculum with Assessment Tools

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Introduction: Obstetric (OB) anesthesia is part of the core requirements of anesthesia residency set by the Accreditation Council for Graduate Medical Education (ACGME).1 The Milestones Framework is a required assessment process for evaluation of residents in an ACGME certified program. These assess the resident's skills, attitudes, and knowledge by providing benchmarks for each level of training. To properly evaluate residents, objective measures of performance are required.2 There are few validated tools to assess performance for OB anesthesia. This abstract describes the process of changing rotation objectives and creation of tools to measure how well the objectives are met.

Methods: Existing first OB anesthesia clinical rotation objectives were revised to a list of 21 objectives: 5 Patient care, 7 Medical knowledge, 2 Practice-based Learning & improvement, 2 Systems-based Practice, 3 Professionalism, and 2 Interpersonal & Communication Skills. Each objective was linked to one or more assessment tools, which were developed by the authors by adapting previously validated tools in the regional anesthesia literature or revising questionnaires in use to reflect the Milestones framework. These assessments were then utilized to determine each resident's achievements of Milestones. Task-specific assessment tools include: Pre-anesthetic Interview and Informed Consent Checklist, Epidural Labor Management Evaluation, Spinal Anesthesia for Cesarean, and Epidural Insertion Checklist3. Global evaluation tools include streamlined end-of-rotation evaluation, pre/post-test, and 360 Degree Evaluation for OB/GYN nurses, residents, and attendings. New learning opportunities include Simulation of General Anesthesia for Cesarean, Case-based Discussion Checklist, and Challenging Case Self-assessment Write-up. The number of assessments for each objective and tool were determined. The new curriculum was implemented with the CA-1 residents in September 2014.

Discussion: Development of meaningful rotation objectives and assessment tools for OB anesthesia are critical to facilitate resident development of skills necessary to become competent. Our evaluation system is designed such that each task-specific assessment is done at the time of procedure and discussed with the resident to provide immediate feedback. This allows us to identify residents with deficiencies and develop action plans to address problems. As the residents progress, advanced rotation objectives will reflect higher levels of competence, with development of new tools that focus on critical thinking skills.

References:

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2. Ebert T, Fox C. Competency-based Education in Anesthesiology: History and Challenges. Anesthesiology 2014;120(1):24-31
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Abstract #:F-44

Introduction of in situ simulation in Yorkshire Maternal Emergency Training programme

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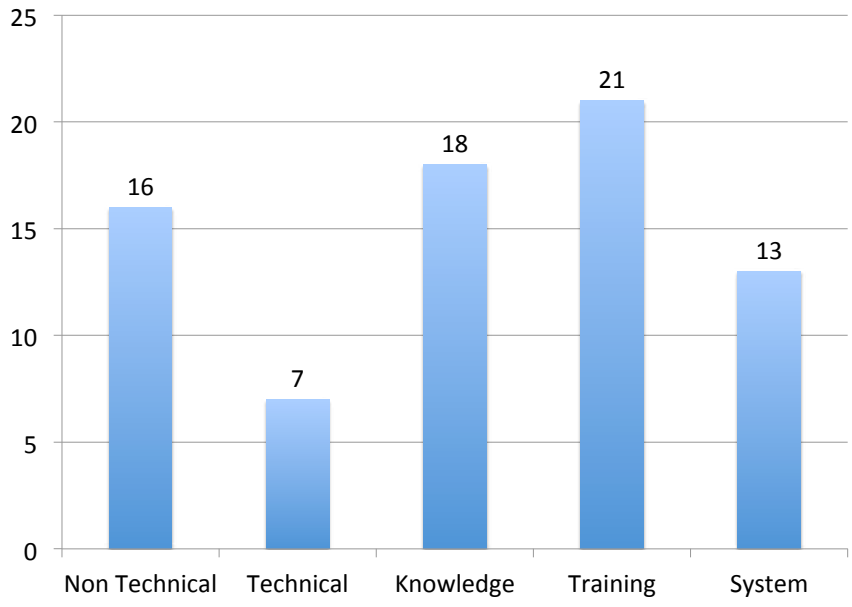
Introduction: YMET (Yorkshire Maternal Emergency Training) has traditionally utilised drills training in classroom environment. In situ simulation (simulation in the workplace) improves realism and additionally identifies latent errors1 (potential hazards in workplace), which can improve patient safety. Our aim was to improve confidence levels in managing an unwell patient and to identify latent errors to improve patient safety.

Methods: In situ simulation was performed on the labour ward using postpartum hemorrhage, pre-eclampsia and maternal cardiac arrest scenarios. 127 candidates participated which included midwives, obstetricians, students, anaesthetists and obstetrics team staff. Participants were given pre-and post-simulation questionnaire to evaluate improvement in confidence levels with regards to managing an emergency patient. Debriefing was performed immediately post scenario. Latent errors highlighted were graded according to NPSA risk matrix and reported to the department with recommendations.

Results: Seventy five latent errors were identified (Non technical 16, technical 7, knowledge 18, training 21, system 13) as shown in figure and reported after grading according to NPSA risk matrix (2). Our results also demonstrate that 70% of the participants felt considerably confident in managing unwell patients, 83% were able to positively figured out changes in there practice that were required to improve individual and team performance and 74% had knowledge gaps amply highlighted by in situ simulation exercise. 94% of the participants rated feedback as very constructive. 87% highly recommended regular simulation sessions.

Impact on practice: Introduction of in situ simulation in YMET training has helped in knowledge enhancement and latent errors identification. Recurring gaps in knowledge are highlighted and are dealt with more focused debriefing. Changes were introduced after recommendations as for example delegates did not realise that perimortem caesarean packs were available on resuscitation trolleys.
Therefore a visible yellow sticker is now placed on all trolleys to alert staff to its presence.



References:

1. Patterson M.D., Geis GL, Falcone RA, et al. In situ simulation: detection of safety threats and teamwork training in a high risk emergency department. BMJ QualSaf. 2013 Jun;22(6):468-77.
2. National Patient Safety Agency. A risk matrix for risk managers. NHS 2008

Abstract #:F-45

Development of Obstetric Anesthesia Cognitive Aids

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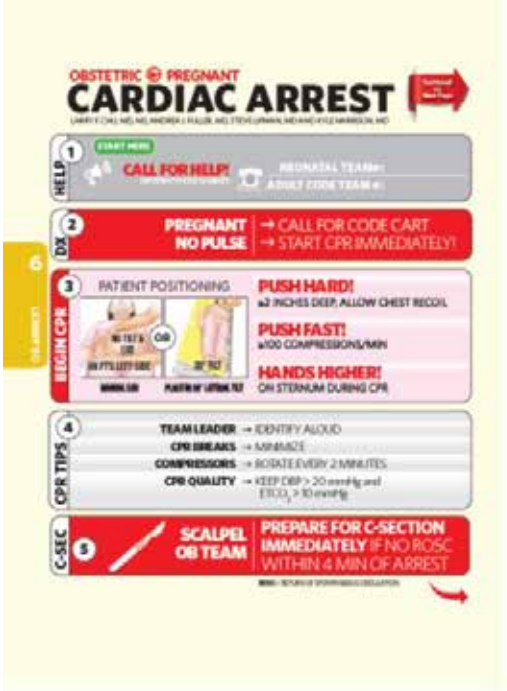
Introduction: Cognitive aids are checklists, guidelines or protocols created to assist users performing certain tasks. The goal is to decrease errors and reduce time taken to complete a set of actions. Medicine has adapted checklists into standard practice, i.e. preoperative time out and surgical safety checklists. Studies have shown the utility of cognitive aids in emergencies with more essential tasks completed when checklists were available.1 In obstetrics there is a constant possibility of acute, life threatening emergencies. The development of well-designed, peer reviewed cognitive aids for obstetric anesthetic emergencies may allow the practitioner to follow best practice guidelines efficiently.

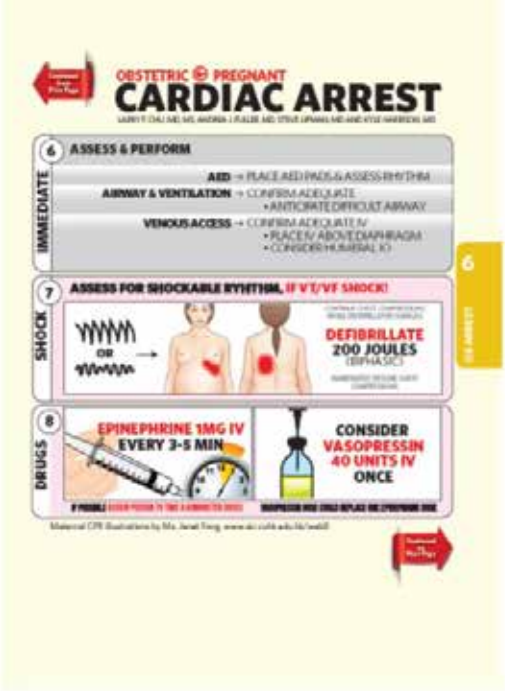
Methods: The aim of this project was to develop a peer reviewed collection of cognitive aids for obstetric anesthesia emergencies. Crisis topics were developed through literature review and agreed upon by consensus. Figure 1 shows a cognitive aid developed for maternal code. Cognitive aids were designed using the Stanford AIM Lab emergency cognitive aid design specifications which were developed for use in the Stanford Emergency Manual.2 The design approach for static paper-based aids was adapted from the Rapid-Read: step-at-a-glance approach previously described for dynamic computer-based aids.3 An object-action structure was implemented to describe checklist action and cognitive steps with the aim to facilitate faster aid usage and knowledge retrieval. Human factors usability testing was completed on our cognitive aid pictographic design for ACLS. Participants obtained drug dosing information 35% faster (p=0.003) and rhythm information 44% faster (p=0.002) when using a pictographic design compared with a text-based design. This collection of pictographic aids will be collated into an obstetric anesthesia emergency manual that can be used for the management of common and uncommon events on L&D units.

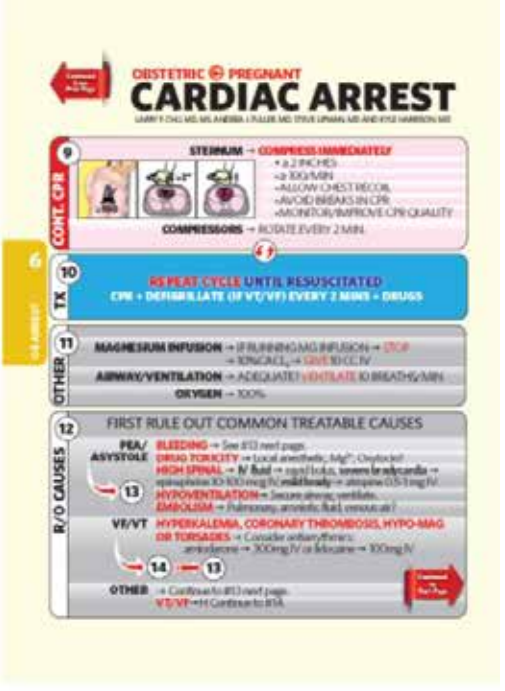
Discussion: Over the next year, the Obstetric Anesthesia Cognitive Aid Emergency Manual will be developed and designed to provide high yield information. We anticipate the manual will be used as a tool in obstetric emergencies and for non-emergency teaching and review. Effective utilization of emergency cognitive aids requires a multidisciplinary approach and will be studied with high fidelity simulation.4

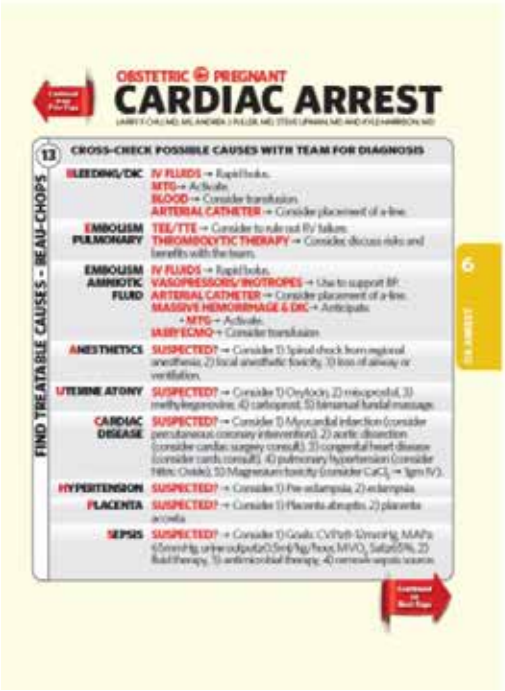
References

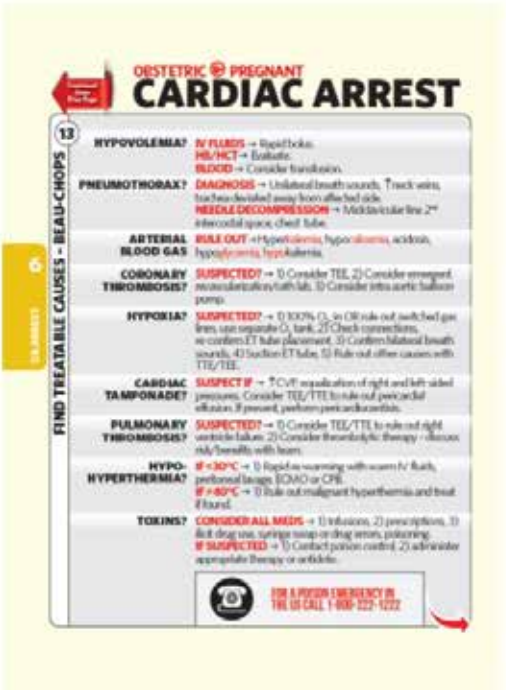
1. N Engl J Med. 2013:368(3):246–253
2. emergencymanual.stanford.edu
3. Pervasive Health 2014: 25-32
4. Anesthesiology. 2014;120(4):801-806

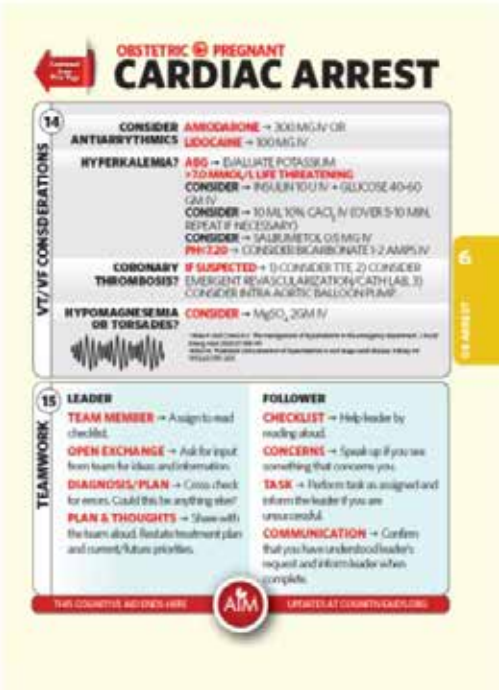

OBSTETRIC PREGNANT
CARDIAC ARREST
1 HELP
START HERE
CALL FOR HELP!
2 DX
PREGNANT NO PULSE
→ CALL FOR CODE CART
→ START CPR IMMEDIATELY!
3 BEGIN CPR
PATIENT POSITIONING
PUSH HARD!
≥2 INCHES DEEP, ALLOW CHEST RECOIL
PUSH FAST!
≥100 COMPRESSIONS/MIN
HANDS HIGHER!
ON STERNUM DURING CPR
4 CPR TIPS
TEAM LEADER → IDENTIFY ALOUD
CPR BREAKS → MINIMIZE
COMPRESSORS → ROTATE EVERY 2 MINUTES
CPR QUALITY → KEEP DBP > 20 mmHg and ETCO2 > 10 mmHg
C-SEC
5
SCALPEL
OB TEAM
PREPARE FOR C-SECTION IMMEDIATELY IF NO ROSC WITHIN 4 MIN OF ARREST


OBSTETRIC PREGNANT
CARDIAC ARREST
IMMEDIATE
6 ASSESS & PERFORM
AED → PLACE AED PADS & ASSESS RHYTHM
AIRWAY & VENTILATION → CONFIRM ADEQUATE
• ANTICIPATE DIFFICULT AIRWAY
VENOUS ACCESS → CONFIRM ADEQUATE IV
• PLACE IV ABOVE DIAPHRAGM
• CONSIDER HUMERAL IO
SHOCK
7 ASSESS FOR SHOCKABLE RYHTHM, IF V T/VF SHOCK!
OR
DEFIBRILLATE
200 JOULES
(BIPHASIC)
DRUGS
8
EPINEPHRINE 1MG IV
EVERY 3-5 MIN
CONSIDER
VASOPRESSIN
40 UNITS IV
ONCE


OBSTETRIC PREGNANT
CARDIAC ARREST
CONT. CPR
9
STERNUM → COMPRESS IMMEDIATELY
• ≥ 2 INCHES
• ≥ 100/MIN
• ALLOW CHEST RECOIL
• AVOID BREAKS IN CPR
• MONITOR/IMPROVE CPR QUALITY
COMPRESSORS → ROTATE EVERY 2 MIN
TX
10
RS PEAT CYCLE UNTIL RESUSCITATED
CPR + DEFIBRILLATE (IF VT/VF) EVERY 2 MINS + DRUGS
OTHER
11
MAGNESIUM INFUSION → IF RUNNING MAG INFUSION → STOP
→ 10% CACL2 → GIVE 10 CC IV
AIRWAY/VENTILATION → ADEQUATE
OXYGEN → 100%
R/O CAUSES
12
FIRST RULE OUT COMMON TREATABLE CAUSES
PEA/ ASYSTOLE
BLEEDING → See #13 next page.
DRUG TOXICITY → Local anesthetic, Mg2+, Oxytocin
HIGH SPINAL → IV fluid → rapid bolus, vasoactive agents →
13
HYPOVENTILATION → Secure airway, ventilate.
EMBOLISM → Pulmonary, amniotic fluid, venous air
VF/VT
HYPERKALEMIA, CORONARY THROMBOSIS, HYPO-MAG OR TORSADES → Consider antiarrhythmics:
amiodarone → 300mg IV or lidocaine → 100mg IV
14 13
OTHER → Continue to #13 next page.
VT/VF → If Continue to #14


OBSTETRIC PREGNANT
CARDIAC ARREST
FIND TREATABLE CAUSES – BEAU-CHOPS
13 CROSS-CHECK POSSIBLE CAUSES WITH TEAM FOR DIAGNOSIS
BLEEDING/DIC
IV FLUIDS → Rapid bolus.
MTG → Activate.
BLOOD → Consider transfusion.
ARTERIAL CATHETER → Consider placement of a-line.
EMBOLISM PULMONARY
TEE/TTE → Consider to rule out RV failure.
THROMBOLYTIC THERAPY → Consider, discuss risks and benefits with the team.
EMBOLISM AMNIOTIC FLUID
IV FLUIDS → Rapid bolus.
VASOPRESSORS/ INOTROPES → Use to support BP.
ARTERIAL CATHETER → Consider placement of a-line.
MASSIVE HEMORRHAGE & DIC → Anticipate:
• MTG → Activate.
HABP/ECMO → Consider transfusion.
ANESTHETICS
SUSPECTED? → Consider 1) Spinal shock from regional anesthesia, 2) local anesthetic toxicity, 3) loss of airway or ventilation.
UTERINE ATONY
SUSPECTED? → Consider 1) Oxytocin, 2) misoprostol, 3) methylergonovine, 4) carboprost, 5) bimanual fundal massage.
CARDIAC DISEASE
SUSPECTED? → Consider 1) Myocardial infarction (consider percutaneous coronary intervention), 2) aortic dissection (consider cardiac surgery consult), 3) congenital heart disease (consider cards consult), 4) pulmonary hypertension (consider Nitric Oxide), 5) Magnesium toxicity (consider CaCl2 → 1gm IV).
HYPERTENSION
SUSPECTED? → Consider 1) Pre-eclampsia, 2) eclampsia.
PLACENTA
SUSPECTED? → Consider 1) Placenta abruptio, 2) placenta accreta.
SEPSIS
SUSPECTED? → Consider 1) Goals: CVP≥8-12 mmHg, MAP≥65 mmHg, urine output≥0.5 ml/kg/hour, MVO2 Sats≥65%, 2) fluid therapy, 3) antimicrobial therapy, 4) remove septic source.


OBSTETRIC PREGNANT
CARDIAC ARREST
FIND TREATABLE CAUSES – BEAU-CHOPS
13
HYPOVOLEMIA?
IV FLUIDS → Rapid bolus.
HB/HCT → Evaluate.
BLOOD → Consider transfusion.
PNEUMOTHORAX?
DIAGNOSIS → Unilateral breath sounds, Tracheal veins, trachea deviated away from affected side.
NEEDLE DECOMPRESSION → Midclavicular line 2nd intercostal space, chest tube.
ARTERIAL BLOOD GAS
RULE OUT → Hyperkalemia, hypocalcemia, acidosis, hypoglycemia, hypokalemia.
CORONARY THROMBOSIS?
SUSPECTED? → 1) Consider TEE, 2) Consider emergent revascularization/cath lab, 3) Consider intra-aortic balloon pump.
HYPOXIA?
SUSPECTED? → 1) 100% O2 in OR rule out switched gas lines, use separate O2 tank, 2) Check connections, re-confirm ET tube placement, 3) Confirm bilateral breath sounds, 4) Suction ET tube, 5) Rule out other causes with TTE/TEE.
CARDIAC TAMPONADE?
SUSPECT IF → ↑CVP, equalization of right and left sided pressures. Consider TEE/TTE to rule out pericardial effusion. If present, perform pericardiocentesis.
PULMONARY THROMBOSIS?
SUSPECTED? → 1) Consider TEE/TTE to rule out right ventricle failure. 2) Consider thrombolytic therapy - discuss risk/benefits with team.
HYPO-HYPERTHERMIA?
IF <30°C → 1) Rapid re-warming with warm IV fluids, peritoneal lavage, ECMO or CPR.
IF >40°C → 1) Rule out malignant hyperthermia and treat if found.
TOXINS?
CONSIDER ALL MEDS → 1) Infusions, 2) prescriptions, 3) illicit drug use, syringe swap or drug errors, poisoning.
IF SUSPECTED → 1) Contact poison control, 2) administer appropriate therapy or antidote.
FOR A PHYSICIAN EMERGENCY IN THE US CALL 1-800-222-1222


OBSTETRIC PREGNANT
CARDIAC ARREST
VT/VF CONSIDERATIONS
14
CONSIDER ANTIARRYTHMICS
AMIODARONE → 300 MG IV OR
LIDOCAINE → 100 MG IV
HYPERKALEMIA?
ABG → EVALUATE POTASSIUM
>7.0 MMOL/L LIFE THREATENING
CONSIDER → INSULIN 10 U IV + GLUCOSE 40-60 GM IV
CONSIDER → 10 ML 10% CACL2 IV (OVER 5-10 MIN, REPEAT IF NECESSARY)
CONSIDER → SALBUMETOL 0.5 MG IV
PH<7.20 → CONSIDER BICARBONATE 1-2 AMPS IV
CORONARY THROMBOSIS?
IF SUSPECTED → 1) CONSIDER TTE, 2) CONSIDER EMERGENT REVASCULARIZATION/CATH LAB, 3) CONSIDER INTRA-AORTIC BALLOON PUMP
HYPOMAGNESEMIA OR TORSADES?
CONSIDER → MgSO4 2GM IV
TEAMWORK
15
LEADER
TEAM MEMBER → Assign to read checklist.
OPEN EXCHANGE → Ask for input from team for ideas and information.
DIAGNOSIS/PLAN → Cross check for errors. Could this be anything else?
PLAN & THOUGHTS → Share with the team aloud. Restate treatment plan and current/future priorities.
FOLLOWER
CHECKLIST → Help leader by reading aloud.
CONCERNS → Speak up if you see something that concerns you.
TASK → Perform task as assigned and inform the leader if you are unsuccessful.
COMMUNICATION → Confirm that you have understood leader's request and inform leader when complete.
THIS COGNITIVE AID ENDS HERE
AIM
UPDATED AT CORNERSTONESIM.ORG

Abstract #:F-46

Teaching epidural catheter placement to left-handed trainees

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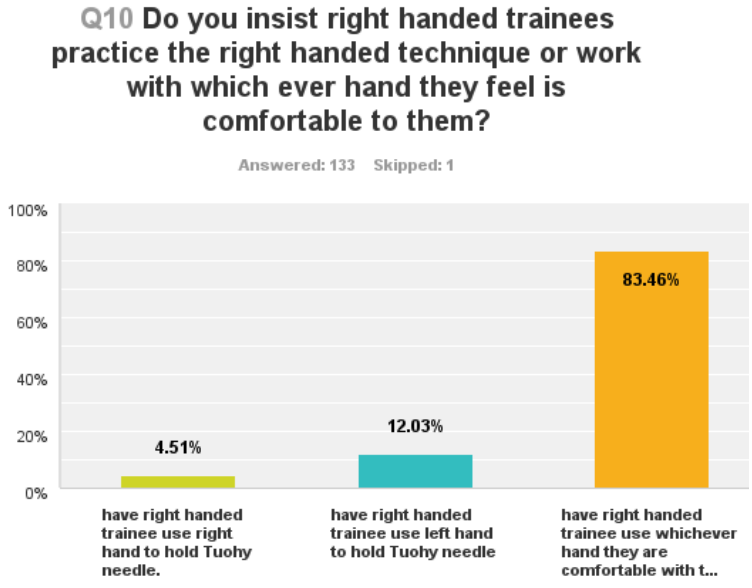
Co-Author: Diana Feinstein D.O. - The Johns Hopkins Univerity - Baltimore, M.D.
Karen Lindeman M.D. - The Johns Hopkins Univerity - Baltimore, M.D.

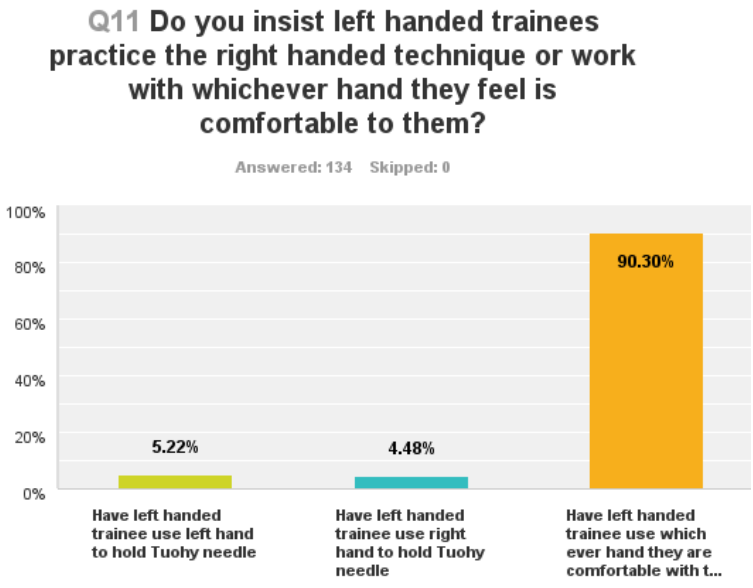
Background: Approximately 10% of the world's population is left handed. Some anesthesia instruments/ procedures, such as laryngoscopes/direct laryngoscopy, were created with only the right handed user in mind. In these instances the left handed person learns the technique using his/her right hand as dominant. For other, more symmetrical procedures, anesthesiologists disagree about the optimal teaching method for left-handed trainees. We created this survey to gain insight into how right handed practitioners teach left handed trainees epidural placement, and vice versa, the goal being to answer if one should teach left or right handed epidural catheter placement to a left hand dominant person.

Method: After Institutional Review Board exemption, we created a 13 question, multiple choice online survey. An email solicitation request was sent out to all anesthesia program directors each residency program director was asked to forward the survey e-mail link to faculty involved in the teaching of epidurals. The anonymous online survey was hosted by the website surveymonkey.com®.

Results: 134 responses were collected from teaching physicians. Of the 86% of instructors who reported that they were right hand dominant, 88% use their right hand to advance the loss of resistance syringe. 83% of instructors allow right handed trainees use which ever hand they feel comfortable with to hold the Tuohy needle. 90% of instructors allow left handed trainees to use whatever hand they feel most comfortable with. Based on a likelihood ratio test with 2 degrees of freedom, the distributions of responses to Question 10 "Do you insist right handed trainees practice the right handed technique or work with which ever hand they feel is comfortable to them?" were statistically different from the distribution of responses to Question 11 "Do you insist left handed trainees practice the right handed technique or work with whichever hand they feel is comfortable to them?". The deviance was 7.3 corresponding to a p-value of .03.

Conclusion: The pattern of responses regarding teaching right handed trainees (question 10) differs significantly from the pattern of responses regarding teaching left handed trainees (question 11). Therefore, it is our conclusion that instructors train right and left handed people differently. These findings provide the basis for further studies to determine the optimal method of teaching left handed trainees epidural catheter placement.





Abstract #:F-47

The cantaloupe study: A novel method for teaching epidural placement

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Co-Author: Connie Tran M.D. - Baylor College of Medicine - Houston, TX
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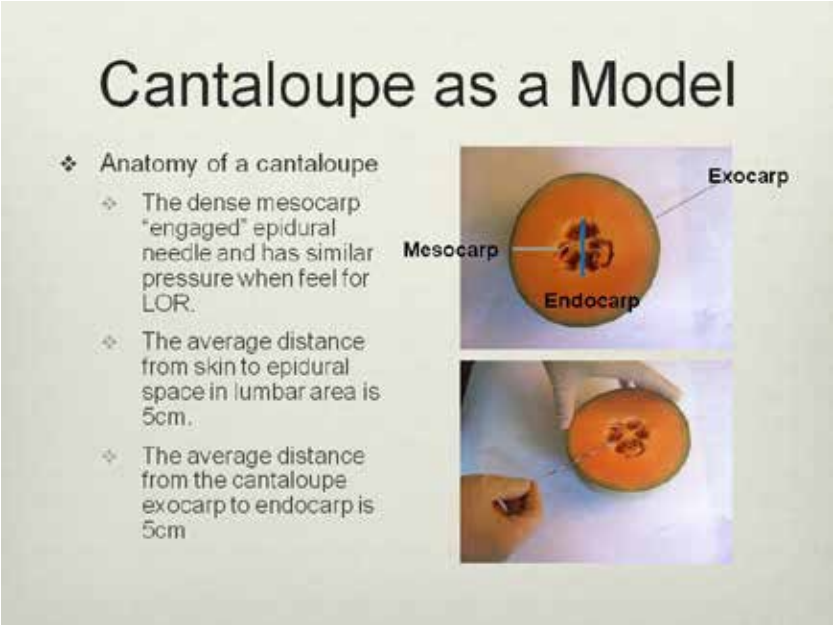
Epidural placement is an important skill for anesthesiologists, yet is a difficult procedure to teach trainees. Loss of resistance (LOR) to air or saline is a commonly used method for finding the epidural space, and is a subjective skill that can be difficult to demonstrate. We investigate the use of a novel model for teaching "feel" for LOR to anesthesia trainees using a cantaloupe as a simulator. Cantaloupes have a unique anatomy, with a thick exocarp (rind), dense and edible mesocarp interior, and a central endocarp containing seeds. The average distance from the exocarp to the endocarp is 5cm. Upon inserting an epidural needle into a cantaloupe, the mesocarp provides an excellent model for needle engagement in the midline ligaments of the back. When the endocarp is reached, the operator experiences a LOR that is similar to that encountered in the epidural space.

Eligible subjects included rotating anesthesiology resident physicians and student nurse anesthetists on their initial obstetric anesthesia rotation at a major training hospital. Trainees who had already placed 20 or more epidurals were excluded. Study subjects were randomized into an intervention and control groups and were given an orientation on epidural placement. The interventional group was offered unlimited practice with the cantaloupe model; the control group was not allowed to use the cantaloupe model. 58 trainees were enrolled in the study from January 2014 through October 2015; 28 were randomized to the control group and 30 were randomized to the cantaloupe intervention group. The majority (n=55, 94.8%) had placed fewer than 5 epidurals at the time of their initial rotation; none had placed more than 10. Across the first 3 epidurals placed by each of the 58 participants, a total of 9 unintentional dural punctures (wet taps) occurred with no significant difference in wet taps between the two groups (p=0.235).

All subjects were asked to practice on the cantaloupe and rate the effectiveness of the cantaloupe as a training tool for epidural placement. 28 of the 30 participants in the intervention group rated the cantaloupe model as helpful in teaching LOR technique for epidural placement. More trainees rated the cantaloupe model as effective for LOR to air (88.2%) than for LOR to saline (74.5%). No significant difference was found in the overall number of wet taps between the control and intervention groups (p=0.98).

The cantaloupe model is an economical and easy to implement method for teaching trainees the LOR technique for epidural placement. The model was rated as helpful by a large majority of participants, and was a useful simulation of LOR to both air and saline. Using models during the early part of learning a new skill can be an effective teaching method, and cultivating the ability to sense a sudden change in pressure can speed up the learning process and potentially decrease the risk of unintentional dural puncture.



Abstract #:F-48

A Randomized Controlled Study to Evaluate the Effects of a Computer-Enhanced Visual Learning (CEVL Neuraxial) Tool to Teach Anesthesiology Residents to Perform Combined Spinal Epidural Placements in Obstetric Patients

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Objectives: In obstetric anesthesiology, educators must balance resident procedural education with clinical time pressures as well as patient safety and comfort. Therefore alternative educational strategies, including E-learning tools, may be beneficial to orient novice learners to new procedures. In this blinded randomized controlled study, we examine whether a two week exposure to an e-learning tool (CEVL neuraxial) improved resident procedural performance and self-confidence.

Methods: A total of 24 CA-1 and CA-2 anesthesiology residents from the University of Illinois at Chicago and Northwestern University were enrolled in the study three weeks prior to their first obstetric anesthesiology rotation. Residents were randomized to receive either on-line access to the neuraxial module (CEVL group) or no access (Control) two weeks prior to the rotation. Subjects were instructed to use the module as they desired and not discuss their group assignment during the rotation. On the first day of the rotation, residents completed a neuraxial self-confidence scale and were observed, by blinded raters, performing combined spinal epidural catheter techniques on laboring patients with BMIs less than 35kg/m2 and no known anatomic spine abnormalities. Raters recorded both performance on a procedural checklist (divided into technical, sterility and needle safety items) and the time to placement (kit opening to dressing placement). Results were characterized by descriptive statistics with t-tests to compare groups.

Results: The CEVL group had significantly shorter placement times compared to the No CEVL group 22.5 ±4.88 vs. 39.5 min ± 7.07 ($p<0.001$) and had higher scores on the overall neuraxial performance checklist 36.4± 6.63 vs. 28.8 2±7.11 ($p=0.012$). The CEVL group had higher scores on the checklist for sterility items 7.91±1.78 vs. 6.58±1.31($p=0.048$) and technical items 26.83±5.45 vs 20.25±6.36 ($p=0.012$). Self-confidence scores for gathering equipment, assembling the kit, positioning, LOR technique, LOR recognition, threading the catheter, calculations of depth, needle safety and applying dressing were not statistically different between groups.

Conclusions: CEVL is a novel teaching tool that can enhance the traditional teaching of neuraxial procedures in obstetric anesthesiology. The group of residents with access to CEVL neuraxial prior to their rotation had a shorter combined spinal epidural catheter placement time and higher scores on procedural checklists during their first neuraxial placement on their obstetric anesthesiology rotation. Performance of checklist items related to both sterility and technique were higher in the CEVL group. Self-confidence ratings at the beginning of the rotation did not appear to differ however. Future research could examine whether the use of such tools for resident education impact provider long term performance or patient outcomes.

Abstract #:F-49

Enhancing Epidural Analgesia for Labor Through Education

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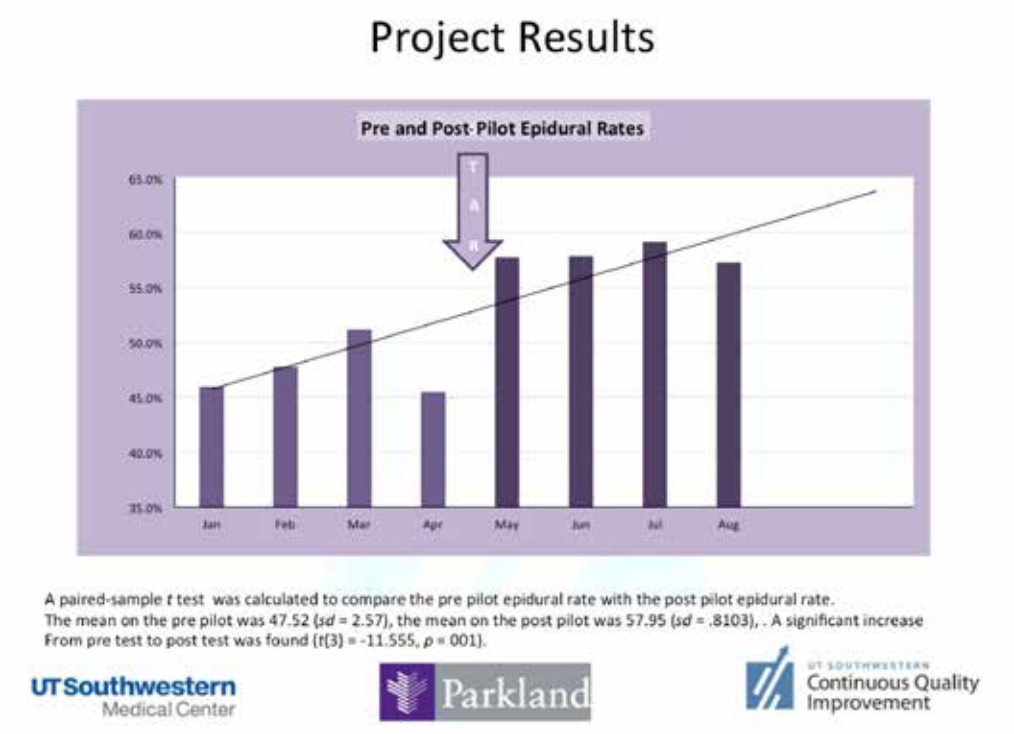
Background: Epidural rates for labor at our facility have historically been low compared to national benchmarks, though in line with rates for similar Hispanic populations. Epidural analgesia facilitates safer care, better pain relief, and is therapeutic for certain common problems such as pre-eclampsia. Our aim for this quality improvement project was to increase the epidural rate by 20% (relatively) over a period of 4 months on one labor unit representing half of our deliveries.

The Project: Two main interventions were planned. One was universal preoperative evaluation and consent upon admission to facilitate later epidural placement if elected. The second was a standard ten point educational script that was presented after preop but prior to consent. The script arose from typical concerns expressed by our patients. It sought to dispel common misconceptions about epidural analgesia. All stakeholders had input into the script and were educated prior to rollout. Multiple Plan-Do-Study-Act cycles were accomplished. Data was collected daily and weekly, which facilitated mid course corrections.

Results: The epidural rate increased over 20% (relatively) from pre-intervention and historic levels. 1430 patients were involved during this 4 month period. This was tied to grant resources that allowed the hospital to further its mission of delivering more and better quality care to the community.

Discussion: This quality improvement project successfully demonstrated that a small investment (involving simple education and minor process change) could have a dramatic impact. The growing nature of this often-underserved population makes this particularly relevant. The harder to quantify benefits may have been even more significant. Interdisciplinary and interprofessional teamwork and collaboration were enhanced; and this will enhance future progress. Satisfaction and safety were increased. An enhanced perspective was achieved by taking an honest look in the mirror. Often the barriers were more related to internal biases and expressed in flawed processes. The presumption going in too narrowly focused on patient misconceptions, without looking more broadly at the entire process.



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Abstract #:F-50

Publication Rate of Research Abstracts Presented at SOAP (2010-2014)

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Introduction: The SOAP annual meeting provides a forum to present new scientific work with the goal of broader dissemination of knowledge through peer review and publication. Publication rates for abstracts presented at biomedical meetings are estimated to be 44%.(1) The objective of this study was to evaluate the rate of SOAP annual meeting research abstracts that resulted in publication in peer-reviewed journals.

Methods: A list of research abstracts presented at SOAP from 2010 to 2014 was generated. The 2014 meeting was selected as the last year analyzed as the median time to publication for research is approximately 18 months [9 to 36 months].(1) A multi-tiered approach was used to identify publications. Searches were performed using PubMed's Advanced Search Builder function (http://www.ncbi.nlm.nih.gov/pubmed/advanced) in January 2016. Three searches were performed including all authors' names using an "or" join and three separate keywords from the title. Verification of institution(s) was performed upon successful match. The primary outcome was the publication rate. The SOAP abstract to publication rate was compared to the rate of for other biomedical meetings using a one-tailed t-test.(1) Comparison of publication rate by year and type of research (clinical/basic science) was performed using a Chi-squared test.

Results: A total of 169 of 631 (26.8%) of research abstracts presented at the 2010-14 SOAP annual meetings were subsequently published. SOAP abstracts resulted in fewer peer-reviewed publications than abstracts presented at other biomedical meetings (P<0.0001). There was no difference in publication rate by year (P=0.38) (Table). Basic science abstracts were more likely to result in publication than clinical science abstracts (45.4% vs. 25.0%, P=0.001). The median time to publication was 17 months (IQR: 10 to 27 months).

Conclusion: Fewer abstracts presented at SOAP result in a peer-reviewed publication than at comparable biomedical meetings. Possible explanations include differential resource and mentorship support for obstetric anesthesiologists or that academic motivations differ between our community and others. It is also possible that that manuscripts were published in non-indexed journals thus would not appear in our search. Investigating barriers to publication in our community may lead to wider dissemination of scientific knowledge and improvements in obstetric outcomes.

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Table: SOAP abstract to publication rate by year (2010-2014)

Year	2010	2011	2012	2013	2014	Total
Abstracts	123	118	123	132	135	631
Publications	32	38	37	31	31	169
Publication rate	26%	32%	30%	23%	23%	27%

Abstract #:F-51

Cesarean delivery in a patient with tuberous sclerosis and lymphangioleiomyomatosis (LAM)

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Our patient is a 31 year old gravida 2, para 1 female who presented for preoperative evaluation prior to her scheduled cesarean delivery. The patient is 173cm and 72 kg. Her medical history is significant for tuberous sclerosis complicated by cortical and ocular tubers however she denies any focal neurological deficits. Her past surgical history includes Cesarean delivery (2013) and right pneumonectomy (2010) for recurrent pneumothoraces. Her baseline pulmonary function tests (PFTs) demonstrated a mild obstructive and severely restrictive ventilatory defect. Additionally, she has lymphangioleiomyomatosis (LAM) syndrome that is complicated by renal/hepatic angiomyolipomas. Renal and hepatic function tests are normal. She also notes sacroilitis complicated by low back pain. The patient's transthoracic echocardiogram showed normal cardiac function and anatomy. Third trimester fetal echocardiogram revealed a mild-to-moderate LVOT obstruction. Her exercise tolerance was not limited on the day of initial consult; she is employed as an engineer which requires moderate physical activity and denies dyspnea despite her respiratory pathology. Her medications include albuterol, which she uses infrequently, and prenatal vitamins. She has a Mallampati class one airway with full range of neck motion, a thyromental distance of 7 cm, and good mouth opening. Examination of her spine showed no obvious deformity. Her delivery plan is for repeat Cesarean delivery in order to limit maternal morbidity associated with LAM syndrome. Her anesthetic plan is for spinal anesthesia with bupivacaine, fentanyl, and morphine. Pregnant patients with tuberous sclerosis are at increased risk for adverse maternal and fetal outcomes. The pregnancy may be complicated by preterm labor, preeclampsia, and fetal demise (1). Women with LAM syndrome are often advised to avoid pregnancy due to higher rates of pneumothorax, premature birth, and miscarriage (2). Patients with a reduced pulmonary reserve after pneumonectomy may have worsening of respiratory symptoms during pregnancy secondary to the increased oxygen consumption and minute ventilation and decreased functional residual capacity (FRC). Spinal anesthesia was safely employed in this patient for a repeat urgent Cesarean delivery and was without complication.

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Abstract #:F-52

Geleophysic Dysplasia, Difficult Airway, and Needle Phobia: Threading the Needle, Balancing Patient Autonomy & Safety

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A 23 year old non-laboring gravida 1 at term, with geleophysic dysplasia and dwarfism, scoliosis, chronic pain, and tracheal stenosis presented for elective cesarean delivery. Two prior intubations were successful, but difficult, requiring a 5.0 ETT, first using a videoscope and bougie (grade 4 view), then a fiberoptic scope. Unfortunately, she had extreme needle phobia. For her, risks of both neuraxial and general anesthesia (GA) were considerable, yet uncertain, including unpredictable spread of intrathecal local anesthetics, potential need for urgent intubation, and risk of failed intubation. Despite thorough and supportive discussion of risks/benefits of general and spinal anesthesia (SA), she refused our strong recommendation for SA, insisting on GA. She agreed to attempt tracheal intubation under GA, and possible need to awaken her and perform SA should intubation be impossible.

After GI prophylaxis, meticulous positioning, and pre-oxygenation, GA was induced with propofol and succinylcholine (1mg/kg). Intubation was impossible after two attempts with a video laryngoscope and 5.0 ETT. Mask ventilation was acceptable, but challenging. She emerged from GA with self-limited stridor that resolved. She was informed of the difficulty and agreed to neuraxial anesthesia, which was successful, but also proved very difficult. Tuohy needle placement took 46 min, after failed attempt at CSE placement. Achieving adequate surgical block took 88 min more.

This case illustrates challenges anesthetizing a parturient with geleophysic dysplasia with dwarfism and tracheal stenosis. It also highlights the equally difficult balance physicians, especially anesthesiologists, must strike between patient autonomy and safety when counseling patients regarding anesthetic options. Regarding patient autonomy in medical decision making, advocates suggest that physicians should guide, not dictate, patient decisions, while others champion the belief that "respect for autonomy does not require suspending the physician's or ethics committee's own critical analysis".1 Most agree on the importance of providing patients with knowledge adequate to make informed decisions, whether or not decisions are made collaboratively. In this case, we chose a collaborative approach to attempt to preserve patient autonomy without jeopardizing safety.

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Abstract #:F-53

Hemolysis, elevated liver enzymes, and thrombocytopenia, but not HELLP syndrome

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Introduction: Babesiosis is rare in pregnancy, and results in hemolysis, elevated liver enzymes, and thrombocytopenia. In this report, we detail a case of babesiosis mistaken for HELLP syndrome.

Description: 34y G3P1 at 38 weeks was transferred from an outside hospital with the diagnosis of HELLP syndrome and anhydramnios on a magnesium infusion. The patient had PANCYTOPENIA (platelets 40,000/mm3, ANC 1,500/mm3, hct 32%), elevated liver enzymes, a urine protein to creatinine ratio of 0.3, and arthralgias. Shortly after arrival, her pathology smear became suspicious for a tickborne illness. The patient received twenty hours of magnesium before it was discontinued.
Due to thrombocytopenia, neuraxial placement was contraindicated. Pain control was via fentanyl PCA. She had a vaginal delivery, and the postpartum courses of her and her neonate were unremarkable, with no evidence of vertical transmission. She was treated with atovaquone and azithromycin for babesiosis, and doxycycline to cover lyme and anaplasmosis. She avoided breastfeeding on atovaquone and doxycycline. The parasite was cleared by day 10.

Discussion: Babesiosis, an intra-erythrocyte parasitic infection that leads to cell lysis, is transmitted by the Ixodes scapularis tick, but there are reports of infections from blood transfusions. Symptoms include fever, chills, fatigue, sweats, chest pain, jaundice, and headache. The disease can progress to DIC, multi-organ failure, and death.
There are few reports in pregnancy. One case details a patient at 20 weeks with concomitant babesiosis and lyme. She underwent an uneventful cesarean section with spinal anesthesia at term. Four days postpartum she developed a coronary artery aneurysm due to either an inflamed and weakened vessel wall or an incidental event. There are no reports of CNS transfer when using neuraxial anesthesia. General anesthesia is not required for patients with babesiosis if the coagulation profile is appropriate.
Four reports suspect vertical transmission of Babesia microti in term pregnancies with infants becoming symptomatic at 3-6 weeks of life. One report discusses an asplenic patient at 30 weeks with fever and rigors whose amniotic fluid and newborn had evidence of babesia.
The most important differential diagnosis in this patient is HELLP syndrome. Although HELLP and babesiosis have similar symptoms and laboratory results, this patient's leukopenia and specific blood smear were hallmarks of babesiosis. Due to serologic similarities and HELLP being more common, treatable cases of babesiosis could be missed leading to unwarranted magnesium or preterm delivery.

Conclusion: This case highlights how a tickborne illness can mimic the diagnosis of HELLP syndrome.

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Abstract #:F-54

A Pregnant Patient with Suspected Spontaneous Coronary Artery Dissection and Cardiac Arrest Likely Secondary to a History of Kawasaki Disease as a Child

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We present a 32 year old G2P1001 at 32w4d estimated gestational age with a past medical history of gestational diabetes and an undisclosed history of Kawasaki Disease (asymptomatic since early childhood). She presented to L&D clinic with nausea and vomiting, fever, chills, and worsening malaise for 6 days. Her office vitals were BP 97/59, T 36.9, HR 100. Monitoring showed no signs of fetal distress. Rapid flu/PCR was negative. Her symptoms were attributed to a viral illness and she received IV Zofran and IVNS, after which she felt dramatically better.

The next day her symptoms returned and became progressively worse. She also began complaining of chest pain and shortness of breath. She returned to the hospital 2 days after the clinic visit and collapsed in the lobby. She was able to avoid trauma to her head. When approached the patient was AOx1 and barely able to keep her eyes open. A code blue and code pink were called. She was brought emergently to the L&D recovery area and received 2L IVNS during transport for tachycardia and hypotension. She was immediately placed in left uterine displacement.

Her vital signs were stable and she was lethargic but lucid, her neurological exam was unremarkable, and her lungs were clear to auscultation. Stat labs were sent (although the results were unknown for roughly 30 minutes), and they were significant for a metabolic acidosis and elevated troponin.

She was having ten second runs of wide-complex tachycardia roughly every 1.5 mins, which were becoming more frequent and prolonged. Fetal bradycardia was noted with each episode. TTE showed LV hypokinesis and EKG showed ventricular tachycardia.

Her blood pressure and heart rate remained normal, but with each run of VT her systolic blood pressure dropped to 70s-80s and the patient's mental status would deteriorate, but both would recover with return of sinus rhythm.

An RSI and intubation was performed with etomidate and succinylcholine in anticipation of defribrillation and potential cesarean section. Roughly thirty seconds after intubation the patient lost her pulse and the A-line flattened. She was immediately defibrillated with a return to VTach and pulselessness. CPR was initiated.

At four minutes the L&D team successfully performed a crash cesarean section, packed the abdomen, and covered the incision with Ioban.

The patient's rhythm eventually deteriorated to ventricular fibrillation. There was never return of spontaneous circulation. After two hours of CPR the patient was declared dead.

The two leading theories of cardiovascular collapse are viral myocarditis and Kawasaki Disease contributing to spontaneous coronary artery dissection (SCAD). Due to religious concerns from the family an autopsy was unable to be performed before burial. All viral cultures were negative, but PCR for enterovirus, adenovirus, and coxsackie virus were unable to be performed. Case reports of sudden death during pregnancy due to SCAD have been described in the literature.

Abstract #:F-55

Anesthetic Managment of the Pregnant Patient with Uterine Arteriovenous Malformation

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Uterine artery arteriovenous malformation (AVM) is a rare cause of blood loss during pregnancy. An AVM is an abnormal communication between artery and vein, and rupture of a uterine artery AVM can be life-threatening for both mother and fetus. There are few case reports in the literature describing uterine artery AVM in the pregnant patient, and even fewer describing appropriate anesthetic management of this challenging situation. We present a case of a 29 year old G1P0 patient at 32 weeks gestation who presented with severe abdominal pain, subsequent hemodynamic collapse and loss of consciousness. Four similar episodes were reported during this pregnancy requiring blood transfusions and even a diagnostic laparoscopy. CT angiography revealed uterine artery pseudoaneurysm and suspected AVM. Multiple subspecialties were involved in this case, including Interventional Radiology (IR), Vascular Surgery, Radiology, Urology, Gynecological Oncology and Anesthesiology. Thorough planning was necessary to ensure the safe management of the patient and her child. She ultimately underwent successful operative cesarean section under general anesthesia following placement of an occlusion balloon catheter in IR preoperatively and AVM embolization was completed immediately post operatively. This case highlights the importance of preparation by the Anesthesia care team, and communication between the multiple healthcare providers involved. Awareness of uterine artery AVM as a cause of bleeding during pregnancy, as well as in the postpartum period, is essential to providing safe anesthetic management in these rare cases.

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Abstract #:F-56

Conversion Disorder in Pregnancy

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Acute neurologic deficits in the obstetric population are relatively rare but carry considerable risk of morbidity and mortality. The broad differential diagnosis mandates precise and expedient diagnostic skills to guide subsequent management and optimize outcomes for mother and child. We discuss the case of a patient who presented with acute onset aphasia and quadriplegia.

A 27-year-old G6P5005 at 32 1/7 with no past medical history and no prenatal care presented after being found minimally responsive and with globally decreased motor function. She had complained of a headache the previous night but woke up normally that morning and returned to bed. Later she was found crying but with her eyes fixed and immobile.

On presentation to the hospital, the patient was lying motionless. Multiple attempts at IV placement were witnessed; however, she did not wince or withdraw to these painful stimuli. The patient was able to make eye contact and began to lacrimate during subsequent IV attempts. A short time later, she was able to communicate by blinking to "yes" or "no" questions. Approximately two hours after arrival, the Neurology service examined the patient and had a working diagnosis of acute basilar stroke – she was flaccid, did not withdraw to pain on all extremities, did not flinch to abrupt scare, and her toes were downgoing bilaterally.

Following a CT scan demonstrating no acute bleeding, the patient was transferred to the neurological ICU, and a tPA bolus was administered for presumed basilar artery thrombus. A CT angiogram was subsequently obtained demonstrating normal cerebral perfusion, and the tPA infusion was stopped. Follow-up examination revealed improving motor function of her upper extremities; however, she continued to have expressive aphasia, consistent with non-neurologic deficits.

The patient began having contractions, and examination revealed dilation to 4 cm and breech presentation. Attempted tocolysis with terbutaline was unsuccessful, and she was taken to the operating room emergently for Cesarean section. The patient was induced and intubated uneventfully. Cryoprecipitate was administered prophylactically for reversal of the tPA. Blood loss was estimated at 800 mL. She was able to be extubated while following commands and revealing good upper body strength.

The next morning the patient had an MRI that was normal. Her differential diagnosis included conversion disorder versus basilar migraine. By PPD #3 the patient had regained all speech and motor function and was discharged home.

Having a thorough differential diagnosis of acute neurologic deficits, while working rapidly in a multidisciplinary setting, is essential to provide excellent care. Conversion disorder, while exceedingly rare and a diagnosis of exclusion, must always be included in this differential diagnosis to improve outcomes by reducing iatrogenic injury. Fortunately we had a good outcome for both mother and baby given the complex presentation.

Abstract #:F-57

Magnesium toxicity and an extreme uterine atony: are you ready for the consequences?

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Introduction: Magnesium sulfate is widely used for seizure prophylaxis in preeclampsia. Magnesium (Mg) prevents seizures, by vasodilation, protecting the blood-brain barrier, preventing cerebral edema, and acting as an anticonvulsant through NMDA receptor antagonism. Mg has proven beneficial effects at therapeutic levels. Toxic levels, on the other hand, can have adverse affects on the parturient's neurological, pulmonary and cardiovascular systems. In extreme cases, magnesium toxicity may lead to uterine atony and the cascade of uncontrolled postpartum hemorrhage and emergent peripartum hysterectomy.

Case description: Our case involves a 31-year-old G3P2A0 female with severe pre-eclampsia who presented at term gestation with spontaneous rupture of membranes in active labor. Magnesium sulfate was administered for seizure prophylaxis but a few hours later the patient was found to have altered mental status and diminished reflexes. A serum magnesium level of 11.5 mg/dL was discovered. Labor became further complicated by an arrest of descent. Consequently, a primary low-transverse cesarean section was performed. One hour after surgery, our patient began to hemorrhage from uterine atony and also suspected to have concurrent disseminated intravascular coagulation. Massive blood transfusion, uterotonics, Bakri balloon placement and correction of coagulopathy failed to stop her hemorrhage. Emergent hysterectomy had to be performed in order to stop the bleeding.

Discussion: Magnesium has been used in parturients for decades now, for various reasons, but its particular use in preeclampsia has gained widespread popularity in preventing seizure, and also as a tocolytic agent for per-term labor. Evidence to support the role of tocolysis in preventing pre-term labor is scarce, but the thinking is that these properties are due to calcium antagonism by magnesium administration which can perhaps lead to a decrease, in intra-cellular calcium as well as in actin-myosin complex activity, leading to uterine muscle relaxation. Many studies have confirmed that magnesium can slow the rate of labor progression. Our patient developed a supra-therapeutic magnesium level of 11.5 mg/dl with signs of magnesium toxicity. In our case, magnesium toxicity can be one of the reason for arrest of labor which then lead to cesarean section and eventual uterine atony, for which patient had peripartum hysterectomy. It becomes prudent to identify early magnesium toxicity which relies on clinical suspicion by experienced medical personal to prevent life altering complications. Ultimately, a toxicity monitoring strategy should be chosen based upon a variety of logistic considerations and patient risk factors.

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Abstract #:F-58

Dilemmas of a Repeat Dural Puncture during Attempted Epidural Blood Patch for Post-Dural Puncture Headache: A Case Report

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Epidural blood patch (EBP) is an effective treatment for postural puncture headache (PDPH) [1]. After accidental dural puncture (ADP) extradural fluid accumulation [1] may complicate EBP procedure by masking appropriate epidural space identification. We describe an approach to this situation, using local anesthetic to confirm catheter position prior to EBP

Case report: 23 years old, G4P3 term parturient with preeclampsia requested epidural analgesia for labor. Epidural placement at L3-4 interspace was complicated by ADP. An intrathecal (IT) catheter was placed. Patient was comfortable throughout labor, vaginal delivery was uneventful and IT catheter was removed after 24 hours. On postpartum day (PPD) 2 patient was developed symptoms consistent with PDPH. After failed conservative treatment, patient agreed to proceed with EBP on PPD3. Using a 17G Tuohy needle the epidural space was identified at L3-4 level using loss of resistance (LOR) to saline technique. Free CSF flow was noted. An 18G epidural catheter was threaded 5cm into the space. During insertion of catheter a marked reduction in CSF flow was noted. CSF aspiration was slow but positive through the catheter. A test dose of 45 mg of lidocaine with 15 mcg of epinephrine was given. It did not produce any sensory/motor block, leading authors to believe the catheter was in the epidural space. Subsequently, 10 ml of 0.125% bupivacaine was administered over 20 minutes and a T10 sensory block was obtained, confirming that catheter was most likely in epidural space. On PPD4 after confirmation that the catheter was still at same depth and aspiration of the catheter was negative for fluid, 23 ml of blood drawn under sterile condition was injected through the epidural catheter. Patient had immediate resolution of headache. Catheter was removed at the end of procedure and patient was discharged on same day.

The optimal timing for EBP following ADP is yet to be determined [1, 2]. Some evidence suggests that early EBP might be related to increased failure rate [2]. Leaking and accumulation of CSF into epidural space may contribute to this failure [2], although significant amount of CSF is not normally seen during an attempted EBP, especially when performed after 24 hours. Chances of a second ADP in a patient whose epidural space is expanded with CSF is less likely, therefore possibility of a large CSF leak in epidural space during a possible second dural puncture must be considered. Giving small-diluted amount of local anesthetics to achieve limited sensory block can help differentiate the location of catheter clinically. Inserting an epidural catheter provides the benefit of having a channel for slow titration of local anesthetic and blood during EBP, and also decreases number of attempts to perform EBP when fluid is encountered, what is associated with less risk of infection [1] and decreasing risks of repeat ADP and its implications

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Abstract #:F-59

Management of Acute Promyelocytic Leukemia during Pregnancy

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Introduction: Acute promyelocytic leukemia (APL) is a variant of acute myeloid leukemia with only 600-800 cases diagnosed annually in the United States. APL is considered a medical emergency due to the extremely high risk of bleeding and disseminated intravascular coagulation (DIC). It has a high cure rate with the mainstay of treatment being all-trans-retinoic-acid (ATRA) and arsenic trioxide (ATO). Both drugs, while effective in treating APL, can lead to differentiation syndrome and a systemic inflammatory response with mortality rate as high as 30%. We present the management of a pregnant patient diagnosed with APL in the third trimester and her eventual positive outcome.

Case: A 37 year old G8P7 at 31 weeks gestation presented to her obstetrician with complaints of fatigue and shortness of breath. Laboratory evaluation revealed severe pancytopenia, with a hemoglobin of 3.8 and platelets of 8. She was transferred to UNC where a bone marrow biopsy was consistent with APL. She was admitted to the MICU for monitoring given her high risk of acute deterioration, and dependence on blood and platelet transfusions to keep her at the recommended goals set by hematology. Her treatment with ATRA was complicated by differentiation syndrome based on findings of tachypnea and pulmonary edema on chest x-ray. Intravenous steroids were administered with resolution of her symptoms. Induction of labor was performed at 33 weeks gestation with subsequent spontaneous vaginal delivery. Her hospital course was complicated by postpartum hemorrhage requiring D&C and Bakri balloon placement under general anesthesia. She stabilized and was discharged to the oncology service on PPD 2 to continue her treatment.

Discussion: Acute leukemia is rare in pregnancy, but the incidence of these complex cases may continue to rise as average maternal age increases. Due to the risk of differentiation syndrome from ATRA treatment, our patient was managed in the medical ICU until she was stable enough to transfer to labor and delivery. This case presented an anesthetic challenge given the patient's pancytopenia and relative contraindication to neuraxial anesthesia, as well as her potential for DIC and massive hemorrhage. During antepartum consultation, it was decided the patient would not be offered neuraxial anesthesia due to her transfusion dependent thrombocytopenia and risk of bleeding. This rare case of APL highlights the need for a multidisciplinary team approach to caring for complex patients. We believe this played a large role in the patient's eventual positive outcome despite her course being complicated by differentiation syndrome and postpartum hemorrhage.

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Abstract #:F-60

Successful Post-Cesarean Pain Management in Patients on Buprenorphine

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Many addicted obstetric patients are now treated with buprenorphine. Buprenorphine has a long serum half-life, binds tightly to the mu opioid receptor, and there is a ceiling to the analgesia buprenorphine can provide. Consequently, patients who present for surgery while receiving buprenorphine may have severe post-operative pain. However, good analgesia can be obtained with regional anesthesia and opioids that bind to the mu receptor as tightly as buprenorphine.(1)

Cases: NSAIDs were given and buprenorphine was continued in all patients. After the epidural catheters were removed, all patients were comfortable with no additional opiates.

1. A 23 yo G2P1 patient on buprenorphine 4 mg tid presented for urgent cesarean delivery. We performed a CSE at L2-3 with spinal bupivacaine 15 mg. Post-operatively, she received PCEA bupivacaine 0.0625% at 10 mL/hour with a bolus dose of 2 mL and a lockout interval of 15 minutes for 2 days. The patient was comfortable with pain scores of 3-4/10. The main problem was leg weakness.

2. A 22 yo G2P1 patient on buprenorphine 8mg bid presented for repeat cesarean delivery. We inserted a paramedian epidural catheter at T10-11 then injected spinal bupivacaine 15 mg at L2-3. She received PCEA bupivacaine 0.0625% at 4 mL/hour with a bolus dose of 2 mL and a lockout interval of 30 minutes for 2 days. On POD 1, the patient could ambulate without assistance. Pain scores were 1/10 on POD 1 and 0/10 on POD 2.

3. A 34-yo G6P5 patient presented for a repeat cesarean. The patient denied substance abuse. We induced spinal anesthesia with bupivacaine 13.5 mg, fentanyl 25 mcg, and morphine 0.1 mg. Then the urine drug screen returned positive for buprenorphine. Three hours after surgery, the patient rated her pain as 10/10. We started a hydromorphone IV PCA infusion. On hydromorphone, the patient's pain score was 5/10.

Discussion:
Buprenorphine binds more tightly to the mu opioid receptor (i.e., has a lower Ki) than most commonly used mu opioid agonists.(1) Post-operative analgesia can be achieved, however, if providers use mu opioids that also have low Ki values. (Table 1) We find that thoracic epidural catheter placement is associated with less leg weakness and better post-cesarean analgesia than lumbar epidural catheter placement.

References:
1. Volpe DA, et al. Uniform assessment and ranking of opioid Mu receptor binding constants for selected opioid drugs. Regul Toxicol Pharmacol 2011;59:385-90.

Table 1
Mu Opioid Receptor Binding Affinities (Ki) for Commonly Used Opioids

Opioid	Ki (nM)
Sufentanil	0.1380
Buprenorphine	**0.2157**
Hydromorphone	0.3654
Oxymorphone	0.4055
Levorphanol	0.4194
Morphine	1.168
Fentanyl	1.346
Methadone	3.378
Alfentanil	7.391
Oxycodone	25.87
Hydrocodone	41.58
Propoxyphene	120.2
Meperidine	450.1
Codeine	734.2
Tramadol	12,486

Data from Volpe DA, et al. Uniform assessment and ranking of opioid Mu receptor binding constants for selected opioid drugs. Regul Toxicol Pharmacol 2011;59:385-90.(4)

Abstract #:F-61

A case of Postpartum Hemorrhagic Posterior Reversible Encephalopathy Syndrome (PRES) not associated with Preeclampsia

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Introduction: Postpartum headaches (PPH) are common in the obstetric patient population. Many are benign, though certain signs or symptoms warrant concern of more serious etiologies. We report a case of PPH associated with visual changes, in which MRI revealed a diagnosis of hemorrhagic posterior reversible encephalopathy syndrome (PRES).

Case: A 32-year old healthy G3P2 presented at 40 weeks in active labor and received epidural analgesia prior to vaginal delivery. On PPD 1 she had tubal ligation under spinal anesthesia, and had sustained hypertension postoperatively. After negative preeclampsia workup, she was discharged on nifedipine. On PPD 6, she presented with severe headache, emesis and vision loss. Nicardipine and magnesium infusions were started. Brain MRI showed acute bilateral occipital lobar hematomas with edema and moderate surrounding SAH, supporting a diagnosis of hemorrhagic PRES. MRV and MRA studies were unremarkable and repeat preeclampsia workup was negative. Over the next 7 days she had gradual improvement in her symptoms prior to discharge on nifedipine and enalapril. She has continued to have headache and blurred vision up to 6 months postpartum and follows with neurology and ophthalmology. Head CT 6 months postpartum revealed encephalomalacia in the areas of previous hemorrhage.

Discussion: PRES is an uncommon syndrome found in a number of medical conditions, including malignant hypertension, eclampsia, and immunosuppressive therapy.(1) Signs and symptoms include headache, altered alertness, seizures, and vision changes. Altered cerebrovascular regulation is thought to result in breakdown of the blood-brain barrier causing characteristic imaging findings of bilateral parieto-occipital edema.(2) Treatment is supportive, with reversibility attributed to early diagnosis, anatomic location of PRES, and clinical history of patients.(1)
Our case was atypical due to the presence of ICH on imaging. Studies report a prevalence of ICH with PRES ranging from 6.4% to 19.4%.(3) PRES related to eclampsia has the highest risk of ICH, while PRES related to hypertension alone has a lower risk.(3) Although our patient experienced acute blood pressure elevation postpartum, preeclampsia was ruled out. ICH with PRES may be an indicator of more severe damage,(4) and the persistent symptoms in our patient supports this as well.

References:

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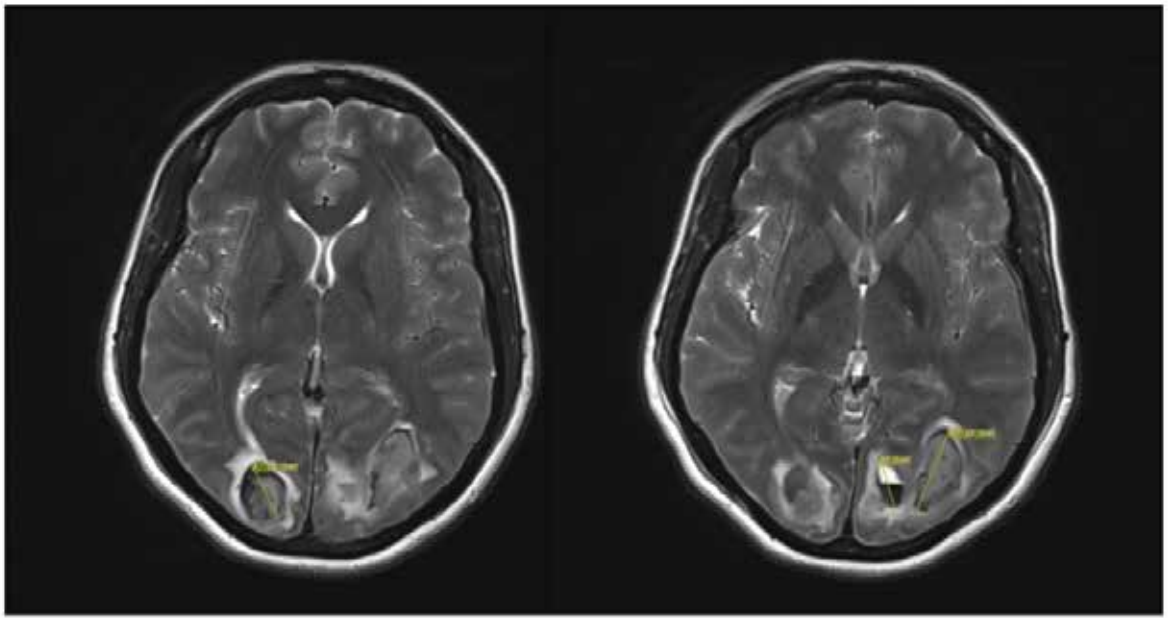

Abstract #:F-62

Post cesarean delivery decompensation in a parturient with scleroderma, severe pulmonary hypertension, and right ventricular failure

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A 43 year old G3 P0111 presented at 29 weeks gestation with worsening shortness of breath. Her past medical history was significant for scleroderma with interstitial lung disease, mega-esophagus, and Raynaud's syndrome. She also had a chronic, markedly elevated left hemidiaphragm of unknown etiology, leading to stomach and bowel in the left thorax and a right mediastinal shift. Echo showed EF >55% with right ventricular systolic pressure (RVSP) of 46-50 mmHg. At 32 weeks gestation, she was scheduled for a repeat cesarean delivery due to worsening RVSP to 60-70 mmHg and inability to optimize her on intravenous (IV) prostaglandins due to her inability to lie flat for a right heart catheterization.

Anesthetic management involved cardiothoracic anesthesiologists, and the plan was for general anesthesia following awake fiberoptic intubation due to the high risk of aspiration. Nitric oxide (NO) was available and extracorporeal membrane oxygenation (ECMO) was on standby in case she decompensated. Prior to intubation and induction, the right brachial artery was cannulated for invasive blood pressure (BP) monitoring. After uneventful awake fiberoptic intubation and induction, a 9 French introducer was placed in the right internal jugular vein. A pulmonary artery (PA) catheter was placed, and initial pulmonary artery pressures (PAP) were 70/30 mmHg. The right femoral artery and left femoral vein were accessed in preparation for possible cardiac bypass or ECMO. Defibrillator pads were placed. PAP remained unchanged at incision and throughout the procedure, ranging from 60s-80s/20s mmHg without NO. A low-dose epinephrine infusion was started after delivery to improve right ventricular (RV) contractility and was continued throughout surgery. Intermittent evaluation of RV function was assessed by transthoracic echocardiography.

Although she remained stable intraoperatively, she was transferred to the ICU on low-dose vasopressors and remained intubated postoperatively in case she decompensated postpartum. She arrived to the ICU with PAP 75/30 mmHg and BP 110/70 mmHg. Within hours, after inadvertent disconnection from the ventilator, she became agitated, hypotensive, and her PAP increased to 111/41 mmHg. Resuscitation required increasing vasopressors and starting inhaled NO and IV epoprostenol. Her PAP slowly stabilized into the 60s/30s mmHg, but she still required vasopressors for BP support. She was extubated to CPAP when her respiratory status improved.

Discussion: Pulmonary hypertension is associated with maternal mortality as high as 30-50%, and may occur a few hours to several days after delivery. In scleroderma, the constricted PAs may not accommodate autotransfusion, resulting in increasing PAP and RV failure. In our case, the patient could not benefit from preoperative epoprostenol and sildenafil, which may have helped to prevent postpartum decompensation.

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Abstract #:F-63

Pubic Symphysis Separation - Possible Cause of Postpartum Neurological Deficits

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Postpartum patients presenting with neurological deficits pose a unique challenge to anesthesiologists. A multidisciplinary team approach is essential to promptly differentiate among various possible etiologies. These range from neurosurgical emergencies such as an expanding hematoma, infection, cauda equina syndrome to prolonged local anesthetic effects, herniated discs, or peripheral nerve injury (1,2,3).

This is a case of a 31 year old, G1P0, at 39.6 weeks gestation who requested labor analgesia. She had an uncomplicated pregnancy and no prior medical history. A CSE was placed uneventfully 8 hours into her labor course with a 17g Tuohy epidural needle and a 27g Pencan spinal needle using isobaric bupivacaine 1.75 mg with fentanyl 15 mcg. Subsequently, the patient received a PCEA with 0.0625% bupivacaine + fentanyl 2mcg/cc throughout her labor at a rate of 12cc/hour. The first stage of labor lasted 14 hours and the second stage lasted 92 minutes, resulting in a spontaneous vaginal delivery of an 8 pound neonate. Subsequently, the patient underwent a 2 hour second degree vaginal repair in the lithotomy position.

PPD 1, the patient complained of an inability to stand without assistance, wobbly gate, back pain, and urinary incontinence. Anesthesia was called to evaluate for a possible neuraxial related injury. Our neurologic exam was limited by severe pain especially upon walking and moving around in bed. Despite this, the lower extremity motor exam revealed 4/5 strength with bilateral hip flexion and extension and 4/5 strength with adduction and abduction. Noteworthy in this case was tenderness to palpation of the pubic symphysis. MRI of the spine on PPD 1 ruled out spinal cord compression and herniated disc.

The patient was diagnosed with pubic symphysis separation, proximal nerve stretching, and neurapraxia from prolonged lithotomy positioning during and after birth. The patient began a physical therapy regimen, was given a belt to stabilize her pelvic girdle, and was discharged home on PPD 4. This case highlights pubic symphysis separation as a possible cause for neurologic deficits post partum. More serious etiologies for neurologic deficits must also be considered and ruled out.

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Abstract #:F-64

Mitral Valve Dehiscence in a 34 week OB Patient with prior Aortic and Mitral Valve Replacement for Endocarditis

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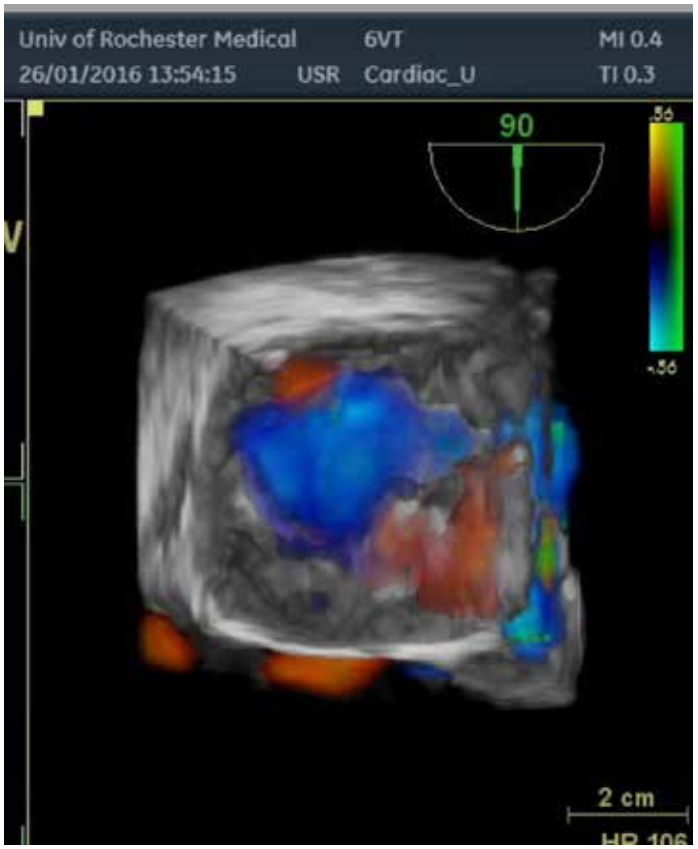
We present a patient with prior valve replacement for infective endocarditis, with mitral valve dehiscence in the setting of recurrent endocarditis and pregnancy.

A 28yo G1P0 with history of IVDU and endocarditis requiring bioprosthetic aortic and mitral valve replacement, presented at 34weeks, 2 days with hypotension, tachycardia, and hypoxia. She reported recent onset fatigability, SOB, fevers, and continued IV cocaine and heroine use. TTE showed mitral regurgitation with rocking and severe pulmonary hypertension. A TEE was performed and under sedation which revealed a significant mitral perivalvular leak without evidence of vegetation. (1) Initial blood cultures were positive and she was started on broad spectrum IV antibiotics, gentle diuresis, and was planned for delivery due to her pulmonary hypertension and ensuing mitral valve decompensation.

Primary cesarean section under general anesthesia was planned for hemodynamic stability and readiness for emergent cardiac surgery intervention if necessary. Pre-induction arterial, internal jugular, and large bore peripheral IV access was secured. She was induced with etomidate, remifentanil bolus, and succinylcholine; and maintained on remifentanil infusion and isoflurane after delivery. After induction she had supraventricular tachycardia which was treated with esmolol. Surgery was complicated by poor placental tone secondary to placenta accreta. IM methylergometrine and IV oxytocin were administered and EBL was 800mL. She was subsequently extubated and admitted to our Cardiac Care Step-down Unit. She was continued on IV antibiotics for treatment of alpha hemolytic streptococcal bacteremia. Her bioprosthetic valves will be replaced upon finishing her antibiotic course, blood culture clearance, and IVDU cessation.



Recurrent endocarditis, and possibly pregnancy, may accelerate bioprosthetic structural valve deterioration.(2) Our patient was at risk of bioprosthetic valve dehiscence and right heart failure secondary to pulmonary hypertension. The successful management of patients with major cardiac issues in pregnancy requires multidisciplinary planning. Our OB/GYN, Cardiology, and OB Anesthesia teams met on multiple occasions to create a plan to deliver this patient safely.

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Abstract #:F-65

Worsening Severe Pulmonary Stenosis in Pregnancy: A Case Report

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Introduction: Women with repaired Tetralogy of Fallot (TOF) can present with significant residual cardiac anomalies such as pulmonary stenosis (PS), pulmonary regurgitation (PR), tricuspid regurgitation and right ventricular (RV) dysfunction. The hemodynamic changes of pregnancy can complicate such cases leading to heart failure and arrhythmias. We present a case of a 24 y/o woman with history of TOF whose pregnancy was challenged by worsening PS and PR.

Case presentation: A 24 y/o G1P0 with history of TOF presented to our institution at 35 weeks EGA for evaluation of non-reassuring fetal heart rate. Her TOF was repaired shortly after birth and she underwent replacement of her pulmonary valve in 2005. Her cardiac disease was complicated by ventricular tachycardia (VT) after which an implantable cardioverter defibrillator was placed.

She had been evaluated by cardiology 4 months prior and was found to have worsening PS and PR. Her transthoracic echo (TTE) at the time showed severe PS and moderate PR with a pulmonic valve gradient of 103mmHg and a mean of 50mmHg. She had signs of right atrial hypertension and an increasing number of premature ventricular complexes (PVCs) putting her at risk for sustained VT.

On admission, she presented with hypertension (HTN) but workup for preeclampsia was negative. On hospital day 2 arterial and central venous lines were placed for monitoring and better-quality access, respectively. A repeat TTE showed normal LVSF (EF 60-65%), right ventricular failure, severe PS and moderate PR with increased CVP. Subsequently, the patient had SROM with late decelerations. She was taken to the OR for cesarean delivery, an epidural catheter was placed and a milrinone intravenous infusion was started. Epidural anesthesia was inadequate and the fetus continued to have recurrent late decelerations, hence general endotracheal anesthesia was induced. Her intraoperative course was complicated by an episode of desaturation, frequent PVCs, and one episode of nonsustained VT. A female newborn with Apgars of 3/9 was delivered. The patient was transported to the ICU after surgery and continued to required vasopressor support for hemodynamic stability. She was extubated on POD 1. Pressor support was weaned and patient was transitioned to beta-blocker therapy for ectopic beats. She was discharged home on POD 5.

Discussion: Cardio circulatory changes associated with pregnancy may result in a significant hemodynamic burden and can lead to morbidity and even mortality in women with cardiac disease(2). Despite being asymptomatic before pregnancy, women with moderate to severe PS can present with serious complications as was seen in our patient (right heart failure and arrhythmias)(1). These patients may require additional hemodynamic monitoring during delivery and should have coordinated care between a congenital cardiac specialist, a high-risk obstetrician and an anesthesiologist.

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Abstract #:F-66

Anaesthesia for Caesarean section in a parturient with newly diagnosed ventricular bigeminy

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Introduction: Ventricular bigeminy is a cardiac arrhythmia which has the potential to degenerate into ventricular tachycardia or fibrillation. This is a case report highlighting the anaesthetic management and postoperative care of a parturient with newly-diagnosed ventricular bigeminy undergoing urgent lower segment caesarean section(LSCS). A multi-disciplinary approach with appropriate monitoring and tailored anaesthetic technique is needed to achieve favourable materno-fetal outcome.

Case Description: A healthy 31 year old primigravida was electively admitted for induction of labour at 38 weeks gestation. Maternal bradycardia was noted and ECG performed revealed ventricular bigeminy with heart rate between 38-45. Urgent cardiology referral was made. Impression was likely PVCs from right ventricular outflow tract obstruction. Decision was made for urgent LSCS.

Low dose combined spinal-epidural was performed in the sitting position, at the L4-L5 interspace. 1.8ml of 0.5% heavy bupivacaine, fentanyl 20mcg and morphine 100mcg were administered. Haemodynamic date such as heart rate, blood pressure and cardiac index were monitored using NEXFIN. Intermittent boluses of ephedrine were given. A healthy 2.5kg male baby was delivered. Intravenous duratocin 100mcg was adminstered.

The patient remained stable and was discharged on the third day. Outpatient investigations revealed high PVC load and beta blocker was commenced with advice on ablation techniques.

Discussion:
The NEXFIN device is a new, non-invasive continuous cardiac output monitor using finger arterial pulse-contour analysis. Arterial pressure is measured directly from a finger cuff using a volume-clamp method, where brachial arterial pressure is reconstructed using waveform filtering with pressure level correction. Advantages include ease of use, rapid installation and non-invasiveness. This avoids the potential serious complications associated with arterial line insertion.

A recent paper validated the use of NEXFIN in the obstetric population, where haemodynamic stability maintained during spinal anaesthesia for LSCS led to good outcomes. As there is no autoregulation of uteroplacental perfusion, maternal hypotension may lead to placental hypoperfusion and fetal ischaemia. The use of NEXFIN device provided continuous cardiac output and blood pressure monitoring, which enabled timely intervention to maintain haemodynamic stability.

Whilst the presence of more than 5 PVCs per minute has been reported to increase cardiac risk, recent studies have shown that aggressive attempts to maintain sinus rhythm do not improve outcomes in asymptomatic patients. Anti-arrhythmic was not administered and the patient remained stable.

Multi-disciplinary team involvement and vigilant monitoring contributed to the successful outcome. NEXFIN-a new finger plethysmography system allows easy installation within minutes and could therefore offer a quick haemodynamic overview, especially in the emergency setting.

Abstract #:F-67

Anesthetic management of a parturient with single ventricle physiology for cesarean delivery

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A 33 year old G3P1011 at 38 weeks gestation presented with labor pain. Her past medical history was significant for tricuspid atresia with Fontan correction at age 4. She denied cardiac symptoms during pregnancy and had normal function of her single systemic left ventricle on an echocardiogram. Her obstetric history was significant for one prior uncomplicated vaginal delivery with epidural analgesia.

An arterial line was placed and intravenous fluids bolused immediately prior to and during labor epidural placement to maintain adequate preload. She received a combined spinal epidural (CSE) for labor analgesia with minimal maternal changes in hemodynamics or fetal heart rate. However, several hours later, she was called for an urgent cesarean delivery (CD) for a nonreassuring fetal heart tracing. The labor epidural catheter was utilized for anesthesia and the CD proceeded uneventfully. She recovered in the cardiac care unit postpartum.

Discussion: The prognosis for patients with congenital cardiac disease has greatly improved, and patients are now surviving to childbearing age and beyond. Tricuspid atresia is a condition where the tricuspid valve is not developed, resulting in a hypoplastic right ventricle. An interatrial communication is needed to sustain single ventricle physiology. The left ventricle provides pulmonary and systemic blood flow in parallel circuits. The ratio of flow is dependent on the ratio of pulmonary vascular resistance to systemic vascular resistance (PVR:SVR). Fontan correction occurs in early childhood to allow for passive blood flow to the lungs from the venous system while the left ventricle supplies systemic flow.

The primary goal during anesthetic care is a high preload and low afterload state with a beneficial PVR:SVR ratio. Stable cardiac output and sinus rhythm must be maintained. Ventilation goals include low peak pressures, short inspiratory times, and a low to normal $PaCO_2$ to maintain a low PVR and high preload. Spontaneous ventilation should be utilized when possible. Neuraxial techniques are generally limited to low-dose CSE or epidural in an effort to avoid a sudden sympathectomy, which could cause shunt reversal and hypoxic systemic flow. For general anesthesia, stable hemodynamics is essential, and ketamine or etomidate can be used for induction.

For our parturient, epidural placement provided labor analgesia and provided neuraxial anesthesia for cesarean delivery, thus allowing for spontaneous ventilation during surgery. Generous preload, incremental epidural dosing, and continuous blood pressure monitoring allowed for hemodynamic stability and avoidance of shunt reversal.

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Abstract #:F-68

Anesthetic Management of a Parturient with Human Immunodeficiency Virus and Associated Pulmonary Arterial Hypertension

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Case Presentation: We present a 30 year-old, G3P0 with WHO group 1 severe pulmonary arterial hypertension (PAH) associated with congenital HIV/AIDS. She was found to be pregnant at 12 weeks gestation and was initially counseled to terminate the pregnancy, which she refused. The patient subsequently presented with shortness of breath, hypoxia, and peripheral edema at 25 weeks. On admission, her CD4 count and viral load were 72/μL and 494 copies/mL, respectively. Pro-BNP was 880pg/mL and PA systolic pressure was 82 mmHg by transthoracic echocardiography (TTE). She was diuresed and received treatment for Pneumocystis pneumonia (PCP). Due to outpatient medication nonadherence, she remained hospitalized for 51 days until her scheduled cesarean delivery for monitoring and symptom management. Serial TTE was obtained to assist in medical management and her PAH was managed with tadalafil.

A multidisciplinary team consisting of cardiologists, obstetricians, and obstetric anesthesiologists planned for delivery. Scheduled cesarean was performed successfully at 33 weeks with continuous inhaled epoprostenol, epidural anesthesia, arterial pressure monitoring, and PICC line for vasopressor infusion. After returning to the cardiac intensive care unit immediately postpartum, the patient's remaining postoperative course was uneventful and she was discharged on postpartum day 7.

Discussion: As a result of the use of highly active antiretroviral therapy (HAART), survival rates for children with congenital HIV have improved dramatically. Thus, an increasing number of these individuals with chronic HIV infection are nearing reproductive age. HIV-related pulmonary arterial hypertension (HIV-PAH) is a rare complication of HIV infection, occurring in about 1 in 200 HIV-infected individuals. Even during the era of HAART, prevalence of HIV-PAH has remained unchanged. As noted in several studies, severe PAH in pregnancy has a mortality rate as high as 30 to 50%. Death most often occurs following delivery as significant changes in physiology occur rapidly over several hours to days. However, prior to delivery, pregnancy related cardiovascular and pulmonary changes can worsen pulmonary hypertension. Therefore, a multidisciplinary team approach prior to delivery is essential to optimize outcomes.

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Abstract #:F-69

Our Obstetric Anesthetic Experience in a Parturient with Ellis Van Creveld Syndrome

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Introduction: Ellis-van Creveld syndrome (EVC) is an inherited disorder of bone growth that occurs in 1 in 60,000 to 1 in 200,000 newborns, resulting in dwarfism. Individuals with this syndrome have short forearms and legs, polydactyly, a narrow chest with short ribs and associated cardiac defects. They are not known to have the airway or spine abnormalities seen in achondroplasia. We describe the anesthetic management of a parturient with this syndrome with an original plan for vaginal delivery with neuraxial labor analgesia but later changed to C-section under GA.

Case: A 32 year-old patient G1P0 with EVC and with an IVF pregnancy was admitted for induction of labor at 36 weeks gestation. She had been diagnosed with preeclampsia at 33 weeks gestation and now complained of a headache of 2 days duration. Her current medical history was significant for moderate mitral regurgitation and mild pulmonary stenosis. She was 4'9" tall and weighed 158 lb. She had the facial features of dwarfism with shortened extremities. Her airway and lumbar spine exam were unremarkable.

Induction of labor was initiated with vaginal misoprostol administration with subsequent request for neuraxial labor analgesia. The lumbar epidural space was easily identified; however we experienced difficulty in threading the epidural catheter. We were able to insert the catheter at another level after two attempts using CSE. A 0.2% ropivacaine infusion was started at a low dose due to initial hypotension, with relief of pain. The patient had infrequent contractions thereafter and reported mild discomfort during her contractions, which was attributed to the low dose of infusion. The infusion rate was increased minimally with no further increase due to concern for hypotension. After being in labor for more than 24 hours, she was started on oxytocin with subsequent arrest of descent. A decision was made to perform a C- section. Local anesthetic was given epidurally. She experienced a one-sided dense anesthetic block discovered on exam. Surgery was performed under GA uneventfully.

Discussion: EVC and achondroplasia are varieties of dwarfism. Failure to establish sensory blockade after spinal anesthesia, in a pregnant patient with EVC has been described (1).We had unexplained unilateral blockade even though the catheter location appeared optimal with about 4 cm in the epidural space. The unpredictable behavior of local anesthetics with neuraxial blocks has been described with achondroplasia (2). We experienced difficulty in threading the epidural catheter, which might be explained by an altered anatomy secondary to her narrow chest. Our patient was scheduled for vaginal delivery, as she was perhaps not thought to have significant cephalopelvic disproportion. We recommend that an elective C-section might be preferable in these patients.

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Abstract #:F-70

Thrombotic Thrombocytopenic Purpura Relapse During Induction of Labor

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Introduction: Thrombotic thrombocytopenic purpura (TTP) is a rare etiology of thrombocytopenia during pregnancy. Most cases of TTP are due to hereditary or acquired inhibition of the enzyme ADAMTS-13 (A Disintegrin And Metalloprotease with ThromboSpondin type 1 domain 13), a metalloprotease that cleaves von Willebrand factor (vWF) so that it does not thrombose the microvasculature. In TTP, vWF multimers bind platelets causing thrombocytopenia, microangiopathic hemolytic anemia, and arterial ischemia.1 We report a patient with TTP who had an acute crisis during induction of labor (IOL) and was treated with tranexamic acid (TXA).

Case: A 26-year-old primigravida with an 8-year history of hereditary TTP, and undetectable ADAMTS-13 levels, was admitted for IOL at 41 weeks gestation. She was previously treated with therapeutic plasma exchange (TPE), immunoglobulin, steroids, and rituximab. Due to multiple TPEs, she was alloimmunized to HLA antigens with one TPE complicated by anaphylaxis. The patient was in remission for two years prior to pregnancy, and remained well until IOL.

The patient's initial platelets were 33 x 10^9/L. A hematology consultant felt the TTP was active and recommended prednisone treatment and aborting the IOL. Despite this, the TTP worsened over three days, with platelets decreasing to 17 x 10^9/L, but without other symptoms. The decision was made for Cesarean delivery. Platelet transfusions are contraindicated in TTP; TPE with FFP was contraindicated in this particular case due to hypersensitivity. We decided to administer two doses of TXA (10 mg/kg) intraoperatively at incision and closing. The patient underwent general anesthesia with an estimated blood loss of 1 liter. On day four, her platelets were 6 x 10^9/L, with hemolytic anemia requiring blood transfusions. The patient was transferred to the ICU and improved with TPE and high dose steroids. She was discharged home three weeks later without complications.

Conclusion: It is important, but difficult, to distinguish TTP from other pregnancy-related thrombocytopenic disease states since it carries a poor prognosis and high fetal mortality.2 Pregnancy itself may precipitate TTP because ADAMTS-13 activity is decreased while vWF increases. All thrombocytopenias may deteriorate rapidly, and misdiagnosis can be fatal, especially when TTP is overlooked. TXA prevents the conversion of plasminogen to plasmin, thereby limiting fibrinolysis. Although generally contraindicated in prothrombotic states such as TTP, TXA has minimal complications with typical doses.3,4 We believed the risk of significant blood loss in this patient outweighed the risk of thrombosis. Further research into the use of TXA in pregnancy is needed.

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Abstract #:F-71

Preeclampsia complicated by hepatic capsular rupture, TRALI and cardiac arrest: A Case for Extracorporeal Membrane Oxygenation

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A 30-year-old healthy term parturient was admitted for induction of labor for elevated blood pressures and right upper quadrant pain. On admission her laboratory findings were significant for an elevated AST and ALT as well as a slightly decreased platelet count and a creatinine of 0.88. She underwent an uneventful CD . Several hours postpartum she was hypotensive and tachycardic. The patient returned to the OR for a D&C for suspected retained products of conception. However, ongoing bleeding occurred and a hysterectomy was performed for uterine atony. During this time, an internal jugular cordis and arterial line were placed. Pressors were initiated. After the administration of 13U of packed red blood cells, 10U of fresh frozen plasma, 6-units of platelets and 190 mL of cryoprecipitate the patient developed high peak airway pressures and hypoxemia. Nitric oxide was administered and low tidal volumes with PEEP and pressure control ventilation were instituted. The patient was placed on veno-venous (VV) ECMO despite ongoing bleeding and pressor requirements with immediate resolution of her hypoxemia. She ultimately required a total of 7750 mL of packed red blood cells and 7000 mL FFP. During resuscitation and re-exploration, the patient suffered a cardiac arrest and was quickly placed on venous-arterial-venous (VAV) ECMO. The patient continued to bleed and was found to have a decapsulated right lobe of the liver with laceration. The patient's course was complicated by cardiac, hepatic, respiratory, and acute renal failure as well as altered mental status. She was decannulated by day six, extubated by day seven and discharged home on day 21. This is the first case to describe the use of ECMO in a patient requiring massive transfusion for peripartum hemorrhage after a cesarean delivery (CD).

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Abstract #:F-72

Cesarean Section In A Parturient With Impending Herniated Brain Tumor – An Anesthetic Challenge

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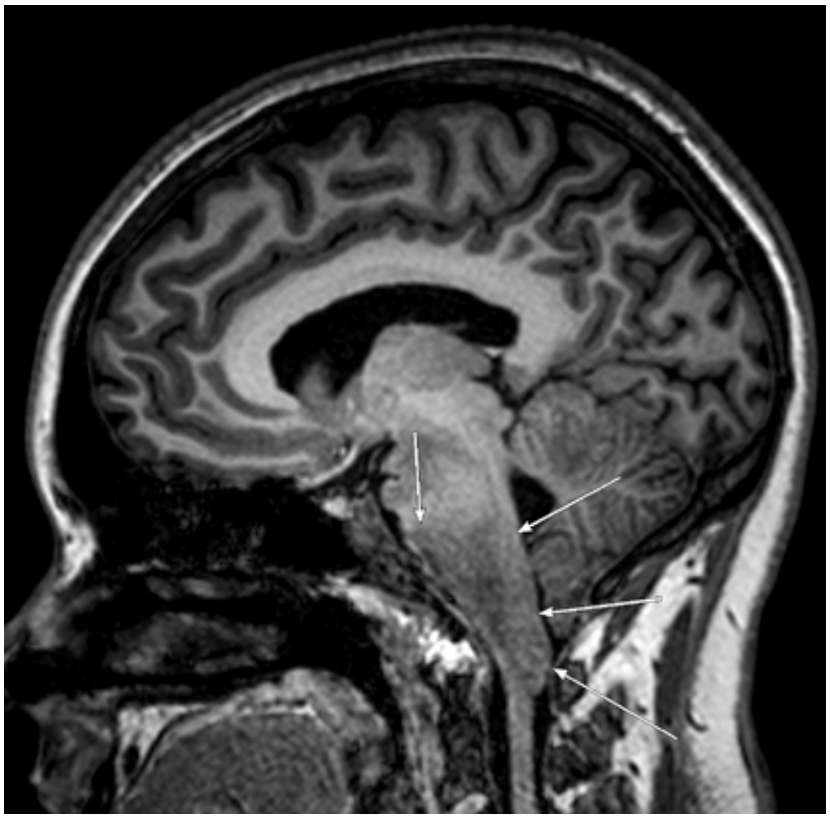
Introduction: Brain tumors in parturients are rare (1). Their presentation can be aggravated or unmasked by pregnancy(1). Potential herniation from a brain tumor is a major concern in constructing the anesthetic plan. Detailed consideration must be given to both maternal and fetal safety.

Case Presentation: A 22 year G2P0 with a posterior fossa mass lesion (figure 1) presented at 22 weeks gestation with headache. She was observed closely with planned continuation of pregnancy. She returned at 34 weeks with worsening neurological symptoms. Emergency cesarean section was planned. General anesthesia was provided after placement of a preinduction arterial line. Remifentanil, lidocaine and esmolol were administered prior to induction. Rapid sequence induction (RSI) was performed with propofol and succinylcholine. A remifentanil infusion was initiated prior to extubation to facilitate smooth emergence and prompt assessment by neurosurgery. Brain biopsy and decompression of the posterior fossa tumor were performed two weeks post cesarean delivery. Both mother and baby did very well.

Discussion: Impending herniation could be catastrophic for both mother and baby. A comprehensive anesthetic plan and smooth intraoperative management are essential to achieve excellent outcomes for both the mother and fetus. Fear of aggravation of brain stem herniation precluded neuraxial anesthesia. Use of general anesthesia was also associated with considerable risks. Airway management in pregnant women can be challenging (2). While there was concern with the possible elevation of ICP associated with succinylcholine, the benefits of using succinylcholine for RSI in this patient at risk for aspiration and difficult intubation were felt to outweigh the risk. Esmolol, lidocaine and remifentanil were used to blunt the hemodynamic response to intubation and emergence thereby decreasing the chance of elevated ICP/herniation. Careful anesthetic and surgical management with multidisciplinary collaboration led to successful cesarean delivery followed by successful tumor resection with excellent results for both mother and baby.



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Abstract #:F-73

Perioperative management of a parturient with severe cardiomyopathy for with postoperative use of an Impella catheter based cardiac assist device

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A 30 year old woman G2P1 @ 35 weeks presented to Labor and Delivery with shortness of breath and poor exercise tolerance. The patient was diagnosed with severe cardiomyopathy with an ejection fraction of 20%. Her right ventricle function was reported as normal. The initial plan by MFM for this patient was an induction of labor and possible vaginal delivery. Evaluation by obstetric anesthesia revealed a patient in severe distress, sitting upright with a respiratory rate in the 30s who appeared to almost require intubation. It was agreed that an induction of labor was not an ideal plan for this patient.

Her clinical status improved with furosemide and blood pressure control with labetalol. The patient was brought to the OR for a cesarean delivery in our main operating room with coordination with obstetrics, NICU, cardiac anesthesia and cardiothoracic surgery. Prior to surgery, CT surgery placed two femoral cannulas for initiation of ECMO if necessary. The patient was unable to lie flat without developing dyspnea and we proceeded with a plan for general anesthesia. After induction of anesthesia with etomidate and succinylcholine and endotracheal intubation, the patient became hypoxic (spO2 80's) with severe pulmonary edema. Transesophageal echocardiogram revealed severely decreased LV function but now the patient also had severely depressed RV function. Vasopressor therapy was initiated with milrinone, dobutamine, and norepinephrine. TEE exam revealed improvement in both RV and LV function after initial inotropic support. The patient's oxygenation improved after delivery of the neonates. The patient still required these three vasopressors for BP support.

Postoperatively, a transthoracic echocardiogram revealed an ejection fraction of <10%. The patient was brought to our cardiac catherization lab for further evaluation and management. A catheter based cardiac assist device, Impella, was placed for cariogenic shock. After placement of the Imeplla, the patient's hypoxia and clinical status improved. Her vasopressors were weaned over the next three days and the patient was extubated on postoperative day #3. Her EF improved to about 10% and the patient Impella device was removed on POD#4. The patient was placed on medical treatment for congestive heart failure.

The case highlights the value of the obstetric anesthesiologist in determining an appropriate plan for our medically challenging patients on labor and delivery. Coordination with cardiac anesthesia helped to facilitate invasive monitoring, rapid use of TEE in the operating room, and appropriate vasopressor management. The Impella device is a newer device used in cardiology that we may see more often in the management of postpartum cardiogenic shock.

Abstract #:F-74

Anti-NMDA receptor antibody encephalitis in a pregnant woman: Anesthetic and pain management considerations for a combined C-section and oophorectomy

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Anti-N-methyl-D-aspartate receptor (anti-NMDAR) encephalitis is caused by production of antibodies to the NMDA receptor and is characterized by psychiatric and neurologic symptoms. Ovarian teratomas are found in the majority of female patients. To date, there have been no reports of pregnant patients with anti-NMDAR encephalitis undergoing neuraxial anesthesia for C-section. Symptoms of this disease such as psychosis, paroxysmal sympathetic hyperactivity, and central hypoventilation pose risks during anesthesia. We provide the first report of neuraxial anesthetic management of a patient with severe, treatment refractory anti-NMDAR encephalitis undergoing C-section.

A 28-yo G1P0 with an intrauterine pregnancy of 16wks estimated gestational age (EGA) was transferred from an outside hospital in status epilepticus where she originally presented with complaints of increasing anxiety, insomnia, and inability to follow commands. She was admitted to our ICU where she was intubated and sedated. Keppra and lacosamide were given to control her seizures. CSF samples obtained at the outside hospital were positive for NMDAR antibody. An abdominopelvic MRI was negative for teratoma, but was notably obscured by the gravid uterus. The patient required initiation of clonidine, bromocriptine, methadone, and propanolol for severe autonomic dysfunction, and also needed prolonged ventilator support and tracheostomy. She completed a total of eleven plasma exchanges and two doses of rituximab with minimal symptom relief.

The patient was discharged to a rehabilitation facility at 21wks EGA, but continued to worsen, experiencing periodic catatonia, anorexia, and intrauterine growth restriction, and was readmitted to our hospital. At 24wks EGA, she received one dose of cyclophosphamide for refractory symptoms. Because of lack of improvement, a C-section was scheduled for 28wks EGA, prior to the next planned dose of cyclophosphamide. This timing would allow for increased fetal maturity without further exposure to chemotherapy. In addition, if a tumor was found, an oophorectomy could be performed to prevent continued secretion of antibodies. We planned a combined spinal-epidural for optimal anesthetic density and duration. Intravenous methadone was given perioperatively to avoid withdrawal and minimize autonomic dysfunction. Anesthesia and delivery occurred without incident, and she underwent a right oophorectomy for a grossly visible lesion which pathology confirmed as a mature cystic teratoma. Satisfactory post-operative analgesia was provided with a combination of neuraxial morphine and subfascial wound infusion of 0.5% bupivacaine at 5ml/hr.

The patient was discharged 2wks after delivery, but returned the next day in status epilpeticus. After another prolonged hospitalization requiring intubation, her seizures were ultimately controlled with high dose keppra, lacosamide, and fosphenytoin. She was discharged 10d later to home health with neurologic follow up.

Abstract #:F-75

An Early Success Story: Extracorporeal Membrane Oxygenation (ECMO) for Acute Respiratory Distress Syndrome (ARDS) during Pregnancy

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A 25-year-old AA female, G2P0010 at 19 weeks GA was admitted with severe sepsis and ARDS following a cardiac arrest secondary to iatrogenic hypoglycemia. History was significant for T1DM, gastroparesis, CRI, hydronephrosis, HTN, and medical non-compliance. Following resuscitation at an OSH, she became difficult to oxygenate. CXR was consistent with aspiration pneumonitis, which likely occurred during ACLS. Despite escalating treatment, she continued to decompensate. Maximum ventilator settings did not improve oxygenation. She was transferred to our tertiary care facility for further management. Given that her fetus was pre-viable, preservation of her life was the primary goal. On arrival, she was immediately cannulated for venovenous ECMO and received a tracheostomy. The fetus was intermittently monitored during ECMO and showed reassuring growth for GA. After 7 days, the patient was decannulated from ECMO. She discharged home 2 weeks later. The following week, she was readmitted with DKA, HTN, and concern for preeclampsia. Despite negative HELLP labs, a non-reassuring fetal assessment prompted urgent cesarean delivery of the infant at 26+3/7 weeks GA. The delivery was uncomplicated, but due to pulmonary edema and social issues, she was not discharged until POD12. The male infant suffered from apnea and feeding difficulties. After 2.5 months in NICU, he was discharged stable on room air, feeding well, with no obvious sequelae of his mother's illness or ECMO requirement.

Mortality from ARDS in parturients is 40-50%. ARDS can develop from many obstetric etiologies (AFE, preeclampsia, septic abortion), but aspiration pneumonitis continues to be an important cause of ARDS and maternal mortality.(2,3)

Less than 70 cases of peripartum ECMO have been reported, most of which were for ARDS from H1N1 influenza. Maternal survival rate is 80%, fetal survival is 70%.(3,4) Aside from technical concerns of low femoral catheter flow due to gravid uterus, the major complication in parturients is catastrophic postpartum hemorrhage due to systemic anticoagulation.(3,4) Our patient required many blood products while on ECMO, but there were no thrombotic complications or hemorrhage from pump trauma or anticoagulation. She was not anticoagulated at time of delivery.

Given the paucity of evidence or guidelines for peripartum ECMO, this is a remarkable success for both our patient and her son. As technology advances, ethical issues will arise regarding use of fetal well-being, in addition to recalcitrant maternal hypoxia, as a factor in the decision to initiate ECMO.(1) Longitudinal studies of maternal and fetal outcomes are required. This case represents a paradigm shift in maternal resuscitation. When non-invasive measures fail, ECMO is a viable life-saving measure for a parturient with ARDS.

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Abstract #:F-76

Seizure in a parturient: Fixation as potential cause for a near miss

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A 37 year old G1P0 with hypothyroidism was admitted for induction of labor for uncontrolled gestational diabetes. Epidural analgesia was initiated uneventfully prior to insertion of a foley bulb. Electronic fetal monitoring demonstrated a category 1 tracing. Seven hours later the OB emergency response team was called for fetal deceleration and maternal seizure. Transfer to the OR for a STAT cesarean without monitors or supplemental O2 was in progress until arrival of the OB anesthesiology team. Upon our arrival, she was noted to be unresponsive and apneic. Midazolam was administered intravenously without improvement. PEA arrest was eventually diagnosed, ACLS was initiated and a STAT cesarean was performed. Endotracheal intubation was successful after four attempts, complicated by an esophageal intubation and aspiration. APGAR scores were 1, 5 and 7 at 1, 5 and 10 min. She received a total of 5mg IV epinephrine, after which she resumed spontaneous return of circulation (ROSC). TTE demonstrated RV strain with LV under-filling, concerning for embolic event. She was transferred to the SICU, at which time she demonstrated signs and symptoms consistent with disseminated intravascular coagulation. She required ionotropic support overnight. Her coagulopathy slowly improved, and she finally was extubated on POD#3. A CT-angiogram was negative for significant pulmonary embolism, confirming the initial suspicion of amniotic fluid embolism. She initially demonstrated severe cognitive impairment with deficits in orientation, memory and reasoning, but had significantly improved by time of discharge on POD#15. Fixation error or getting "cognitively stuck" can occur more commonly during a crisis or times of stress resulting in focusing on a single source of information, missing a crucial piece of information, failing to revise one's cognitive processes, or failing to accept the most likely etiology. This leads to fixating on a diagnosis, treatment or avoidance in requesting additional help resulting in significant morbidity and mortality unless harm is avoided, in which case it is a near miss. Near misses provide opportunities to: 1) learn about our systems, abilities, vulnerabilities, and structure 2) identify problems 3) formulate plans to mitigate errors. Seizure in a parturient inspires the diagnosis of preeclampsia. This avoids all other potential causes and misses the appropriate treatment, which almost occurred until PEA arrest was recognized. Fixation is a natural by-product of specialty training and of guidelines created to deal with crises and uncertainty, i.e. anesthesiologists are trained to manage airway and circulation, and thus focus on maintaining hemodyamic stability and airway patency, often forgetting in utero resuscitation. Using this reasoning, fixation on fetal deceleration almost resulted in a timely and costly transfer to the OR that would have likely resulted in maternal and fetal mortality.

Abstract #:F-77

Multidisciplinary Management of Life-Threatening Hypokalemia and Rhabdomyolysis in the Pregnant Patient: The OB Anesthesiology Consultant's Role in Obstetric Critical Illness

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A 37 year old non-laboring G3P1 at 29 weeks EGA was admitted with a 2-week history of progressive lower extremity weakness and several days of upper extremity weakness. She had history of hypertension, morbid obesity (BMI 46), tobacco use, narcolepsy/cataplexy, and possible diagnosis of multiple sclerosis (MS), thought to be quiescent. Admission findings included severe hypokalemia (K+ 1.4mmol/L), BP 160-197/74-115, acute kidney injury (AKI) [BUN/Cr: 6mg/dL and 1.1mg/dL], acute tubular necrosis (ATN) [FENA 1.6], creatine phosphokinase 1765, and CK-MB fraction levels consistent with rhabdomyolysis. Neurology consultant confirmed isolated motor weakness of lower and upper extremities with no other deficits, inconsistent with M.S. flare. The nephrology consultant diagnosed rhabdomyolysis induced by hypokalemia secondary to ATN. Initial management was on the obstetric ward, but the obstetric anesthesiology consultant recommended invasive blood pressure monitoring, central venous access, and transfer to a medical intensive care unit (ICU), to facilitate safe and more rapid potassium repletion. The day before ICU admission, she received 80 mEq KCL. On the first ICU day, she received 360 mEq KCl (160 mEq IV, 200 mEq PO), which raised her plasma K+ from 2.1 to 3.8, with complete resolution of weakness. Subsequently, oral KCl, 40 mEq TID, sufficed to maintain normal K+ levels. She was discharged on hospital day 7 and delivered at term via elective cesarean.

This case reflects recent reports of parturients with hypokalemia-induced rhabdomyolysis. The case also highlights benefits of multidisciplinary collaboration in such patients in facilitating timely and effective correction of life-threatening hypokalemia, mitigating risks of rapid potassium repletion. The OB anesthesiology consultant served a role similar to the perioperative physician, providing intermediate medical care for a critically ill pregnant patient requiring intensive care services. Severe hypokalemia can result in respiratory failure and death. The safe and timely repletion of a severe total body potassium deficit was facilitated by central venous access and telemetry monitoring in ICU. Close working relationships with our critical care colleagues facilitated streamlined patient care. Obstetric management is multidisciplinary by nature (midwives, obstetricians, nurses, neonatologists, anesthesiologists), yet roughly 70% of perinatal deaths are attributed to miscommunication. Modeling after the perioperative surgical home, a multidisciplinary approach to providing care for a critically ill obstetric patient, with a team leader familiar with peripartum physiology and able to coordinate care, may improve outcomes.

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Abstract #:F-78

Management of a parturient with untreated WPW during cesarean section

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A 37 year old G3P1 presented in labor for urgent cesarean section. She had a previous cesarean delivery and desired a repeat cesarean section. The patient's past medical history was significant for Wolff-Parkinson-White Syndrome(WPW). The patient was diagnosed with WPW during her 7th month of pregnancy. At that time, she had an episode of palpitations and was brought to the emergency room. Her EKG revealed normal sinus rhythm with a WPW pattern. An echocardiogram showed an ejection fraction of 52% and was otherwise unremarkable. The cardiologist's recommendations was to avoid medication treatment at that time due to the pregnancy and then proceed with ablation during the postpartum period. The patient reported no further episodes of palpitations.

To avoid sudden hypotension and need for vasopressors, an epidural anesthetic was planned for the patient. A 1000 cc intravenous bolus of Lactated Ringers was administered. Anti-arrhythmic medications and a defibrillator were immediately available. After placing blood pressure, pulse oximetry and continuous EKG monitoring, an epidural catheter was placed uneventfully at L3-4. The catheter was injected with lidocaine 45 mg to test for a subarachnoid placement and 0.5ccs of air to rule out intravascular placement of the catheter. After a negative test dose was determined, the epidural catheter was bolused with 3% 2-chloroprocaine. Despite bolusing the catheter with 20 cc of 3% 2-chloroprocaine and 8 cc lidocaine 2% with 1:600K epinephrine, the patient's sensory block remained at T9. The epidural catheter was then removed and another epidural catheter was placed with sterile technique at L2-3. After a negative test dose with lidocaine 45mg and 0.5cc air, the epidural catheter was then bolused with 5 cc of 3% 2-chloroprocaine. A bilateral T4 sensory block was obtained. A cesarean section proceeded uneventfully and a healthy infant was delivered. An oxytocin infusion (20 units/1000ml) was started at 200 cc/hr. The patient's blood pressure and heart rate remained stable with no need for vasopressors or signs or symptoms of arrhythmia throughout the surgery and postoperative period.

Discussion: Wolff-Parkinson-White Syndrome(WPW) accounts for most of the supraventricular tachycardia arrhythmias in women of reproductive age.(1) Because the commonly used medications to treat WPW cross the placenta and are only recommended for patients with severe symptoms or sustained arrhythmias(2), the WPW patients that present to labor and delivery are often untreated. We discuss our management of an untreated WPW parturient presenting for urgent cesarean section and review the perioperative goals and recommended anesthetic management.

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Abstract #:F-79

Heavy Metal Labor- Patient Rocking Wilson's Disease

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A rare case of copper toxicity in a parturient with Wilson's disease.

A 32 y/o G2P0 at 13 weeks' gestation with known Wilson's disease that was diagnosed in 2014, and history of IVDA presented for MFM consult with exacerbation of her neurologic symptoms including: altered mental status, weakness, dysphagia, dysarthria, gait disturbance and increasing tremors. Patient had increasing neurologic symptoms subsequent to withdrawal of her chelation therapy drugs for a known pregnancy. The patient was previously on trientine, gabapentin, levetiracetam, carbidopa-levodopa, and trihexyphenidyl. She was switched from chelation therapy to treatment with zinc acetate. Her laboratory values showed no signs of liver failure, but her neurologic status continued to deteriorate and she was intubated for airway protection. Plasmapheresis was initiated for copper toxicity. The patient was unable to have a PEG tube placement due to her gravid uterus, and had an NG tube throughout the remainder of pregnancy. Serum copper level was 66 and ceruloplasmin level 18 prior to plasmapheresis. Her weakness and bulbar symptoms improved after plasmapheresis and follow up MRI showed no new cranial lesions or signs of encephalitis. Patient's worsening neurologic status was presumed to be due to increasing copper in her brain parenchyma and the symptoms improved after resuming her original therapy with tryihexyphenidyl and trientine. This patient's neurologic symptoms slowly improved after approximately 6 weeks of hospitalization, re-initiation of chelation therapy, and intensive OT/PT. Patient decided to continue with pregnancy and adamantly refused termination. She was then seen for induction of labor at 40 weeks and 6 days. A labor epidural was placed without complications, and she had a NSVD of a 3138g male infant. A Nexplanon was inserted prior to discharge and she continued her chelation therapy with trihexyphenidyl and trientine.

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Abstract #:F-80

Insanity on the Labor Unit: Schizophrenia and Ethical Dilemas

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Our goal is to present a case that poses interesting ethical issues in the practice of medicine and obstetrical anesthesiology in particular. Globally there has been much written about the responsible care of pregnant patients with major mental disorders. The ethical dilemmas include 4 components: the concept of the fetus as a patient, the definition of maternal decision-making capacity, the concept of maternal assent, and beneficence-based clinical judgement.

The patient was a 35 year old woman who was gravida 6, para 5005. All her off spring resided in foster care. She presented to our institution at 39 weeks estimated gestational age as a transfer from a psychiatric hospital. She carried a long-standing diagnosis of paranoid schizophrenia with a history of violent tendencies towards healthcare workers, as well as incarceration for assault. She had been transferred for possible vaginal bleeding and refused any form of examination pre-transfer. She had been involuntarily committed earlier in her pregnancy and it was determined that she was confined to the hospital without the capacitance to leave against medical advice (AMA). Psychiatry deemed this patient to be lacking in capacity to make medical decisions for herself and the unborn fetus. After multiple failed attempts to reach relatives and close acquaintances, it was determined that the physicians would make decisions that were in her best interest. They stipulated that she could not refuse any necessary procedures during this period, such as vaginal exams and / or cesarean section for maternal or fetal indications. Appropriate care was taken to ensure the safety of this patient and hospital staff including removing potentially dangerous objects from the area, appointing a patient sitter, chemical restraints on stand by, and medical staff entering and examining the patient in pairs. As she progressed towards active labor, multidisciplinary discussions around the placement of a labor epidural occurred. As a labor epidural is generally regarded as an elective procedure, it was unclear if the guidelines set forth by psychiatry would cover this procedure. The patient had undergone epidural placement with prior pregnancies. Patient at this time requested a labor epidural for pain control. The anesthesiology team along with maternal fetal medicine determined that an epidural would be in her best interest. A full discussion of risks, benefits, and alternatives was had with the patient who appeared to fully understand these concepts, although a consent form was not formally signed. A labor epidural was placed without issue and the patient had an uneventful labor course resulting in a spontaneous vaginal delivery. Postpartum the baby was released to responsible foster parents and the patient was returned to inpatient psychiatric care.

References:

1. Babbitt KE, et.al . Professionally responsible intrapartum management of patients with major mental disorders. Am J Obstet Gynecol. 2014 Jan;210(1):27-31

Saturday, May 21, 2016

Abstract #:SA-01

Postpartum hemoglobin levels are not associated with maternal health-related quality of life measures

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Background: Delivery has a major impact on health-related quality of life (QoL),(1) however it is unclear whether other modifiable factors, such as maternal hemoglobin (Hb), influence postpartum QoL. The primary aim of this prospective observational study was to examine the relations between postpartum Hb levels and QoL. For our secondary analyses, we examined the relations between postpartum Hb with maternal fatigue and depression.

Methods: After obtaining IRB approval and patient consent, we enrolled 60 patients admitted to a large obstetric center intending vaginal delivery. We assessed QoL, maternal fatigue, and depression on postpartum day 2, using the following validated survey instruments: the RAND 36-Item Short-Form Health Survey (SF-36), the Multidimensional Fatigue Inventory (MFI), and the Edinburgh Postnatal Depression Scale (EPDS). Maternal Hb levels were measured on postpartum day 2. We abstracted maternal obstetric/peripartum data from the medical records. Data are presented as mean (SD), median [IQR], and n (%). We performed unadjusted and multivariate linear regression (adjusting for age, parity, mode of delivery, and race) to assess the associations between post-delivery Hb and each subscale of the SF-36 and MFI. Using EPDS, Hb levels were determined for women with vs. without depression. $P<0.01$ as statistically significant.

Results: Within our cohort, 53 women (88.3%) had vaginal delivery and 7 (11.7%) had cesarean delivery. The race distribution was: 39.4% Hispanic, 26.2% Asian, 24.6% Caucasian, and 9.8% Other. The mean postpartum Hb level was 10.8 (1.4) g/dl. We observed no statistically significant associations between postpartum Hb level with each SF-36 QoL subscale (Table). Additionally, postpartum Hb was not independently associated with any of the five MFI subscales. Using the EPDS, Hb levels were similar among women with vs. without postpartum depression (11 [9.7-11.5] g/dl vs. 11.5 [11.2-13.7 g.dl; P=0.05).

Conclusion: Our findings suggest that postpartum Hb levels may not influence health-related QoL, fatigue or the likelihood of postpartum depression. This may be explained by the fact that the degree of postpartum anemia in our cohort was not severe. Future studies are needed to determine whether postpartum Hb influences QoL among women with moderate-severe anemia (Hb less than 8 g/dl).

Reference:

1. Womens Health Issues 2008; 18: 267-80.

Unadjusted and Adjusted Multivariate Linear Regression of the Relations between Postdelivery Maternal Hemoglobin and Postpartum RAND/SF-36 Subscale Indices.

Outcome	Unadjusted Analyses			Multivariate Analyses*		
	Beta Coefficient	95% CI	P value	Beta Coefficient	95% CI	P value
Physical functioning[a]						
Post Hb (g/dl)	0.78	-3.88 - 5.44	0.74	0.81	-4.68 - 6.31	0.77
Role limitations due to physical health[b]						
Post Hb (g/dl)	0.65	-6.89 - 8.19	0.86	2.00	-5.91 - 9.91	0.61
Role limitations due to emotional problems[b]						
Post Hb (g/dl)	-0.53	-8.28 - 7.22	0.89	-2.35	-10.51 - 5.80	0.57
Energy/fatigue[a]						
Post Hb (g/dl)	1.52	-1.87 - 4.91	0.37	1.53	-2.13 - 5.19	0.40
Emotional well being[a]						
Post Hb (g/dl)	0.53	-3.59 - 4.65	0.80	0.41	-4.03 - 4.85	0.85
Social functioning[c]						
Post Hb (g/dl)	2.04	-1.89 - 5.96	0.30	0.74	-3.24 - 4.72	0.71
Pain[b]						
Post Hb (g/dl)	1.65	-1.81 - 5.10	0.34	1.77	-2.01 - 5.56	0.35
General Health[c]						
Post Hb (g/dl)	1.64	-2.57 - 5.85	0.44	1.48	-2.98 - 5.94	0.51

* adjusted for maternal age, race/ethnicity, parity, mode of delivery.

[a] n=55

[b] n=56

[c] n=53

Abstract #:SA-02

Iron Deficiency Anemia and Peripartum Transfusion in a High-Risk Urban Patient Population

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Introduction: Anemia in pregnancy, which is defined by the World Health Organization as hemoglobin (hgb) of < 11 g/dL, is common.1 Iron deficiency anemia (IDA) is associated with multiple adverse consequences for the patient and her infant, including low fetal birthweight, compromised maternal-neonatal bonding, and an increased incidence of maternal postnatal depression.2 We performed a retrospective observational study to identify the rates of third trimester and peripartum anemia among transfused obstetric patients registered versus unregistered within the University of Chicago hospital system prior to their admission delivery.

Methods: Following IRB approval we identified transfused patients who delivered at ≥23 weeks gestation between January 2011 and March 2015 from an institutional database. Data extraction included hgb levels during 3rd trimester and on delivery admission and discharge, mode of delivery, estimated blood loss, units transfused, 6 wk postpartum hgb levels, oral or IV iron supplementation, self-reported adherence to iron therapy, and postpartum Edinburgh depression scores. Whether patients were registered or unregistered to our institution at time of delivery was documented.

Results: Among the 6265 women included in our database144 (2.3%) were transfused (registered 93 (2.0%) and unregistered 51 (2.4%) (P=0.23)). Rate of anemia in the third trimester was 66% among patients who received prenatal care at our institution, and 62% on delivery admission for all patients. Registered patients had lower rates of anemia on admission than unregistered patients (62% vs 78% P=0.048). Among transfused patients adherence to iron therapy was reported by only 35%. In transfused patients, 31% had an abnormal Edinburgh, indicating depression, although Edinburgh's were not recorded for 92 patients.

Conclusions: The prevalence of anemia was high in our cohort of transfused women compared to the prevalence of IDA of 17% in industrialized countries,3 and anemia was apparent in the third trimester in a large proportion. With low adherence to oral iron, there may be a role for more aggressive intravenous therapy to treat antepartum anemia, decrease transfusion requirements, and to improve Edinburgh scores.

References:

1. WHO. Iron deficiency anemia. 2001;WHO/NHD/01.3
2. Milman: Am Hematol 2011;90:1247-3
3. Khalafallah: Journal of Pregnancy 2012;2012:1-10

Abstract #:SA-03

Practitioner Survey Regarding Knowledge of Iron Deficiency Anemia in Pregnancy

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Introduction: Iron deficiency anemia (IDA), defined by the World Health Organization (WHO) as hemoglobin (Hgb) <11 g/dL, is common in pregnancy and is associated with multiple adverse consequences for the mother and her infant. IDA is prevalent, affecting 17.4% of pregnant patients in industrialized countries, and 51% of pregnant patients worldwide.1 Negative outcomes include low fetal birth weight, reduced maternal cognitive performance, and an increased incidence of postpartum clinical depression.2

Due to the prevalence of IDA and the ability to intervene and correct IDA prior to delivery with iron therapies, as part of a needs assessment we surveyed residents, fellows and faculty to evaluate their understanding of iron deficiency anemia in pregnant women.

Methods: Following IRB approval, we sent a survey to Obstetric and Gynecology (OB/GYN) and Anesthesia residents, fellows and faculty. The survey was administered using REDCap through the University of Chicago. Questions were prepared by OB/GYN and OB Anesthesia attendings with expertise in IDA and an OB anesthesia fellow. Questions were presented to survey respondents two separate times; after respondents entered an answer the correct answer was displayed so that this survey could also act as a learning opportunity.

Results: Forty-nine participants completed the 35 question survey for a response rate of 40.5%. Of those who completed all questions, the average score was 22 (62% correct). The WHO definition of anemia in pregnancy was correctly identified by 45% of respondents; 59% correctly identified the amount of oral iron needed to treat IDA. Only 22% of respondents knew the correct amount of iron absorbed daily through the GI tract, with most respondents overestimating the amount. Providers scored well in questions asking them to consider when to use IV iron; 82% and 94% correctly selected IV iron use in women with poor adherence to oral iron or in women with GI issues. Almost half, 47%, of respondents knew that a 1g increase of hemoglobin in 1 month demonstrated effectiveness of oral treatment.

Discussion: While many survey respondents were able to identify situations where IV iron therapy may be indicated, there is demonstrable need for additional education about iron deficiency anemia in parturient women. A minority of respondents were able to correctly identify the WHO definition of anemia in pregnancy, the amount of iron absorbed, or the Hgb rise that marks effective iron treatment. With more education, practitioners may recognize IDA early and intervene with intravenous iron therapy to raise Hgb levels and reduce transfusion rates when patients are intolerant to oral iron therapy.

References:

Khalafallah AA, et. al. Journal of Pregnancy 2012; 2012: 1-10

Milman N. Am. Hematol 2011; 90:1247-53

Abstract #:SA-04

Massive Transfusion Protocol: Does it translate into improved outcomes in postpartum hemorrhage? A retrospective cohort study.

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Introduction: Over the past decade, Massive Transfusion Protocols (MTP) have been developed and proposed to advance the severe postpartum hemorrhage (PPH) management. MTPs main goal is to synchronize surgical, anesthesia, laboratory and blood bank responses in an immediate and sustainable manner. The MTPs clinical impact in obstetrics is yet to be determined. This study was undertaken to compare the massive transfusion management and clinical outcomes in a labor and delivery unit where MTP is implemented (MTP+) to another where no MTP is implemented (MTP-).

Methods: After obtaining REB approval, Health Record archives of two centres with more than 4000 deliveries a year, were approached to identify all hospitalization of patients that required at least 5 units of red blood cell (RBC) transfusion in the first 24 hours after delivery. In one centre, a specific obstetrical MTP was implemented and running (MTP+) and in the MTP- centre, no MTP was in place. The sampling method was a convenient one including all consecutive obstetric patients between September 2010 and January 2015. Demographic, Obstetrical, management data and outcomes (48 hours survival; mechanical ventilation, length of stay in ICU and hospital; sepsis, acute renal failure; acute respiratory distress syndrome and multiple organ failure) were extracted retrospectively from patient hospital records. Statistical analysis: Student t and Chi-square tests were applied when appropriate (SPSS V20 package; statistical significance at $P<0.05$).

Results: The main results are presented in Table 1. The 48 hours survival was 100% in both centres.
Table 1. Demographic, obstetrical, management and outcomes data (mean± standard deviation/frequencies and percentages)

Discussion: Considering the massive transfusion management, the main finding was that the frequency of tranexamic acid administration was significantly higher in the MTP+ centre ($P=0.003$). Of note, both centres presented low FFP:RBC transfusion ratio (below 0.5). In the MTP+ centre patients stayed longer in hospital but shorter in ICU ($P=0.008$ and $P<0.001$, respectively). As it is a retrospective study, reporting bias and cofounding factors cannot be ignored. Massive Transfusion in Obstetric is an important but rare event. Larger multicentre studies are warranted to determine the MTP clinical impact in obstetrical settings.

References:

1. J trauma 2010;68(6):1498-1505.
2. IJOG 2012;21(3):230-5.
3. AJOG 2013;209(5):449 e441-7.

		MTP+	MTP-	
	N	21	20	
Demographic data	Maternal age (years)	30±7.5	31.1±7.8	
	Primipara	12 (57.1%)	9 (45%)	
	BMI (Kg/cm2)	28.03±4.5	26.97±3.9	
Obstetrical Data	Severe Pregnancy Inducted Hypertension	1 (4.8%)	1 (5%)	
	APH	**10 (47.6%)**	**5 (25%)**	***P=0.001****
	Cesarea delivery	10 (47.6%)	15 (75%)	
	Induction of labor	6 (28.6%)	7 (35%)	
	Abnormal placentation	6 (28.6%)	5 (25%)	
	Placental abruptio	4 (19%)	3 (15%)	
	Chorioamnionitis	2 (9.5%)	2 (10%)	
Management Data	Hysterectomy	8 (38.1%)	9 (45%)	
	Tranexamic acid	**12 (57.1%)**	**2 (10%)**	***P=0.003****
	24h- RBC (units)	9.05±4.15	10.45±3.73	
	24h- FFP (units)	6.40±4.29	4.26±2.28	
	24h- Platelet (units)	**2.07±1.14**	**1.15±0.67**	***P=0.008****
	FFP:RBC ratio	0.41±0.34	0.38±0.17	
	24h- Cryoprecipitate (pool)	1.69 ±0.63	1.27 ±0.65	
Outcomes	Mechanical ventilation (hours)	11.75±8.78	13.53±9.55	
	LOS ICU (hours)	**23.38 ±10.4**	**42.85 ±19.41**	***P<0.001****
	LOS Hospital (days)	**12.57 ±13.39**	**7.65 ±4.68**	***P=0.008****
	Sepsis	0	2 (10%)	
	Acute renal failure	0	1 (5%)	
	ARDS	0	1 (5%)	
	MOF	0	1 (5%)	

APH= antepartum hemorrhage; 24h= transfusion within 24hours after delivery; LOS= length of stay; ARDS= acute respiratory distress syndrome; MOF= multiple organ failure

Abstract #:SA-05

Value of a Preoperative Anemia Clinic in a High-Risk Obstetric Population

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Introduction: Anemia during pregnancy, defined by the World Health Organization as hemoglobin (Hb)<11g/dL, affects up to 30% of pregnancies and is associated with significant maternal and fetal morbidity. The most common etiology of anemia is iron deficiency.[1] Oral iron, the first line therapy, is poorly tolerated in the obstetric (OB) population due to GI side effects, and a recent systemic review showed intravenous (IV) iron to be more effective in treating iron-deficiency anemia of pregnancy. [2] Thus, obstetricians, OB anesthesia, and blood conservation at our institution collaborated to coordinate care for iron-deficient pregnant women, with the goal of improving anemia and reducing blood transfusions.

Methods: As of January 2015, patients at our High-Risk Obstetric (HROB) Clinic noted during routine screen to have iron-deficiency or other risk factor for transfusion, were referred to the Preoperative Anemia Clinic (PAC) for evaluation of anemia and consideration of IV iron. With IRB approval, we performed a retrospective review of patients referred from HROB to PAC from January to December 2015. Recorded date included initial Hb and ferritin at referral, number of iron infusions, Hb at delivery, time between referral and delivery, and peripartum blood transfusions. Significance of the Hb change was assessed by a Wilcoxon Signed Rank test, and the difference in Hb change between those that did and did not receive IV iron was assessed with a Wilcoxon Rank Sum test.

Results: 108 parturients were referred to the PAC. Of these, 77 (71.3%) received one dose, and 9 (8.33%) received two doses of IV iron. 22 patients missed their appointment, delivered prior to treatment, or opted for oral iron. Of all 108 patients, the mean (SD) Hb at referral was 9.45 (1.04) and the median (IQR) ferritin levels were 8.0 (6,14). The mean (SD) Hb at delivery was 10.55 (1.17), and the Hb increase was significant (median 0.9; IQR (0.4,1.7); P<0.0001). The median time from referral to delivery was 40 days. Of the 108 patients referred, 6.5% received a peripartum red blood cell transfusion. Of the 86 patients who received IV iron, the median Hb increase from referral to delivery was significantly higher than that of the 22 who did not receive IV iron (1.0 vs. 0.55; P=0.0148).

Conclusion: This study shows that patients receiving antepartum IV iron had significantly greater increases in Hb level than those that did not. Further, a relatively low percentage of patients (6.5%) required blood transfusion, showing the value of referral of anemic parturients to a PAC.

References:

1. McLean, E., et al., Worldwide prevalence of anaemia, WHO Vitamin and Mineral Nutrition Information System, 1993-2005. Public Health Nutr, 2009. 12(4): p. 444-54.
2. Shi, Q., et al., Intravenous Iron Sucrose versus Oral Iron in the Treatment of Pregnancy with Iron Deficiency Anaemia: A Systematic Review. Gynecol Obstet Invest, 2015. 80(3): p. 170-8.

Abstract #:SA-06

The Risk of Epidural Hematoma After Neuraxial Techniques in Thrombocytopenic Obstetric Patients: A Report from the Multicenter Perioperative Outcomes Group Research Consortium

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Introduction: Thrombocytopenia is considered a relative contraindication to neuraxial techniques due to the perceived increased risk of bleeding complications, but the magnitude of this risk remains poorly defined. A recent systematic review of all cases reported in the literature described outcomes following neuraxial techniques in 499 obstetric patients with platelet counts of <100,000 mm-3 (173 patients from a multicenter study combined with 326 patients from prior studies)(1). Given that epidural hematomas are rare, the small number of cases reported in the literature limits the robustness of risk estimates that can be generated. Our primary aim is to further define the risk of epidural hematoma following neuraxial techniques in thrombocytopenic obstetric patients through a multicenter retrospective cohort study.

Methods: The database of the Multicenter Perioperative Outcomes Group (MPOG), a consortium of medical centers that combines electronic health record data for research purposes, was queried from 2004 to 2015 for all obstetric patients age 18-55 with a platelet count <100,000 mm-3 receiving a neuraxial technique, excluding those on anticoagulant or antiplatelet agents. From this cohort, patients were identified who underwent surgical evacuation of an epidural hematoma within 6 weeks of receiving a neuraxial technique. Thrombocytopenic obstetric patients receiving neuraxial techniques were stratified according to their platelet count, and 95% confidence intervals for the frequency of epidural hematoma were reported using the "rule of 3" (2).

Results: 573 thrombocytopenic obstetric patients who received neuraxial techniques were identified in MPOG. The results are presented in Table 1. No cases of epidural hematoma resulting in decompressive surgery were identified in thrombocytopenic patients. After combining data from previous case series, the upper bound of the 95% confidence interval for the frequency of epidural hematoma following neuraxial techniques in thrombocytopenic obstetric patients was calculated as 0.28%.

Discussion: The data from this large multicenter retrospective study approximately doubles the number of thrombocytopenic obstetric patients in the available literature who received neuraxial techniques and shows that the risk of hematoma in this population is exceptionally rare. However, the risk of hematoma associated with placement at a count of <50,000 mm-3 remains uncertain.

Table 1: Neuraxial Techniques in Thrombocytopenic Obstetric Patients Reported from the Multicenter Perioperative Outcomes Group

Platelet Range (mm^{-3})	n (%)	95% Confidence Interval For Incidence of Epidural Hematoma
0 – 49,000	15(2.6)	0 to 20.0%
50,000 – 74,000	74(12.9)	0 to 4.1%
75,000 – 99,000	484(84.5)	0 to 0.62%
Total	573(100.0)	0 to 0.52%
Total Including Previous Case Studies in the Literature	1,072	0 to 0.28%

References:

1. Anesth Analg 2015;121:988-91
2. JAMA 1983;249:1743-5

Abstract #:SA-07

The Use of Thromboelastography in Obstetric Anesthesiology: A Survey of Current Practice

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Introduction: Thromboelastography (TEG) is an in-vivo point of care hemostatic test that assesses both coagulation and fibrinolysis. It has been used to guide clinical decision making in a variety of situations by obstetric anesthesiologists. We sought to identify practice patterns and areas for further research which may help broaden the use of TEG in our specialty.

Methods: After obtaining IRB approval, an electronic survey via Survey Monkey® (www.surveymonkey.com) was sent to all members of the Society for Obstetric Anesthesiology and Perinatology (SOAP) in April 2015. Chi-square analysis was performed to identify significant practice differences among the various sub groups. P value <0.05 was considered significant.
Results: A total of 180 responses were received from the 1,058 recipients of the request. Of the providers that responded, 156 (88%) were practicing in the United States. 130 (73%) report practicing at academic hospitals, 44 (25%) at non-academic hospitals. Nearly 67% (117) do not use TEG during their practice. Of the 58 providers who indicated that they use TEG, 53 identified as practicing at academic hospitals. Providers at academic hospitals were significantly more likely to use TEG than those practicing in non-academic hospitals (p value <.01). Of the providers not using TEG, 73%, (87) gave their reason as "not available at their institution", with 41 of 44 respondents at non-academic hospitals giving that reason. The predominant use for TEG is to assist in management of hemorrhage (75% of users), though 39% also use it to assess a patient prior to neuraxial blockade.

Conclusion: TEG in obstetric anesthesia appears to be predominately used by those practicing at academic hospitals. TEG is limited by its availability to providers at the institutions in which they practice, though unfamiliarity with the its use and the belief that there is not enough evidence to support its use also limit utilization. Clinicians are using TEG mostly to assist in management of hemorrhage, but also to assess for placement of neuraxial anesthesia. TEG has been shown to be a useful and feasible tool in obstetric anesthesia particularly for hemorrhage management (1-2). However, despite this evidence, its use is still limited even within the academic setting. Future studies validating the utility of TEG in obstetric hemorrhage management and examining its validity in guiding neuraxial anesthesia are needed before widespread adoption in anesthesia practice occurs.

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1. Ekelund K, Hanke G, Stensballe J, Wikkelsøe A, Albrechtsen CK, Afshari A. Hemostatic resuscitation in postpartum hemorrhage – a supplement to surgery. Acta Obstet Gynecol Scand 2015; 94: 680–692.
2. Hill JS, Devenie G, Powell M. Point-of-care testing of coagulation and fibrinolytic status during postpartum haemorrhage: developing a thromboelastography- guided transfusion algorithm. Anaesth Intensive Care 2012 Nov;40(6):1007-15.

Abstract #:SA-08

Interventional radiology (IR) procedures for emergency and elective obstetric cases- a reduction in blood loss versus potential complications

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Introduction: A previous case series has demonstrated that IR can lead to reduced blood loss during placental pathology caesarean section (LSCS)but not to reduce requirements for caesarean hysterectomy.

Reference: Mok M, Heidemann B, Dundas K et al. Interventional radiology in women with suspected placenta accreta undergoing caesarean section. IJOA (2008)17, 255-261.
After discussion with obstetricians and interventional radiologists within our NHS healthboard, we were interested to see if these findings extended to emergency cases and also what complications might arise from IR procedures in both elective and emergency case settings.

Methods: Across 2 tertiary obstetric units (6000 deliveries/annum each), we undertook a 5 year retrospective analysis of obstetric cases requiring IR input. Patients were identified using theatre and critical care admissions systems and a case note review was then done. Collected data included mode of delivery, cause of haemorrhage, blood loss, transfusion requirements, cell salvage use, balloon occlusion, use of embolization techniques and maternal/ foetal complications, morbidity and mortality.

Results: 28 cases were reviewed: x7 emergency LSCS, x18 elective LSCS and x3 SVD. Underlying diagnoses were: placenta percreta x11, placenta accreta x5, placenta praevia x3, abruption x1, uterine fibroids x2 and PPH from other causes x6. Sheaths were sited electively in 17 cases and as an emergency in 11. Balloons were inserted in 17 cases and inflated in 12. Mean inflation time was 53.9 minutes. 16 patients required arterial embolization. Mean blood loss was 6069ml (range 300-17000ml). Mean blood transfusion was 6.9 units (range 0-34). Cell salvage occurred in 12 elective patients (mean salvage return 1266ml, range 0-3330ml). 14 patients required hysterectomy. Immediate complications occurred in 4 patients (pain x1, non-target embolization x1 and foetal bradycardia requiring expedited delivery x2).Later complications were noted in 5 cases, including thrombus distal to sheath x3, PTE x1, CVA x1 and acute kidney injury x1. There was no foetal or maternal mortality.

Discussion: The overall hysterectomy rate was 50%. Even in spite of IR input, the mean blood loss and transfusion requirements for these cases was still high. Cell salvage occurred in less than half of patients but yielded a good blood return when utilised. IR can be a life saving measure, particularly in the emergency setting when other surgical techniques have failed. It can, however, be associated with short and long term complications that the patient should be made aware of, if possible prior to the procedure.

Abstract #:SA-09

Norepinephrine to prevent hypotension after spinal anesthesia for Cesarean delivery: a dose finding study

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Introduction: Norepinephrine (NE) has recently been proposed as an alternative to phenylephrine (PE) for the management of hypotension during Cesarean delivery (CD) under spinal anesthesia [1]. A concern with PE is its propensity to reduce maternal heart rate and cardiac output, which may be detrimental in a compromised fetus [1,2]. Norepinephrine is a potent alpha agonist with some beta agonist activity, which leads to less negative chronotropic effects. The optimum bolus dose of NE required to prevent hypotension in this setting has not been established. The purpose of this study was to determine the ED90 of NE in this context.

Methods: With Institutional Ethics Committee approval and the informed consent of each participant, this study was conducted as a double-blind, sequential allocation dose-finding study, using the biased coin up-and-down design targeting ED90. Women undergoing elective CD under spinal anesthesia were recruited. Systolic blood pressure (SBP) was assessed every minute until delivery and NE was given whenever the SBP decreased to less than 100% of baseline. A dose of 3 μg was used for the first patient. The dose given to subsequent patients varied by increments or decrements of 1.0 μg (range 3-8 μg), and was determined by the primary outcome, which was the SBP maintained above 80% of baseline in the previous patient. If a patient did not respond adequately to the current dose (the SBP decreased to less than 80% of the baseline), the dose was considered to have failed and the subsequent dose for the following patient was increased to the next higher dose level. If the patient responded to the current dose, this was considered a success, and the dose for the next patient was decreased to the next lower dose with a probability of 1/9, otherwise it remained unchanged. The primary outcome was the success of the NE dose to maintain the SBP at or above 80% of baseline, from induction of spinal anesthesia to delivery of the fetus. Sample size was calculated at 45 subjects.

Results: So far we have recruited 7 patients and plan to have recruited the last patient by March 2016. Preliminary results show 86% successful maintenance of SBP at or above baseline with a range of 5-11 boluses of the study dose of NE over a 17-25 min time frame from induction to delivery. Incidences of hypotension, hypertension, bradycardia, nausea and vomiting were 14%, 14%, 0%, 29% and 0%, respectively.

Discussion: NE boluses so far appear to be effective at maintaining SBP post spinal anesthesia in elective CD, with no instances of bradycardia. The ED90 will be calculated at the end of the study. Final discussion and conclusion will be presented at the meeting.

References:

1. Anesthesiology 2015;122:736-45;
2. Anesth Analg 2010;111:1230–7

Abstract #:SA-10

Peripartum and postpartum cesarean section hemodynamics - a preliminary study using a novel noninvasive technique.

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Objective: To assess hemodynamic changes during scheduled cesarean section (SCS) using noninvasive cardiography

Methods: a prospective observational study of healthy term parturients undergoing SCS using noninvasive cardiac system (NICaS): preoperatively, immediately after spinal anesthesia (SA), two minutes after baby delivered (AD), 1 hour(1hr), 24 hours (24hr)and 48 hours (48hr) postoperatively. The NICaS ,a whole body plethysmography system measuring cardiac output and its derivatives (mean arterial pressure (MAP), heart rate (HR), stroke volume (SV), cardiac output (CO), and total peripheral resistance (TPR), has been found to be highly accurate compared to themodilation (1).
Women underwent either SA using bupivicaine 12 mg, fentanyl 20 μg and morphine 0.1 mg with a prophylactic phenylepherine (PE) drip (PED) of 50 μg/ min continued until end of CS or same spinal regimen without pe drip (NPED). The choice to use pe drip was the anesthesiologist's discretion. Immediately after delivery, oxytocin 20 units was injected into a liter of Ringer Lactate and infused. No other uterotonics were given.

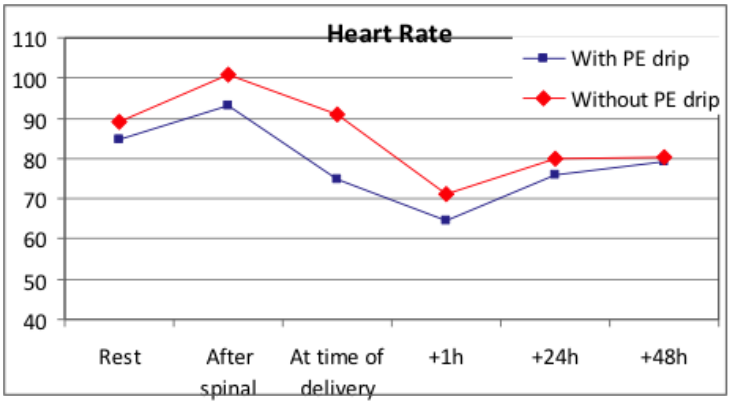
Results: 38 women were studied: 27 women PED and 11 women NPED.

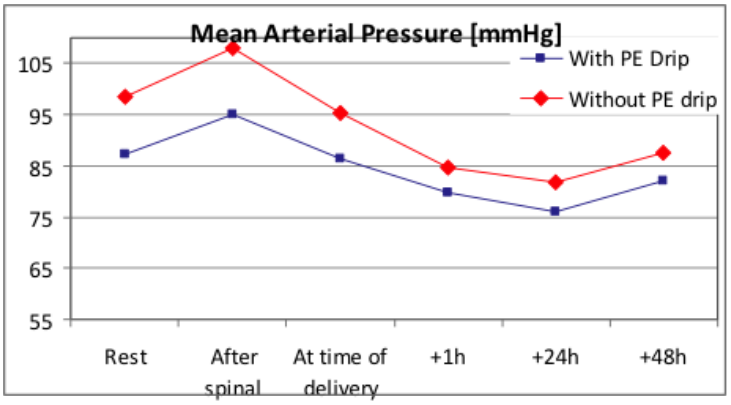
1. Before CS: there was a significant difference between groups in MAP (PED 87±10 mm Hg, NPED 101±19mm Hg, $p<0.01$).
2. SA: in PED there was an increase in MAP and in NPED there was an increase in HR .Between the groups there was a difference in MAP (PED 93±13 mm Hg, NPED 105±20 mm Hg, $P<0.05$).
3. AD: in PED there was a decrease in HR and TPR .In NPED there were no changes. There was a difference in HR between the groups (PED 75±16, NPED 91±19, $p=0.01$)
4. 1 hr: in PED there was a decrease in MAP, HR, CO and increase in TPR. In NPED, there was a decrease in HR and CO. There were no differences between groups.
5. 24 hr, in PED there was a decrease in MAP, HR and CO. In NPED there was a decrease in MAP, HR, and CO, and an increase in TPR
Between groups there was a difference in MAP (PED 79±9 mm Hg, NPED 88±17 mm Hg,$p<0.05$).
6. 48 hr: in PED there was a decrease in HR and CO and an increase in TPR. In NPED, there was a decrease in MAP. There were no differences between the groups.

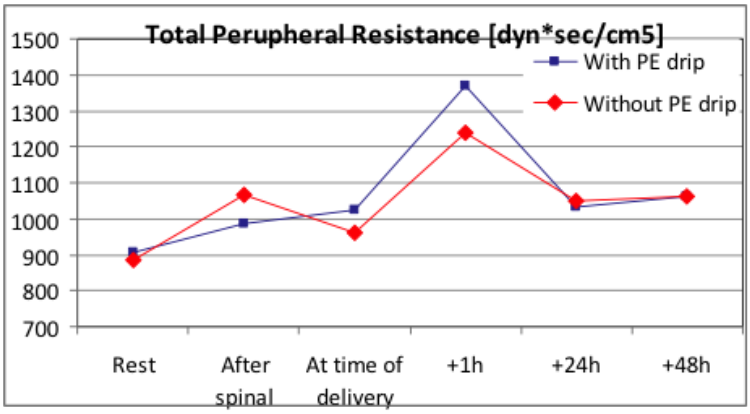
Conclusions: Using this noninvasive technique there was a significant decrease in CO 1 hour after delivery compared to predelivery values with continued low values for the first 48 hours.

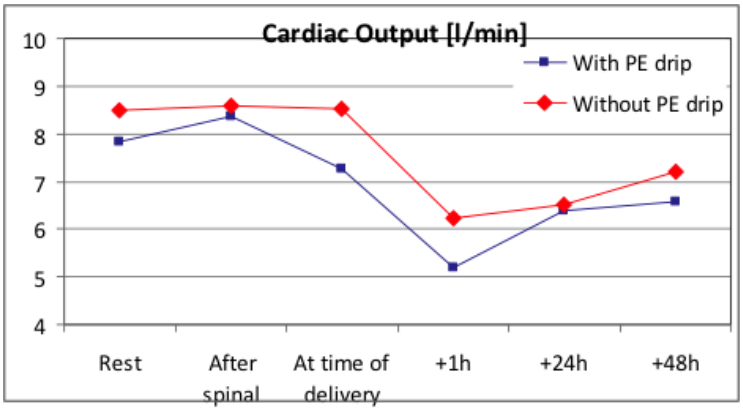
References:

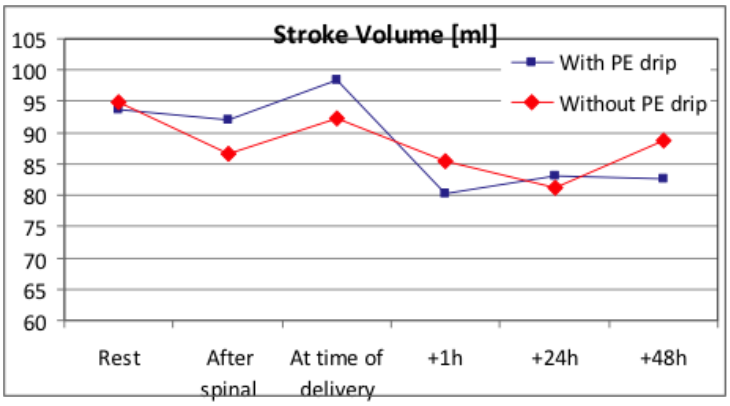
1. Cotter G. Accurate Noninvasive Continuous Monitoring of Cardiac Output by Whole Body Electrical Bioimpedence. Chest 2004;125: 1431-1440.


Heart Rate
With PE drip
Without PE drip
110
100
90
80
70
60
50
40
Rest
After spinal
At time of delivery
+1h
+24h
+48h


Mean Arterial Pressure [mmHg]
With PE Drip
Without PE drip
105
95
85
75
65
55
Rest
After spinal
At time of delivery
+1h
+24h
+48h


Total Perupheral Resistance [dyn*sec/cm5]
With PE drip
Without PE drip
1500
1400
1300
1200
1100
1000
900
800
700
Rest
After spinal
At time of delivery
+1h
+24h
+48h


Cardiac Output [l/min]
With PE drip
Without PE drip
10
9
8
7
6
5
4
Rest
After spinal
At time of delivery
+1h
+24h
+48h


Stroke Volume [ml]
With PE drip
Without PE drip
105
100
95
90
85
80
75
70
65
60
Rest
After spinal
At time of delivery
+1h
+24h
+48h

Abstract #:SA-11

A novel assessment of the microcirculation during cesarean delivery with spinal anesthesia and the impact of phenylephrine prophylaxis to prevent spinal anesthesia-induced hypotension

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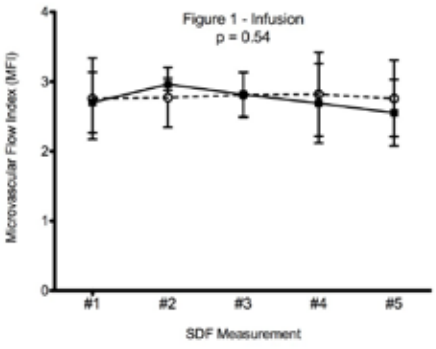
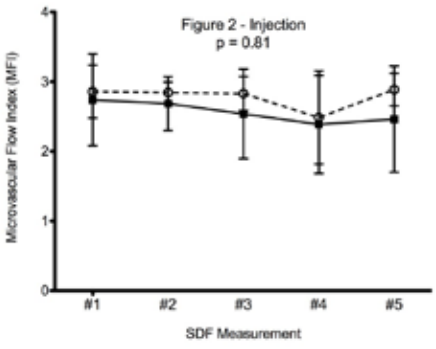
Introduction: The most common side effect of spinal anesthesia is maternal hypotension due to physiologic changes to the macrocirculation. However, the microcirculation, consisting of the smallest vessels of the vasculature, is responsible for delivery of oxygen and regulation of blood pressure. The purpose of this study was to determine the impact of spinal anesthesia on the microcirculation of pregnant subjects and to determine the impact of phenylephrine on the microcirculation of subjects undergoing a cesarean delivery.

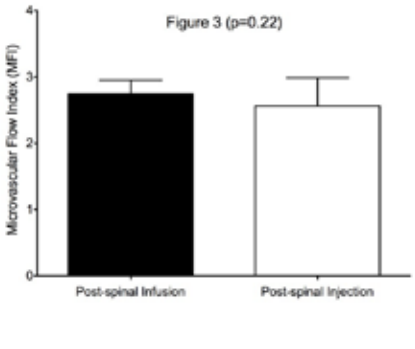
Methods: Following institutional REB approval and written informed consent, healthy, non-labouring women with singleton, term, pregnancy scheduled for an elective cesarean were recruited. Participants were randomly assigned into two groups: the phenylephrine infusion group or phenylephrine bolus group. Spinal anesthesia was standardized. A sidestream dark field (SDF) device was applied to the sublingual mucosa to obtain microcirculation images/videos in five different visual fields. SDF videos were recorded before and after spinal anesthesia. The resultant video clips were analyzed randomly and blindly. The mean microvascular flow index (MFI) values were compared before and after spinal anesthesia using a two-way ANOVA. The difference in MFI following spinal anesthesia in patients who received a prophylactic phenylephrine infusion (50 mcg/min) was compared to that of patients who received phenylephrine boluses for treatment of spinal anesthesia-induced hypotension.

Results: Thirty-two patients were recruited for the study; twenty-two patients had complete video sets for analysis. Baseline characteristics were similar between the two groups. Data are presented as mean ± SD. There was no significant difference between pre- and post-spinal MFI in either group (Figure 1). The post spinal MFI within the infusion group (2.74 ± 0.21) was not significantly different compared to the injection group (2.56 ± 0.42, p=0.22 Figure 1). The mean dose of phenylephrine in the infusion group was 1603 ± 470 mcg. Nine patients in the injection group received vasopressors with a mean dose of 200 ± 142 mcg of phenylephrine and 13 ± 6 mg of ephedrine.

Conclusions: Despite the theoretical physiological implications of phenylephrine on the microcirculation, the continuous infusion for prophylaxis of spinal anesthesia-induced hypotension did not result in a significance alternation of the microcirculation compared to those who were treated for hypotension.







Abstract #:SA-12

Relationship between maternal heart rate variability and fetal heart rate deceleration at induction of labor analgesia with intrathecal analgesics - a pilot study-

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Objective: Induction of labor analgesia with a small dose of intrathecal local anesthetic with/without an opioid may be associated with an increased frequency of fetal heart rate (FHR) abnormalities. The mechanism underlying such events remains unclear: Some studies suggest an association between FHR changes and increased uterine contractility due to sympathetic blockade from analgesia. Here we measured sympathetic nervous tone to assess the association between sympathetic nervous tone and FHR abnormality. The sympathetic nervous tone was evaluated as low frequency to high frequency (LF/HF) ratio of maternal heart rate variabilities (HRV).

Methods: Eighteen full-term pregnant non-laboring women scheduled for induction of labor under combined spinal-epidural (CSE) analgesia provided informed consent. No women had cardiac arrhythmia or hypertension. Labor was induced using prostaglandin E2 p.o. and intravenous infusion of oxytocin. When a patient required pain relief, electrodes were attached to the distal flexor surface of the left and right forearms and connected to a HRV analysis device (Check My Heart®, Trytech, Tokyo, Japan). After the baseline recordings of HRV, FHR, blood pressure (BP), heart rate (HR), and oxygen saturation (SpO2) in parturients, bupivacaine 2 mg and fentanyl 20 μg were administered into the intrathecal space using a CSE needle via the L3/4 interspace in the sitting position. HRV was analyzed at 5, 10, 15, and 30 min after injections of analgesics in the lateral position. Changes in LF/HF ratio were analyzed using one-way analysis of variance. A p-value < 0.05 was considered statistically significant. In cases with FHR abnormality (late, variable or prolonged deceleration within 30 min after intrathecal analgesia), we analyzed underlying factors using binomial logistic regression analysis.

Results: The LF/HF ratio was significantly reduced at each time point after intrathecal analgesia than before. No significant differences in BP, HR, SpO2 were observed between before and each time point after intrathecal analgesia. Of 18 patients, fetal deceleration was observed in two patients. Binomial logistic regression analysis of factors associated with fetal deceleration demonstrated a greater reduction in LF/HF ratio at 5 min after initiating intrathecal analgesia than before.

Conclusions: Intrathecal analgesia with fentanyl combined with bupivacaine for labor pain significantly decreased the LF/HF ratio. Thus, which suggests that intrathecal analgesia blocked sympathetic activity resulting in parasympathetic nerve predominance. Greater reduction in the LF/HF ratio might be associated with higher incidence of FHR decelerations at induction of labor analgesia.

Abstract #:SA-13

Do warming iv fluids during the management of spinal- induced hypotension decrease the incidence of hypotension and reduce the amount of fluid, transfusion and ephedrine requirement?

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Objective: This prospective, double-blinded, randomized, controlled study was undertaken to evaluate whether warming IV fluids (37 oC) resulted in lower incidence of hypotension, less ephedrine and transfusion requirement and lower fluid consumption than use of room-temperature fluids (22 oC) in cesarean delivery patients undergoing spinal anesthesia.

Methods: Following approval of faculty and ministry of health ethics committee and written informed patient consent, 63 healthy pregnant women undergoing elective cesarean delivery with spinal anesthesia were recruited. Parturients were allocated using computer generated random numbers and sealed envelopes to one of two groups as follows: Unwarmed fluid group (Group C, n=30) and warmed fluid group (Group W, n=30). Lactated Ringer's infusions were launched at the maximal possible rate before the induction of spinal anaesthesia, in both groups. In order to maintain blinding, all hotline monitors and giving sets were covered in tubular bandage or invisible package, and all intravenous fluids were given via a Hotline fluid warmer which was only switched off in group C and switched on in group W. Maternal body temperature, hemodynamic parameters, the incidence of hypotension, fluid, ephedrine and transfusion requirements and side effects (bradycardia, hypoxemia, pain, shivering, nausea and vomiting) were recorded intraoperatively. After delivery, umbilical artery blood gas samples were taken and neonatal Apgar scores were recorded at 1 and 5 min by an attending pediatrician who was unaware of the patient group.

Results: Maternal body temperatures were significantly higher in the warm fluid group compared with the control group only at 15 min (p=0.02). There was no significant difference between the two groups in the incident of hypotension (70% (21/30), 56.7% (17/30) in group C and W, respectively),(p=0.42). Blood loss (p=0.63), fluid requirement (p=0.38) and ephedrine consumptions (p=0.11) were similar between two groups and no patient needed blood transfusion (Table 1). Six patients (20 %) in the control group and one patient (3.3 %) in warm group shivered and all required treatment with iv tramadol (p=0.1). No complication or major side effect related with spinal anaesthesia was recorded.

Conclusion: In cesarean section patients undergoing spinal anesthesia, warming IV fluids (37 oC) resulted in lower incidence of decreased core temperature but did not affect the incidence of maternal hypotension, ephedrine and transfusion requirement and total volume consumption.

Table 1: Maternal body temperatures, incidence of hypotension, estimated blood loss, volume consumption and ephedrine requirements in groups.

	Group C (n=30)	Group W (n=30)	P value
Maternal body temperatures (°C)			
Preop control (On arrival)	36.5±0.3	36.5±0.2	0.53
Intraop 15 min	36.3±0.3	36.5±0.1	**0.02**
Intraop 30 min	36.2±0.4	36.3±0.2	0.19
Estimated Blood Loss (mL)	518 ±166	474±666	0.63
Total volume (mL)	1870±386	1796±251	0.38
Hypotension (n %)	21(70%)	17(56.7%)	0.42
Ephedrine (mg)	20.6±18.5	13.6±15.4	0.11
	20 (0-50)	10 (0-50)	

Abstract #:SA-14

Reducing Spinal Anesthesia induced Hypotension during Cesarean Delivery with Serotonin Receptor Antagonists: a Meta-Analysis

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Introduction: Hypotension is the commonest complication associated with spinal anesthesia for cesarean delivery that can have deleterious effects for both mother and baby.(1) The objective of this meta-analysis was to determine the efficacy of serotonin (5-HT3) receptor antagonists at reducing hypotension associated with spinal anesthesia for cesarean delivery.

Methods: A literature search (Medline, Embase, CINAHL, Scopus and Pubmed) was performed to identify randomized controlled trials (RCTs) investigating the effect of prophylactic 5-HT3 antagonists on spinal-induced hypotension for cesarean delivery. The primary outcome was incidence of hypotension. Secondary outcomes included: dose of vasopressor used (phenylephrine equivalent), incidences of bradycardia, nausea, vomiting and pruritus. Odds ratios (OR) and mean differences (MD) were calculated using random effects modeling with 95% confidence interval.

Results: Ten RCTs met our inclusion criteria. A total of 1096 patients were recruited in all study groups: 636 patients in the 5-HT3 group and 460 patients in the control group. The incidence of hypotension was significantly reduced in the 5-HT3 group compared to the placebo control group (OR 0.30 [0.13, 0.69]; p= 0.005). Administering prophylactic 5-HT3 antagonists also reduced the dose of phenylephrine needed (MD -230.98mcg [-384.05, -77.91mcg]; p= 0.003). The incidences of bradycardia, nausea and vomiting were also lower in the 5-HT3 group with ORs of 0.46 [0.23, 0.91]; p= 0.03, 0.22 [0.13, 0.36]; p<0.00001, and 0.27 [0.10- 0.75], p=0.01 respectively. Pruritus was similar in both groups.

Discussion: Prophylactic use of serotonin receptor antagonists reduces the incidence of spinal-induced hypotension as well as the dose of vasopressor needed during cesarean delivery. Additional maternal benefits include reduction in nausea, vomiting and bradycardia. Findings confirm the potential efficacy of prophylactic ondansetron on reducing spinal anesthesia-induced hypotension,(2) and although further studies investigating any potential side effects from 5-HT3 antagonists are required, current evidence suggests routine use during cesarean delivery should be considered.

References:

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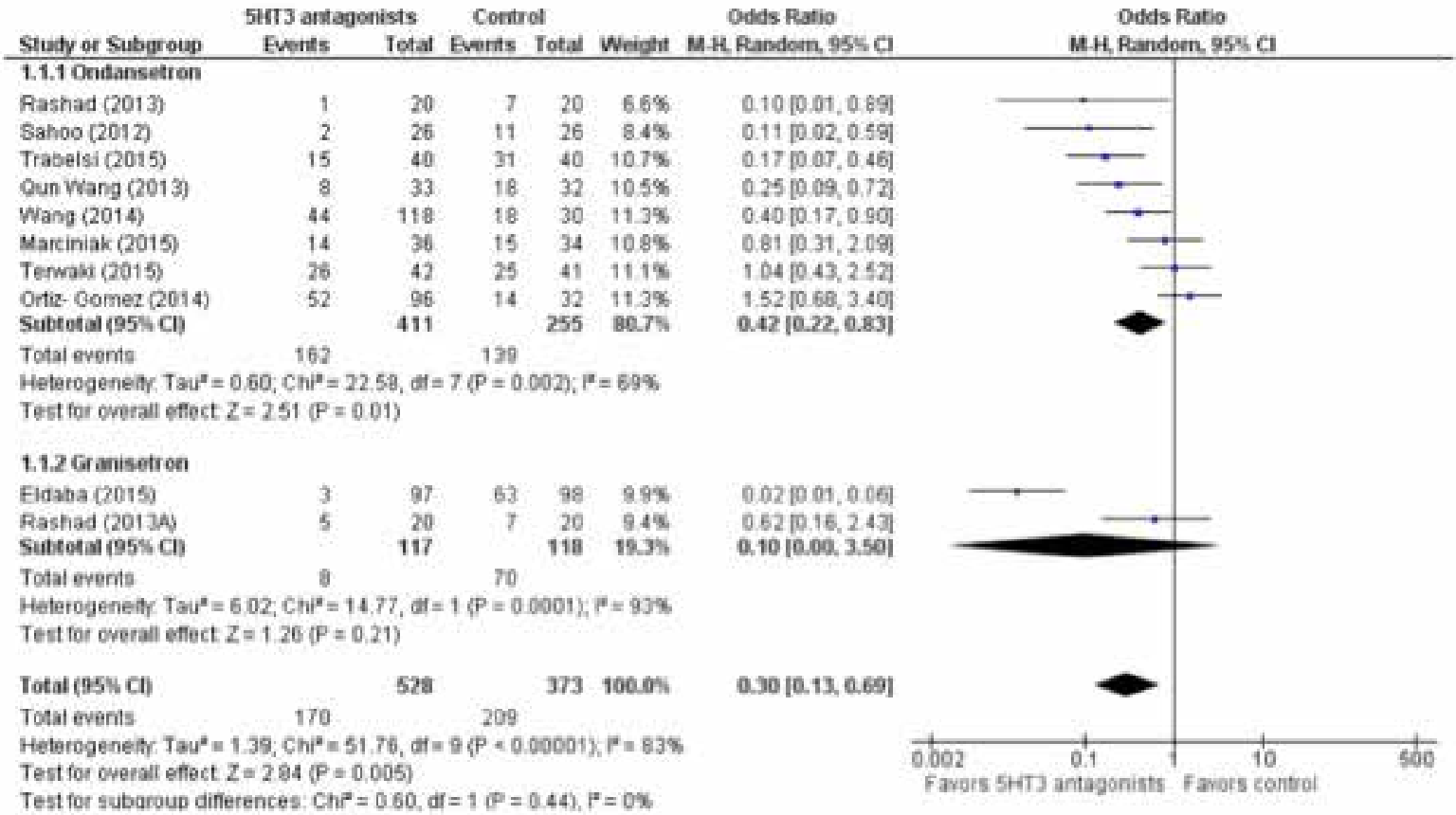
2. Gao et al. Int J Obstet Anesth. 2015; 24:335–343



Forest plot for incidence of hypotension

Abstract #:SA-15

A Noninvasive Computational Method for Monitoring Compensatory Changes in Obstetrical Patients: The Compensatory Reserve Index

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Nicholas Behrendt M.D. - University of Coloroado Hospital - Aurora, Colorado
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Steven L Moulton M.D. - Children's Hospital Colorado - Aurora, Colorado

Background: The mother and fetus experience a wide variety of compensatory changes during the peripartum period, as a result of sympathetic blockade, the administration of vasoactive drugs and/or hemorrhage. These physiological changes are being elucidated by recent developments in machine learning, advanced statistical methods and fast computing technology. The Compensatory Reserve Index (CRI) is a computational algorithm that accurately tracks the compensatory phase of central volume loss for high and low tolerant human subjects. CRI requires no reference measurement to normovolemia and is measured on a scale of 1 to 0, where 1 equates to normovolemia and 0 is the point at which hemodynamic decompensation occurs. Values between 1 and 0 indicate the compensatory reserve of the subject.
Hypothesis: CRI accurately measures and trends compensatory changes during the peripartum period.

Methods: Pregnant women undergoing a fetal intervention and/or an operative/vaginal delivery, ages 15-44 years old were enrolled over a 4 month time period. A custom-made pulse oximeter was used to collect continuous photoplethysmographic (PPG) waveforms, which were retrospectively processed by the CRI algorithm to produce beat-to-beat CRI values. Changes in CRI were compared to changes in traditional vital signs during key procedural events, including sympathetic blockade (SB), induction of general anesthesia (GA), hysterotomy, and delivery. Results: 15 patients were enrolled in the study; 3 were excluded for technical reasons. The 8 patients who underwent SB had a pre-SB CRI of 0.86 + 0.1, which decreased to an average nadir CRI of 0.45 + 0.17. Six patients had GA, of which 2 underwent initial SB. Their pre-GA CRI was 0.84 + 0.12, which decreased to 0.51 + 0.23. For all 12 patients, the average CRI just prior to delivery improved to 0.91 + 0.12. Immediately following delivery, however, CRI decreased to 0.66 + 0.19, and then rebounded to > 0.80 during the recovery phase. In comparison, traditional vital signs showed minimal change during these events (Table 1).

Conclusion: The compensatory reserve index algorithm, unlike traditional vital signs, provides real-time, moment-to-moment insight into the physiology of compensation during labor and delivery. Importantly, the underlying technology is based on a learning platform. As a result, the CRI algorithm will become more accurate and more broadly applicable as it is exposed to greater amounts of modeling data.

Table 1 Pre and post event changes in CRI/HR/SBP/MAP ± standard deviation

Variable	Pre-Induction	Post-Induction	Pre-Delivery	Post-Delivery	Pre-Sympathetic Blockade	Post-Sympathetic Blockade
CRI	0.84 ± 0.12	0.51 ± 0.23	0.91 ± 0.12	0.66 ± 0.19	0.86 ± 0.1	0.45 ± 0.17
HR	91 ± 19	95 ± 16	78 ± 11	78 ± 11	88 ± 10	86 ± 8
SBP	115 ± 15	115 ± 14	113 ± 13	109 ± 12	116 ± 9	110 ± 13
MAP	82 ± 9	78 ± 12	78 ± 9	74 ± 9	81 ± 9	76 ± 10

Abstract #:SA-16

Agreement between Echocardiography-Measured Cardiac Output and Non-Invasive Cardiac Output Monitoring (NICOM) in Primagravid Mothers

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Introduction: Non-invasive cardiac output (CO) monitoring using bioreactance (NICOM) in pregnant mothers is gaining interest with the potential to predict the evolution of pre-eclampsia and monitor treatment response. However, this method of CO monitoring lacks validation in this population.

Aims: To compare simultaneous CO readings obtained using NICOM and echocardiography (echo) in a group of healthy primagravid pregnant women.

Methods: Simultaneous stroke volume (SV) and CO measurements were obtained using NICOM and echo in a group of healthy primagravid women between 24 and 28 weeks gestation enrolled in a large observational prospective study assessing the ability of NICOM to predict the evolution of pre-eclampsia and intrauterine growth restriction (HANDLE study). Paired SV and CO readings were obtained using NICOM and echo over a 15 minute period in the semi-recumbent position. The echocardiographer was blinded to the NICOM readings during measurement. Agreement between NICOM and echo measurements of SV and CO was assessed using Bland Altman analysis and the intraclass correlation coefficient (ICC). Data were presented as means (SD).

Results: Thirteen mothers with a mean age, weight and gestation of 33 (6) years, 72 (11) Kg and 171 (27) days respectively were enrolled. There was no difference between the mean NICOM and echo SV [74 (12) vs. 80 (21) ml, p=0.2] or the mean NICOM and echo CO [6.4 (1.0) vs. 6.4 (1.0) L, p=0.8] in the cohort. There was good agreement between NICOM and echo measured SV [Mean bias 0 (LOA -1.6 to +1.6 L), ICC 0.8 (95% CI 0.4 – 0.9, p=0.004]. Similarly, there was good agreement between NICOM and echo measured CO [Mean bias 6 (LOA -21 to +33 ml), ICC 0.8 (95% CI 0.4 – 0.9, p=0.004].

Conclusion: SV and NICOM measurements obtained using NICOM are comparable to those obtained using echocardiography. NICOM may be an acceptable method for monitoring the haemodynamic status of pregnant mothers.

Abstract #:SA-17

Defining a reference range for vital signs in healthy term pregnant women undergoing cesarean section

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Introduction: Early warning systems(EWS), used to identify deteriorating patients, are based on measurement of vital signs(VS). When patients are pregnant, most EWSs still use non-pregnant reference ranges of VSs to determine trigger thresholds.1 Peripartum complications, including those that occur around the time of caesarean section must be recognised early. A common serious complication at this time is hemorrhage & it is essential that early warning signs of hemorrhage are recognised. From our clinical experience we had observed that many women with serious obstetric hemorrhage often had heart rates(HR) between 100-110 BPM & did not meet the trigger EWS threshold of 120 BPM & we thought that EWS triggers might need to be adjusted for pregnancy. There are no published reference ranges for all VSs in pregnancy. We aimed to define VS reference ranges for term pregnant women on the day of their cesarean birth & to determine appropriateness of current EWS triggers in pregnancy.

Method: After IRB approval we conducted a 1-year retrospective study in a tertiary referral obstetric hospital. The study sample was healthy term women(ASA I) undergoing planned cesarean section. Measurement of VS was performed by peri-operative nurses using standardized, automatic monitoring systems (Spot Vital Signs® WelchAllyn,NY,USA) to measure systolic & diastolic blood pressure(BP), HR, & oxygen saturation(SpO2). Respiratory rate(RR) was measured by counting the RR in a minute. Temperature(temp) was measured using a tympanic thermometer(Genius™ 2 AccuSystem, Covidien, Massachusetts, USA). Data were recorded in the pre-operative record & retrieved by study investigator(LH).

Results: 258 women met inclusion criteria. Mean± SD age, term body mass index,& gestation were 30±10.1 years, 29±3.4 kg.m-2, 39±1.2 weeks respectively. Vital sign data for the study group compared with current Modified Early Obstetric Warning Score(MEOWS) triggers are shown in the Table as well as a proposed healthy reference range based on study mean values ±2SD.

Conclusions: This study has helped define a reference range for vital signs in healthy term pregnant women on the day of cesarean birth. Study findings suggest that currently used criteria for EWS triggers, based on non-pregnant values, are too extreme for timely detection of deteriorating pregnant patients especially for HR. We suggest HR triggers be modified to ≤50 & ≥110 BPM in pregnant women.

Reference:

1. Singh S et al. Anaesthesia 2012;67:12-8.

Vital sign	Study mean ± SD Healthy Reference Range	MEOWS Trigger values
SBP (mmHg)	118 ± 11.2, 96-140	≤ 90 or ≥ 160
DBP (mmHg)	75 ± 10.3, 54-96	> 100
HR (BPM)	84 ± 10.2, 64-104	≤ 40 or ≥ 120
RR (BPM)	18 ± 1.5, 15-21	≤ 10 or ≥ 30
SpO2 (%)	99 ± 1.0, 97-100	≤ 95
Temp (°C)	36.4 ± 0.43, 35.5-37.3	< 35.0 or > 38.0

Abstract #:SA-18

Quantification of hemodynamics and myocardial tissue characteristics in healthy pregnant women and women with preeclampsia using cardiac magnetic resonance

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Introduction: Preeclampsia(PE) is a hypertensive cardiovascular(CVS) disorder & a leading cause of global maternal mortality. Women with PE have increased cardiac output, reduced diastolic function, pericardial effusions & increased left ventricular(LV) wall diameters on echocardiography(TTE). Women with PE also have higher risk of CVS complications in later life that may be related to PE induced changes within the myocardial tissue (myocardial edema or fibrosis). TTE cannot differentiate between causes of increased wall thickness & cannot characterize the myocardium therefore it is uncertain whether this finding on TTE in women with PE is true LV hypertrophy or myocardial edema & whether fibrosis is present. Furthermore some healthy pregnant women(HP), for unknown reasons, have increased LV wall diameters & altered hemodynamics. Cardiac magnetic resonance(CMR),a new non-invasive imaging technique, can assess hemodynamics & characterise myocardial tissue. There are no studies of CMR in women with PE. We aimed to determine hemodynamics & myocardial structure using CMR in healthy pregnant(HP) & PE women.

Method: After IRB approval & consent 36 women(31 HP & 5 PE) underwent CMR. HP women were ASA 1 & non-smokers. PE women had new onset hypertension & end organ dysfunction. Women with chronic hypertension, multiple pregnancy, BMI>45 kg.m-2 were excluded. CMR was performed & analysed using CMRtools(Cardiovascular Imaging Solutions,UK) for volumetric analysis, & semi-quantification of STIR (short-tau inversion recovery) images for myocardial edema assessment. Myocardial edema was assessed by measuring myocardial signal intensity & comparing to the signal intensity from skeletal muscle(serratus anterior). Signal intensities were measured from 16 LV segments (basal(6),mid-chamber(6),apical(4)) & averaged to obtain global myocardial signal intensity. Myocardial edema was defined as a myocardial:skeletal tissue intensity ratio of ≥2.0.
Results:The mean±SD age, gestation & body mass index for HP & PE women was 33±4.5 vs 36±3.4 years (p=0.22), 36±3.9 vs 33±5.0 weeks (p=0.29), 30±5.0 vs 28±2.1 kg.m-1 (p=0.15) respectively. Table shows hemodynamic & signal intensity data.

Conclusions: CMR can quantify hemodynamics & characterise myocardial tissue composition in HP women & in women with PE. Our data suggests that women with PE have a different myocardial wall composition & this may be due to edema not muscle. Further work is needed to investigate this novel finding.

Table. Hemodynamic & signal intensity data

Variable	HP	PE
Systolic BP (mmHg)	117 ± 11.1	142 ± 14.7*
Diastolic BP (mmHg)	69 ± 9.3	88 ± 9.2*
LV EDV (mL)	130 ± 22.1	134 ± 31.5
LV EDV index ($mL.m^{-2}$)	65 ± 15.9	74 ± 11.5
LV ejection fraction (%)	64 ± 5.2	65 ± 6.0
LV mass (g)	127 ± 20.1	151 ± 43.8
LV mass index ($g.m^{-2}$)	65.4 ± 9.4	83 ± 20.3
RV EDV (mL)	131 ± 30.5	116 ± 35.5
RV EDV index ($mL.m^{-2}$)	67 ± 13.3	52 ± 32.4
RV ejection fraction (%)	55 ± 5.1	60 ± 7.6
Cardiac output ($ml.m^{-1}$)	6.6 ± 1.3	6.0 ± 1.2
Cardiac index ($ml.m^{-1}.m^{-2}$)	3.4 ± 0.58	3.3 ± 0.56
Heart rate (BPM)	75 ± 11.0	73 ± 9.4
Myocardial:skeletal intensity	1.1 ± 0.15	1.6 ± 0.47*

*p <0.05 (one-sided unpaired t-test with Welch's correction)
E=end, v=volume, BP=blood pressure, RV=right ventricle

Abstract #:SA-19

The effect of spinal anesthesia on cerebral saturation measured by Near Infrared Spectroscopy

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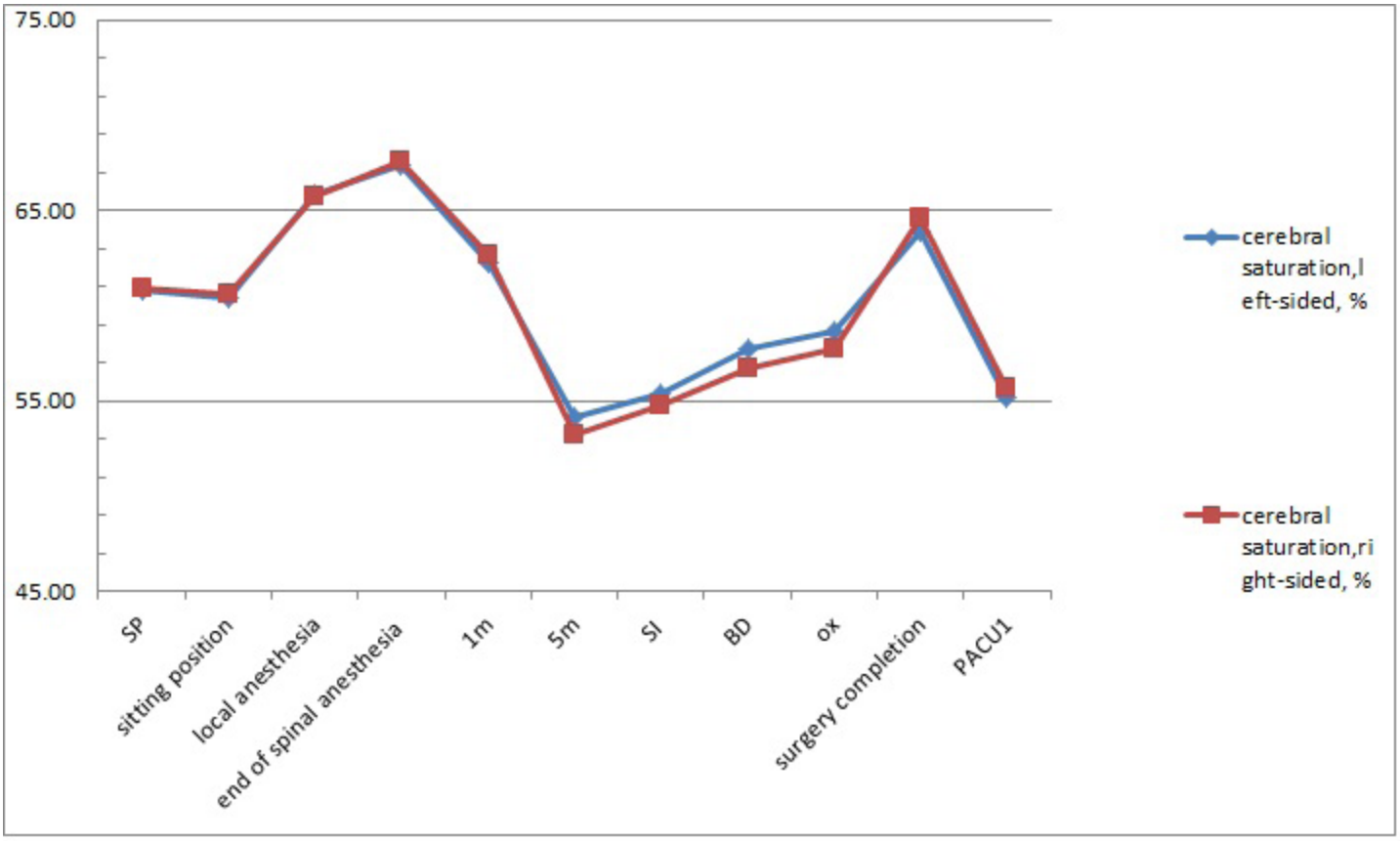
Objective: The effect of spinal anesthesia (SA) on cerebral saturation (COx) has never been studied. We aimed to measure brain saturation and discover if cerebral saturation correlates with changes in blood pressure.

Methods: A prospective observational study with measurement of right and left-sided brain saturation (COxR and COxL respectively) in healthy women undergoing scheduled cesarean section (SCS) using Near Infrared Spectroscopy (INVOS Cerebral/Somatic Oximeter|Covidien) - a direct non-invasive measurement of blood oxygenation in the brain microvasculature that has shown a high level of accuracy and can be used to detect an index of brain oxygenation(1). The measurements were done at the following points: preoperatively in supine position (SP), preoperatively in the sitting position, sitting during local anesthesia for SA, sitting at the end of SA, supine 1 minute postspinal (1m), supine 5 minute postspinal (5m), at skin incision (SI), after baby delivered (BD),1 minute after beginning of oxytocin infusion (ox), surgery completion and 1 hour after surgery(PACU1). Women underwent SA using bupivacaine 12 mg, fentanyl 20 μg and morphine 0.1 mg with a prophylactic phenylephrine infusion of 50 μg/min from beginning of SA to the end of surgery. Immediately after delivery, oxytocin 20 units was injected into a liter of Ringer Lactate and infused. No other uterotonics were given.
Results: 50 women were studied. Average age was 33.9±5.8 years and weight 72.2±11.6 kg. There was no significant correlation between changes in blood pressures and changes in COxR and COxL. There was no significant correlation between blood pressures and COx at each point. There was no significant difference between changes in COxR and COxL. There were significant drops in COxL and COxR compared with SP at 5m, SI, BD, ox and PACU1 (figure 1).
Figure 1: Cerebral saturation (left and right side) measured by INVOS at different points in time.

Conclusion: Brain saturation significantly decreased after spinal anesthesia with maximum at 5 minute postspinal and did not return to baseline even 1 hour after the surgery with no significant correlation with blood pressure changes. Further studies are required to assess the exact cause and clinical significance of these changes.

References:

1. Near-infrared spectroscopy as an index of brain and tissue oxygenation. Murkin JM, Br J Anaesth.,2009


75.00
65.00
55.00
45.00
SP
sitting position
local anesthesia
end of spinal anesthesia
1m
5m
SI
BD
ox
surgery completion
PACU1
cerebral saturation,left-sided, %
cerebral saturation,right-sided, %

Abstract #:SA-20

Cardiac Output at Term Pregnancy as it Relates to Maternal Position and Body Mass Index

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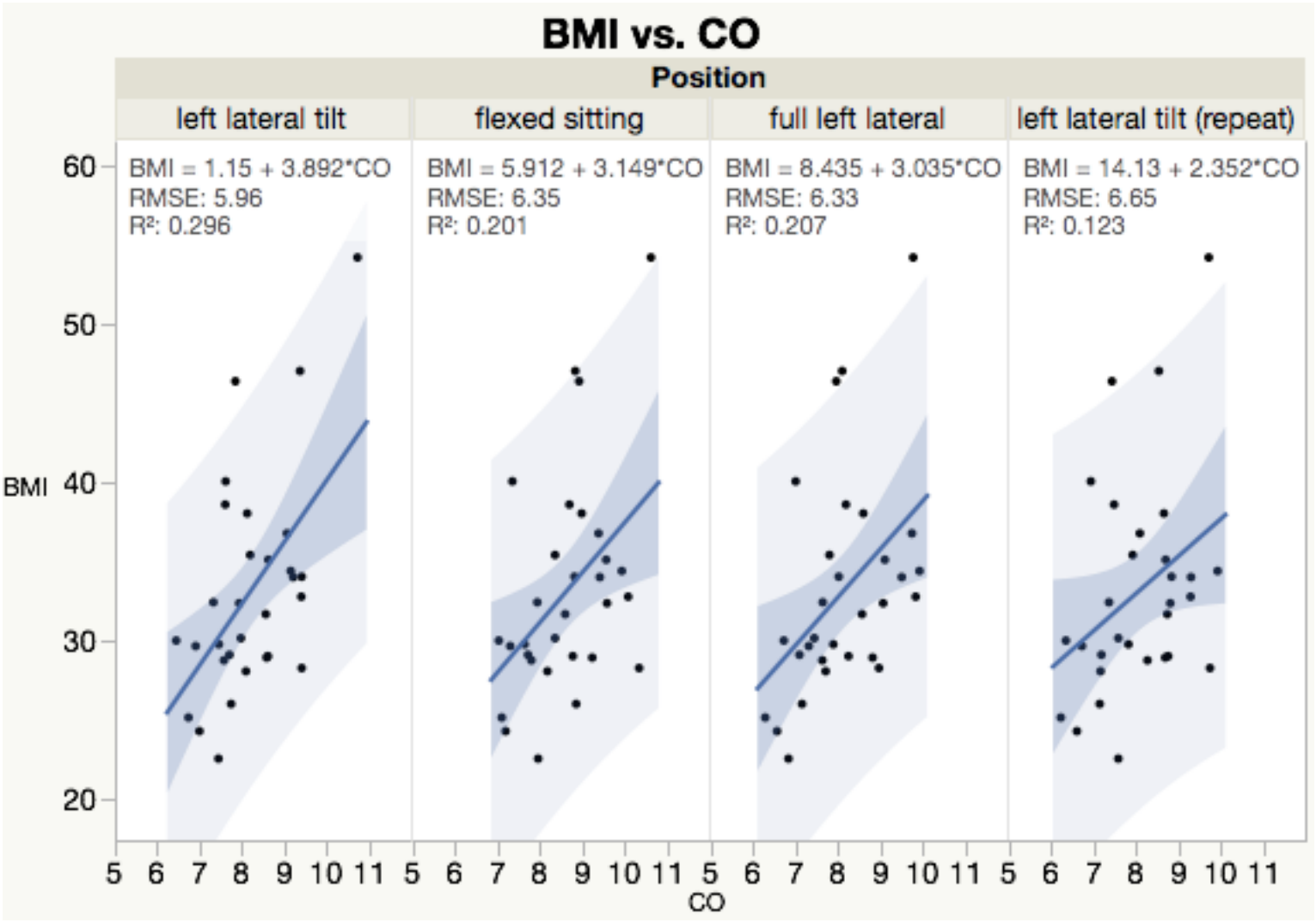
Background: It is well documented that supine hypotensive syndrome occurs in term parturients in the supine position due to aortocaval compression by the gravid uterus. Cardiac output can also be affected by patient positioning for epidural placement. Currently, there is no study that addresses the effect that body mass index (BMI) has on maternal cardiac output in the two common epidural positions – flexed sitting and lateral decubitus. The aim of this study is to determine if increasing BMI will negatively affect cardiac output (CO) in patients placed in traditional epidural positions. We hypothesize that the cardiac output will be the lowest in the flexed sitting position when compared to lateral tilt and lateral decubitus and that patients with a greater BMI will have a significantly decreased CO when compared to normal weight patients.

Methods: A total of 32 out of 40 patients have been recruited to this prospective, observational study. Two out of the 32 have been excluded from the analysis – one due to equipment error and the other due to initiation of oxytocin during hemodynamic measurements. Measurements were taken noninvasively using the ClearSight System (Edwards Lifesciences). Using left lateral tilt as our hemodynamic baseline, measurements were taken in the following order: left lateral tilt, flexed sitting, left lateral tilt then finally full left lateral. Hemodynamic measurements investigated were CO, stroke volume (SV), heart rate (HR) and fetal heart tones (FHT).

Results: Position and BMI have a significant effect on CO. Positioning from left lateral tilt (LLT) up to flexed sitting (FS) is positively correlated to an increase in CO. Of the CO components, HR was more profoundly altered than stroke volume. The FS position was associated with a 0.38 L/min ($p < 0.0001$) increase in CO compared to the left lateral tilt position. In regards to BMI, there was a highly significant ($p<0.0001$) positive correlation between BMI and CO. An increase in BMI from 30 to 40 correlated to a 0.6 L/min increase in CO. Notably, this positive correlation does not change with position. There was no significant change in FHT with change in maternal position or in relation to maternal BMI.

Conclusion: We found an elevation in CO with FS position and an elevation in CO with increasing BMI. This would suggest that parturients with marginal placental perfusion and/or non-reassuring FHT would benefit from the sitting epidural position.


BMI vs. CO
Position
left lateral tilt
flexed sitting
full left lateral
left lateral tilt (repeat)
BMI = 1.15 + 3.892*CO
RMSE: 5.96
R²: 0.296
BMI = 5.912 + 3.149*CO
RMSE: 6.35
R²: 0.201
BMI = 8.435 + 3.035*CO
RMSE: 6.33
R²: 0.207
BMI = 14.13 + 2.352*CO
RMSE: 6.65
R²: 0.123
BMI
60
50
40
30
20
5 6 7 8 9 10 11
CO

Abstract #:SA-21

Immediate birth – an analysis of women undergoing time critical birth in a tertiary referral obstetric hospital

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Introduction: Rapid anesthesia for emergency birth is a core requirement for an obstetric anesthesiologist. A request for an immediate birth may be due to life-threatening fetal &/or maternal conditions. Hospitals often have an emergency code system for these time critical emergencies. In our institution an emergency "Code Green" activates the system for immediate birth. We aimed to review the number of women undergoing Code Green CS, the indications for Code Green CS, the type of anesthesia used, the decision to delivery interval(DDI), & maternal & neonatal outcomes.

Method: After IRB approval, all Code Green births(January 1 2013 & December 31 2014) were analysed. The DDI based on anesthesia type was assessed using Kruskal-Wallis one-way analysis of variance on ranks & Dunns' method for multiple comparison of groups. Analyses were performed comparing groups using non-parametric tests.

Results: 14,115 women birthed between 2013-2014. 387 women underwent Code Green births-322(83%) by CS. The mean±SD age, gestation & body mass index for women undergoing Code Green CS was 32±8.3 years, 39±3.8 weeks, 26±5.5 kg.m-2. The most common indication for Code Green CS was prolonged fetal bradycardia (>5 minutes) (n=204, 53%), however cord prolapse (n=17, 4%) produced the most rapid DDI median (IQR) 14(13-16)vs17(14-23) minutes(p=0.005) for the whole group. Epidural top-up anesthesia was the commonest anesthetic method(Table). 8% of women undergoing neuraxial anaesthesia were converted to general anaesthesia(GA) during CS. 62% of Code Green CS occurred after-hours(between 17:00pm–06:59am) with 1 in 3 women having a general anaesthesia(GA – either initial GA or conversion to GA).Of the 103 GAs there was 1 failed intubation(1%)(successful ventilation). 11(3.4%) women were admitted to higher acuity care. There were no maternal deaths. Babies born with a DDI >30 minutes were significantly less likely to have a time to establish respiration of >1 minute (16.7%vs22.6%, P<0.001), but had a hospital stay of more than 3 days (60.0%vs38.9%, p<0.05).

Conclusions: Immediate CS is a common emergency occurring after-hours. Fastest DDI is achieved with GA however epidural top-up anesthesia only marginally prolongs DDI. Neuraxial failure requiring conversion to GA needs to be anticipated. DDI has little relationship to short-term neonatal morbidity, likely due to shorter DDIs in more at risk fetuses. Rapid DDI is achieved with an integrated emergency response system.

Anesthesia type	DDI (minutes)
GA (n=83)	14 (12 - 16)
Epidural top-up anesthesia (n=146)	16 (14 - 19)*
Conversion to GA (n=20)	20 (15 - 23)*
Spinal anesthesia (n=65)	25 (22 - 29)*#
Spinal-epidural anesthesia (n=8)	31 (30 - 37)*#

Data are median (IQR), DDI: decision-to-delivery interval, GA = initial GA
*p<0.05 compared with general anesthesia.
#p<0.05 compared with epidural anesthesia

Abstract #:SA-22

Skin to Skin Following Cesarean Delivery: Is it good for mothers too?

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Intro: Early skin-to-skin (STS) contact after delivery has important neonatal benefits. Early STS contact is a "Healthy Birth Practice" and is routine in many institutions after vaginal delivery. Research characterizing maternal benefits of STS contact is limited. Cesarean section (C/D) remains a barrier to STS contact. The purpose of this study was to compare the impact of STS contact in the operating room (OR) on pain scores maternal satisfaction, and opiate use in the first 24 hours postdelivery with routine care.

Methods: After IRB approval and informed consent, we enrolled 55 English speaking, ASA 1 or 2 elective C/D pts under spinal anesthesia with neuraxial morphine. Enrolled patients had their neonate placed STS when both were deemed stable. The baby remained STS through the C/D unless removed by request or necessity. This STS intervention group was compared to 55 women, matched by surgical group, who received routine care, with partner holding the neonate nearby. All participants rated their pain and satisfaction at 24 hours using a sliding visual analog scale, recorded as 0-100. Charts were reviewed to determine medication administration over 24 hours. Welch's independent samples t-tests or Pearson's chi squared test were used to detect differences in pain scores, morphine equivalent consumption, maternal satisfaction, and need for intraoperative analgesic supplementation.

Results: Average time to initiation of STS following delivery was 10.45 mins (range 3-15). There was no significant difference between groups in need for intraop supplementation of spinal anesthesia ($\chi 2=0.72$, $p=0.40$) or 24 hr morphine equivalents ($t=0.66$, $p=0.51$). Reported pain scores (resting, evoked, average and worst pain over 24 hours) were not statistically different between groups (Table). Both groups were similarly satisfied with pain control and anesthesia care. The STS pts did report significantly higher satisfaction with the OR atmosphere compared to controls, specifically greater "sense of control" and "ability to bond with the baby"(Table).

Conclusion: This study demonstrates improved maternal satisfaction with the operative experience with earlier STS contact compared to routine care. Given improved satisfaction and known neonatal benefits, early STS contact after C/D should be considered for routine application in the OR. In our experience, staff availability and willingness to facilitate are possible barriers to routine implementation.

Table: Comparison of Visual Analog Scores of Skin to Skin versus Routine Care

	Skin to Skin: Mean (sd)	Routine Care Mean (sd)	t-test	p value	ffect Size (Cohen's d)
Resting Pain[ŧ]	17.64(19.88)	23.69(18.58)	1.65	0.10	0.32
Evoked Pain	43.55(25.34)	46.06(23.52)	0.54	0.59	0.10
Average Pain over 24 Hrs	37.97(23.88)	37.96(20.93)	0.00	1.00	0.00
Worst Pain Over 24 Hrs	62.31(25.32)	63.67(26.22)	0.28	0.78	0.05
Satisfaction: Anesthesia Care[¥]	95.91(8.19)	93.56(12.38)	-1.17	0.24	0.22
Satisfaction: Pain Control in the OR	94.93(15.52)	93.51(15.03)	-0.49	0.63	0.09
Satisfaction: Pain Control Over 24 Hrs	81.51(23.68)	85.86(12.91)	1.20	0.24	0.23
Satisfaction with OR Atmosphere[*]	95.98(8.94)	83.18 (14.76)	-5.04	<0.001	0.97
Maternal satisfaction scale for cesarean delivery adapted from Morgan and Halpern IJOA. 1999.					
ŧFor pain scores, 0 = no pain, 100 = worst pain imaginable.					
¥For satisfaction scores, 0 = not at all satisfied, 100 = completely satisfied.					
*Composition of Visual Analog Scores rating satisfactionsuch as partner and neonatal interaction in OR, sense of control, and communication with staff.					
The item total correlation was 0.59 or greater, and the internal consistency reliability of the OR atmosphere scale was 0.75.					

Abstract #:SA-23

Intraoperative Sedation after Conversion of Neuraxial Labor Analgesia for Cesarean Delivery

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Barbara M Scavone M.D. - University of Chicago - Chicago, IL

Background: Between 57-77% of patients having vaginal delivery in the US choose neuraxial labor analgesia.(1) One advantage of neuraxial labor analgesia is the ability to quickly extend the blockade for cesarean delivery (CD), thus avoiding administration of general anesthesia (GA). Unfortunately, failure to extend blockade sometimes occurs, and in those cases, clinicians may administer GA, generally considered higher risk than neuraxial in this population.(2) Alternatively, one may provide systemic or inhalational sedative/analgesic supplementation, but parturients are at increased risk for airway difficulties and aspiration,(3) and supplementation may elevate these risks, especially at high doses. Meta-analysis reveals that 5% (95% CI 3.5-6.5%) of patients having CD after neuraxial labor analgesia receive GA; risk factors include high number of epidural catheter redoses during labor, urgent vs non-urgent CD, and non-obstetric specialist anesthesiologist.(4) Supplementation occurs at a rate of 10.7% (95% CI 4.2-17.3%), but risk factors for this outcome have not been as clearly delineated as those for GA.4 We undertook this study to determine GA and systemic/inhalational supplementation rates in this clinical setting and to determine risk factors for both outcomes.

Methods: In this IRB-approved study, as part of a departmental Quality Improvement project, we identified patients who had CD after neuraxial labor analgesia through billing records. We reviewed medical records for relevant demographic (age, BMI), obstetric (decision to incision time interval), and anesthetic (epidural vs CSE labor analgesia, duration labor analgesia, number of times patient seen by anesthesiologist per hour labor analgesia, number of redoses per hour labor analgesia, details of local anesthetic used, supplement type/dose administered, intraoperative time interval, and obstetric specialist vs non-specialist attending anesthesiologist) variables.

Results: GA rate was 4.5%; supplementation rate, 53%. High-dose supplementation (other than < 2 mg Midazolam and < 100 mcg Fentanyl) occurred in 23% of cases. Risk factors for high-dose supplementation included lack of additives in local anesthetic solution and care by non-obstetric specialist faculty members. Longer duration labor analgesia increased risk of both GA and high-dose supplementation. Patients whose epidural catheters were replaced during labor had evidence of poor results intraoperatively: (40% GA, 40% high-dose supplementation).

Conclusions: Risk factors for systemic/inhalational supplementation during attempted conversion of epidural labor analgesia to CD anesthesia are similar but not identical to those for GA. Patients who require replacement of neuraxial analgesia catheters should be warned of risk for poor results after repeat neuraxial procedures.

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1. Bucklin: Anesthesiology 2005;103:645
2. Hawkins: Anesthesiology 2016;124:epub ahead of print
3. McDonnell: IJOA 2009;17:292
4. Bauer: IJOA 2012;21:294

Abstract #:SA-24

Enhanced recovery for elective caesarean section: The patient's perspective

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Danny Morland FRCA - Royal Victoria Infirmary - Newcastle-upon-Tyne, Tyneside
Shilpa Ratnaparkhi M.B.B.S. - Royal Victoria Infirmary - Newcastle-upon-Tyne, Tyneside
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Introduction: Enhanced recovery has been used for over 10 years in many surgical specialties, improving outcomes and reducing length of stay [1]. Use in obstetrics is more recent, but has shown similar benefits [2]. The introduction of an enhanced recovery pathway in our hospital has led to demonstrably improved practice measures, such as reduced fasting times, earlier ambulation and skin to skin contact. Although welcome, these outcomes are not the whole story. We were interested to explore individual patient experiences.

Methods: We prospectively evaluated 50 consecutive patients over a 4 week period, all of whom underwent enhanced recovery elective caesarean section. This was done using a patient satisfaction questionnaire on Day 1 post delivery, and then a telephone interview on Day 10-14. Patient responses were collated and thematically analyzed by 2 independent practitioners. Themes were then compared and a consensus arrived at. The main themes are shown in Figure 1.

Results: 39 patients completed the satisfaction questionnaire. Of these, 30 agreed to telephone follow up and were contacted. Especially popular interventions were early ambulation and catheter removal, the latter allowing for greater ease of infant care. Comments were not universally positive, for example a few patients reported that they would have appreciated more assistance with mobilising, and suggested that increased staffing levels may have been helpful to this end. However, the overall quality of care provided by staff was highly praised. Interestingly, reporting of post operative pain was highly variable- some patients were pain free by Day 2, whereas a number still reported significant pain at 2 weeks. Nonetheless, overall satisfaction levels were high, with all patients rating their experience as good or excellent.

Discussion: Enhanced recovery has proved highly popular with our patients, notably so amongst women who previously underwent elective caesarean section prior to it's introduction. Such positive patient experiences reinforce the peri-operative benefits previously reported.

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2. Jan H, Long O, Garratt C, et al. Outcomes following introduction of an enhanced recovery in obstetric surgery (EROS) protocol for elective caesarean sections; RCOG World Congress 2013, www.epostersonline.com/rcog2013/?q=node/ 1852&posterview=true

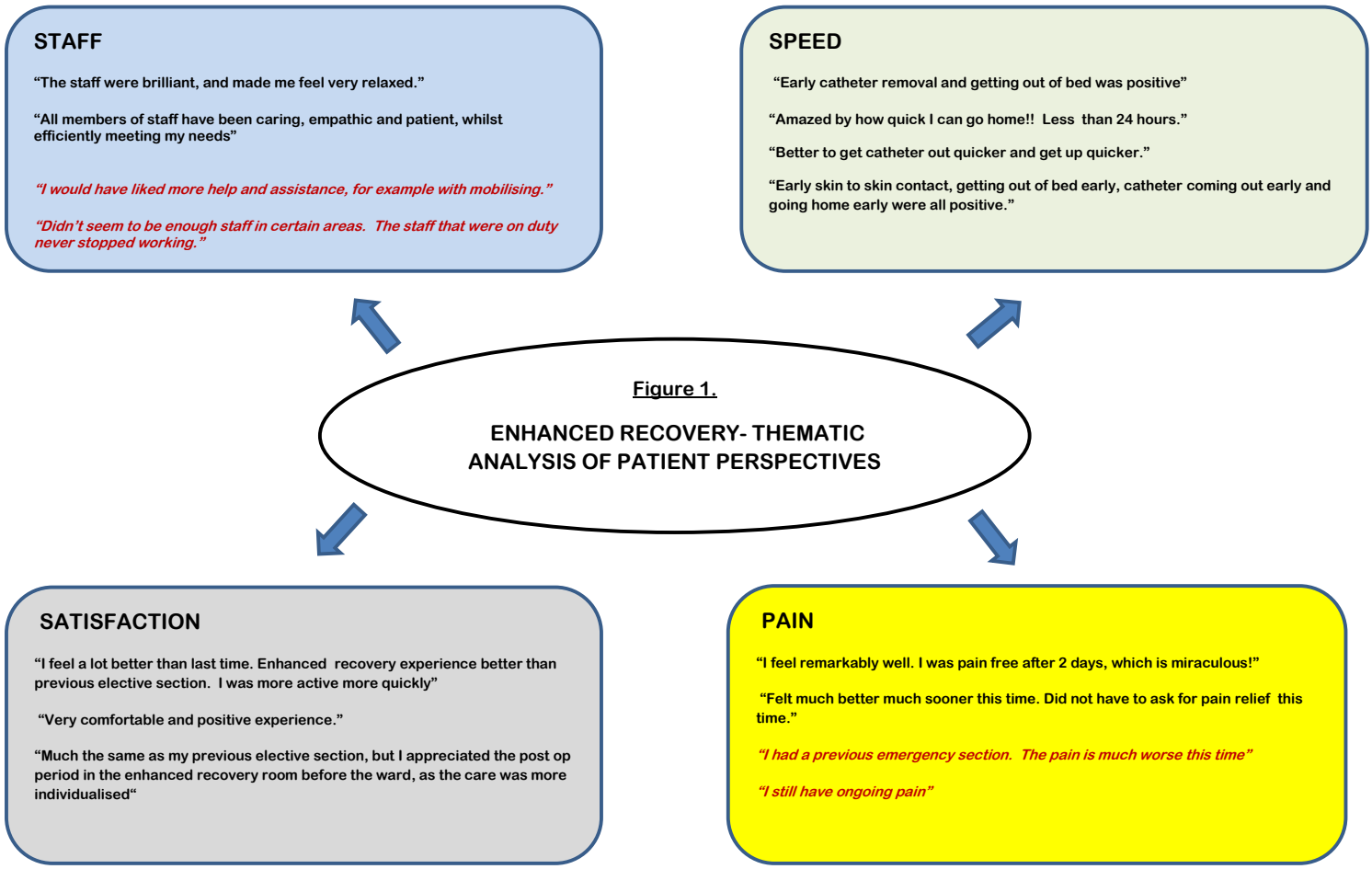

Figure 1.

ENHANCED RECOVERY- THEMATIC ANALYSIS OF PATIENT PERSPECTIVES

Abstract #:SA-25

Intravenous dexmedetomidine for the treatment of shivering during cesarean delivery under neuraxial anesthesia : a randomized placebo-controlled trial.

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Trial design: Monocentric, randomized, prospective, double-blind, placebo-controlled, parallel-group study.

Background: Neuraxial anesthesia is the preferred technique for cesarean delivery. In about 55% of these patients, spinal or epidural anesthesia may be associated with shivering which may be very distressing (1) and interfere with the monitoring of vital signs. Recent studies have shown that dexmedetomidine could help to alleviate shivering associated with neuraxial anesthesia (2).

Objective: To test whether dexmedetomidine, an alpha 2-adrenergic agonist, reduces the duration of shivering episodes associated with neuraxial anesthesia during cesarean delivery.

Methods: Eighty healthy parturients, 18 years of age or more, undergoing cesarean delivery under neuraxial anesthesia at the CHU Sainte-Justine were enlisted in this prospective, randomized, double-blind trial. We obtained the approval of Health Canada to use dexmedetomidine for this application. After childbirth, when shivering occurred, the intervention group (n = 40) received a single intravenous bolus of dexmedetomidine (30 mcg) while the control group (n = 40) received a single intravenous bolus of normal saline. Randomization and allocation were based on a computer generated list. The primary outcome measure was the time lapse for an observable decrease in shivering after the intervention.

Findings: A preliminary analysis was performed after 7 months. 201 patients undergoing a cesarean section under neuraxial anesthesia were recruited, of whom 70 presented shivering and were randomized. Our study shows that dexmedetomidine reduces the duration of shivering: mean time to decrease chills after the bolus is 2.3 minutes (CI 95% 1.7-3.0min) with dexmedetomidine, and 20.3 minutes (CI 95% 16.2- 24.5min) with saline. At 5 minutes, chills had stopped in 77% of the patients in the intervention group versus 11% in the control group. Chills significantly decreased at 5, 10 and 15 minutes after the administration of a 30 mcg IV bolus of dexmedetomidine. No adverse effects, including bradycardia, have been observed. In cases where slower heart rates were noticed, no medical intervention was needed.

Conclusions: This study demonstrates that an intravenous bolus of dexmedetomidine is an effective treatment to decrease the duration of shivering during cesarean delivery under neuraxial anesthesia. More patients are needed to fully assess safety.

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Abstract #:SA-26

Reducing Spinal Hypotension During Cesarean Delivery with Glycopyrrolate: A meta-analysis

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Introduction: Hypotension is a common and important complication associated with spinal anesthesia for cesarean delivery.(1) The objective of this meta-analysis was to determine if prophylactic glycopyrrolate administration reduces the hypotensive changes associated with spinal anesthesia.

Methods: A literature search (Medline, Embase, CINAHL, Scopus and Pubmed) was performed to identify randomized controlled trials investigating the effect of glycopyrrolate on spinal-induced hypotension for cesarean delivery. Primary outcomes were incidence of hypotension and dose of vasopressor used (ephedrine equivalent). Secondary outcomes included: incidence of bradycardia, incidence of nausea and vomiting and incidence of dry mouth. Risk ratios (RR), odd ratios (OR) and weighted mean differences (WMD) were calculated using random effects modeling with 95% confidence interval.

Results: Five RCTs met our inclusion criteria. A total of 311 patients were recruited in all study groups: 153 patients in the glycopyrrolate group and 158 in the control group. The incidence of spinal-induced hypotension was no different with prophylactic glycopyrrolate administration compared to placebo controls (RR 0.93 [0.71, 1.21]; p=0.59), but the dose of ephedrine required to treat hypotension was significantly reduced in the glycopyrrolate group (WMD -5.3 mg[-8.80 mg, -1.79 mg]; p=0.003). The glycopyrrolate group had a lower incidence of bradycardia (RR 0.15 [0.03, 0.80]; p=0.03), and the maximal HR achieved was significantly higher compared to the control group (MD 15.85 [7.90, 23.81]; p<0.0001). The incidences of nausea and vomiting, and dry mouth were similar between both groups with OR 0.7 [0.2, 2.45]; p=0.58 and RR 1.56 [0.10, 23.24]; p=0.75 respectively.

Discussion: Prophylactic glycopyrrolate administration for cesarean delivery does not affect the incidence of spinal-induced hypotension, but does result in a modest reduction in vasopressor requirements and incidence of bradycardia. Utilizing glycopylorrate for cesarean delivery under spinal anesthesia should be considered. However larger, adequately powered studies investigating side-effects are still needed before routine use can be recommended.

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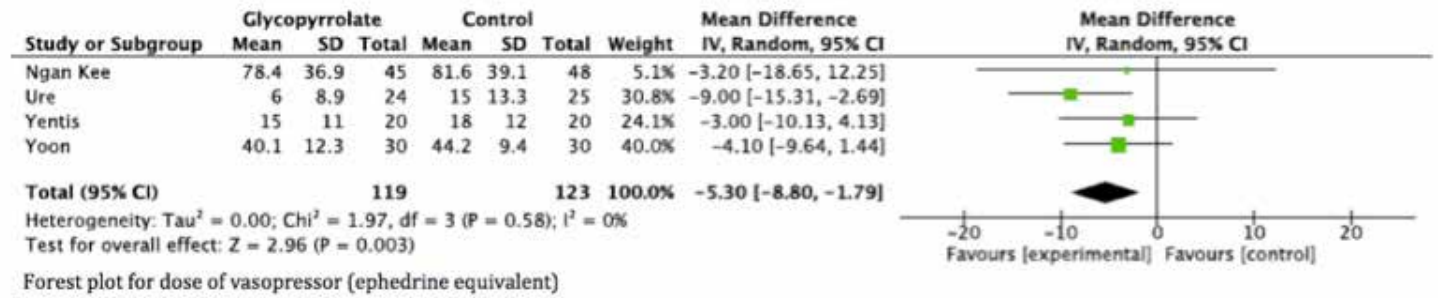

Forest plot for dose of vasopressor (ephedrine equivalent)

Abstract #:SA-27

Ondansetron and Spinal Anesthesia-Associated Hypotension: Using Risk Difference to Assess Therapeutic Effectiveness

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Introduction: Ondansetron, an agent frequently used for nausea/vomiting prophylaxis and treatment, has been shown to reduce spinal anesthesia-related hypotension, bradycardia, nausea, and vomiting in obstetric and non-obstetric patients(1). However, given the potential adverse effects of antepartum administration of ondansetron, we questioned the clinical relevance of these findings.

Methods: We included data from ten randomized controlled trials identified in a recent meta-analysis(1) that evaluated risk ratios in treatment and control groups. Inclusion/exclusion criteria were as described(1). We calculated risk differences with 95% confidence intervals (CIs).

Results: Six of the ten randomized trials compared ondansetron with control in obstetric patients. Five of six trials revealed at least a 20% risk difference between ondansetron and control groups (Figure), such that ondansetron prevented hypotension. The overall risk difference of ondansetron administration vs. placebo was -21.54 (95% CI -21.63 to -21.45).

For non-obstetric and obstetric surgery (10 studies), the overall risk difference for spinal anesthesia-related nausea with ondansetron administration vs. placebo was -21.62 (95% CI -21.7 to -21.54).

Discussion: Estimates of risk difference provide more clinically relevant information than risk ratio(2). Using risk difference to analyze data from ten randomized controlled trials, we found that patients in the ondansetron group had approximately 22 fewer cases of hypotension or nausea per 100 patients when compared with control group. Thus, ondansetron reduces the incidence of spinal anesthesia-related hypotension in obstetric patients in a clinically significant way. However, practitioners should consider the risks of antenatal administration, including QT prolongation and potential effects on the fetus, when deciding whether to use prophylactic ondansetron.

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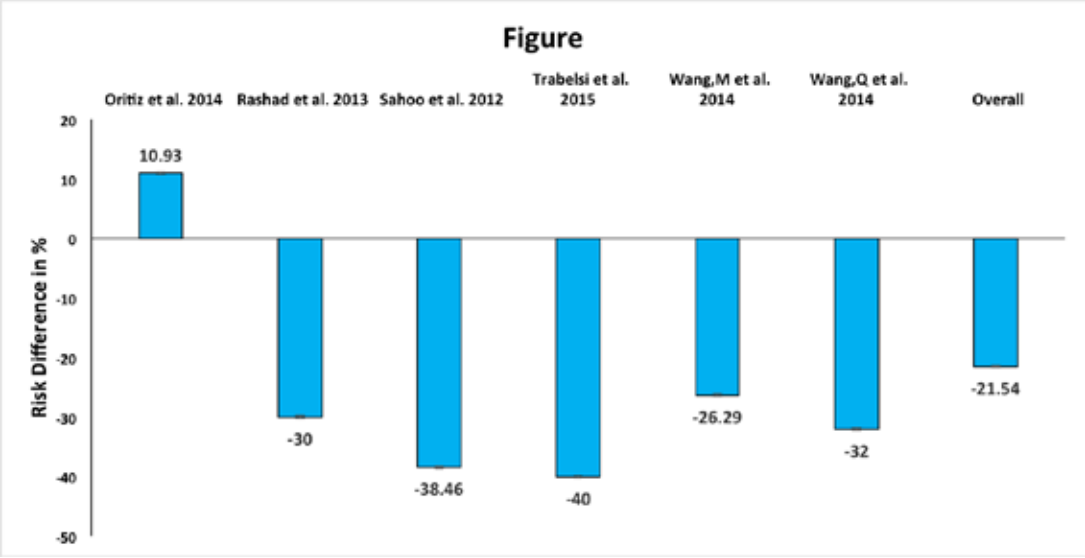

Abstract #:SA-28

Risk Factors for the use of General Anesthesia for Cesarean Sections: A systematic review

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Introduction: General anesthesia use for Cesarean section (GACS) is not ideal due to the lack of maternal participation in the delivery and risk of airway compromise.1 Although reviews have examined risk factors for neuraxial anesthesia failure, no reviews have addressed primary use of GACS. The objective of this study is to identify the risk factors associated with primary use of GACS.1

Methods: A literature search was performed using PubMed, The Cochrane Library, and Scopus for epidemiologic studies and clinical trials between January 1971 and December 2015 referencing risk factors for pregnant patients receiving GACS. The search terms included synonyms for "general anesthesia", "neuraxial anesthesia", and "Cesarean section". Included studies had patients undergoing cesarean sections with a primary ("intended") or secondary ("back up") general anesthetic. Studies were excluded if they were abstracts, not in English, or failed to report any association with GACS or risk factors for GACS.

Results: The search yielded 2,565 combined results of which 12 studies underwent review. Worldwide, the most common risk factors for primary GACS include: BMI > 31.52, low-volume regional (non-urban) hospitals3, perceived lack of time4, Category II and III fetal heart tracing4-6, early gestational age7, abnormal placentation5, 6, 8, antepartum hemorrhage4, coagulopathy4, 6, preeclampsia4, malpresentation4, nighttime delivery5, failed neuraxial techniques9, non-obstetric anesthesiologist3, 10, and maternal congenital heart disease.7

Four studies showed a correlative association between primary GACS and: 1) emergency CS (i.e. Category II and III FHT, abnormal placentation, cord prolapse, uterine rupture, antepartum hemorrhage)4-6, 10, and 2) partial or inadequate neuraxial anesthesia9, 11-13. Two studies showed increased likelihood of receiving GACS related to: 1) having anesthesia provided by a non-obstetric trained anesthesiologist3, 10, and 2) anesthesiologists perceiving a lack of time to perform neuraxial anesthesia5, 11. One study showed that regionally located (non-urban) hospitals in the Czech Republic were more likely to perform GACS14.

Conclusion: Current research has identified patient-level risk factors for primary GACS and many fewer hospital- or provider-level risk factors for primary GACS. In order to develop interventions to decrease primary GACS, further research is needed to better characterize physician- and system-level predictors of GACS.

Author	Location	Study Type	Number of Subjects (CS)	Data Collection	Outcome	Identified Risk Factors for or Association with GACS
Johnson (2002)[3]	Canada	Database review	13,884	1998-2000	Influence of physician specialty on GACS	Hospitals with < 50 deliveries per year, family/general practitioner performed anesthesia, low-volume epidural provider at hospital
Orbach-Zinger (2006)[2]	U.S.	Observational, prospective study	101	2001-2002 (6 months)	Failed labor epidural	Increasing number of labor epidural top-ups
Kinsella (2008)[11]	U.K.	Prospective audit	5,080	1999-2004	Neuraxial anesthesia failure requiring GACS	Poor quality epidural block, epidural only recently inserted, lack of time for top up, maternal anxiety and previous accidental dural puncture
Visser (2009)[6]	The Netherlands	Retrospective cohort study	693	2001-2005	Spinal anesthesia following failed epidural anesthesia	Severe fetal distress, maternal request, thrombocytopenia, placental abruption, uterine rupture
Lee (2009)[12]	Singapore	Retrospective chart review	1,025	18 months	Failed labor epidural for GACS	Sensory block height below T5, poor quality, & patchy block
Rafi (2010)[13]	U.K.	Prospective audit	2,273	1997-2002	Rates of conversion from in-situ epidural to GACS	Failed top-ups, partial/inadequate spinal block
Palanisamy (2011)[5]	U.S.	Retrospective chart review	56,937	2000-2005	Indications for CS and GACS	True emergencies (Category II and III FHT, abnormal placentation, cord prolapse), nighttime delivery, PEC continuum, perceived lack of time for neuraxial anesthesia, maternal contraindications
Tonidanel (2014)[15]	U.S.	Retrospective cohort study	460	2010-2011	Anesthetic and Ob outcome in morbid obesity	Weight < 136 kg
Lai (2014)[4]	Taiwan	Database review	25,606	2000-2008	Change in the annual prevalence rate for each mode of anesthesia for CS	Age > 35, previous CS, emergency CS (Category II and II FHT), PEC, antepartum hemorrhage, early or & threatened labor, malpresentation
Ioscovich (2014)[9]	Israel	Prospective observational	831	2010-2011	Anesthesia and Maternal outcomes for High-Order CS	Inadequate epidural anesthesia, failed spinal anesthesia
Charoenraj (2014)[8]	Thailand	Retrospective cohort study	562	2005-2009, 2010-2011	Choice of anesthesia in placenta previa patients	Higher ASA status, anterior placentation, intraoperative HR > 125
Stourac (2015)[14]	Czech Republic	Cross-sectional	1,943	2010-2011	Current practice in Ob anesthesia in the Czech Republic	Regional (non-urban) hospitals
Ismail (2015)[10]	Pakistan	Prospective observational	1,465	2012-2013	Failed conversion of LE to surgical anesthesia for CS	Non-Ob anesthesiologists, emergency CS, inadequate analgesia during labor, VAS > 3 during labor

Key: U.S. = United States; U.K. = United Kingdom; FHT = Fetal Heart Tones; PEC = preeclampsia; CS = cesarean section; HR = Heart rate; ASA = American Society of Anesthesiologists; VAS = Visual analog scale; Ob = Obstetric

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Abstract #:SA-29

Fetal Response to Labor Epidural Initiation– Finding the Best Solution

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Introduction: There is a long-standing concern that Combined Spinal Epidural (CSE) for neuraxial labor analgesia initiation (NLAI) is associated with increased risk of fetal heart rate abnormalities (FHRA), mostly bradycardia. The risk is traditionally linked to relatively large doses of spinal opioids. We propose using a low dose fentanyl (from pharmacy pre-made epidural solution), which provides excellent NLAI while minimizing FHRA. We did a large-scale retrospective study to assess the risk of FHRA following low dose fentanyl CSE compared to bupivacaine only CSE and straight epidural (SE) initiation.

Method: We reviewed electronic medical records of all parturients who received NLAI at our institution in 2014. We collected demographic and obstetric data, pain scores, blood pressures (BP), FHRA events, body mass index (BMI) and Apgar scores. Patients were divided into groups based on the type of NLAI: low dose fentanyl/bupivacaine CSE (2.5 mg bupivacaine with fentanyl 5 mcg, CSE+), bupivacaine alone CSE (2.5 mg, CSEo), and SE. A generalized linear model was built using the presence or absence of FHRA as a logistic outcome and demographic and obstetric data as independent or random factors.

Result: 709 records were reviewed (345 CSE+, 138 CSEo, 226 SE). Type of NLAI was non-predictive of FHRA (p=0.71, Figure 1). In the logistic model, predictors of FHRA were increased parturient age (p=0.028) and decreased BP 15 min after NLAI (p=0.042). Factors predictive of low BP 15 min after NLAI were lower BMI (p=0.003) and lower gestational age (p=0.005). There were no significant differences in Apgar scores and post-NLAI pain scores reduction between the groups.

Conclusion: CSE initiation with 5 mcg of fentanyl and bupivacaine is not associated with increased risk of FHRA compared to CSE with bupivacaine alone or SE initiation. There is no difference in Apgar scores or maternal outcome between groups. This solution provides an effective, safe and cost-effective method for NLAI. In patients with increased age, low BMI, low pre-NLAI BP, or low gestational age, precautions should be taken to reduce the impact of NLAI on BP.

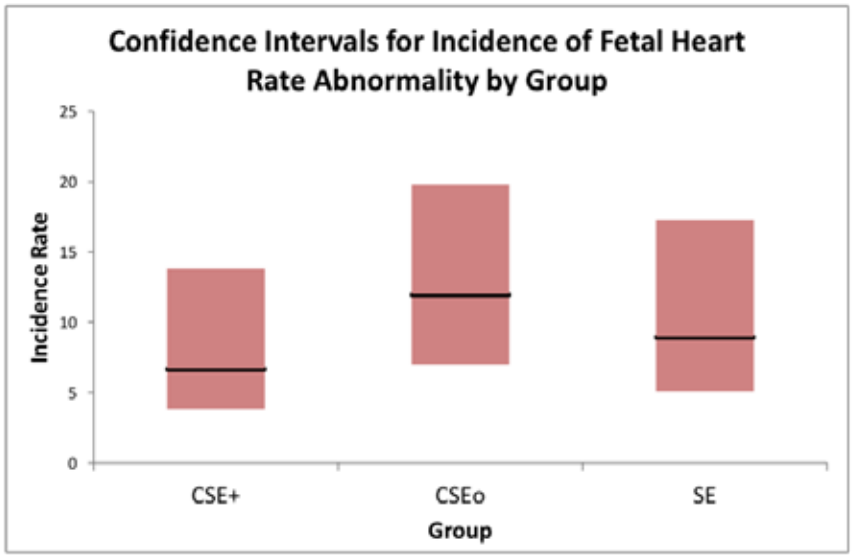

Figure 1 – 95% confidence intervals for incidence of FHRA for analgesia type (CSE+: combined spinal/epidural with low-dose opioid; CSEo: combinded spinal/Epidural with local only; SE: Epidural). There is no significant difference between groups.

References:

1. Patel NP et al. Fetal effects of combined spinal-epidural vs epidural labour analgesia: a prospective, randomized double-blind study. Anaesthesia 2014; 69: 458–67.
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Abstract #:SA-30

The Impact of Continuing Epidural Analgesia during the Second Stage of Labor and the 2014 ACOG Definition of Arrest of Labor on Mode of Delivery and Newborn Outcomes in a Chinese Academic Medical Center

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Background: The No Pain Labor & Delivery-Global Health Initiative (NPLD) was initiated in The Second Affiliated Hospital of Wenzhou Medical University in 2009. Despite an increase in rates of neuraxial labor analgesia (NA) and improved maternal outcomes, continuation of NA in the second stage of labor (CEADSSOL) was interrupted by care providers due to fears of increased risk of operative vaginal or cesarean delivery (CD) and adverse neonatal outcomes. Also, Chinese women and obstetric providers are quick to proceed to CD with arrest of labor with the belief that CD may be safer for the baby. This SOAP funded study evaluated the implementation of CEADSSOL and the ACOG statement in 2014 on proceeding to CD following arrest of labor on neonatal and maternal outcomes. We hypothesis that the jointed interventions would not have an adverse impact on neonatal or maternal outcomes.

Methods: This is an impact study. Data collection began March 2014 and ended in May 2015, one year after implementation of both interventions using an electronic medical record system and verified using case logs in the L & D suites. The primary outcome was NICU admission. The implementation of CEADSSOL with 0.08-0.15% ropivacaine and sufentanil 0.1-0.2 mcg/mL. The chi-squared test were used for analyses. A $P < 0.05$ was required to rejecting the null hypotheses.

Results: There were a total 10,414 deliveries during the study period. Post-intervention NICU admissions, antibiotics usage, intubation, and 7-day mortality rates were dramatically reduced compared to pre-interventions (Figure and table). Maternal outcomes including monthly rates of forceps, episiotomy, and intrapartum CD remained unchanged.The impact of the interventions was sustained between the first three and the last three months post interventions. The NA rate increased from 44% to 57% before and after the interventions as the CD rate decreased from 40% to 36%.The primary outcome was not changes when corrected for the increase in NA rate. There was no maternal death and only one 3 degree of perineal laceration during the study period.

Summary: The important finding of this study was the improvement in neonatal outcomes by implementing two jointed interventions without a cost of increased operative delivery. In fact, the jointed interventions decreased the CD rates in the post-intervention period with sustained effects. Similar finding have been observed at two additional Chinese hospitals that implemented NPLD.

Figure: The Impact of Continuing Epidural Analgesia during the Second Stage of Labor and the 2014 ACOG Definition of Arrest of Labor on NICU Admission Rates and Mode of Delivery

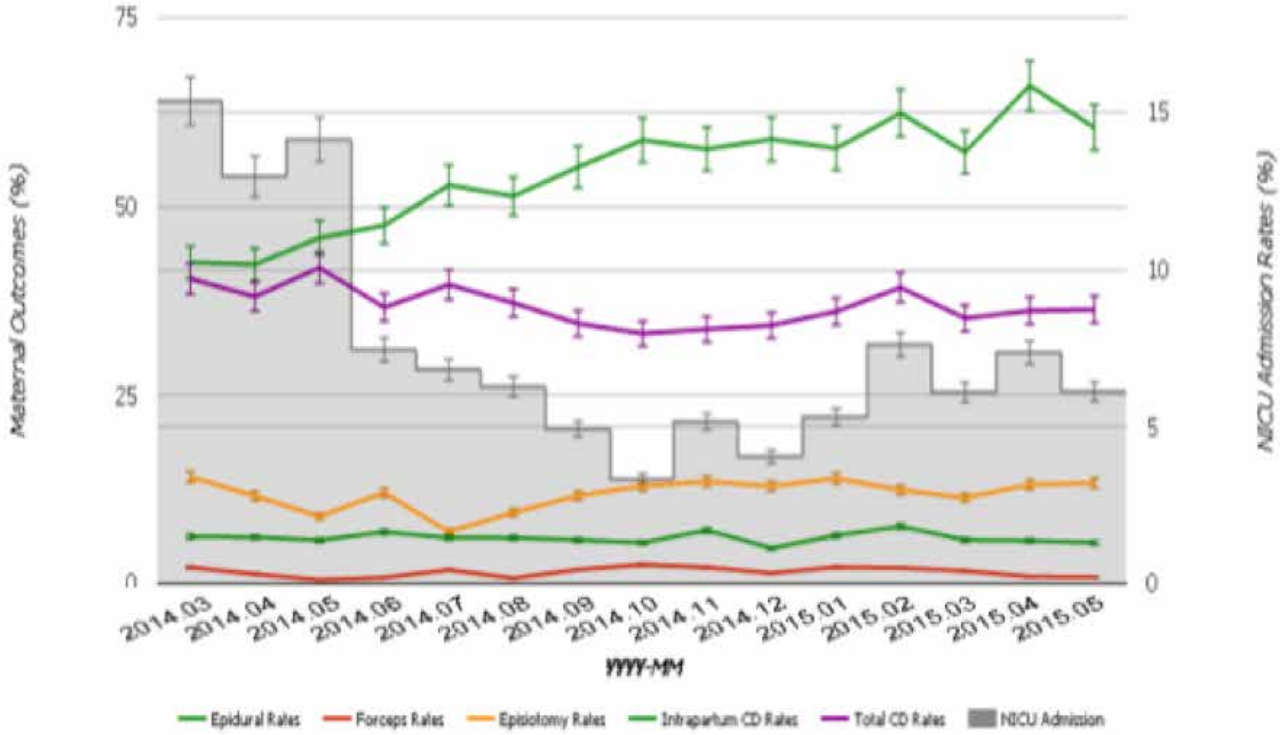

Table: The Impact of Continuing Epidural Analgesia during the Second Stage of Labor and the 2014 ACOG Definition of Arrest of Labor on Mode of Delivery and Newborn Outcomes

Clinical Outcomes	Pre-Intervention Phase (%)	Post-Intervention Phase (%)	P Value	Earlier Post-Intervention Phase (%)	Later Post-Intervention Phase (%)	P Value
Total Numbers of Deliveries	1870	8544		2080	1913	
Neonatal Parameters						
NICU Admissions	264 (14)	491 (5.7)	< 0.001	142 (6.8)	125 (6.5)	0.73
Apgar ≤ 7 @ 5 min	12 (0.64)	29 (0.34)	0.06	6 (0.29)	12 (0.63)	0.11
7-Days Mortality	12 (0.64)	14 (0.16)	< 0.001	4 (0.19)	1 (0.05)	0.21
Antibiotics Usage	136 (7.3)	285 (3.3)	< 0.001	94 (4.5)	66 (3.5)	0.10
Intubation	41 (2.2)	92 (1.1)	< 0.001	22 (1.1)	25 (1.3)	0.47
Maternal Parameters						
Total Cesarean Delivery	750 (40)	3067 (36)	0.02	788 (38)	687 (36)	0.38
Episiotomy	217 (12)	1031 (12)	0.62	196 (9.4)	243 (13)	0.003
Forceps	254 (14)	137 (1.6)	0.32	23 (1.1)	22 (1.2)	0.90
Neuraxial Analgesia	519 (28)	3330 (39)	< 0.001	698 (34)	795 (42)	< 0.001

Abstract #:SA-31

Epidural Analgesia During The Second Stage Of Labor And Obstetric Outcomes: A Randomized Controlled Trial

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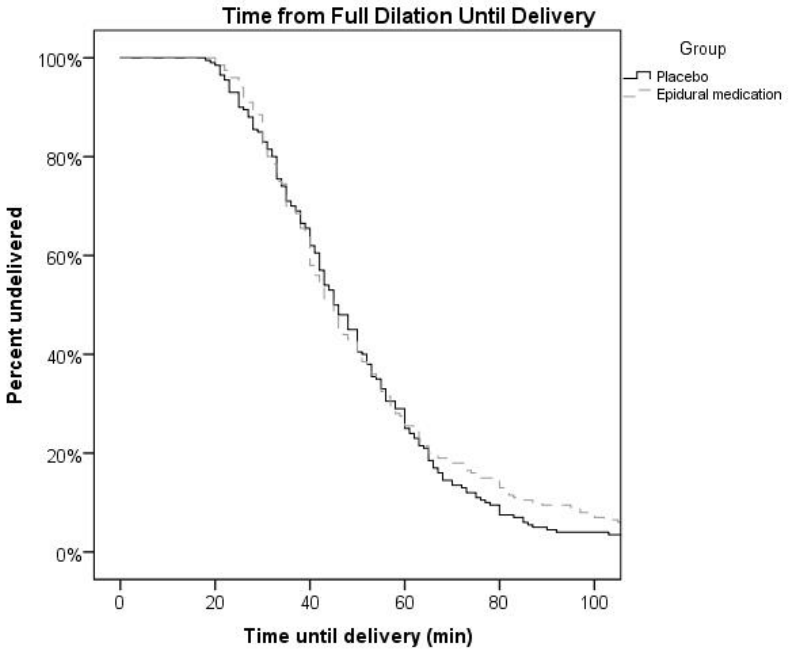
Background: The effect of epidural analgesia on the second stage of labor remains controversial.(1) In clinical practice, the epidural infusion is sometimes reduced or turned off when second stage is prolonged.

Methods: The IRB (Clinical Research Ethics Committee) of Nanjing Maternity and Child Health Care Hospital, China, approved this randomized, double-blind trial with written informed consent. Inclusion criteria: Nulliparous parturient with a term, cephalic, singleton pregnancy, ASA 1 or 2, who requested epidural analgesia and achieved full cervical dilation. Exclusion criteria: prior use of opioids, induction of labor, cervical dilation ≥6cm at epidural request, delivery in 1 hour after epidural placement and cesarean delivery before full dilation.

Epidural analgesic solution (0.08% ropivacaine + 4 mcg/ml sufentanil) was infused at 8ml/hour with PCEA in the first stage of labor. At full dilation, parturients were randomized in a blinded fashion to: NORMAL SALINE (Control Group, n=200) or STANDARD EPIDURAL SOLUTION (Study Group, n=200), both infused at 8ml/hr. Physician- or self- bolus was allowed for breakthrough pain. 100-mm visual analog scale (VAS) assessed pain at 30' intervals. Second stage duration, VAS-pain, satisfaction score (10-point scale), delivery mode, and neonatal outcomes were compared. $p<0.05$ was considered significant.

Results: 560 parturients were screened for eligibility, 160 had exclusion criteria. Demographic and obstetric factors were similar between groups. The duration of the second stage was similar (52±27 min in Study Group vs. 51±25 min in Control Group, p=0.52, Fig.1). VAS pain increased in Control Group and decreased in Study Group in the second stage(p=0.02 within groups), but were similar between groups (p=0.96 between groups). No difference in cesarean delivery (p=0.25) or forceps delivery rate (p=0.28). More women in Study Group had complete satisfaction (score ≥9: 84% vs. 70% in Control Group, p=0.001). No significant differences between groups in Apgar scores or umbilical cord blood values (p=NS for all).



Summary: Continuing epidural analgesia in the second stage had no effect on the duration of second stage, the incidence of cesarean or instrumental delivery, or neonatal outcomes. Maternal satisfaction was improved with continuation of medication (Registration identifier: ChiCTR-IOR-15005875).

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1. Obstet Gynecol 2014; 123:527-535

Abstract #:SA-32

Does magnesium sulfate exposure attenuate the effect of steroids administered for fetal lung maturation?

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Objective: Tocolysis with magnesium sulfate ($MgSO_4$) may often be considered for women with PPROM who receive steroids. Data from animal studies suggest that $MgSO_4$ can interfere with the fetal lung maturation effect of corticosteroids through an intracellular calcium-dependent mechanism. However, there is a dearth of clinical data to verify this phenomenon. In this retrospective study, we examined whether fetal exposure to $MgSO_4$ among women with PPROM receiving steroids is associated with an increased risk of respiratory neonatal morbidity.

Methods: This is a secondary analysis of the MFMU BEAM study. We included all women who received one course of antenatal steroids and had PPROM at < 32 wks. We compared rates of respiratory distress syndrome (RDS) and the need for ventilator support for infants born to women who received $MgSO_4$ compared to those born to mothers who received placebo. To account for potential confounders, we performed multivariate logistic regression, adjusting for diabetes, delivery route, other tocolytics, and gestational age at delivery.

Results: Our cohort comprised 1496 women who received one course of steroids and had PPROM; 735 (49.1%) women received $MgSO_4$ and 761 (50.9%) women received placebo. We observed a lower likelihood of RDS and ventilatory support among infants exposed to $MgSO_4$ compared to non-exposed infants (table). After adjustment, the risk of RDS and need for ventilator support did not differ according to $MgSO_4$ exposure.

Conclusions: Among women receiving steroids for PPROM, our findings suggest that the risk of neonatal respiratory morbidity is not adversely influenced by fetal exposure to $MgSO_4$.

Table 1. Rates of Respiratory Distress Syndrome and Ventilatory Support for infants born to women with PPROM who received $MgSO_4$ and Placebo in the MFMU BEAM study.

	No RDS (n=764)	RDS (n=732)	aRR* (95% CI)	No Ventilatory Support (n=697)	Ventilatory Support (n=799)	aRR* (95% CI)
Placebo	375 (49.1%)	386 (52.7%)	Reference	330 (47.3%)	431 (53.9%)	Reference
Mg	389 (50.9%)	346 (47.3%)	0.97 (0.84-1.12)	367 (52.7%)	368 (46.1%)	0.93 (0.81-1.07)

aRR = adjusted relative risk; CI= confidence interval
*** adjusted for exposure to other tocolytics, maternal diabetes, delivery route, gestational age at delivery**

Abstract #:SA-33

Trends in Obstetric Critical Care

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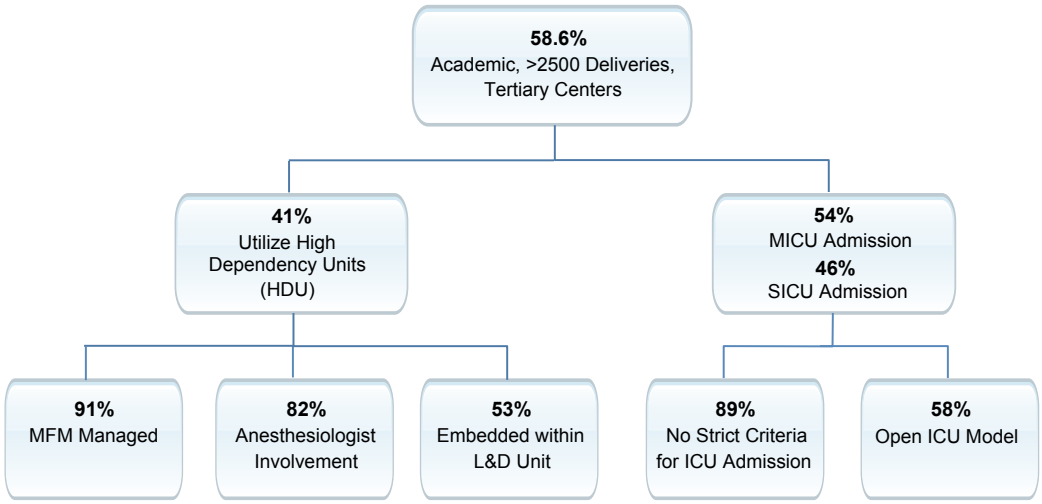
Introduction: Due to improvements in achieving fertility, an aging maternal population and advanced treatment of diseases, we now care for parturients with complex co-morbidities. Care for the critically ill maternal population is facility specific and driven by resources available to the providers. However, there may be some commonalities in practice to offer insight into how to better care for the critically ill obstetric patient. We sought to determine how frequently high dependency units (HDU) versus intensive care units (ICU) are utilized to care for critically ill parturients and how these units are staffed and modeled.

Methods: Following a review of literature on critical care in the maternal population, we developed a twenty-five-question survey to assess facility, HDU and ICU demographics. The questionnaire was distributed via email and electronic survey to all active members of SOAP.

Results: Survey response rate was 17%, with the majority practicing in large, academic, tertiary referral centers. Only 41% reported utilization of an HDU for obstetric patients, with 53% of these HDUs being embedded within the labor and delivery unit. A majority of HDUs provide arterial line monitoring, telemetry, and drug infusions with 82% reporting anesthesiologist involvement in management. Regarding ICU models, 89% of responders do not adhere to strict criteria for ICU admission. 58% of providers utilize an open model. Responders were divided on MICU vs. SICU admission (54% vs. 46%, respectively).

Conclusion: Significant practice variation exists in caring for the critically ill parturient, with little guidance regarding best practices. HDUs, although recommended for the critically ill parturient not requiring ICU admission, do not exist in a majority of tertiary referral centers. Improved outcomes have been demonstrated with a closed ICU model, but most critically ill obstetric patients are admitted to an open ICU. The majority of obstetric ICU admissions are due to hemorrhage and pre-eclampsia, but over half of responders report admission to the MICU, where competencies do not include management of obstetric or surgical patients. Further investigation is required to determine best practices for management of the critically ill parturient.

Trends in Obstetric Critical Care



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Abstract #:SA-34

Evaluation of Maternal Early Warning Criteria at a Tertiary Obstetric Care Center

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Intro: The National Partnership for Maternal Safety recommended Maternal Early Warning Criteria (MEWC) to promote earlier recognition of critical illness in the obstetric patient1. The simplicity and specificity of this single parameter risk assessment tool was endorsed for use in the US. The aggregate-weighted scoring of the Modified Early Obstetric Warning System (MEOWS) in the UK has a reported 89% sensitivity, 79% specificity, 39% positive predictive value (PPV), and 98% negative predictive value (NPV) for predicting morbidity2. The purpose of this study was to evaluate MEWC in our tertiary care obstetric center.

Methods: Data was collected retrospectively from electronic medical records of patients admitted to the labor and delivery unit over a month-long period. Morbidity was defined by MEOWS diagnostic criteria and retrieved from the admission note or discharge summary. Maximum and minimum values for systolic and diastolic blood pressure (BP), heart rate, respiratory rate, oxygen saturation (SaO2) and urine output (UO) were retrieved from vital sign flowsheets.

Results: To date, data retrieval is complete for 200 patients and continues for an additional 300. Thirty-four of 200 experienced some form of morbidity. The most common morbidity was pre-eclampsia (71%), followed by suspected infection (35%), hemorrhage (18%), pulmonary edema (5%), and acute asthma exacerbation (3%). No maternal deaths were reported and 1 patient was admitted to the ICU. By MEWC, 63.5% of patients would have triggered a bedside evaluation by a clinician. Like the MEOWS results, the most frequent trigger was high BP (42%), followed by tachycardia (27%), and low BP (15%). Respiratory rate, SaO2, and UO were the least frequent triggers (5%, 5% and less than 1%, respectively). Four patients with diagnosed morbidity did not meet MEWC. The overall sensitivity of MEWC in predicting morbidity was 88%, specificity 42%, PPV 24% and NPV 95%.

Discussion: Based on early analysis, the MEWC did not demonstrate specificity and PPV expected of a risk assessment tool in our obstetric population. Analyses of a more complete data set (to be presented at SOAP) will give a more definitive look at the feasibility of implementation. Our methodology is limited by the retrospective approach. Specifically, parameter documentation practices were not audited and abnormal triggers were not verified by repeat measurements. However, the current designated triggers in this single parameter scoring system may result in excessive calls for bedside evaluation by a clinician, exhausting limited resources and possibly leading to diminished attention to patient decompensation. Prior to implementation at a high risk center, the MEWC may need to be modified by institution or patient population to improve outcomes.

References:

1. Mhyre et al. The maternal early warning criteria. Obstet Gynec2014;124:782-6
2. Singh et al. A validation study of the CEMACH recommended MEOWS. Anaesthesia2012;67:12-8

Abstract #:SA-35

Maternal morbidity – an analysis of High Dependency Unit care in pregnant or recently pregnant women

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Introduction: Pregnant women may become critically unwell with estimates of one intensive care unit (ICU) admission for every 370 births. Obstetric complications in previously healthy women contribute the majority of these admissions. The main causes of critical care admissions are hypertensive disorders & obstetric hemorrhage. Maternal mortality rates have been decreasing worldwide but maternal morbidity remains unreported with best estimates suggesting that 1 in 200 pregnant women suffer a significant complication. High dependency unit(HDU) care is an important level of care between standard(low acuity) ward care & intensive unit(high acuity) care. We aimed to determine the number of obstetric women receiving HDU care (1 nursing staff:2 patients) in our unit, the major reasons for obstetric admissions & to assess the interventions received.

Method: After IRB approval, a 5-year retrospective analysis (July 1 2008–June 30 2013) was undertaken at our a tertiary referral obstetric centre (>6000 births per year). This time period corresponded with the colocation of this hospital with a tertiary referral adult non-obstetric hospital.

Results: There were 31,848 births & 632 women admitted to HDU (~1 in 50 births). 55% of women were transferred from the postoperative care unit to HDU. Mean±SD age was 32±5.9 years. The commonest cause for admission was obstetric hemorrhage (39%)(Table). The commonest monitoring intervention was intra-arterial blood pressure monitoring(45%). Only 36(6%) women received a central venous catheter. The mean±SD length of stay was 35±42.9 hours with 610(97%) women being transferred from HDU to lower acuity care & only 22(3%) women requiring transfer to higher acuity care (coronary care unit or ICU). There were no maternal deaths. 103(16%) women were admitted for postoperative monitoring due to complicated surgery, for miscellaneous medical or surgical conditions or because of pre-existing comorbidities.

Conclusions: Our data suggests that admission to HDU is 7 times more common than admission to ICU but the maternal morbidity leading to admission; hemorrhage, hypertension, cardiac disease & sepsis, is similar in both settings. In HDU 1 in 6 women admitted are stable but require closer monitoring usually with an arterial line. Most women are discharged within a short period of time to standard ward based care.Hospital based educational programs need to focus on the 4 major causes of morbidity, their diagnosis & optimal management.

Admission diagnosis	n	Rate per 1000 births
Obstetric haemorrhage	248	7.8
Hypertension*	87	2.7
Cardiac disease	52	1.6
Sepsis	49	1.5
Early pregnancy conditions	35	1.1
Neurological conditions	20	0.6
Anaesthetic complications	14	0.4
Thrombotic conditions	13	0.4
Acute pulmonary oedema	11	0.3

*preeclampsia or gestational hypertension

Abstract #:SA-36

Intracardiac epinephrine as fetal resuscitation during ultrasound guided fetal intervention Introduction

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Background: Advances in fetal diagnostic ultrasound have enabled the use of ultrasound-guided fetal treatment for such conditions as anemia, hydrops fetalis, pleural effusion. and pericardial effusion. Anesthesiolosists are asked to provide fetal anesthesia for pain relief and immobilization of the fetus. Our standard anesthetic method is maternal intravenous administration of diazepam and fentanyl for better placental transfer. We have encountered severe fetal bradycardia during such procedures, in which fetal intracardiac epinephrine has been effective for resuscitation. The purpose of this study was to review such cases to show the success rate and complications.

Methods: After institutional review board approval, the medical and anesthesia records of fetal anesthesia were retrospectively reviewed, between 2001 to 2015. Fetal resuscitations with intracardiac epinephrine were reviewed with regard to gestational age, fetal diagnosis, procedure, timing of cardiac arrest, intracardiac drug, and long term outcome.

Results: Severe bradycardia or cardiac arrest occurred in 7 occasions in 6 fetuses among total of 253 cases. The table shows details of 7 episodes. The trimester at the time of the procedure was 0 in the 1st, 3 in the 2nd, and 4 in the 3rd trimester. Therapeutic procedures were cordocentesis and fetal blood transfusion in 4 cases, thoracentesis and cordocentesis in 1 case, and thoracoamniotic shunt in 1 case. Cardiac arrest occurred during or right after the procedures in all cases. Intracardiac epinephrine was successful in resuscitation in 71% of the attempts. Resuscitation was difficult or unsuccessful in cases of fetal transfusion at early gestational age. 3 out of 6 babies are still alive. There was one complication, i.e., fetal pericardial effusion due to needle trauma, resulting in cardiac tamponade. The ultrasound guided drainage was successful.

Discussion: There has only been one report of fetal resuscitation by intracardiac epinephrine administration in the literature. Although resuscitation was successful, the fetus died within the following 12 h in this case report. Thus our experience is the first to show the survival after intracardiac epinephrine as a means of fetal resuscitation.
It is now our practice to have fetal resuscitation drugs ready before starting the procedures on fetal hydrops, and to assess fetal heart rate during the procedure.

Table. Cases of fetal cardiac arrest or severe bradycardia with intracardiac drug administration.

Gestational age (weeks)	Fetal diagnosis	Procedure	Timing of cardiac arrest	Intracardiac drug	Outcome
17	Hydrops fetalis Parvovirus	Cordocentesis Blood transfusion	After blood transfusion	Epinephrine 0.01, 0.02, 0.05mg	Resuscitated
			30 min. later	Epinephrine+glucose+insulin Pericardial drainage	Resuscitated
27	Same as above	Cordocentesis Blood transfusion	After blood transfusion	Epinephrine 0.01, 0.02mg	died
31	Hydrops fetalis Hemophagocytic Syndrome	Cordocentesis Blood transfusion	After blood transfusion	Epinephrine 0.02mg	died at 59 d.o.
34	Hydrops fetalis	Cordocentesis Thoracentesis	After cordocentesis	Epinephrine 0.02, 0.04mg*2 maternal atropine 0.5mg*2	Alive
33	Pleural effusion	Thoracoamniotic shunt	After shunt	Epinephrine 0.025*2,0.05mg	Alive
29	Anemia	Blood trancesion	After blood transfusion	Epinephrine 0.014mg*2	Alive
21	Hydrops fetalis Parvovirus	Blood transfusion	After blood transfusion	Epinephrine 0.035mg Pericardial tap	Resuscitated
			After 90min	Epinephrine 0.03mg*2 Atropine 0.015mg	Resuscitated
			After 240min	Epinephrine 0.03*2,0.06mg	IUFD 12h later

Abstract #:SA-37

Implementing a triage system to reduce waiting time and prioritize care for high-risk obstetric patients in a Ghanaian regional hospital

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Introduction: There is limited data regarding obstetric triage in low-resource settings. In Ghanaian childbirth facilities, a first-come, first-serve approach is standard care, thus creating delay for women presenting with hemorrhage, pre-eclampsia and other dangerous conditions. At Ridge Regional Hospital in Accra, approximately 70% of women are referred and frequently wait for long periods before assessment. It is important to quickly prioritize at-risk patients through a triage process. A collaboration began in 2012 between Ridge and Kybele, Inc. to measure delay and to design and employ an obstetric triage system.

Methods: Following institutional review board approval, obstetric triage data was collected at Ridge Hospital to determine referral patterns and timeliness of care. Patient demographic information, work flow patterns, care practices and compliance to local guidelines were assessed. A 2-day triage training program was developed to provide a structured approach to clinical assessment, risk recognition, decision making, and communication employing a joint problem solving approach. Implementation of quality improvement ideas locally generated by course participants was monitored by hospital midwives selected to be clinical champions and role models. Post-training data was collected to evaluate the recognition of risk and timeliness of care.

Results: Pre-and post-training triage data were collected September-November 2012 and December 2014, respectively. Sixty-two midwives completed triage training over 12 months. Colored wrist bands (red, yellow and green) were introduced to identify high, medium and low risk patients. In 2014, quantitative and qualitative wrist band use was 92% and 93%, respectively. A diagnosis and plan were recorded in 85% and 82% of audits. The mean±SD [IQR] wait from arrival until assessment decreased from 88±155[15-100)] min to 63±83[12.5-78] min ($p<0.05$). Maximum wait time was reduced from 1 day 2.5 hours to 8 hours 50 min.

Conclusion: It is important to quickly and correctly triage high-risk obstetric patients to reduce poor maternal and newborn outcomes. The triage training program developed at Ridge Hospital will be scaled to four other regional hospitals in Ghana through an extended collaboration. Major infrastructural improvements were made following the program and final data collection is in progress.

Abstract #:SA-38

The Cost Effectiveness of a Quality Improvement Program to Reduce Maternal Mortality in a West African Regional Hospital

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Objective To evaluate the cost-effectiveness of a quality improvement intervention aimed at reducing maternal mortality and stillbirth in Accra, Ghana.

Background Few studies have examined the cost effectiveness of interventions to improve comprehensive emergency obstetric care (CEmOC) in low-resource settings. Providing access to high-quality CEmOC is a significant barrier to achieving Sustainable Development Goal 3 to reduce maternal mortality to less than 70 deaths per 100,000 live births. From 2007-2011 Kybele, Inc partnered with the Ghana Health Service to improve care at Ridge Regional Hospital, a tertiary referral center in Accra, Ghana by employing quality improvement methodologies with a focus on system, personnel, and communication. During the intervention 39,234 deliveries occurred and significant increases were observed in the volume and acuity of patients. Previous reports have shown that the intervention successfully prevented maternal deaths, but it is imperative that this success be scrutinized for cost-effectiveness.

Methods Quasi-experimental, cost –effectiveness evaluation. Data from the Kybele-Ghana Health Service Partnership were linked with the program budget including the opportunity cost of volunteered professional time. Disability-adjusted life-years (DALYs) were calculated for maternal deaths and stillbirths. Cost-effectiveness was calculated based on various models for estimating the number of maternal deaths prevented.

Main outcome measure Incremental cost-effectiveness ratio (ICER), which represents the cost per DALY averted by the intervention for each modeled scenario.

Results The program cost $2,723,700 with volunteered professional time accounting for $1,209,400 (44%) of the budget. Based on program estimates 43 maternal deaths (range 39-239) and 129 intrapartum stillbirths were prevented leading to an ICER of $250 USD (range $112-$256). This value is well below the GDP-based highly cost-effective threshold of $2917 USD. Factors that were considered in the modeling were the annual rate of change for maternal mortality in Ghana; changing volume, incidence, and case-fatality rates at Ridge Regional Hospital; and local case-fatality rates at comparable institutions. In each scenario modeled, the program remained highly cost-effective.

Conclusion Quality improvement focused on systems-level improvement of comprehensive emergency obstetrical care can be a highly cost effective approach to reduce maternal and fetal mortality.

Table 1: Sensitivity Analysis

	Static CFR*	Local CFR†	Static MMR‡	Observed§	ARC Reduced ||
Deaths due to OH	190	81	44	34	33
Deaths due to HDoP	131	149	71	55	54
Deaths due to Other	68	61	81	63	93
Total deaths	397	295	195	152	148
Maternal Deaths averted	237	139	43	---	39
Stillbirths averted	129	129	129		129
DALYs averted	24,400	17580	10890	---	10614
ICER	$112	$155	$250	---	$256
GDP/ICER	26.1	18.8	11.7	---	11.4

* Static CFR assumes a no-effect hypothesis with no change in CFR overtime.
† Local CFR assumes improvement only to the level observed in nearby teaching hospitals
‡ Static MMR assumes the MMR ratio and proportion of each cause remained the same.
§ Observed presents the deaths that occurred due to each cause during the intervention
|| ARC reduced takes into account the annual rate of change in MMR for Ghana, reducing the deaths attributed to the intervention.

Abstract #:SA-39

Where are they now? A survey of the graduates of Nurse Anesthesia Training School at Ridge Regional Hospital in Ghana.

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Introduction: There are few physician anesthesiologists in sub-Saharan Africa. This shortage has led to task shifting to nurse anesthetists and anesthesia assistants to provide anesthesia coverage. In Ghana, there were only 3 anesthesia training programs(1 for physicians and 2 for nurse anesthetists) for a country of 24 million resulting in no or low availability of anesthesia services in many hospitals. In 2007, leaders of Ridge Regional Hospital(RRH) in Accra, and Kybele, Inc. endeavored to start the 3rd nurse anesthesia training school(NATS) in Ghana.Efforts accelerated, a curriculum was created and the school opened in 2008. By September 2015, 5 classes have graduated from the 2 yr program. The purpose of this survey was to gather information from the graduates about their work environment and training preparedness.

Methods: A 39 question survey was developed with input from faculty of RRH NATS and Kybele. Graduates received an email detailing the purpose of the survey and were then called from a member of Kybele not previously affiliated with the training program. Calls were made from May 2014 to September 2015 to graduates of 4 classes(2011, 2012, 2013, 2014).If unavailable by phone, graduates attending a September 2015 refresher course in Accra were given a paper survey.

Results: Among the 93 graduates,75 surveys(80%)were completed. Graduates worked in 39 hospitals across 7 of 10 regions in Ghana, however,46% remained in Accra. Six(8%)worked alone and 16(21%) were 1 of 2 providers. The average number (range) of anesthetist and anesthesiologist per hospital was 5.4(1-24) and 0.4(0-3), respectfully. Fifty-three(70%) had no physician anesthesiologist. Equipment availability varied: 79(98%) laryngoscope, 69(92%) anesthesia machine, 71(94%) pulse oximeter, 46(61%) electrocardiography, 44(58%) capnography and 8(10%) nerve stimulator. Few had rescue airway equipment. Fifteen (21%) of graduates experienced patient death during anesthesia; 2 of 44 responses indicated difficult airway and 5 of 42 spinal anesthesia (SA). For CS, 6/61(10%) reported maternal death during GA and 10/63(16%) SA, but SA was used more frequently. For training quality, 64(85%) felt "definitely" prepared, 8(11%) "somewhat" prepared, 1(1%) "neutral", 1(1%) "poorly" prepared and none were unprepared. Respondents were most confident in obstetric anesthesia and least confident in pediatric and difficult airway management.

Discussion: A survey conducted among RRH NATS gradates had a high response rate. Most graduates remain in Ghana, filling an important healthcare gap, especially in areas without other providers. The number of deaths reported during anesthesia is troubling and underscores the need to reinforce safe practice and vigilance, although optimum care may be hampered by poor equipment availability. The survey will help guide curriculum development and identified training gaps, especially in pediatric anesthesia and difficult airway management.

Abstract #:SA-40

The Influence of an International Teaching Program on the Use of Neuraxial Analgesia for Labor and Regional Anesthesia for Cesarean Delivery in a Serbian Obstetric Hospital

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Introduction: In Serbia, the use of regional anesthesia (RA) and analgesia techniques for obstetrics has been low, despite local efforts to increase the use. Members of the Department of Anesthesia at Clinical Center Vojvodina (CCV), requested a multi-year Kybele program in 2012 to help train physicians in the use of RA techniques for labor and Cesarean Section (CS). In order for CCV to become recognized as a leading facility in obstetric anesthesia, the use of RA techniques must gradually increase. This study updates the efforts of Kybele and CCV physicians to increase obstetric RA use.

Method: Since 2012, Kybele has conducted annual visits to CCV to provide didactic and hands-on training. In 2015, a Kybele team, visited CCV twice to conduct training in RA and neuraxial analgesia for labor (NAL). Data was prospectively collected on the use of RA for CS one week before the visit (R1), the week during (R2), and at one (R3) and two (R4) weeks and two months (R5) following the visit. Multiple logistic regression was used to quantify the changes in odds of RA across weeks adjacent to visitation and visit sequence. Simple logistic regression was used to assess the annual changes in the odds of RA and NAL use.

Results: Adjusting for the visit sequence (1 visit in 2012-14 and 2 visits in 2015), the odds of RA during the week of visitation are 2.5 times greater (OR: 2.57; 95% CI: 1.60, 4.14) than the preceding week. However, RA use regresses: the week after, the odds of RA were 1.96 (95% CI: 1.22, 3.16) than the pre-visit odds. By week 2 and 8, the ORs were 1.66 (95% CI: 1.01, 2.72) and 1.70 (95% CI: 1.04, 2.79). While the trend across visits indicates increasing RA use over time, only at the June, 2015 visit were the odds of RA use greater relative to the 2012 visit (OR: 1.78; 95% CI: 1.11, 2.85). NAL increased 57% from 2012 to 2013, 42% from 2013 – 2014, and 31% from 2014 – 2015 (330% increase overall, $p< 0.001$ for the trend)

Conclusion: With the help of the Kybele team, the use of RA for CS increased 87% over the 4 year period. Use of NAL increased nearly 3 ½ times. The limited availability of trained anesthesiologists and a lack of patient education on the benefits of RA and NAL are likely barriers to further increased RA and NAL use. Future Kybele team visits for training of practitioners beyond CCV and to improve patient education to increase RA and NAL utilization are planned.

Table 1: Neuraxial analgesia (NAL) for labor use and number of Cesarean deliveries (CS) performed under Regional Anesthesia (RA) at Clinical Center Vojvodina (CCV) around Kybele visits and overall, Calendar Years 2012 – 2015

	Year				
Interval	2012	2013	2014	6/2015 *	9/2015
R1	**13%**	**21%**	**22%**	**17%**	**21%**
# C/S	38	33	45	35	33
R2	**31%**	**42%**	**38%**	**40%**	**38%**
# C/S	29	36	37	42	39
R3	**24%**	**39%**	**17%**	**43%**	**33%**
# C/S	33	38	36	44	45
R4	**24%**	**18%**	**30%**	**39%**	**33%**
# C/S	34	38	33	36	36
R5	**28%**	**20%**	**25%**	**39%**	**34%**
# C/S	32	41	36	31	38

Yearly Percentage C/S under RA		#yearly C/S
1/2011 – 12/2011	14.0%	1779
1/2012 – 12/2012	16.1%	2043
1/2013 - 12/2013	18.4%†	1998
1/2014 - 12/2014	26.4%†	2004
1/2015 – 12/2015	25.0%†	1996

Yearly Percentage NAL for Vaginal Delivery ~		# Vaginal Deliveries
1/2012 – 12/2012	3.2% ~	4312
1/2013 – 12/2013	5.8% ~	4330
1/2014 – 12/2014	8.0% ~	4500
1/2015 – 12/2015	10.5% ~	4574

#; number

*p = 0.016, compared to 2012

† p < 0.001 compared to 1/2011 – 12/2011

~ p < 0.001 for the trend year over year

R1 = week's data, week before Kybele visit
R2 = week's data, week during Kybele visit
R3 = week's data, week after Kybele visit
R4 = week's data, 2 weeks after Kybele visit
R5 = week's data, 2 months after Kybele visit

Abstract #:SA-41

The Influence of an Individual Obstetrician on the Use of Regional Anesthesia for Cesarean Section in a Serbian Obstetric Hospital

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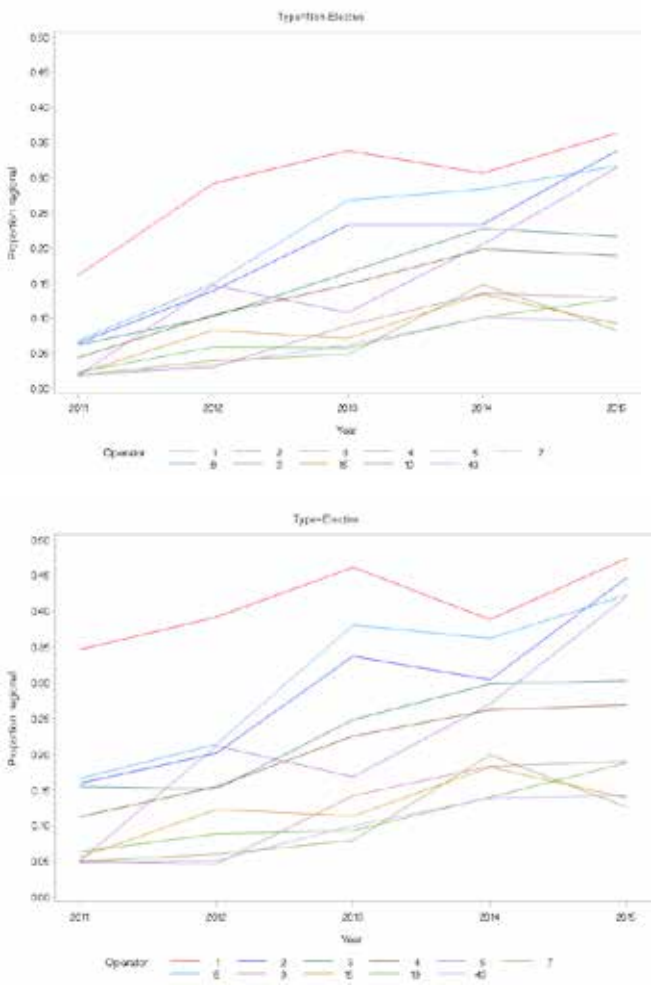
Introduction: In Serbia, the use of regional anesthesia (RA) and analgesia techniques in obstetrics has been low, despite local efforts to increase the use. Members of the Department of Anesthesia at Clinical Center, Vojvodina (CCV), requested a multi-year Kybele program in 2012 to help train physicians in the use of RA techniques for labor and cesarean section (CS). CCV is large obstetric hospital with approximately 6500 deliveries per year. In order for CCV to become recognized as a leading facility in obstetric anesthesia, the use of RA techniques must increase. We looked at the factors that may be influencing choice of anesthesia for CS including individual obstetrician differences in RA use for CS, and whether the prevalence of their RA use was related to their total CSs.

Method: From the CCV delivery database for period 2011-2015 data on the use of general (GA) and RA for elective and non-elective CS were obtained. Differences in the use of RA for elective and non-elective cases between individual practitioners were determined and the influence of the number of total cases performed by each on RA and GA use. A logistic regression analysis was used to quantify the ratio of RA to CS overall, adjusting for year, elective and non-elective CS, and obstetrician. Appropriate adjustments for multiple comparisons were made.

Results: During the study period, data were available for 9808 procedures, for 48 obstetricians. RA use increased among elective cases from 20% in 2011 to 30% in 2015 (p=0.002); from 5% in 2011 to 18% in non-elective cases (p<0.001). There was no significant effect of total number of cases performed by an obstetrician on their use of RA (p=0.109). There were marginally statistically significant differences among obstetricians in overall prevalence of RA use (p=0.091) and in rate of change over time (p=0.068). Due to the large number of obstetricians, graphs include only those who did more than 250 procedures during the evaluation period (Figure 1).

Conclusion: Although no differences in RA use could be determined among all 48 obstetricians included in the analysis, the results can be used to target education effort to obstetrician staff at CCV on use of RA among those who perform the largest number of CS. The use of RA between obstetricians varies widely, suggesting that more effort should be placed in education of use of RA in obstetricians with lower usage of RA.

Figure 1: Pooled and individual obstetricians increase in use of regional anesthesia for elective non-elective cesarean delivery over time at Clinical Center Vojvodina (CCV), Serbia



Abstract #:SA-42

Effectiveness of three implementation programs of The WHO Safe Childbirth Checklist (WSCC) in Colombia, South America

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Introduction: In 2008 WHO established The WHO Safe Childbirth Checklist (WSCC) in order to determine whether its application had any impact on maternal/neonatal mortality
In Colombia the WSCC has not been implemented and its impact is unknown therefore studies to determine its applicability and the acceptance by health professionals are needed.

Objective: To adapt, implement and evaluate the effectiveness of 3 different strategies on how to use the WSCC in Colombia

Methods: Quasi-experimental design before and after study.

A baseline measurement of the 29 items included in The WSCC in 3 hospitals was performed by observers in each one of the centers

3 different interventions based on the CUSP and TeamSTEPPS programs to improve patient safety behaviors and attitudes were applied randomly one in each center

Intervention A(10 days) comprising the empowerment and active participation of administrative and clinical leaders of the center to generate a commitment to implementation of the checklist and a 2 hour educational session in which the principles on safety in childbirth, status of current practice and how to use the WSCC were addressed.Written support material were delivered

Intervention B(3 weeks) comprising the empowerment and active participation of administrative and clinical leaders of the center to generate a commitment to implementation of the checklist and an 4 hours educational session in which the principles on safety in childbirth, status of current practice and how to use the WSCC were addressed.Written support material and training time with demonstration videos and role plays were given.

Intervention C(3 months) Intervention same as intervention B plus in situ training were given. The in situ training consisted in accompaniment to professionals in the process of implementing the checklist for 2 weeks and feedback and support in handling situations that could make implementation difficult. Monitoring and supervision were provided for 2 months.

Evaluation of the effectiveness and acceptance of the checklist was subsequently performed using Kirkpatrick & Kirkpatrick model which establishes that to determine the effectiveness of a training program it should take into account 4 levels of evaluation:participant reactions, evaluation of their knowledge and attitudes,skills and changes in the behavior after training and finally the impact on the organization

Results: A comparison between the baseline and the post intervention measurements of each one of the 3 groups will allow us to determine which one of the proposed strategies is more effective in improving patient safety behaviors and attitudes. Data collection is currently 75% of the total; the results will be ready to be presented in May 2016

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Abstract #:SA-43

Individual Anesthesiologist Use of Regional Anesthesia for Cesarean Delivery in a Serbian Obstetric Hospital

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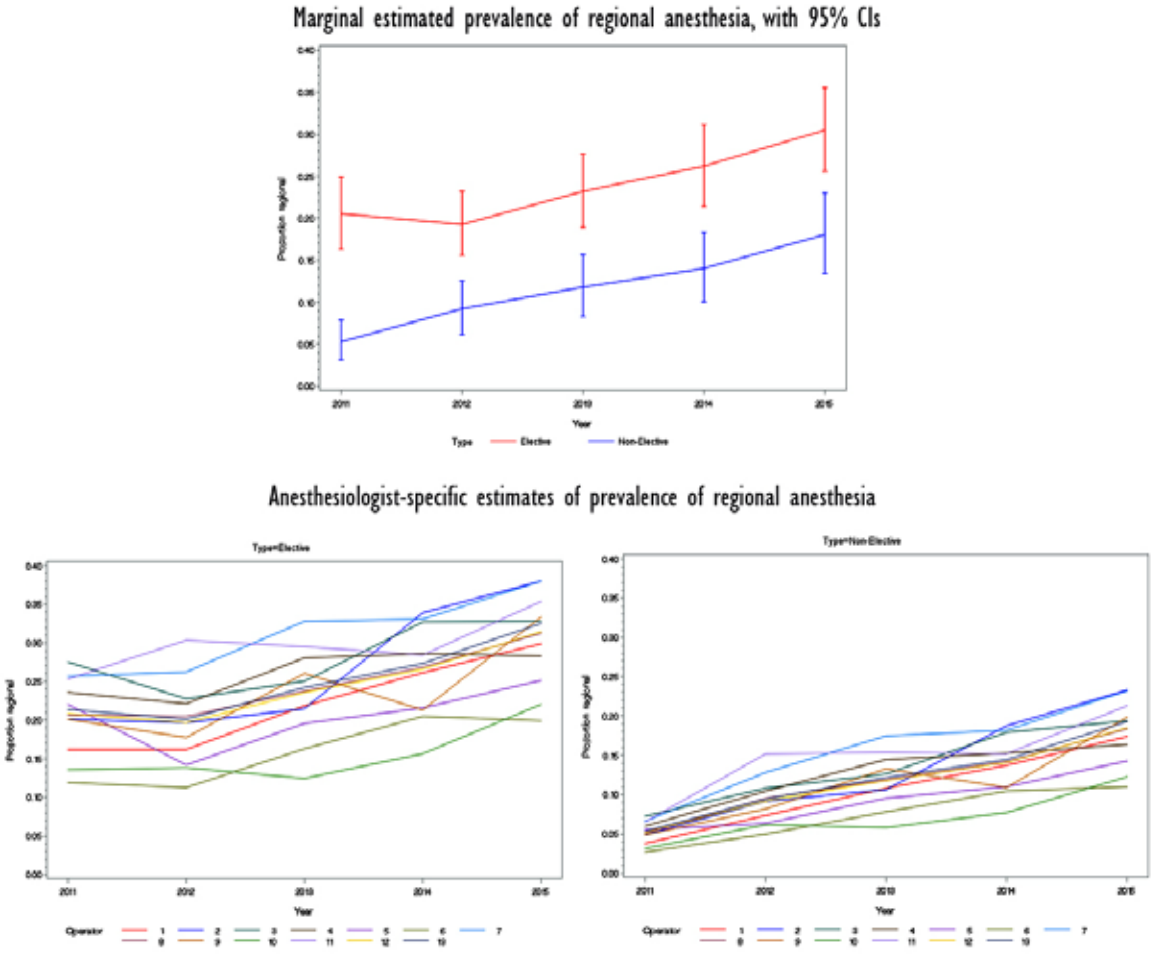
Introduction: In Serbia, the use of regional anesthesia (RA) and analgesia techniques in obstetrics has been low, despite local efforts to increase its use. Members of the Department of Anesthesia at Clinical Center, Vojvodina (CCV), requested a multi-year Kybele program in 2012 to help train physicians in the use of RA techniques for labor and cesarean section (CS). CCV is large obstetric hospital with approximately 6500 deliveries per year. In order for CCV to become recognized as a leading facility in obstetric anesthesia, the use of RA techniques must increase. This study looked at individual anesthesiologist differences in RA use for CS since the beginning of the Kybele/CCV partnership and if the prevalence of RA was related to the number of CS they performed.

Method: From the CCV delivery database for period 2011-2015, data on the use of general anesthesia (GA) and RA for elective and non-elective CS were obtained. Differences in the use of RA for elective and non-elective cases between individual practitioners and the influence of the number of total cases performed by each anesthesiologist on their RA and GA use were determined. A logistic regression analysis was used to quantify the odds of RA versus GA use for CS overall, adjusting for year, elective and non-elective CS, and anesthesiologist. Appropriate adjustments for multiple comparisons were made.

Results: Total CS deliveries averaged 1964±94 per year (range 1779 – 2043). RA use increased from 20% in 2011 to 30% in 2015 among elective cases ($p=0.002$); from 5% in 2011 to 18% in non-elective cases ($p<0.001$). The increase in the use of RA was greater among non-elective cases versus elective procedures, over the interval 2011- 2015 ($p=0.014$) (Figure 1). There were significant differences in use of RA between anesthesiologists ($p=0.003$) and trajectory of use over time ($p=0.008$). There was no significant effect of total number of cases performed by anesthesiologist on RA use ($p=0.109$).

Conclusion: The use of RA between anesthesiologists varies widely, suggesting that more effort should be placed in the education of anesthesiologists in benefits/risks of RA among those with lower usage of RA and trend for use over time. The greater increase in RA use among non-elective cases was a surprising result, suggesting patient and obstetrician preference for GA might affect the choice of RA vs. GA more for elective CS than for non-elective CS.

Figure 1: Pooled and individual anesthesiologist's increase in use of regional anesthesia for elective and non-elective cesarean delivery over time at Clinical Center Vojvodina (CCV), Serbia



Abstract #:SA-44

Why is labor epidural rate low and cesarean delivery rate high in China? A Survey of Chinese Perinatal Care Providers

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Background: The cesarean delivery (CD) rate in China is as high as 50% (1). One of the reasons is patient request for CD due to the fear of labor pain. Neuroaxial analgesia (NA), an approved safe method to lower CD (2), is not widely provided or used in China (3). Opinions on NA and CD were investigated for better solutions.
Methods: An online survey was conducted for 2 months. Responses were collected and presented as percentages. Chi-square is used for comparisons.

Main Results: A total of 1412 respondents including 43% anesthesiologists (ANs), 35% obstetricians (OBs), 12% midwives, 4% L&D nurses, 2% hospital administrators (HAs) and 4% unspecified completed survey for analysis. Three main groups, AN, OB and midwives/L&D nurses (MN) are chosen for comparisons.

Opinions on length of stages of labor were divided between ANs and the other two groups that have almost same percentage of answers. A similar pattern was found regarding lower back pain and baby wellbeing. MNs concern more than OBs as shown in the sum of answers "yes" and "uncertain". Positively, 60% and 77% of respondents, respectively, answered "no" to each question. Respiratory depression is the top concern for neonates (11% of 1412), followed by "uncertain" (3.0%), brain (1.5%), breastfeeding (1.2%), and heart (0.5%) (Table 1).

In table 2, All three groups agreed the low NA rate is related to: 1) lack of ANs (60%, confirmed in Q9 with 80% of suggesting to hire more ANs) or midwives (32%, 63% of suggesting to increase in hiring in Q9); 2) unwillingness of family members (26%), ANs (25%) or parturient (18%) (Q6). However, when comparing the answers from each group, ANs thought it is related to OB's reluctance (44%) and higher incentive of CD (19%, confirmed by Q 7 with 20%); OBs believed no harm of CD to mothers (13% in Q 7), lack of NA experience (9.9%), and ineffective NA (9.1%). The MNs concern more about NA complications (8.0%) or harm to fetus (5.0%). All providers do believe that high CD rate is related to: 1) no long term complications in mothers, 2) no harm to babies; 3) culture; 4) malpractice (Q7). Most are willing to provide NA even with low income (Q8).

Summary: This is the first national multidisciplinary survey for NA and CD, specially seeking solutions conducted by NPLD – GHI. It provides lots of information for policy makers, HAs, medical societies, and department leaders to improve clinical practice and management, and may be useful for other developing countries.

Table 1. Respondents' Opinions on Labor Epidural Analgesia

Survey Questions	Total Reponses		Obstetricians		Anesthesiologists		Midwives/L&D Nurses		P vale
Answers	N	%	N	%	N	%	N	%	
	1412		495		606		219		
1) Do you think Epidural prolongs the 1st stage of labor?									
Single Choice	1168	83							
Yes	244	17	110	22	72	12	48	22	<0.001
No	838	59	289	58	393	65	104	48	0.066
Uncertain	330	23	96	19	141	23	67	31	0.038
2) Do you think Epidural prolongs the 2nd stage of labor?									
Single Choice	1412	100							
Yes	446	32	217	44	121	20	89	41	< 0.001
No	618	44	168	34	335	55	71	32	< 0.001
Uncertain	348	25	110	22	150	25	59	27	0.535
3) Do you think Epidural causes chronic Lower Back Pain?									
Single Choice	1412	100							
Yes	112	8	32	6.5	44	7.3	25	11	0.100
No	848	60	274	55	427	71	92	42	<0.001
Uncertain	452	32	189	38	135	22	102	47	< 0.001
4) Do you think Epidural is harmful to fetus?									
Single Choice	1412	100							
Yes	55	4	23	4.6	5	0.8	19	8.7	< 0.001
No	1082	77	349	71	541	89	125	57	0.001
Uncertain	275	19	123	25	60	9.9	75	34	< 0.001
5) If answered "yes or uncertain" to the last question, what effects do you think epidural has on the fetus?									
≥ one choices	179	13	92		82		73		
Brain	21	1.5	6	1.2	5.0	0.8	7	3.2	0.037
Respiration	151	11	67	14	33	5.4	43	20	< 0.001
Heart	7	0.5	0	0	4.0	0.7	3	1.4	0.058
Breast Feeding	17	1.2	3	0.6	3.0	0.5	8	3.7	0.000
Uncertain	43	3.0	9	1.8	23	3.8	7	3.2	0.168
Others	27	1.9	7	1.4	14	2.3	5	2.3	0.543

Table 2. Respondents' Opinions on Reasons of Low Labor Epidural Analgesia and High Cesarean Rates, and How to Improve

Survey Questions	Total Reponses		Obstetricians		Anesthesiologists		Midwives/L&D Nurses		P value
Answers	N	%	N	%	N	%	N	%	
	1412		495		606		219		
6) What reasons do you think regarding low NA rate (≥ one choices)?									
CD is safer than VD because local anesthetics and opium in NA are bad to fetus	38	2.7	12	2.4	8.0	1.3	11	5.0	0.011
More complications from VD with NA	55	3.9	15	3.0	19	3.1	18	8.2	0.003
More incentive from CD and lost money if providing NA for VD	156	11	19	3.8	115	19	12	5.5	< 0.001
Never have experiences of NA and do not know how to do it	103	7.3	49	9.9	30	5.0	16	7.3	0.013
Gave it up because of its ineffectiveness from previous experiences	87	6.2	45	9.1	24	4.0	13	5.9	0.004
Lack of anesthesia manpower	842	60	314	63	357	59	124	57	0.628
Lack of midwife or nurse manpower to monitor patients	447	32	143	29	188	31	84	38	0.199
Obstetricians do not want it	353	25	35	7.1	267	44	30	14	< 0.001
Hospital administrators do not want to provide NA services	160	11	31	6.3	110	18	13	5.9	< 0.001
Anesthesiologists do not want to provide NA service	355	25	145	29	151	25	42	19	0.079
Parturients do not want NA	249	18	89	18	87	14	46	21	0.127
Family members do not want NA	370	26	124	25	155	26	66	30	0.301
Others	194	14	53	11	102	17	27	12	0.032
7) What would be the reasons resulted in high CD rate in China in your opinion (≥ one choices)?									
Try to avoid lawsuit or Yinao due to parturient request even knowing CD is harmful without medical indications	1155	82	443	89	483	80	166	76	0.281
Chinese Superstition culture for selecting particular dates of their childbirths even knowing CD without medical indications is harmful	907	64	280	57	428	71	129	59	0.058
CD is very safe and not harmful to babies	144	10	41	8.3	67	11	21	9.6	0.374
CD is very safe and not harmful to mothers	68	4.8	13	2.6	34	5.6	13	5.9	0 .045
CD is very safe and results in no long term complications	29	2.1	4	0.8	15	2.5	6	2.7	0.086
CD is very safe along with better incentive than VD with NA	176	12	20	4.0	123	20	17	7.8	< 0.001
Others	172	12	60	12	68	11	32	15	0.511
8) Would you support NA if you know it is beneficial to mothers and babies instead of harmful (≥ one choices)?									
Yes, even if decrease in income	1082	77	421	85	411	68	172	79	0.046
Yes if income is the same	335	24	83	17	193	32	47	21	0.000
No, I think that NA is harmful to mothers and babies	15	1.1	4	0.8	3.0	0.5	5	2.3	0.060
No, do not want to decrease in our income since it has been low to start with	40	2.8	6	1.2	29	4.8	5	2.3	0.003
9) How to suggest hospital administrators to promote NA service presuming they are willing to support (≥ one choices)?									
Increase in incentive amount	977	69	291	59	504	83	144	66	0.001
Increase in anesthesia manpower	1136	80	420	85	466	77	167	76	0.494
Increase in midwife manpower	895	63	334	67	315	52	180	82	< 0.001
Increase in L & D nurses	207	15	70	14	74	12	43	20	0.070
Increase in obstetricians	537	38	261	53	132	22	95	43	< 0.001
Others	171	12	31	6.3	105	17	23	11	< 0.001

Abstract #:SA-47

Implementing an interactive curriculum for obstetric anesthesia residents: impact on resident competency and satisfaction

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Introduction: Emerging educational paradigms – spaced education, evidence-based practice, and simulation – have been validated for resident education, but their impact on obstetric (OB) anesthesiology residents is unreported. Our OB anesthesia service has traditionally employed a twice-daily lecture or whiteboard presentation format, however, average subsection Anesthesia Knowledge Test (AKT) scores and interest in new paradigms have prompted a re-evaluation of this approach. We thus implemented a novel, more interactive curriculum and sought to evaluate its impact on residents' knowledge and satisfaction.

Methods: After IRB exemption, OB anesthesia residents attended daily 40-minute didactic sessions by OB anesthesia faculty and fellows. The study design was as follows, in an alternating-month pattern for 8 months:
Control group: traditional lectures
Intervention group: problem-based learning, low-fidelity simulation, evidence-based literature review, and question-answer sessions, followed by an electronic quiz to assess and reinforce topics
Both groups completed a knowledge pre- and post-test at the beginning and end of their rotation, respectively. In addition, satisfaction with educational offerings was surveyed daily and at rotation's end. Resident AKT scores will be compared before and after the intervention once available in July 2016.

Results: Pre-and post-test performance and resident satisfaction results from 5 months (3 control,2 intervention) have been completed to date (table 1). Resident satisfaction with the interactive curriculum in aggregate was significantly higher (p=0.045) compared to traditional lecture. However, overall end-of-rotation satisfaction was equally high in both groups. Post-intervention AKT scores are pending.

Discussion: Residents' daily satisfaction increases with a more interactive curriculum during their OB anesthesia subspecialty month, although no changes in pre- and post-knowledge were recorded. How new educational paradigms can be optimized in terms of content and frequency is still in need of further evaluation, particularly as it relates to improvement of long-term knowledge transfer. As medical subspecialties vary significantly in subject matter, cognitive tasks, and pace of diagnosis and treatment, efficacious teaching modalities for one's subspecialty residents should be critically, and individually, assessed.

TABLE 1. Knowledge and Satisfaction Scores

	First OB Month			≥2 OB Months	
	Control Mean (SD)	Treatment Mean (SD)	P-value	Control Mean (SD)	Treatment Mean (SD)
Pre-Test Score (%)	55.3 (12.3)	63.6 (17.9)	0.215	57.1 (18.4)	61.1 (19)
Post-Test Score (%)	72.8 (5.8)	76.7 (6.9)	0.171	72.6 (5.4)	74.1 (3.4)
Didactic Satisfaction	1.5 (0.5)	1.7 (0.7)	0.442	2.3 (1.4)	2.1 (1.1)

*didactic satisfaction measured on 1 (Strongly Agree) to 5 (Strongly disagree) scale

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Abstract #:SA-48

Development of a Post-Partum Hemorrhage/Uterine Atony Cognitive Aid

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Introduction: Post-partum hemorrhage (PPH) is an important contributor to maternal morbidity and mortality. Deficiencies in clinical practice are associated with 60–80% of fatal obstetric hemorrhages. Lack of treatment algorithms, organization, and knowledge/training have been identified as contributors(1,2). Providing a cognitive aid for uterine atony, the most common cause of PPH, may help trainees under conditions of stress and unfamiliarity. Cognitive aids are prompts which guide individuals through complex tasks(3). We describe the development of a Post-Partum Hemorrhage/Uterine Atony Cognitive Aid and present the final product for dissemination.

Methods: The development of a PPH cognitive aid for uterine atony was identified as a priority. Although there are existing consensus statements and guidelines for PPH, we tailored the content for our practice environment, made it more trainee-friendly, and simplified the design(2-4). Among existing work, the Stanford Emergency Manual does not include a PPH tool(5). Areas of perceived weakness were prioritized for inclusion. A flow chart was developed incorporating evidence from the literature, clinical practice guidelines, and institutional recommendations with careful consideration given to design and visuals with a graphic designer(6). A process was followed comparable to the development of similar tools(2, 3, 5). The product was presented for feedback and improved in an iterative process leading to the final design.

Results: The cognitive aid was received favourably by trainees, with feedback from users being positive. Medical and surgical treatment options are depicted in detail, including dosing. A logical order for intervention, communication, and escalation of care is provided in addition to treatment goals. The final product (Figure 1) is in the format of an 11"x17" poster, and is available for free download on our website www.PPHTool.com.

Discussion: We hope our cognitive aid will facilitate teaching in the operating room, make trainees familiar with crisis resource management, and enable timely and appropriate treatment of PPH.

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POST-PARTUM HEMORRHAGE

(UTERINE ATONY) COGNITIVE AID

Tissue, trauma, thrombin (DIC, unrecognized coagulopathy)

CRITICAL SCENARIO → COMMUNICATE → CAUSE OF BLEEDING

Monitors, IV access, start crystalloids, consider arterial line

1.) Notify as necessary:
- Anesthesia
- OB
- Nursing
- Blood Bank
-Pediatrics/NICU
-MSICU

2.) Labs as indicated (Hemocue, CBC, X&T, PT, aPTT, Fibrinogen)

UTERINE ATONY (80% OF PPH)

Continuous reassessment and visual assessment of blood loss:


Soiled Sanitary Towel
30 ml


Small Soaked Swab 10x10 cm
60 ml


Soaked Sanitary Towel
100 ml


Incontinence Pad
250 ml


Large Soaked Swab 45x 45 cm
350 ml


Full Kidney Dish
500 ml


PPH on Bed only
1000 ml


100 cm Diameter Floor Spill
1500 ml


PPH Spilling to floor
2000 ml

Credit to Bose et al. Queen Charlottes Hospital London for images

Medical Treatments

Surgical Treatments


Consider Tranexamic Acid 1-2 g IV slow bolus


Rule of 3's
Oxytocin 3U bolus IV
3 minute intervals
3 total doses
3L/hr maintenance
(20-40 U/L)


A.) ERGOT/Ergonovine
- 250 mcg IM or slow IV
- For IV route, dilute into 10 mL or add to IV bag
- May repeat once in 15 min, then q2h

Contraindications:
HTN
Pre-eclampsia
CAD


B.) CARBOPROST/ Hemabate
- 250 mcg IM or IM/M
- Repeat q 15 min up to 2 mg

Contraindications:
Pulmonary HTN
Hypoxemia
Reactive airways


C.) MISOPROSTOL
-400 mcg SL or 1000 mcg PR
-No repeat
-No contraindications

Ongoing or large volume blood loss
Is patient a candidate for transfusion?

Consider Massive Transfusion Protocol
Cryo early:
- Target Fbg ≥ 2 g/L or if clinical status highly suggestive of low Fbg
(1 U Cryo / 10 kg IV over 10-30 min will increase Fbg by 0.5 g/L)

Last resort rVIIa (off-label)
- Temp > 35, pH ≥ 7.2, Fbg ≥ 1.5, pts > 50
- 60 - 90 mcg/kg IV bolus over 2 - 5 minutes
- Can repeat once in 20 min

Uterine fundal massage (minimum 15 seconds)

Intrauterine tamponade (gauzes, Bakri balloon, foley)

Consider uterine artery embolization early if bleeding ongoing at moderate/high rate

If c-section and open:
- B-Lynch suture / hemostatic multiple square suturing
- Bilateral uterine artery ligation /O'Leary sutures
- Hysterectomy

Developed by J. Bartoszko, S. Bragg, J. Goldmacher, R. Sharma, E. Su

Abstract #:SA-49

From the Mayflower to the Maternity Ward: Obstetric Anesthesia and Mt. Auburn Cemetery

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Mt. Auburn Cemetery in Cambridge, Massachusetts, is home of the tombs of Henry Wadsworth Longfellow, Oliver Wendell Holmes, Sr., and Walter Channing. One may admire the tombstones for their aesthetic beauty, yet not realize that these men played an important role in the development of obstetric anesthesia.

Longfellow, famed author of "Paul Revere's Ride" and "The Song of Hiawatha" documents the birth of obstetric anesthesia on April 7, 1847: "Fanny [Longfellow's wife] heroically inhaled the vapor of sulfuric ether, the great nepenthe, and all the pain of labor ceased, though the labor itself went on and seemed accelerated. This is the first trial of ether at such time in this country." (1) Nathan Cooley Keep, dean of Harvard Dental School, administered the ether; Walter Channing delivered the child.

Channing's father was Attorney General of Rhode Island, his grandfather was a signer of the Declaration of Independence, and his home in Cambridge was a revolutionary war headquarters of George Washington. Thus, the origins of American obstetric anesthesia are directly connected to the earliest foundations of the United States. Channing would use ether during childbirth for most of his career. In his treatise on 581 cases of etherization in childbirth, Channing makes one of the earliest references to anesthetic safety: "My object was to learn if this use of [ether] has been safe, safe both to mother and to the child." (2)

Holmes, Sr., was a physician, elite American literary figure, and coiner of the word "anesthesia." He was the father of Oliver Wendell Holmes, Jr., a civil-war combatant, prominent jurist and Theodore Roosevelt-appointed Supreme Court Justice. Holmes Sr. proposed the controversial idea of hand hygiene: "The disease known as Puerperal Fever is so far contagious as to be frequently carried from patient to patient by physicians and nurses." (3) Some opposed his views, stating that, "physicians are gentlemen and a gentleman's hands are always clean." (4) It is evident that many healthcare workers today still adhere to this notion, by the staggeringly high rates of non-compliance with hand washing protocols. (5)

Mt. Auburn Cemetery, the final resting place of many important American historical figures, is one of the most beautiful cemeteries in the world. It is a place with ties to the birth of obstetric anesthesia and the very foundations of the United States. This is the magic that is Mt. Auburn Cemetery.

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Abstract #:SA-50

Anesthetic Management of a Parturient with Pheochromocytoma--A Case Report

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Introduction: Pheochromocytoma is a catecholamine-secreting tumor known to precipitate life-threatening hypertension. The occurrence of this condition is exceedingly rare in the parturient, presenting a challenge for anesthetic management.

Case: A 36 year-old G7P4 at 19 weeks gestation presented with hypertensive urgency. Her medical history is notable for Von Hipple-Lindau Syndrome, pheochromocytoma status-post remote bilateral adrenalectomy with subsequent primary adrenal insufficiency, recurrence of norepinephrine-secreting paraganglioma, asthma, DVT on heparin, and complex social situation. After weeks of poor outpatient compliance, she was admitted at 24 weeks for medical management for the duration of her pregnancy.

A pharmacologic regimen consisting of doxazosin and labetalol was initiated. A hydromorphone PCA was also required for tumor-related abdominal pain, which precipitated hypertensive episodes. A PICC was placed for prolonged access. In consultation with vascular and oncologic surgery, the decision was made to forgo resection of the pheochromocytoma given its proximity to the IVC and the need for bypass during the operation.

After a multidisciplinary team discussion, an elective cesarean delivery was planned at 33.2 weeks gestation. Given her relative hemodynamic stability with maintenance of alpha and beta blockade, we utilized a combined spinal-epidural technique as the primary anesthetic.

Preoperatively, additional intravenous and arterial access was obtained. Several vasoactive infusions were available to counteract hyper- or hypotension as needed. Intraoperatively, midazolam was administered for anxiolysis, and a CSE was placed. After an intrathecal dose of bupivacaine 2.5mg and fentanyl 15mcg, we slowly titrated 2% lidocaine via the epidural catheter to achieve a surgical anesthetic level. During the operation, our patient required use of a nicardipine infusion for hypertension but was overall hemodynamically stable.

Postoperatively, in addition to her hydromorphone PCA, the epidural catheter was maintained for analgesia using an infusion of bupivacaine, fentanyl, and clonidine. She was given intermittent boluses of IV labetalol and nicardipine for further blood pressure stabilization, which she no longer required after optimization of pain control and re-initiation of her oral anti-hypertensives. She was admitted to the ICU for postoperative monitoring.

Discussion: There is no consensus recommendation for the anesthetic management of patients with pheochromocytoma, particularly the parturient. As such, anesthetic decisions should be tailored to the individual. Our primary management concerns included the choice of anesthetic technique and maintenance of hemodynamic stability. Therefore, a wide range of vasoactive medications, adequate access, and additional help should be readily available. Making thorough preparations with a multidisciplinary team approach is also essential for caring for these high-risk patients.

Abstract #:SA-51

Acute Disc Herniation with Cauda Equina Syndrome in the Setting of a Labor Epidural

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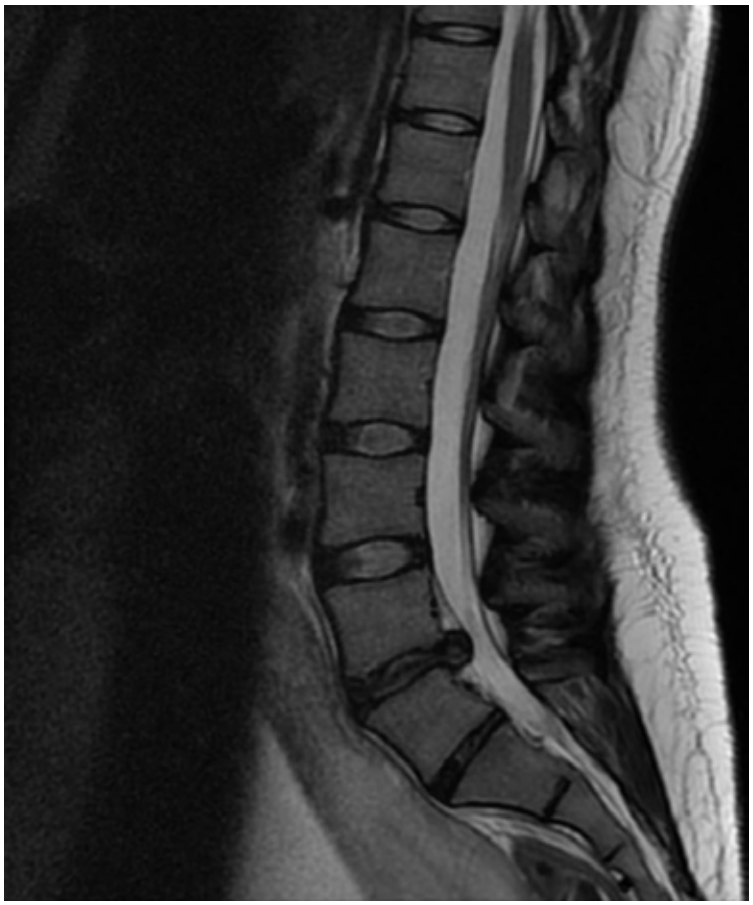
Case: A 35-year-old G5P4 female at 40week EGA presented to L&D in active labor. At the patient's request, an epidural was placed at the L4-L5 interspace with LOR at 6.5 cm. A catheter was threaded 5 cm into the epidural space. Aspiration was negative for heme and CSF. Test dose was negative. An epidural infusion of 0.1% bupivacaine with 2 mcg fentanyl per ml was started. After 4 hours, she developed left sided pain. The catheter was withdrawn 1 cm and bolused with 5 ml of 0.0125% bupivacaine with improvement in pain. She had an uneventful vagninal delivery. 2 hours later, her epidural catheter was removed. The patient reported residual paresthesia in her right foot but motor strength was intact. 7 hours later, the patient was unable to lift her leg or flex her knee. She had a right sided sensory block from T10 to toes. Sensation on the left was normal. She also complained of 7/10 lumbar back pain. Epidural hematoma was suspected. A STAT MRI of lumbar-spine was obtained, demonstrating posterior disc extrusion at L5-S1 causing marked central spinal and neural foraminal stenosis. The orthopaedic surgical team was consulted. The patient was taken to the OR the next day for L5-S1 discectomy. Postoperatively, the patient had slow recovery of RLE sensation and motor function and was discharged from the hospital on POD 4.

Discussion: Acute lumbar disc herniation has a prevalence of 1 in 10,000 pregnancies. Less than 2% of lumbar disc herniations result in cauda equina syndrome (CES), which requires emergent surgical decompression(1). Acute disc herniation with CES during labor and delivery is an even more rare presentation. There are only a few cases described in the past (2). This is the first report of acute disc herniation with CES during labor with a concurrent epidural. In our case, the overlap of epidural placement with the onset of disc herniation made the correct diagnosis very difficult. Furthermore, the residual paraesthesia from an epidural could last over 24 hours, which makes early diagnosis a daunting task. Early diagnosis is key for early surgery and improved outcome with more neurological recovery. This highlights the importance of thorough post epidural neurological exams.



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Abstract #:SA-52

Bell's palsy Post-Partum- Did the Epidural play a role?

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Introduction: Bell's palsy, also known as idiopathic facial nerve palsy, is characterized by acute onset of unilateral facial paralysis due to neuropathy of the seventh cranial nerve. We present the case of a patient who underwent uneventful combined spinal/epidural labor analgesia and developed acute onset facial weakness two days post-partum.

Case: A 29 yr old G3P2 underwent induction of labor at 37 weeks' gestation for intrahepatic cholestasis of pregnancy. She underwent an uncomplicated combined spinal epidural block and received programmed intermittent epidural boluses for maintenance of labor analgesia. Ten hours later she had a spontaneous vaginal delivery. The patient noted numbness on the left side of her tongue 12 hrs after delivery. On postpartum day 2, she was discharged home but then developed left facial droop, difficultly moving her mouth, and decreased facial sensation on the left side. On examination, she had intact pupillary reflexes, left facial droop, decreased left facial sensation, lack of forehead wrinkling, and incomplete left eye closure. The patient denied headache, visual changes, tinnitus, nausea, or vomiting. She was discharged home with acyclovir, prednisone, eye lubricant, and eye patching with follow up from obstetric anesthesia and obstetric providers.

Discussion: Postpartum Bell's palsy following neuraxial labor analgesia has been poorly described with only isolated case reports. Bell's palsy is the most common cause of unilateral facial paralysis with a rate of 17:100,000 in the general population and 40:100,000 in the pregnant population.1 Herpes simplex virus re-activation in the geniculate ganglion, which occurs more frequently post-partum, is the most likely cause. The anesthetic technique in labor may play a role in the development of this disorder. Intrathecal morphine has been shown to increase herpes reactivation and may precede development of Bell's palsy postpartum, yet our patient did not receive intrathecal morphine.2 There are case reports of post dural puncture headache induced cranial nerve palsies, secondary to traction on cranial nerves from CSF leak. Our patient did not demonstrate headache symptoms, positional or otherwise. Epidural blood patches have also been implicated in cranial nerve palsies, possibly related to increased pressure translocating up the epidural space. Another possible etiology includes pressure induced facial nerve injury from increased fluid balance in term and immediate post-partum parturients, specifically in patient suffering from preeclampsia.3 Postpartum follow up is recommended to monitor resolution of symptoms. If the presentation is atypical or symptoms have not improved after four months, then imaging and EMG studies are recommended to exclude other causes, such as malignancy.3

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Abstract #:SA-53

Management of a Precipitous Vaginal Delivery through a Placenta Previa

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Introduction: Cesarean section is the preferred mode of delivery for women with placenta previa. If these patients experience preterm premature rupture of membranes (PPROM), they may require expeditious delivery and are at high risk for major postpartum hemorrhage. We describe the case of a woman who underwent pre-term precipitous vaginal delivery through a placenta previa resulting in massive hemorrhage and hysterectomy.

Case: A 43 year old G8P1 female with a history of one prior cesarean delivery presented to our hospital with PPROM at 18 weeks gestation. She was diagnosed with complete posterior placenta previa by transvaginal ultrasound and admitted for inpatient monitoring. At 25 weeks, the patient experienced a 300cc vaginal bleed. After maternal stabilization, magnesium was initiated for fetal neuroprotection. At 27 weeks, the patient complained of new onset abdominal pain and vaginal bleeding and was transferred to the OR, where she precipitously delivered vaginally. After delivery, she experienced a severe post-partum hemorrhage (>6L blood loss) due to uterine atony and retained placenta. To allow surgical intervention, general anesthesia was induced and an arterial line and large bore peripheral access were placed. Her management was complicated by uterine atony refractory to treatment with misoprostol, oxytocin, carboprost tromethamine, and methylergonovine. Blood loss continued despite dilation & curettage, and placement of a Bakri balloon. To achieve better surgical control of bleeding, a subtotal hysterectomy was performed. A TEE was used intraoperatively to guide fluid resuscitation. The patient received a total of 23 units RBCs, 12 units FFP, 4 pooled platelets, and 3g fibrinogen concentrate. She remained hemodynamically stable throughout. TAP blocks were performed at the end of surgery for post-operative pain relief. The patient was transferred to ICU intubated, without inotropic or vasopressor support. She was extubated 6 hours postoperatively. Her postpartum course was uneventful, and she was discharged home on postpartum day 7. Pathologic examination of the uterus demonstrated placenta accreta.

Discussion: This case highlights the challenges faced by obstetricians and anesthesiologists when managing patients with unsuspected placenta accreta who experience precipitous delivery. The delivery of the baby through her placenta previa resulted in massive postpartum hemorrhage. Anesthesiologists should be vigilant for placenta accreta in patients with placenta previa with a history of cesarean delivery. Furthermore, major postpartum hemorrhage should be anticipated when managing patients with placenta previa who require expeditious delivery.

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Abstract #:SA-54

Laparoscopic Pheochromocytoma Resection at 23 Weeks of Gestation: Fetal and Maternal Considerations.

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Pheochromocytoma during pregnancy is an extraordinarily rare (0.002%) and life-threatening condition. If undiagnosed the tumor carries a nearly 40-50% mortality rate for both the mother and fetus. Management during pregnancy depends on gestational age, tumor size and accessibility, as well as maternal and fetal well-being. While the second trimester is the safest period for performing surgery, fetal monitoring may be challenging and a plan for neonatal resuscitation must be established should fetal distress arise. Case: 29 year-old female G6P2032 was referred to our hospital at 22nd week gestational age with uncontrolled blood pressure, diaphoresis, severe headaches, blurred vision and episode of suicidal ideation. Laboratory data revealed elevated 24-hour urine epinephrine and norepinephrine. MRI showed 2.8 X 2.2 cm left suprarenal lesion consistent with pheochromocytoma. Multidisciplinary team decided to perform left laparoscopic adrenalectomy at the 23rd week of gestation after hemodynamic optimization using alpha-adrenergic blocker terazosin. After premedication with midazolam and fentanyl, an arterial line was cannulated for hemodynamic monitoring and the patient placed in left uterine displacement. To minimize the risk of aspiration the patient received famotidine and sodium citrate prior to procedure. After preoxygenation, cricoid pressure was applied and anesthesia was induced with fentanyl (100mcg), lidocaine (50mg), propofol (200mg) and rocuronium (70mg). After tracheal intubation, anesthesia was maintained with sevoflurane and continuous infusion of remifentanil. Magnesium sulfate and nitroglycerine infusions were used to achieve cardiovascular stability. Nitroglycerine (total 1740mg), esmolol (total 210mg) and remifentanil (240mcg) were bolused during laryngoscopy, intubation and tumor manipulation. After ligation of the tumor's venous drainage phenylephrine infusion was initiated. At the end of the surgery phenylephrine drip was weaned off and patient was uneventfully extubated. Immediate postoperative period complicated by hypoglycemia treated with dextrose. Doppler monitor was used for fetal heart monitoring prior and immediately after surgery. Subsequent postoperative course was uncomplicated for both mother and fetus, with complete resolution of maternal hypertension.

Discussion: Multidisciplinary approach for management pheochromocytoma in pregnant patient requires close co-ordination between anesthesiologist, surgeon, obstetrician and endocrinologist. Fetal monitoring, as well as risk of emergent delivery and goals of neonatal resuscitation at 23rd week of gestation in case of fetal distress should be discussed with parents prior to procedure. Anesthetic considerations during pheochromocytoma resection in pregnant patient include perioperative hemodynamic optimization, airway management and effect of drugs and anesthetic agents on uterine activity and fetus.

Abstract #:SA-55

Atypical Presentation of Uterine Rupture

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38 y.o., G2P1, at 36+3 weeks presented with a 9 hour history of generalized abdominal pain. The patient had a history of morbid obesity, a primary c-section in 2008, and an open myomectomy in 2009. The pain was constant, sharp, localized in the epigastric region, and associated with pelvic pressure. Upon sitting, the pain remained in the upper quadrants and upon standing it radiated throughout the entire abdomen. There was no evidence of labor, fetal movements present were present, and maternal vital signs were stable. She was admitted for workup and observation.

Transabdominal and transvaginal ultrasounds showed moderate fluid in the pelvis, in the cul-de-sac and RLQ, consistent with debris or hemorrhage. A 3.3 cm echogenic focus was read as a possible subserosal calcified fibroid. The fetus was vertex with a BPP of 10 and a posterior placenta. The initial FHR tracing was category 1 and external tocography showed irregular, painless contractions (4.0 per 10 min). Overnight, the patient was noted to have one episode of SOB, tachycardia, and RUQ pain. However, chest CT, angiography, and LFT's were all normal.

The following morning, the tracing worsened to category II with minimal FHR variability and the decision was made to bring the patient to the OR for c-section and exploratory laparotomy. A CSE with Bupivacaine 0.75% 1.4 cc + PF-Morphine 0.15 mg + Fentanyl 15 mcg was placed. Post neuraxial anesthetic, FHR was noted to be 145. A vertical skin incision was made and upon entering the peritoneum, approximately 2 liters of mixed old and new blood was noted in the abdomen. After evacuation of the hemoperitoneum, the infant was delivered with APGARS. After delivery of the placenta, the uterus was explored and a large posterior uterine wall rupture was discovered, measuring approximately 3x3 cm. The uterus was exteriorized and the low transverse incision was repaired first followed by the posterior uterine rupture. Hemostasis was noted and no further surgical procedure was necessary. In addition to the hemoperitoneum, EBL was estimated to be 1 L and the urine output was 100 cc. The patient received 2 units of PRBC, 250 cc of albumin, and 2500 cc LR. The patient's post-operative course was complicated by a bowel obstruction and she was brought back to the OR for lysis of adhesions 4 days post-op. The patient and the baby recovered well.

This case highlights an atypical case of uterine rupture because the typical presentation involves a patient in labor with sharp abdominal pain, vaginal bleeding, and abnormal fetal heart rate patterns. This patient presented prior to the onset of painful contractions with a normal fetal heart rate tracing and without vaginal bleeding. Uterine rupture usually occurs at the site of the prior c-section scar from wound dehiscence. This case is also unusual due to the posterior location of the uterine rupture and the associated symptoms, likely a result of the previous myomectomy.

Abstract #:SA-56

Ultrasound Guided Quadratus Lumborum Block for Analgesia After Cesarean Delivery: Case Series

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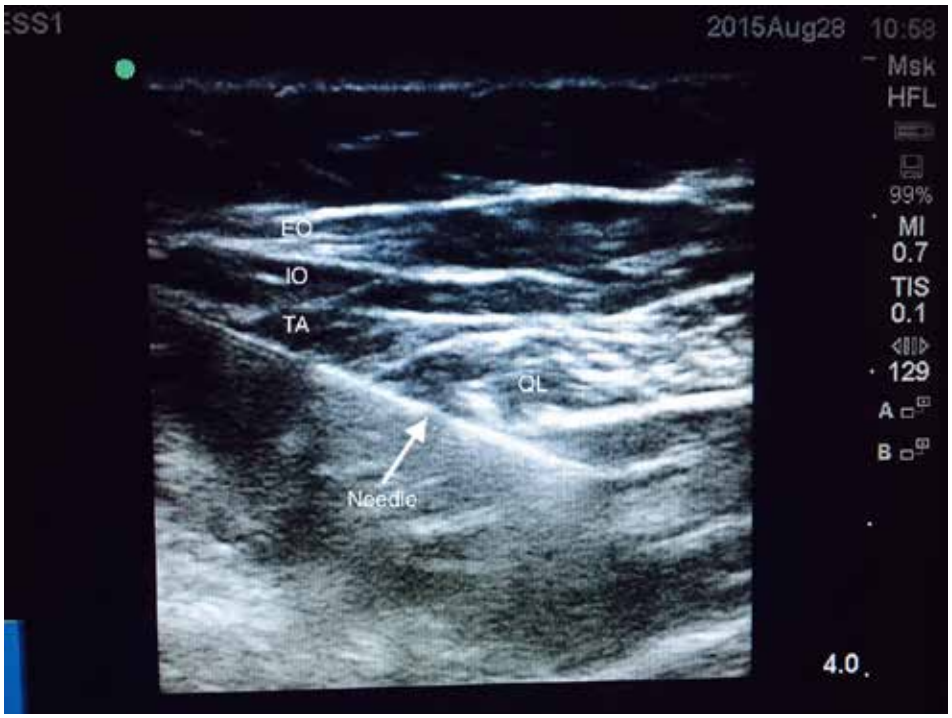
Introduction: The majority of women having planned cesarean section receive spinal anesthesia for the procedure. Typically, spinal opioids are administered during the same time as a component of multimodal analgesia to provide pain relief in the 16-24 hr period postoperatively. However, duration of analgesia with intrathecal morphine is unclear. Previous studies in the obstetric and non-obstetric surgical population failed to demonstrate a linear relationship between morphine dose and duration of analgesia.(1,2) The quadratus lumborum (QL) block is a regional analgesic technique that blocks T5-L1 nerve branches and has an evolving role in postoperative analgesia for lower abdominal surgeries and may be a potential alternative to spinal opioids. (3) If found effective, it will have the advantage of a reduction in opioid associated adverse effects while providing similar quality of analgesia.

Methods: After obtaining written informed consent, a bilateral Quadratus Lumborum block was performed in 3 women who received a spinal anesthetic for a cesarean delivery and evaluated their post-operative opioid consumption and patient satisfaction. Under ultrasound guidance, 0.25% Ropivacaine 30 mL was injected on each side through an 18G Tuohy needle (Fig), 15 mL on the anterior aspect of the muscle (Borglum approach) (4) and 15 mL on the posterior aspect (QL type 2, Blanco approach). (3)

Results: In all 3 patients, there was no additional opioid consumption during the first 24 hours after the block. Numeric rating scale (NRS) was less than 6 for the first 24 h. Women were all very satisfied with the quality of pain relief.

Discussion: Our results showed that this technique was associated with minimal pain during the first 24 hours postoperatively. In addition, we found that the QL block analgesia was longer lasting than the published duration of intrathecal morphine analgesia (1,2).
Our patients did not require any opioids during the first 24 hours after surgery. Randomized controlled trials comparing QL block with intrathecal morphine wil be needed to confirm our findings of prolonged analgesic efficacy of QL block for post cesarean anaglesia.



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Abstract #:SA-57

Anesthetic management of scleroderma in pregnancy

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Introduction: Scleroderma is a connective tissue disorder characterized by vascular changes, inflammation, and fibrosis. The estimated incidence is between 2 and 10 per 1,000,000 and is three times more common in women (1). We report the successful peripartum anesthetic management of a parturient with scleroderma.

Case Report: A 33-year-old primigravida presented at 28 1/7 weeks' gestation with chest pain and dyspnea. Her medical history included scleroderma diagnosed 3 years prior; she also reported recent reflux and orthopnea. Persistently elevated blood pressures prompted her admission with presumptive diagnosis of preeclampsia versus sclerodermal renal crisis. Physical examination was notable for skin tightness, restricted oral opening, Mallampati III classification, short hyomental distance, and a prominent overbite.

Subsequent clinical, laboratory, and hemodynamic assessment established a working diagnosis of preeclampsia with severe features and labor induction was initiated. After discussion with the patient and obstetrics team, epidural placement was pursued preemptively in an effort to mitigate any potential risk related to management of the patient's difficult airway should emergent cesarean delivery ensue. After starting oxytocin, late decelerations were observed and the decision was made to perform urgent cesarean delivery. Surgical anesthesia was achieved via incremental epidural bolusing of 2% lidocaine. A T4 dermatomal level was confirmed by absence of sensation to pinprick testing and Allis clamping. Of note, intravenous ketamine and fentanyl were required intraoperatively to alleviate patient discomfort. She delivered a viable female infant weighing 1301g with Apgar scores of 7 and 9; estimated blood loss was 600cc. Her postpartum course included an episode of pulmonary edema that responded well to diuresis, and she was discharged home four days later.

Discussion: Scleroderma has a wide range of physiologic effects and may be accelerated by pregnancy. Scleroderma can increase risk for cardiopulmonary compromise and can be masked by other disorders with similar symptoms. Many of scleroderma's connective tissue changes have direct anesthetic implications such as difficult airway findings and challenging intravascular access. Decreased LES sphincter tone may elevate the risk for aspiration of gastric contents. These patients may also be more sensitive to the effects of local anesthetics, so careful dosing is advisable (2). In summary, successful peripartum management of a parturient with scleroderma can be achieved using epidural anesthesia. A clear knowledge of scleroderma's effects in parturients is integral to developing a safe, effective anesthetic strategy.

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Abstract #:SA-58

Parturient with a CPA Tumor and difficult Intubation

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We present a 33 year old parturient with a CPA mass measuring 2.5 by 3.5 cm who presented at 34 6/7 weeks gestation with evidence of fetal growth restriction and fetal MCA centralization.

The patient was admitted to the labor suite for expedited delivery.

Neurosurgical consultation resulted in recommendations for "no contraindications to vaginal delivery", however regional anesthesia should only be performed if no CSF leak could be guaranteed. Neurological symptoms included significant tongue deviation to the right and severe dysphagia, necessitating spitting of saliva into a cup preoperatively. Other than compromise of cranial nerve XII and the symptoms described above, the patient was alert and oriented with no neuromuscular or cognitive deficits.

From a fetal standpoint it was likely that the fetus would not tolerate labor well and that emergent cesarean delivery would potentially be more harmful for both mother and fetus, especially since regional labor analgesia was not advisable due to risk of maternal brain herniation if an unintentional dural puncture should occur. Hence plans were made for a cesarean section under general anesthesia.

The anesthetic was complicated by an unanticipated difficult direct laryngoscopy and equipment failure of the video assisted laryngoscopy. While trouble shooting and eventually getting functional video laryngoscopy, the patient was bag mask ventilated for about two minutes, even though the SPO2 monitor did not show evidence of hypoxemia, because it was thought to be important to maintain normocarbia in this parturient with a significant CPA mass. Successful video assisted laryngoscopy and intubation ensued and the cesarean section was otherwise uneventful. The patient emerged immediately following the procedure and was successfully extubated and neurologically at baseline.

Her post partum course was uncomplicated.

Neonatal outcome was favorable with Apgars of 8 and 9 at one and five minutes respectively.

The patient has known about her CPA mass for over 19 months prior to this pregnancy and has as of yet not scheduled the recommended neurosurgical intervention.

Abstract #:SA-59

Reverse-Positional Post-Dural-Puncture Headache (PDPH)

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Background: Patients with PDPH typically present with headache that is worse when upright and better when supine within 6 to 72 hours of dural puncture [1,2]. Epidural blood patch is a therapy that provides quick relief; the first relieves pain in the majority of cases, and the second is successful in nearly all cases [3]. However, we encountered a patient with PDPH that was better when upright.

A 27-year-old G5P3A1 with history of migraines (controlled on an over-the-counter combination pill of acetaminophen, dichloralphenazone, and isometheptene), GERD, and history of pancreatitis presented at 39 weeks for repeat C-section (3 prior C-sections). Combined epidural-spinal was placed prior to C-section. During the epidural placement with a Touhy needle, CSF was aspirated. The needle was retracted, and epidural was successfully placed at another level without CSF aspiration with subsequent spinal placement. Patient was discharged on POD2 without headache, supine or upright, or any other complication.

She returned on POD3 crying complaining of headache. She reported sensitivity to light without vision changes. She denied neck pain, numbness, tingling, muscle weakness, phonophobia, nausea, vomiting, ear pain, fever, chills, chest pain, dizziness, palpitations, or dyspnea. She, interestingly, stated that her headache was worse lying flat. She was able to ambulate without difficulty. Her headache was not relieved by acetaminophen-codeine tablets she was discharged with. She stated that her headache was frontal, unlike her migraine headache that is temporal, and was different in quality and worse in severity than her usual migraines. The pain, nonetheless, was relieved by sitting up. She denied neurological deficits. Neurological exam was unremarkable as was the rest of her physical exam. Non-contrast head CT was ordered, and the result was interpreted as unremarkable and normal.

Despite the unusual nature of the headache (pain relief when upright), given the history of inadvertent lumbar puncture with a larger bore needle (17-gauge, 8.83-cm Touhy needle) that is known to increase the odds of having PDPH [4], she was offered epidural blood patch. The patch provided immediate relief of the headache.

Conclusion: Though typically positional in nature, PDPH can even present with improving symptomatology when upright; therefore, anyone who is at risk for PDPH, especially involving a smaller gauge needle, should be offered a blood patch.

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Abstract #:SA-60

Subdural Hematoma in a Patient with HELLP Syndrome

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Introduction: Neuroaxial anesthesia is a common and popular mode of analgesia for pregnant patients. Though safe, epidural and spinal blocks do have rare complications, such as epidural hematoma and intracranial subdural hematoma with an incidence of approximately 0.05% or 1:200,000. We report a case of subdural hematoma in a parturient with HELLP syndrome.

Case Report: A 19 years old, G1P0, presented to labor and delivery with new onset of labor with a cervical exam of 2.5 cm dilated and 80% effaced. On admission, patient was found have elevated blood pressures and lower extremity edema. PIH labs were sent, showing platelets of 63, with giant platelets observed on slide examination. Magnesium therapy was initiated for seizure prophylaxis. Patient continued to have labile blood pressures and increasing facial edema. A decision was made to proceed with urgent C-Section for severe pre-eclampsia. Pre-operative platelet count of 52,000. Within this clinical setting, the potential for severe airway edema was evident and the decision was made to proceed with C-Section under spinal anesthesia after an infusion of one unit of platelets. Spinal was performed using a 27 gauge Whitacre needle, bupivacaine, fentanyl and morphine. C-section was performed with no anesthetic or surgical complications. Neurochecks were performed every one hour for twenty four hours to evaluate for manifestations of potential epidural hematoma.

The patient's post-operative course was uneventful until post-op day 2, in which the patient began to complain of a non-positional headache with accompanied blood pressure elevations. On post-op day 3, an MRI of the brain was ordered. Initial MRI showed thin bilateral acute subdural hematomas in the frontotemporal regions, as well as findings of benign intracranial hypotension. Neurosurgical evaluation did not reveal any gross or focal neurological deficits and recommendation was to monitor the neurological function. Repeat MRI on post op day 4 showed no acute worsening of the subdural hematomas and the headache began to resolve. The patient experienced complete resolution of the headache by post-op day 5 and was subsequently discharged.

Discussion: HELLP syndrome is a variant of severe preeclampsia and parturients develop dysfunctional and low platelet count. Low platelets alone are a risk for atraumatic parenchymal bleeding and subdural hematoma. Understandably, dural puncture in a patient with HELLP syndrome is relatively contraindicated due to the potential risk of epidural hematoma and CSF leak. Prolonged CSF leak results in intracranial hypotension which can lead to caudal traction on the brain, rupture of bridging veins and subsequent subdural hematoma.
Small subdural hematomas can be treated conservatively with fluids, caffeine, analgesia, and a close neurology and MRI follow up to recognize worsening symptoms as early as possible and proceed with surgical decompression for progressive neurological deficits.

Abstract #:SA-61

Anesthetic Management of a Parturient with "Ondine's Curse"

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Ondine's Curse or Congenital Central Hypoventilation Syndrome (CCHS) is a rare disorder resulting from mutations in the PHOX2B gene, characterized by impaired ventilatory response to hypercapnia and hypoxemia (1). Voluntary breathing is intact while the patient is awake, but during periods of sleep there is no central control of ventilation resulting in alveolar hypoventilation (2). We report a case of a parturient presenting with CCHS for spontaneous vaginal delivery.

A 29 year old primigravida presented for consultation regarding anesthetic management for labor and delivery due to a history of CCHS. She had been managed since birth via tracheostomy with ventilator support needed only when sleeping. She denied any other medical problems and her pregnancy was uncomplicated.

Consultation involved a multidisciplinary approach to determine how the anesthesia, obstetric, and nursing team would manage the patient's condition and ventilator requirement. The patient and her family expressed a desire for as normal a delivery process possible preferably on the labor and delivery unit.

After discussion including, obstetrics anesthesia, maternal-fetal medicine, nursing, respiratory therapy and critical care medicine, it became evident there were multiple systems-based challenges to overcome which would require an intensive care unit environment. Critical care nursing with intermittent mechanical ventilator support for her intended delivery and postpartum care would be necessary for adequate patient safety.

The patient presented at 37 weeks gestational age in active labor. She was admitted to our surgical intensive care unit where a labor and delivery nurse, as well as critical care nurse, were designated for her care.

We will discuss the anesthetic concerns in caring for a patient with CCHS, the anesthetic plan intended for her proposed vaginal delivery, an alternative plan for possible surgical intervention as well as possible concern for the newborn. We will also examine the multiple systems based challenges involving the care of this parturient while providing a safe but family centered care environment.

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Abstract #:SA-62

Perioperative Management of a Parturient with Refractory Idiopathic Intracranial Hypertension requiring Optic Nerve Fenestration

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Introduction: Idiopathic intracranial hypertension (IIH) is a syndrome of increased intracranial pressure in the absence of hydrocephalus or mass lesion with an increase in CSF pressure. This rare disorder is often seen in obese women of reproductive age and can present during pregnancy.

Case: 32 year old, G3P1A1, African American female presented at 38 weeks gestational age with a history of previous cesarean delivery. She was diagnosed with IIH 6 months prior with symptoms of nausea, vomiting, tinnitus, dizziness and acute vision loss in the right eye. Following diagnosis she underwent urgent right optic nerve fenestration that was complicated by central retinal artery occlusion resulting in complete and permanent vision loss in the right eye. The patient declined placement of a shunt and left optic nerve fenestration due to her previous intraoperative complication and was managed conservatively. She received serial lumbar punctures with opening pressures up to 40 cmH2O and at times had symptoms of post-dural puncture headaches that were resistant to conservative management. She was also managed with titrated doses of acetazolamide up to 1500mg BID. On presentation, she described a 1 month history of intermittent paresthesias of the fingers, ankles and toes, and worsening vision in her left eye. With her worsening neurological symptoms, the plan for an urgent cesarean delivery was deemed necessary to salvage the vision in her left eye. Her cesarean delivery was done under general anesthesia with controlled induction and she delivered a healthy male baby with apgars of 6,8. She did well postoperatively and was discharged on post operative day 4.

Discussion: The optimal anesthetic management of IIH during cesarean delivery still remains controversial1; this case highlights the utility of general anesthesia in a parturient with IIH. Regional anesthesia has been performed safely in pregnant patients with IIH as they have no specific contraindications to neuraxial techniques2; however, in this parturient it was avoided due to her worsening neurologic symptoms.

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Abstract #:SA-63

Anesthetic Management of Primigravidad with Arthrogryposis Congenita (AMC) for Caesarian Section

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Arthrogryposis Multiplex Congenita (AMC) is a multifactorial genetic condition resulting in multiple joint contractures evident from birth. Our patient is a 34 yr old G1P0 female (152cm, 63.6kg) with AMC and severe scoliosis presenting with contractions at 38 wks gestation, one week prior to a planed caesarian section for fetal macrosomia and unfavorable pelvic anatomy. Her medical history includes multiple orthopedic procedures and extensive spinal fusion from T3-S2 for severe scoliosis as a child. Patient has been wheelchair bound since age of two. She had been on lovenox for thromboembolic prophylaxis during pregnancy and was bridged to subcutaneous heparin (5000 units) BID two weeks prior to presentation. She also has a history of hypertension with normal pressures during pregnancy and T wave abnormalities seen on EKG with normal follow-up echocardiogram.

Patient was previously seen in anesthesia consult clinic. Her airway exam showed a Mallampati class 2 airway with full range of cervical motion, full dentition, adequate mouth opening and >3 FB thyromental distance. Due to patient's discomfort, spinal anesthesia was attempted with patient in lateral decubitus position. Tactile feedback from dural puncture was not obtained. After multiple attempts, decision was made to proceed with general anesthesia. Glidescope 3 was used with grade 1 view obtained. Initially we had trouble passing a size 6 ETT until cricoid pressure was briefly released. Patient's pharyngeal anatomy appears slightly distorted: her epiglottis appeared to be more omega shaped and tissues around arytenoids appeared contracted. Patient tolerated the procedure without any issues maintained on 0.5 MAC volatile agents and 50% NO. She was extubated without any issues.

There are several perioperative and intraoperative concerns for this patient including mechanical respiratory compromise, difficult intubation, inability to obtain intravenous access, coagulopathy due to immobility and challenge of spinal/neuraxial technique. Respiratory function is affected due to advancing gestation in normal women due to increased intraabdominal girth, leading to a reduction in functional residual capacity which may be more pronounced in women in AMC due to contractures and spinal deformity. The risk of DVT in this patient was greater given her poor mobility in the setting of hypercoagulable state of pregnancy. Most importantly neuraxial techniques in such a patient would naturally be challenging given her underlying contractures, spinal deformities and surgical adhesions. The possibility of a failed spinal due to inability to access intrathecal space and the possibility of a patchy epidural due to inadequate spread from scarring were discussed with patients in preop clinic.

Abstract #:SA-64

Continuous Care of a Parturient with Severe Tracheal Stenosis

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Introduction: Tracheal stenosis signifies a functional impairment, with a decrease in peak expiratory flow to 30% in a trachea that normally is 2 cm. Tracheal stenosis may be congenital or acquired; the most common cause being trauma from prolonged endotracheal intubation. As related to the pregnant patient, physiologic changes such as increased oxygen consumption, decreased FRC, airway mucosal swelling may exacerbate tracheal stenosis symptoms. Therefore, tracheal stenosis in a pregnant patient presents a significant challenge to safely manage during intrapartum period.

Case: 33 yo female at G4P2102 at 21w4d was referred to Pre-Anesthesia clinic for workup with a PMH including history of tracheostomy with subsequent multiple reconstruction surgeries. Two months prior to anticipated due date, the patient underwent fiberoptic laryngoscopy with ENT that showed distorted laryngeal anatomy with bilateral vocal cord fixation and prolapse of R arytenoid tissue with the inability to visualize the vocal cords. Further, ENT stressed that no airway manipulation, including awake fiberoptic, should be attempted without their presence.

An elective tracheostomy was declined by the patient, with the understanding that one would be done should respiratory distress become apparent, more likely becoming a permanent tracheostomy. A multidisciplinary team of MFM, obstetrics, obstetric anesthesia and ENT managed the peripartum patient care. The patient presented to labor and delivery for trial of labor after c-section (TOLAC) at 39w2d. After much convincing of the patient, a labor epidural was placed easily with LOR at 5 cm, secured at 9 cm at the skin. A dedicated tracheostomy was at bedside, along with a difficult airway cart comprised of the standard precautions including adult and pediatric fiberoptic scopes and ETT ranging from 4.0 to 6.0 in size. The patient underwent a successful vaginal delivery, and delivered a healthy neonate.

On postpartum day 6, the patient presented with postpartum hemorrhage. Despite extensive discussions with patient, family, MFM, anesthesia and ENT regarding anticipated surgical and anesthetic plans, she again declined an elective tracheostomy. A Combined Spinal Epidural technique was done, with LOR at 5 cm and again secured at 9cm; spinal 1.4 ml of 0.75% bupivacaine and 10 mcg of fentanyl. The same set up was in the operating room with ENT presence. The patient underwent a Dilation and Curettage without any adverse events, with a blood loss of 1200 cc.

Discussion: In patients with known subglottic stenosis, coordination between care teams is paramount. One must consider the risks and benefits associated with airway management and neuraxial anesthesia in lieu of potential unanticipated problems that could arise in the obstetric population. Thus, having a secondary and even tertiary plan available is critical for the safe outcome of both mother and baby.

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Abstract #:SA-65

Management of a Parturient with Severe Non-Ischemic Cardiomyopathy: A Multidisciplinary Approach

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Introduction: Non-ischemic cardiomyopathy (NICM) is rarely encountered in pregnancy but may be associated with significant mortality. Characterized by either left ventricular or biventricular dilatation and impaired contractility, NICM results in progressive congestive heart failure. Peripartum anesthetic management of these patients may be challenging and is best achieved using a multidisciplinary approach. This case report illustrates successful multidisciplinary management of a parturient with severe NICM.

Case: A 25 yo G3P0020 at 27 wk gestation presented with CHF and palpitations. Her medical history was remarkable for viral NICM (EF 20-25%), ventricular tachycardia, and placement of a dual chamber AID. She experienced multiple shocks from the AID over the years. Prior to this admission, she had an episode of atrial fibrillation w/ RVR and was placed on enoxaparin and sotalol. Despite good rate control, her cardiac function declined as she presented with significant volume overload, dyspnea, palpitations, and tachycardia. Antenatal assessment showed severe IUGR with estimated fetal weight <3%.
A multidisciplinary team comprised of maternal fetal medicine, obstetrics, cardiology, obstetric and cardiovascular anesthesiology managed the peripartum care. Despite optimal medical management, the fetus started demonstrating severe decelerations with evidence of placental abruption, leading to urgent cesarean delivery.
After emergent intraortic balloon pump placement, general endotracheal anesthesia was established uneventfully via rapid sequence induction using etomidate and succinycholine. Monitoring included radial and pulmonary artery catheterization and intraoperative TEE, which were used to guide administration of fluids and pressors (norepinephrine, dopamine, and milrinone drips). EBL was 600 cc. The neonate was delivered, transferred to NICU, and cesarean delivery proceeded uneventfully. The patient was transferred to the cardiac intensive care unit intubated with pressor support. She was weaned off pressors on postoperative day 1 and extubated successfully on postoperative day 2.

Discussion: Patients with severe cardiomyopathy pose a significant anesthetic challenge. There is controversy regarding the best anesthetic technique with case reports supporting both general and regional techniques. A review of the literature shows a preference for general anesthesia as neuraxial may result in catastrophic effects secondary to the decrease in systemic vascular resistance.
The successful management of this patient warranted the collaborative efforts of a multi-disciplinary team with an advance plan in place. The goal was to prevent PVR and SVR changes to maintain enough pulmonary blood flow to oxygenate, but to prevent increases in pulmonary blood flow that would lead to pulmonary edema and congestive heart failure.

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Abstract #:SA-66

Safety of neuraxial anesthesia in a preeclamptic patient receiving recombinant anti-thrombin infusions

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A 34 year-old G4P2012 at 34 weeks gestation with severe preeclampsia, characterized by severe range blood pressures and headaches, presented for Cesarean section (CS). She was enrolled in the PRESERVE-1 (Prospective Randomized Evaluation of the Safety and Efficacy of Recombinant Antithrombin in Very Preterm Preeclampsia) clinical trial, which involved daily infusion of either recombinant anti-thrombin (rhAT) or placebo up until 34 weeks gestation. Her final "blinded" infusion had been stopped just 5 hours prior to deciding to proceed with CS, thus complicating her anesthetic plan. The obstetrician requested a spinal anesthetic, insisting that the (potential) rhAT infusion would not pose any increased risk for coagulopathy, or possible epidural hematoma. The patient's hematocrit was 32.4, and platelets 273; no coagulation studies were available.

Preeclampsia is a pregnancy-specific disorder affecting approximately 4% of all pregnancies, characterized by hypertension (>140/90) and proteinuria with or without other systemic symptoms. While it is a leading cause of maternal and perinatal morbidity and mortality, its precise etiology and optimal treatment strategy remain uncertain, with delivery being the only effective treatment modality (1). Patients with preeclampsia are suspected to have aberrant trophoblastic invasion of the placenta into the myometrium, along with endothelial cell dysfunction, and activation of the coagulation cascade with decreased antithrombin levels. Studies have been investigating various ways to halt the progression of preeclampsia, thereby delaying delivery, allowing more time for the fetus to develop in-utero. Plasma-derived anti-thrombin has been administered as a treatment for preeclampsia in several small clinical trials with success in improving both perinatal and maternal outcomes. PRESERVE-1 is another such trial, assessing the pharmacokinetic properties and safety of rhAT in preterm severe preeclampsia (2).

To plan for the safest course of action in this patient, coagulation studies were obtained, which returned within normal range. Rotational thromboelastometry (ROTEM) was also tested, which resulted in normal coagulation for pregnancy. The patient then underwent a safe and successful spinal anesthetic, followed by uncomplicated CS. She was discharged home in good condition on post-operative day 7.

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Abstract #:SA-67

Implications of Performing a Combined Spinal-Epidural Technique for Labor Analgesia in a Parturient with Metastatic Lung Adenocarcinoma and Altered Mental Status

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Introduction: Neuraxial analgesia is the most effective technique for labor analgesia.1 Case reports have demonstrated permanent neurological injury following neuraxial techniques placed under general anesthesia, 2 so to increase the safety profile, neuraxial analgesia is primarily performed in alert, cooperative parturients. Despite this practice, neuraxial anesthesia is frequently performed under general anesthesia and deemed safe in the pediatric population. 3 We present a woman with mental status changes due to metastatic malignancy in whom neuraxial anesthesia could be provided only with extensive sedation.

Case Presentation: This woman was a G2P1001 at 29 weeks who presented to the emergency room with altered mental status and word finding difficulties over the previous two months. Radiographic imaging demonstrated multiple brain lesions found to originate from a poorly differentiated lung adenocarcinoma. MRI suggested no bony involvement in the lumbar spine. Craniotomy was performed nine days after presentation followed by whole brain radiation. On POD 10 she went into preterm labor. She was unable to follow instructions or remain motionless for epidural catheter placement. After discussion with the neurosurgeon, obstetric team and family, regarding her and her family's wishes and goals of care during labor, the decision was made to perform a CSE using sedation after informed consent. ASA monitors were applied and monitored anesthetic care was provided in the OR with intermittent boluses of propofol 20-30mg (280 mg total). Fetal monitoring was continuous and reassuring throughout placement of the epidural catheter. A CSE was placed without complication in the right lateral decubitus position. Labor analgesia was maintained with a programmed intermittent bolus (bupivacaine 0.1% with fentanyl 2µg/ml 10ml q60 min). A healthy baby girl was born via normal spontaneous vaginal delivery. There were no neurologic sequelae of the technique being performed under sedation.

Discussion: In our patient, the benefit of neuraxial labor analgesia to reduce suffering and improve her quality of life was of paramount importance to her and her family. Our patient's limited ability to cooperate and remain motionless during placement of the CSE was safer using sedation than attempting the technique awake. Additionally, potential neurologic damage would be of much smaller long term consequence given her poor disease prognosis. The risk benefit ratio of doing a neuraxial technique under deep sedation may be dramatically altered in patients with metastatic disease whose immediate comfort may outweigh risks of long term sequelae.

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Abstract #:SA-68

Point of Care Transthoracic Echocardiography for Peripartum Hypotension

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Introduction: Hypotension following epidural placement is a common clinical scenario encountered in the obstetric population. Sympathectomy resulting in decreased vascular tone is the primary etiology. Hypotension in this setting is commonly managed with intravenous fluids (IVF) and vasopressors. We report a case of post-epidural hypotension refractory to IVF and vasopressors and the usefulness of point of care (POC) echocardiography in its management.

Case: A 35-year-old parturient (G4P3) at 41 weeks of gestational age with no significant past medical history was admitted to the labor and delivery floor for induction of labor. The patient was noted to have an episode of variable decelerations. On day 2, a lumbar epidural at L3-4 level was placed without any complications. Three boluses of 5 mL of a mixture of 0.125% bupivacaine with 2 mcg/mL fentanyl were administered over 15 minutes, and an infusion was continued at the rate of 6 mL/h. The baseline systolic blood pressure (SBP) was noted to be around 110mmHg. Minutes after the last bolus, the patient became comfortable; however, the SBP was noted to be in the 90s mmHg which was treated with 1L IVF and intermittent doses of vasopressors. One hour after the epidural, late decelerations were noted and the anesthesia team was called for evaluation. SBPs were noted be 80s-90s mmHg . At this time, oxytocin infusion was stopped by the obstetric team. Given the persistent hypotension despite fluid bolus and vasopressors, a POC bedside transthoracic echocardiogram (TTE) was performed to evaluate volume status. The TTE was notable for preserved left ventricular function, well filled ventricles, and the absence of inferior vena cava (IVC) respiratory variations. At this time, the decision was made to not administer additional IVF and to treat with vasopressors. The blood pressure returned to baseline shortly thereafter as well as a reassuring fetal heart tracing. Oxytocin was subsequently resumed at a lower dose. The patient was surgically delivered 12 hours later for recurrent decelerations.

Discussion: With advances in image quality and availability, ultrasound has now become ubiquitous in clinical practice. It is a valuable tool that can be used to evaluate cardiac parameters such as systolic function, valvular function, volume status via left ventricular end diastolic volume and IVC fullness. We have presented a case of persistent hypotension in a parturient with an epidural. The POC TTE allowed us to rule out life threatening pathologies through an efficient and non-invasive modality. It also facilitated in tailoring the clinical management of such patients with intriguing clinical presentations by sparing them from unnecessary treatment with additional IVF. POC TTE can be be used to better manage common clinical scenarios like this encountered by the obstetric anesthesiologist.

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Abstract #:SA-69

Implicit faith in technology can mislead: A case of epidural infusion pump malfunction.

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Modern medicine relies on technologically advanced equipment. We tend to believe that our equipment is highly reliable. Subtle malfunction can go unnoticed and negatively impact patient care. Malfunctions occurring without an error message worsen the situation. Troubleshooting new equipment is more challenging if we do not understand them fully.

We describe an epidural pump (CADD-Solis Model #2110 CE) malfunction that led us to question our epidural placement.

A primigravida admitted to our birthing suite received a routine labor epidural with a standard analgesic solution of 0.2% ropivacaine and 2mcgs of fentanyl per ml with good pain relief and a demonstrable sensory block at T10. Anesthesiology was notified an hour later of breakthrough pain. Patient was dosed with 10 cc of 0.2% ropivacaine over a few minutes with significant pain relief. In an hour, patient was in pain again. At this time, a lack of sensory level to cold was noted. Patient opted to have the epidural replaced and obtained reasonable pain relief with a standard bolus and delivered within an hour.

Our second patient was admitted to the same labor room as the previous case, for a scheduled induction of labor that day. She received a combined spinal epidural due to her morbid obesity and to additionally confirm epidural placement. Patient received 2.5 mg of bupivacaine intrathecally and epidural catheter was threaded without any difficulty. When subarachnoid block had receded, epidural catheter was bloused with 10 cc of 0.2% ropivacaine with 2mcg/of fentanyl per ml in divided doses after a negative test dose to achieve a T-10 sensory block. A standard epidural infusion as was used with the previous case was begun. Four hours later, the patient was in pain and had no detectable sensory level to cold. A bolus of 10 cc of 1% lidocaine was used to rapidly assess the functionality of the epidural catheter. Great pain relief and bilateral T-12 sensory level was achieved with the diagnostic bolus and the epidural infusion was continued. In 2 hours, patient was in excruciating pain and remarked that only physician delivered boluses relieved pain. Neither the infusion nor the PCEA boluses provided any relief. Decision was made to replace the epidural catheter which was done and the infusion restarted after a standard bolus, with good pain relief that again dissipated in 2 hours. Further investigation of this recurrent, timed waning of pain relief found that the epidural infusion bag contained the initial volume that we hung at starting the first epidural. This brought to light the reason why our boluses seemed to help. The pump while appearing to be functional, was not delivering the set dosage. We promptly removed the pump and replaced it with another working epidural pump. This replacement led to good pain relief and the patient progressed to a very comfortable delivery.

The manufacturer returned a report of pump mal-delivery; pump required some replacement of parts.

Abstract #:SA-70

Management of a Parturient with Arnold-Chiari Malformation during Cesarean Section

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Arnold Chiari malformations are caused by structural defects in the cerebellum and may present with a vast array of neurological sequelae. The classification system used to diagnose Arnold Chiari malformation (types I-IV) is based on the parts of the cerebellum that herniate through the spinal cord and the severity of the symptoms. Arnold-Chiari type I is due to the downward displacement of the cerebellar tonsils and vermis through the foramen magnum, which compresses local nerve fibers, and can cause neck pain, cervical kyphosis, headache, ataxia, and sensory or motor deficits. Although surgical treatment can relieve these symptoms, symptomatic improvement ranges from only 60-90%. Parturients are under a considerable amount of physiological stress that may contribute to increased ICP, and anesthetic management of these patients is controversial.

We present a 32 year-old female who presented with Arnold-Chiari malformation type I with C1-2 laminectomy and surgical decompression, now with occipital headaches, who presented to UHB in active labor. She had a past medical history of asthma, anxiety, type II diabetes, and obesity. After multi-disciplinary discussion, we decided to electively c-section the patient for concern for ICP changes during active labor. Her airway exam was likewise concerning: Mallampati class III, obese, limited neck extension. We therefore elected to perform an awake fiberoptic intubation followed by general anesthesia. Her supraglottic airwaywas topicalized with 4% lidocaine with suppression of the gag reflex. After visualization of her glottis, an epidural catheter was placed via the fiberoptic side port between the vocal cords, and the trachea was topicalized with 4% lidocaine. The endotracheal tube was passed on the second attempt. General anesthesia was subsequently administered with propofol and sevoflurane.

Due to its rarity, anesthetic management for parturients with symptomatic Arnold-Chiari malformations must be carefully considered, as there is an increased risk for both labor analgesia and anesthesia for c-sections. Combined spinal-epidurals have been given successfully to a patients with this condition, and while a spinal can theoretically decrease ICP through dural puncture, the increased extradural pressure from the epidural aspect can lead to increased ICP and progression of symptoms, and the risks and benefits of this technique must be considered and discussed with the patient. We present a method of anesthesia that sidesteps both the ICP concerns of the neuraxial technique, and also the concern of a difficult airway present in pregnant patients.

Abstract #:SA-71

Normally weak, weaker during pregnancy: An interesting case of Congenital Myasthenic Syndrome

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Introduction: Congenital Myasthenic Syndromes(CMS)a heterogenous group of genetic diseases of AR inheritance, characterized by a dysfunction of neuromuscular transmission. Prevalence is estimated at 1 in 500,000.1

Case report: A 24 years old primiparous lady presented with a history of CMS. She was diagnosed at the age of 11 years and was wheel chair bound since. She was started on fluoxetine at the age of 15, which caused depression and was changed to Quinidine which improved her symptoms. During her pregnancy her weakness got worse and she started using the wheel chair more often due to fatiguability. She had bilateral ptosis, complex ophthalmoplegia, proximal muscle weakness. She was seen in the high risk anaesthetic clinic at 36 weeks and a multidisciplinary plan was made by anaesthetists, neurologists and obstetricians.

The anaesthetic plan was to continue Quinindine peripartum, provide early epidural in labour, regional for Caesarean section and in an unlikely event of Caesarean section needing GA to avoid or restrict the use of muscle relaxants.

Discussion: CMS is classified as presynaptic (defects in Acetylcholine synthesis or release), synaptic (anomaly of the cholinesterase collagen tail),postsynaptic defects (decreased expression of acetylcholine receptors, fast and slow channel CMS).2

Diagnosis1- decreased response of the compound muscle action potential (CMAP, absence of anti-acetylcholine receptor and anti-MuSK antibodies in the serum, lack of improvement with immunosuppressive therapy and absence of pathology in a skeletal muscle biopsy.

Treatment is based on the type of CMS. Most benefit from Acetylcholinestrase inhibitors like pyridostigmine, 3,4-diaminopyridine increases the release of ACh. Ephedrine & Albuterol for refractory cases. Quinidine & fluoxetine for slow channel CMS. Our patient was diagnosed with slow channel type of CMS.

Our patient's symptoms worsened during pregnancy and she was wheelchair bound. Prevention of secondary complications and monitoring side effects of drugs used is important.

Neuraxial block is preferred to avoid general anaesthesia (NM blocking drugs and anticholinesterses). Down regulation of acetylcholine receptors makes them resistant to depolarising muscle relaxants and sensitive to non-depolarising relaxants.

Labour and delivery can cause fatiguablity. To avoid stress epidural was sited early in labour. Total labour time was kept short by augmentation and ventouse delivery.

Summary: A proper balance should be achieved between managing pregnancy, safety of the mother and the foetus from the drugs used in its management. Multi-disciplinary clinics are essential in the managing complex conditions like CMS.

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Abstract #:SA-72

A severe postpartum headache status post wet tap, does not necessarily equal PDPH

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A 25 year-old G1P0 with a history of Crohn's disease presented in labor, requesting an epidural. Placement was complicated by accidental dural puncture (ADP). On postpartum day (PPD) 1, she developed a bilateral frontal headache, aggravated when upright and alleviated when recumbent. Conservative therapy for suspected post-dural puncture headache (PDPH) included caffeine, acetaminophen and increased fluid intake. On PPD 2, she was discharged home, but returned complaining of unresolved headache and photophobia on PPD 8. She received a therapeutic epidural blood patch (EBP) and tolerated 9 ml of autologous blood due to lower back pressure. Vital signs remained stable for 2 hours, and she was discharged home. On PPD 11, she returned to the ED, complaining of different headache, bilateral at temples with the addition of chills, nausea, and emesis. She received IV fluids, metoclopramide, magnesium, and caffeine with relief of her symptoms, so she was discharged without further workup. On PPD 15, she developed difficulty ambulating with a right-sided headache that radiated to the right eye. A CT angiogram revealed a dural venous sinus thrombosis with complete occlusion of the superior sagittal sinus. MR venogram revealed a subacute thrombosis of the superior sagittal sinus, with extension of abnormal signal into several cortical veins. She was admitted to the neurology service and started on a heparin infusion. She was discharged on warfarin with complete resolution of all symptoms, without any residual deficits.

Headaches are common in the postpartum period due to stress, dehydration and exhaustion. The differential for other etiologies (beyond PDPH and pre-eclampsia/eclampsia) include subdural hematoma, intracranial hemorrhage, and cerebral venous sinus thrombosis (CVST). The incidence of intracranial venous thrombosis in parturients is increased 50% from baseline (1). The risk of all venous thromboembolism (VTE) is highest within 6 weeks postpartum, and declines to baseline by 12 -18 weeks.

This patient was at an increased risk for thrombosis both from pregnancy and Crohn's disease. Pregnancy is associated with an increase in coagulation factors and a decrease in protein S (2). As an inflammatory state, Crohn's disease increases the risk of VTE and leads to hypercoagulability and coagulation cascade abnormalities(3).

CVST may be life threatening, but is treatable if recognized early. It should be considered, among other neurologic conditions in any woman presenting with persistent neurologic deficits in the postpartum period irrespective of whether or not they also sustained an ADP.

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Abstract #:SA-73

Severe Hypotension Following Spinal Anesthesia for Elective Cesarean Section

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Intro: The management of hypotension after spinal anesthesia is a concern for obstetric anesthesiologists. Phenylephrine is the vasopressor of choice in obstetrics, but in cases of hemodynamic instability that persist despite appropriate treatment, other etiologies of hypotension should be considered.

Case Report: The patient is a 43 year-old G3P0111 who presented at 38 weeks 2 days gestation for scheduled repeat cesarean due to polyhydramnios. Her past medical history was significant for gestational hypertension not treated with pharmacologic intervention, gestational diabetes requiring insulin, hypothyroidism on levothyroxine, and a mood disorder treated with lithium, quetiapine, clonazepam, and fluphenazine. The patient was of normal height and weight and had NKDA. Her pre-induction vital signs were as follows: HR 90 bpm, BP 141/102 mmHg, RR 18 breaths/min, SpO2 97% on RA, and temperature 36.7° C. In the pre-operative area, the patient received 1L lactated ringer's. In the OR, she underwent spinal anesthesia in the sitting position with 1.6 cc hyperbaric bupivacaine, 20 mcg fentanyl, and 200 mcg preservative-free morphine. An infusion of phenylephrine at 50 mcg/min was initiated at the time of the spinal injection. The patient was then placed in supine position with left uterine displacement, and an infusion of 2000 mg cefazolin was started for antibiotic prophylaxis. Immediately after being laid supine, BP was 60/30 mmHg, HR 50 bpm, and SpO2 100%. The patient maintained consciousness, evidenced by her ability to communicate continuously with the anesthesia team, and normal upper extremity strength remained intact. The cefazolin infusion was discontinued due to concern for anaphylaxis in the setting of persistent, severe hypotension, and the phenylephrine infusion was increased to 200 mcg/min. An IV bolus of 10 mg ephedrine, in addition to high-dose phenylephrine and wide-open crystalloid infusion, did not result in an increase in BP. At this time, the fetal heart rate was noted to be in the 60s, prompting the need for immediate delivery. A T4 anesthetic level was confirmed and 8 mcg IV epinephrine was given in divided doses, which resulted in return of the patient's vital signs to baseline. Delivery of a liveborn infant with APGARS (5/9) was completed otherwise uneventfully.

Discussion: In this case, severe hypotension after spinal anesthesia persisted despite conventional treatment. Therefore, other etiologies of hypotension were considered, including high spinal and anaphylaxis, both of which were ruled out due to the presence of isolated hypotension. A Bezold-Jarish reflex was also considered. Interestingly, there are reports of refractory hypotension under spinal and general anesthesia in patients taking atypical antipsychotics. We believe that this patient's use of an atypical antipsychotic played a role in her response to spinal anesthesia.

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Abstract #:SA-74

Successful use of Epidural Anesthesia facilitated with Invasive monitoring (Pulmonary artery catheter and Arterial line) for cesarean delivery of a parturient in Sickle cell crisis and severe pulmonary Hypertension

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Introduction: Parturients with Sickle Cell Disease (SCD) can have serious life-threatening sequelae that make the peripartum care very difficult. Pulmonary hypertension, thrombotic events and pain crises are the challenges places the parturient and fetus at risk for adverse events. We present a difficult case of a parturient with SCD developed severe pulmonary hypertension from chronic pulmonary emboli (PE) presenting for cesarean section was successfully managed with slow, controlled epidural anesthesia and pulmonary artery catheter (PA) for monitoring.

Case: 26 yr old G1P0 at 26w1d presented for urgent cesarean section due to severe IUGR with worsening fetal heart tone. Her past medical history includes SCD, pulmonary hypertension from chronic PE, lupus anticoagulant, asthma, OSA on CPAP, type 1 Diabetes, stage 2 renal failure. She is on 2L/min of O2 at home and therapeutic Lovenox for chronic PE and receives exchange transfusions every 3 weeks. Recent echocardiogram revealed moderate pulmonary hypertension (RVSP 66mmHg) with preserved right and left ventricle function. She has shortness of breath (NYHA III) and 3 pillow orthopnea with PND. For the last 8 days she was hospitalized for pain crisis, and dyspnea requiring 5L/min of O2. She received exchange transfusion and treated for pneumonia in the ICU. She was also started on oral sildenafil at 12.5 mg 3 times a day. With multidisciplinary team approach our plan was to do incremental dosing epidural anesthesia and PA catheter and arterial line for monitoring during cesarean delivery. PA catheter was placed prior going to the operating room which revealed PAP 54/18 with mean of 30 and A- line prior to epidural catheter placement. After a negative test dose, 2% Lidocaine was given in 3 cc increments every 5 minutes until T6 sensory level was obtained. C-section performed and viable infant was delivered. Mother remained hemodynamically stable throughout surgery and transferred to ICU for post op monitoring. She was discharged from ICU POD 2 and home on POD 7.

Discussion: Peripartum management of parturients with severe SCD and pulmonary hypertension can be very challenging. We were able to successfully manage our patient with pre op placement of PA catheter and slow titration of epidural anesthesia. Monitoring the PA pressures helped us to manage the hemodynamic changes that occur during and immediate post- partum period when maternal mortality is at its highest. Multi-disciplinary team (Obstetrician, Hematologist and Cardiologist) approach helped us to have the best outcome when dealing with patients with complex disease.

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Abstract #:SA-75

Clinical Experience with a Cesarean Section for a Patient with Extreme Morbid Obesity ; Utilization of an Intrathecal Catheter and Surgical Transversus Abdominis Plane Block with Wound Closure by Applying a Negative Pressure Vacuum-Assisted Closure Device

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Case: A 35 year old woman G2P0 was admitted for an elective primary caesarean section at 38 weeks and 6 days. Her BMI on admission for C-Section was 90. Other comorbidities included chronic hypertension, diabetes, and obstructive sleep apnea. On the day prior to the surgery, she obtained an IR guided peripheral vascular access. Continuous spinal anesthesia was planned secondary to extreme morbid obesity. Her epidural space was identified at 9cm in a seated position with an ultrasound guidance, and the needle was advanced further until clear CSF was seen flowing back. A 20G intrathecal catheter was placed into the L3-L4 interspace with a total of 5 cm left inside the space. A T6 sensory block was achieved with 0.5ml of 0.75% hyperbaric bupivacaine followed by additional 15 microgram of fentanyl intrathecally. The surgical approach involved the use of a vertical midline incision that was located below the level of the umbilicus, followed by uneventful cesarean delivery. Surgical duration was approximately 2 hours and 10 minutes. A total of 2L of crystalloid fluid was administered, and total blood loss was estimated about 800 ml. For the postoperative pain control, 200 mcg of preservative free morphine was administered intrathecally after delivery, and a transversus abdominis plane (TAP) block was performed with a total 20 milliliters of 0.75% Ropivacaine bilaterally by the surgeon. To prevent wound complication, a negative pressure wound management system was applied by the surgeon during wound closure. She was given IV/PO acetaminophen 1000mg every 8 hours and IV ketorolac 30 mg every 6 hours for 36 hours postoperatively, and discharged home on postoperative day 2 with her baby without any complication.

Discussion: The advantage of an intrathecal catheter includes that there is a continuous and tested means of providing adequate surgical anesthesia, and the blockade can also be reliably extended. Our choice is similar to that made by Polin et al in their case series of three super morbidly obese patients who underwent caesarean delivery. In our case the patient's incision was vertical which allowed us to use a TAP block successfully by the surgeon during wound closure. A unique aspect of the wound management in this patient is the use of a negative pressure wound management system due to the attendant risk of compromised wound healing. In an obese parturient careful planning for labor and delivery should be undertaken to ensure that they are able to deliver safely.

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Abstract #:SA-76

When Postpartum Headaches are not Benign

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Introduction: Our parturient developed a headache in the postpartum period following a difficult epidural placement and uneventful spontaneous vaginal delivery. Diagnosed as a postdural puncture headache (PDPH), she received a blood patch with a worsening of symptoms prompting further work-up.

Case Description: MA, a 31 y.o. G4P3A1 Hispanic female at 39 weeks gestation presented in active labor. Upon request for analgesia, a CSE was planned. During the first attempts by the resident, loss of resistance was achieved using air, a 25-g spinal needle was introduced, but we were unable to obtain CSF. The procedure was reattempted by faculty again no return of CSF. An epidural catheter was threaded without resistance, there was negative aspiration and a negative test dose. The patient was comfortable throughout her labor course & had an uneventful delivery. She developed a frontal headache and neck pain on postpartum day 1. She opted for conservative management, but on postpartum day 3, the headache worsened. With the presenting symptoms and the possibility of an undetected dural puncture, a diagnosis of PDPH was made and she requested an epidural blood patch. Immediately following injection of 16 mL of autologous blood, she reported that the headache had increased in intensity and was accompanied by new onset nausea, vomiting, photophobia, and phonophobia. On further work-up, a CT scan of the brain was performed and revealed a pituitary macroadenoma measuring 1 cm anterior-posterior X 1.5 cm transverse x 1.4 cm craniocaudal. Endocrinology was consulted and the patient was discharged on postpartum day 4.

Discussion: This case highlights that not all postpartum headaches are benign and sometimes further work-up is required. While a PDPH was the primary diagnosis, the presence of a pituitary tumor complicated the picture. Etiology distribution of severe postpartum headache is tension (39%), preeclampsia or eclampsia (24%), PDPH (16%), migraines (11%), and hemmorrhage/thrombosis/vasculopathy (10%)1. It is unclear why we were unable to obtain CSF, but repeated dural punctures were the likely reason for the PDPH.
The presence of the pituitary adenoma was likely unmasked by the epidural blood patch, and timing of symptoms in relation to it being performed supports this theory. Injection of blood into the epidural space causes an immediate rise in pressure in the CSF2. We are of the opinion that this transmitted to the brain causing an increase in intracranial pressure producing a "pseudo" mass effect. The parturient exhibited classic symptoms of PDPH, but it is a reminder that we must be diligent of other possible causes of postpartum headache as the aforementioned distribution suggests.

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Abstract #:SA-77

Cesarean Delivery after Bilateral Orthotropic Lung Transplant and Acute Rejection

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Co-Author: Ashraf Habib M.D. - Duke University - Durham, North Carolina

Introduction: Management of a parturient with cystic fibrosis and a history of bilateral lung transplant poses unique challenges to the obstetric anesthesiologist.

Case: A 26 year old G1 was referred for anesthesia consultation at 36 weeks gestation with past medical history significant for cystic fibrosis s/p a bilateral orthotropic lung transplant. She had 1 episode of acute rejection in the past year; chronic CMV infection, a history of pseudomonas aeruginosa infection, poorly controlled diabetes, chronic hypertension, chronic kidney disease stage 1, and anemia. Pulmonary function tests were stable, FEV1/FEV 84 and FEF 25-75% 2.38. A recent bronchoscopy revealed well healed anastomosis sites with moderate narrowing of the right main bronchus. Echocardiogram revealed normal LVEF and good ventricular function. The patient refused vaginal delivery despite counseling about the risks of cesarean delivery and insisted on receiving a general anesthetic (GA) for the procedure. She received extensive counseling from the anesthesia team about risks of GA in all parturients, in addition to the extra risks specific to her condition including aspiration, infection and problems with mechanical ventilation. The patient then agreed to neuraxial anesthesia only if sedated. For her cesarean delivery, five 4mcg boluses of dexmedetomidine were given for anxiolysis. A combined spinal epidural was placed using 12mg of hyperbaric bupivacaine with 15mcg fentanyl and 150mcg morphine. A phenylephrine infusion was used for hemodynamic support. The cesarean delivery proceeded uneventfully. Apgar scores were 7 and 9.

Discussion: GA was purposely avoided in this parturient. Her condition escalated the risk of aspiration secondary to pancreatic dysfunction, poorly controlled diabetes and gastric atony. [1] Pneumonia after endotracheal intubation is feared in the immunosuppressed. Ventilation can be challenging in transplanted lungs and barotrauma, bronchospasm, volume overload and postoperative atelectasis should be anticipated. Anorexia from malabsorption and chronic adrenal suppression causes difficulty in extubation and prolonged ventilation. Due to severe anxiety, sedation was needed for block placement. We chose dexmedetomidine since it has been shown to provide analgesia and anxiolysis while maintaining respiratory drive [2]. The use of neuraxial anesthesia with dexmedetomidine sedation allowed for successful management of this challenging parturient.

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Abstract #:SA-78

Timing of delivery and aortic replacement in a pregnant patient with Marfan syndrome and rapidly advancing aortic dilation

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Introduction: Patients with Marfan syndrome are at risk of aortic dissection during pregnancy, and risk increases with degree of aortic dilation. Pregnancy may be contraindicated, pre-pregnancy aortic repair may be required, or more emergent repair may be needed for precipitous aortic enlargement or dissection. We present a patient with Marfan syndrome complicated by rapid aortic dilation, and discuss management dilemmas including timing of cesarean delivery and aortic replacement.

Case: A 25-year-old with Marfan syndrome and prior mitral valve replacement for infectious endocarditis presented to prenatal clinic at 11 weeks gestational age (GA). Echocardiogram, delayed until 26 weeks GA due to poor compliance, showed an aortic diameter of 44 mm consistent with dimensions obtained 3 years prior. Cardiac MRI at 34 weeks GA revealed rapid advancement of dilation to 50 mm, and the patient was admitted for cardiology and cardiac surgery consultation, antenatal steroids, and delivery planning. Cesarean delivery was performed under epidural anesthesia. Epidural blockade was incomplete despite large volumes of local anesthetic, and supplemental propofol infusion was needed for sedation. She was hemodynamically stable throughout and a healthy infant was delivered without complication. Due to concern for unacceptably high risk of intraabdominal bleeding from the heparin dose required for cardiopulmonary bypass (CPB), aortic replacement was scheduled for 6 weeks postpartum (PP). Due to surgical cancellations, the patient ultimately underwent aortic root replacement 3 months PP.

Discussion: Pregnancy may accelerate aortic root dilation of Marfan syndrome due to cellular changes in the elastic wall of the aorta as well as hemodynamic changes. Patients with a genetically mediated aortopathy such as Marfan's should undergo replacement when aortic diameter is 50 mm or growth is >5 mm/year (class I recommendation); prophylactic replacement should be considered pre-conception when aortic diameter >40 mm (class IIa).1 Rapid aortic dilation became apparent at 34 weeks GA in our patient, and it was necessary to weigh the risk of dissection with continuation of pregnancy against the risks of prematurity. Cesarean delivery is recommended to avoid increases in aortic intraluminal pressure and shear force across the aorta, which are common during the second stage of vaginal delivery. Neuraxial anesthesia was desirable to help maintain even hemodynamics, though effective blockade was challenging, as is common in Marfan patients due to a high prevalence of scoliosis and dural ectasia.2 Following cesarean section, there are no guidelines for the safe timing of CPB-dose anticoagulation in a case that is neither emergent nor elective, as was the case in our patient. The risk of life-threatening post-operative hemorrhage must be weighed against the risk of aortic dissection.

References:

1. Circulation 2010;121:266-369
2. Int J Obstet Anesth 2014;23:287-8

Abstract #:SA-79

Pulmonary Artery Thrombectomy in a Postpartum Patient

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Introduction: Venous thromboemboli (VTE) can be disastrous in pregnant and postpartum patients. Prophylaxis is crucial but does not guarantee against embolic events. We present a case where a postpartum patient developed near fatal pulmonary embolus despite appropriate prophylaxis as well as management of emergent pulmonary thrombectomy.

Case Presentation: 36 year old female presented 3 days after cesarean section with sudden onset chest pain and shortness of breath. History was significant for VTE 5 years prior which was attributed to immobilization and oral contraceptives. During pregnancy she was placed on prophylactic enoxaparin until one week prior to her scheduled delivery, when she was transitioned to subcutaneous unfractionated heparin (UFH). Upon arriving to the hospital on PPD #3 she was tachycardic and tachypneic with SpO2 87% on room air. CT showed saddle pulmonary emboli. She was transferred to a tertiary medical center for further care. Following transfer she was taken to the operating room for emergent pulmonary artery thrombectomy. Despite cautious induction using fentanyl, midazolam, and propofol, she suffered near circulatory collapse requiring boluses of phenylephrine, epinephrine, vasopressin, and an epinephrine infusion; this was later presumed to be due to right-to-left shunting through a previously unrecognized patent foramen ovale (PFO). Intraoperative transesophageal echocardiography demonstrated right ventricular pressure and volume overload, pulmonary artery thrombus, and a PFO. She was started on inhaled epoprostenol and placed on cardiopulmonary bypass for thrombectomy and PFO closure. Epinephrine and milrinone were required post-bypass and she was extubated within hours of surgery. Ultrasound demonstrated right lower extremity DVTs. Postoperatively she was continued on therapeutic UFH, vasoactive infusions weaned, inferior vena cava filter placed, and transitioned to warfarin. She was discharged home POD 7 and continues to do well.

Discussion: Anticoagulation following cesarean section increases the risk of postpartum hemorrhage. Current guidelines recommend waiting 12 hours for prophylactic and 24 hours for therapeutic enoxaparin or UFH after delivery (1). Although treated appropriately, this patient likely developed VTE during the time prophylactic anticoagulation was held. Expedient transfer to a tertiary center for definitive operative management proved to be life-saving.

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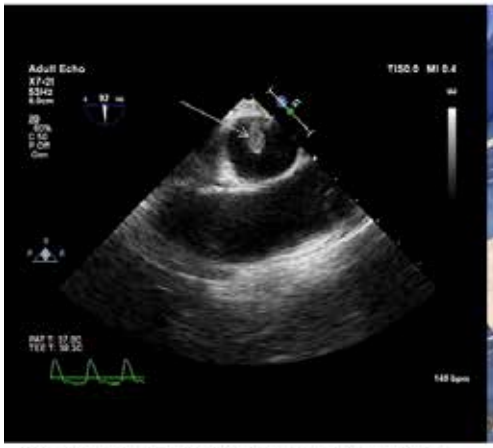
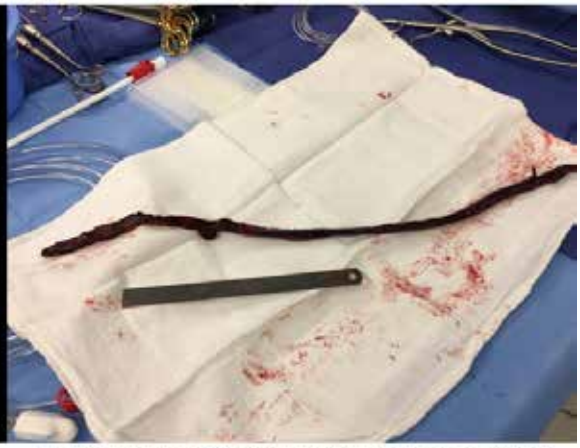


TEE, midesophageal ascending aorta long axis view (90°) – Large thrombus is visualized in the right pulmonary artery



14 inch pulmonary embolus evacuated from main pulmonary artery, as well as bilateral pulmonary arteries

Sunday, May 22, 2016

Abstract #:SU-01

Minimal Opioid Anesthetic Use in India

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Tight governmental regulation reduces access to opioids for India's hospitals. Less postoperative monitoring also encourages use of non-respiratory depressant drugs, especially via the intrathecal route.

This case report highlights the low-opioid anesthesia practice common in Punjab, India. A 25 year old ASA I primigravida with breech position presents for Cesarean section. Preoperatively, the patient receives 50mg of oral diclofenac. The anesthesiologist administers a 0.5% bupivacaine only spinal, and post neonatal delivery with APGARs 8 and 9, administers 1mg of intravenous butorphanol. Postoperatively, the patient received 75mg of intramuscular diclofenac every 8 hours for analgesia.

Due to restricted access, anesthesiologists in Punjab heavily utilize non-ultrasound based regional techniques, non-opioid analgesics, and low abuse potential opioids such as butorphanol. Epidural utilization, while increasing, is still uncommon due to cost, lack of knowledge, and prevalent cultural beliefs.

Abstract #:SU-02

Spontaneous epidural abscess during pregnancy

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Introduction: The typical presentation of an epidural abscess includes fever, back pain and neurologic deficit.1 However, this triad is not always manifested so clearly.1 Our patient experienced only one of these symptoms underscoring the importance of a high index of suspicion and urgent imaging when an epidural abscess is suspected. We present a case of a woman at full term with a history of drug abuse and hepatitis C who developed an epidural abscess causing paralysis requiring urgent delivery secondary to active labor followed by a decompressive laminectomy. She had a viable infant but did not regain function in her lower extremities.

Case Description: A 31 yr old G4P3 woman at 37 1/7 weeks presented to an outside hospital with acute onset weakness in her bilateral lower extremities. Her history included hepatitis C, drug abuse, and three prior cesarean deliveries (CD). MRI revealed a 4x1x1cm epidural mass at T9-T12 with cord compression. On arrival to our ICU she had 0/5 strength, decreased sensation in bilateral lower extremities and no rectal tone. During her evaluation she was noted to be in active labor and, given her history of multiple prior CDs, the decision was made to proceed with CD and BTL followed by a laminectomy. She had a normal BMI, airway and normal heart and lung exams. She was brought to the OR and a RSI was performed with lidocaine, fentanyl, propofol, and succinylcholine. An infant was delivered with APGAR scores of 7 & 9. He was positive for cocaine & opiates. Placement of the arterial line was difficult but was achieved prior to the laminectomy. The patient was then turned prone and underwent a T10-T11 hemilaminectomy and decompression. She tolerated the procedure well, was extubated, and transported to the ICU. She was discharged on POD 12 to a rehab facility. To our knowledge, she has not regained motor function.

Discussion: While the incidence of substance abuse during pregnancy is relatively high at 5.2%,(2) spontaneous epidural abscesses during pregnancy are extremely rare.3 Risk factors include IV drug use, alcoholism, diabetes, infection and immunosuppression.3 When our patient initially presented, it was evident she suffered a major neurologic insult however these patients can simply present with back pain & fever. Thus it is important to have a high index of suspicion particularly if other risk factors are present. Our patient went into active labor with variable decelerations 15 minutes before proceeding to the OR and while we were concerned that delaying the laminectomy may cause permanent paralysis, we were more concerned for intra-operative uterine rupture and IUFD. Ultimately, we decided to proceed with delivery followed by the laminectomy. Identification of an epidural abscess during pregnancy may be more difficult but rapid diagnosis followed by definitive treatment is critical.

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2. Med Clin North Am. 1997; 81:979.
3. Obstet Gynecol. 2010; 116:498-501.

Abstract #:SU-03

Catastrophic Antiphospholipid Syndrome Presenting in the Puerperium Period

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Co-Author: Agnes M Lamon M.D. - Duke University Medical Center - Durham, North Carolina
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Introduction: Catastrophic Antiphospholipid Syndrome (CAPS) was first defined in 1992 by Asherson and is characterized by small vessel occlusive disease with high associated mortality around 50% [1]. Diagnosis is difficult, especially during pregnancy, as it can mimic or coexist with other more common microangiopathic syndromes [2]. Although rare, CAPS should be considered in pregnant women with microangiopathy and a history of antiphospholipid syndrome (APS).

Case: A 26-year-old G2P0010 at 25 weeks presented with acute onset RUQ and epigastric pain. PMH was significant for APS diagnosed in the setting of recurrent venous thrombosis, later serologically confirmed. The patient was maintained on warfarin anticoagulation and transitioned to LMWH prior to becoming pregnant. Initial laboratory tests were unremarkable and RUQ ultrasound was negative for gallbladder pathology. On hospital day 2, she had a witnessed tonic-clonic seizure. A brain MRV showed posterior reversible encephalopathy syndrome (PRES) with no evidence of hemorrhage, infarct, or thrombosis. Labs revealed thrombocytopenia to 22,000 and AST and ALT elevations greater than 1000. Initial data was concerning for eclampsia/HELLP syndrome, and the patient underwent a C-section under general anesthesia. Postpartum, the platelet count recovered to 102,000 and liver enzymes began to normalize. The patient's abdominal pain resolved. On POD3 the patient complained of new back pain; she was treated with analgesics and discharged home on POD4. She was readmitted within 24 hours for severe back pain, fever, and tachypnea. On POD5, lab testing revealed thrombocytopenia again (42,000), and hematology was consulted. A V/Q scan showed chronic pulmonary emboli, and MRI of the abdomen revealed small wedge shaped infarcts of the liver. No infectious etiology was found, and given her history of APL, the diagnosis of CAPS was suspected. The patient was started on high-dose steroids and plasma exchange on POD9. She had marked improvement in clinical symptoms and her platelets recovered to normal range after 6 rounds of plasmapheresis.

Discussion: Venous thromboembolism risk increases significantly during pregnancy with up to a 20-fold increased risk reported in the puerperium period, likely even higher in patients with APS. Unlike APS, however, CAPS predominantly affects small vessels, resulting in multiple-organ failure, which leads to a systemic inflammatory response and organ dysfunction [3]. The most common organ systems affected are renal, pulmonary, dermatologic, and cerebral. In the majority of the cases the trigger is unknown, but can be from infection or trauma. Here we describe a complicated case of eclampsia, HELLP, and CAPS and investigate the challenge of diagnosing a rare microangiopathic disease in the setting of a complex patient.

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Abstract #:SU-04

Anesthetic Management of a Cesarean Section in a Parturient with New Onset Multiple Myeloma Complicated by a Sacral Plasmacytoma, a Case Report

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Introduction: Multiple myeloma (MM) involves the neoplastic growth of plasma cells which produce immunoglobulins. Only one prior case has addressed anesthetic considerations in pregnancy (1). We present the anesthetic management for delivery of a parturient with newly diagnosed MM, complicated by a sacral plasmacytoma.

Case: A 26 year old G1P0 presented at 31 weeks EGA with 5 weeks of low back pain. Labs showed hypercalcemia (18.2 mg/dL) and acute renal failure (Cr 2.09 mg/dL). Pelvic MRI revealed a lytic mass in the right sacral ala (4.4 x 3.0 cm), extending across the SI joint, with extraosseous spread to adjacent soft tissue and marrow replacing lesions. X-rays found disease in the left humerus and femur. A CT guided biopsy showed CD 138+ plasma cells with kappa light chain restriction. Combined with high urine free kappa light chains, the diagnosis of MM was established. Following treatment, (IV fluids, diuretics, calcitonin, pamidronate, dexamethasone) a plan for vaginal delivery was formulated by a multidisciplinary team. However, PPROM, polyhydramnios, fetal edema, and uncontrolled pain necessitated operative delivery 2 weeks later. With no evidence of macro lesions in the lumbar vertebrae, we planned a spinal anesthetic. As sitting was too painful, we placed the spinal laterally at L3-4 and a cesarean section (C/S) was performed for a viable male infant. In anticipation of severe postoperative pain, 20 mL liposomal bupivacaine was injected incisionally and multimodal analgesia including hydromorphone, pregabalin, tramadol, and a lidocaine patch was utilized. Subsequently, she underwent radio (32Gy) and chemotherapy (bortezomib, dexamethasone); unfortunately, the plasmacytoma caused cauda equina syndrome requiring operative decompression. Her disease now involves the axial and appendicular spine.

Discussion: The pathobiology of MM is complex, leading to replication of a malignant clone of plasma cells (2). It is responsible for up to 10% of hematologic malignancies. MM during pregnancy is rare as the median age at diagnosis is 66, with just 2% younger than 40. Of 32 cases during pregnancy since 1965 (3), only one discusses anesthetic considerations (1). Most delivered by C/S (82%) due to extensive disease and pelvic instability (3). Accepting the risk of pathological fracture, our patient elected for a vaginal birth to facilitate chemotherapy, but C/S became necessary. At maternal request, we chose a single injection spinal over GA (normal coagulation/platelets, no macro lumbar disease). A CSE or epidural were also possibilities, but intense pain limited prolonged positioning and we wished to avoid an indwelling catheter. We describe successful placement of a spinal for C/S in a parturient with rapidly progressing MM. This complicated patient required a collaborative multidisciplinary team for successful delivery.

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Abstract #:SU-05

Recurrent Respiratory Papillomatosis in a Parturient Presenting for Cesarean Section: a Case Report

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Introduction: Recurrent respiratory papillomatosis (RRP) is characterized by multiple benign squamous papillomas, primarily of the larynx which may be multifocal and recurrent, requiring surgical excision.(1,2) Lower respiratory tract involvement leads to respiratory obstruction, pneumonia, abscesses, parenchymal lung destruction, and respiratory failure. (3) We present a 37 wk pregnant female with congenital RRP, morbid obesity and GERD for cesarean delivery (C/S) and PPTL using combined spinal/epidural (CSE) anesthesia.

Case: A 24-year-old G2P1 female (BMI 51) at 37 wks was admitted for repeat C/S and management of RRP. Diagnosed at age 2, she required over 100 CO2 laser excisions to date, complicated by bronchial obstruction, bronchospasm, hypoxia, and bradycardia. After C/S #1 (epidural), she developed SOB, airway obstruction requiring emergent tracheal intubation, and papilloma debridement. A multi-disciplinary team of Obstetrics, Anesthesia, and Otolaryngology (ENT) planned this delivery. Both at 26 and 35 weeks she required bronchoscopic debridement under GA necessitating multiple periods of apnea, (continuous FHR monitoring) and we replaced the 6.0 ETT frequently as it became occluded with papillomas. At 37 wks, she underwent repeat C/S and PPTL with CSE.

Discussion: Papillomaviruses are double-stranded DNA viruses only infecting human epithelial cells.(5) The juvenile form (more prevalent and aggressive) is acquired during passage through the birth canal.(1,4,5) HPV 6 and 11 can undergo malignant transformation to squamous cell CA in the lungs but can be prevented with vaccination.(3) Common symptoms of RRP are hoarseness and stridor and it is often misdiagnosed as asthma in children. When surgery is needed > 4x/yr or lesions extend beyond the larynx, adjuvant therapy (interferon, etc.) is considered.(1) Pregnancy worsens RRP as with our patient.(3) The C/S was performed using CSE (ENT immediately available) to provide a dense spinal block of extended duration (2nd C/S, morbid obesity) and to avoid manipulating her narrow, friable papilloma filled airway. Securing a possibly difficult airway using GA was considered, however we intubated her in the past without problems. This case illustrates the need for multidisciplinary team planning and management to ensure a good outcome.

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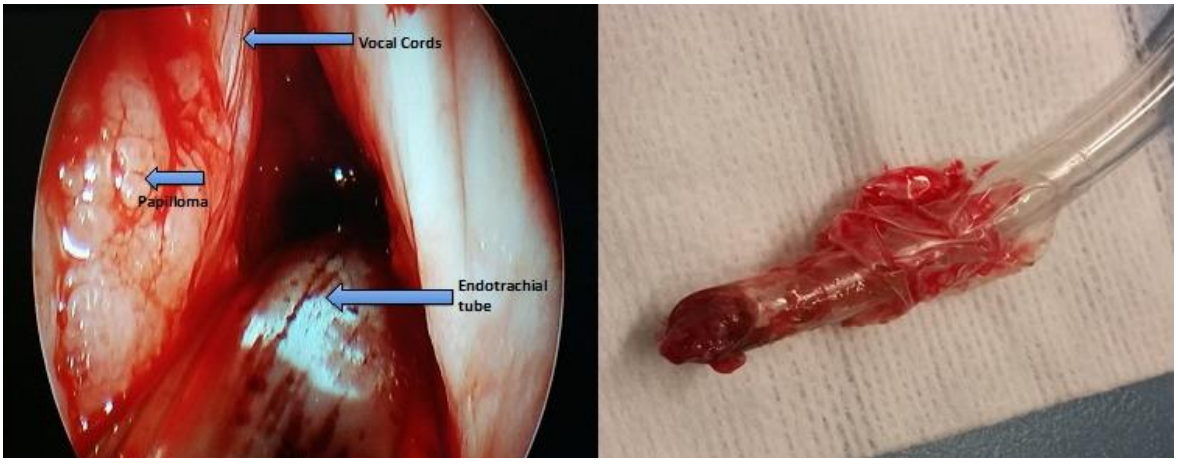

Abstract #:SU-06

Successful use of Epidural Anesthesia for Cesarean Delivery in a Parturient with Unrepaired Coarctation of the Aorta and Post Ductal Aortic Aneurysm

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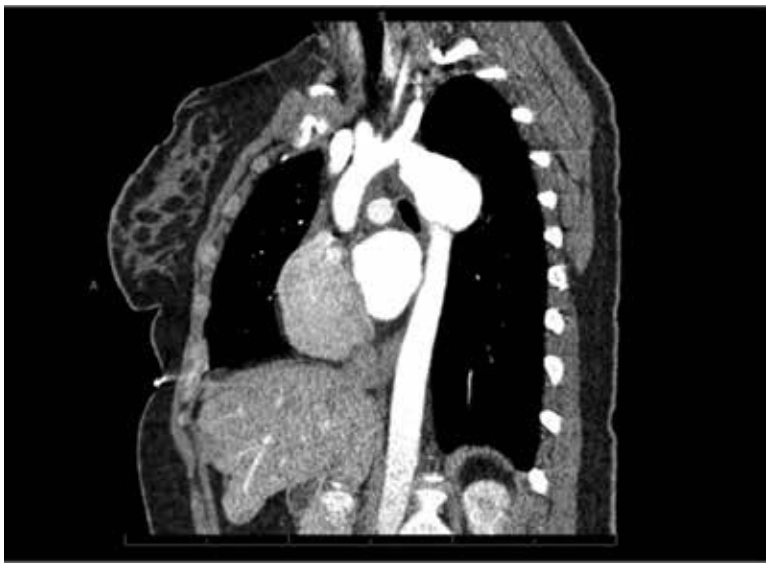
Introduction: The number of parturients with congenital heart disease is growing, which presents unique challenges for the anesthesiologist. These patients normally do well, but during pregnancy there is increased risk to the mother and fetus. We present the successful use of slow controlled epidural anesthesia in a parturient with unrepaired coarctation of the aorta and post ductal aortic aneurysm (F) for cesarean delivery.

Case Report: A 26-year-old G2P1 at 37 weeks gestation presents for primary cesarean section due to fetal malpresentation. She has a history of unrepaired coarctation of the aorta, chronic hypertension and asthma. Her first pregnancy was complicated by pre-eclampsia. The patient was referred to our hospital for palpitations during pregnancy and was found to have undiagnosed significant coarctation of the aorta associated with post ductal aneurysm (5x4cm). Our anesthetic plan was to do slow, controlled epidural for her cesarean delivery. Epidural was successfully placed at the L4/L5 level. Following a negative test dose, epidural catheter was dosed with 3cc of 2% Lidocaine with fentanyl every 5minutes till T6 level of analgesia was reached. A non-invasive blood pressure cuff was placed both in the right upper and lower extremity, and blood pressures were taken every 2 minutes. She had a successful cesarean delivery, resulting in a healthy female infant with Apgar of 7 and 9. 2 months after surgery she underwent repair of her coarctation of aorta and descending aortic aneurysm with cardiac bypass for distal arch augmentation and discharged home uneventfully.

Discussion: Ninety percent of children with congenital heart disease survive into adulthood, due to advances in cardiothoracic surgery. It is crucial for anesthesiologist to understand the physiology of congenital heart disease during pregnancy to manage these patients for obstetric and non-cardiac surgeries. Our anesthetic goal in this parturient was to maintain hemodynamic stability by avoiding severe hypotension which will compromise the fetus because of the coarctation and to avoid hypertension which may rupture the aneurysm. Proceeding with slow dosing epidural anesthesia minimized the effect of the rapid sympathectomy associated with spinal anesthesia and avoided the hypertension associated with induction of general anesthesia. Slow dosing of epidural anesthesia allowed us to keep the patient hemodynamically stable and successfully manage this complex patient.



Abstract #:SU-07

Successful Use of Combined Spinal and Epidural Anesthesia for Intra uterine fetal Thoracentesis due to Evolving Pleural Effusion and Repeat Cesarean Delivery Complicated by Fetal AV Canal Defect with Fixed Bradycardia requiring External Pacing immediately

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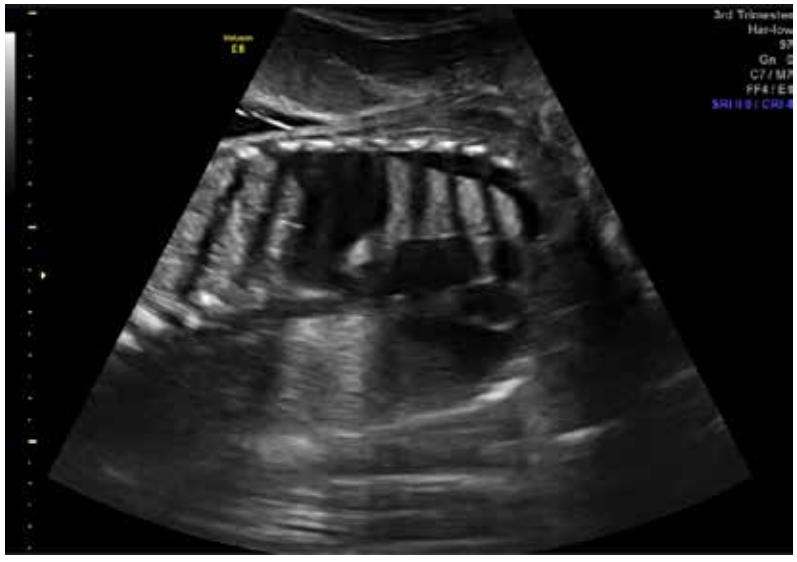
Introduction: The number of high risk parturients we encounter is on the rise. Advances in invasive intra uterine fetal procedures pose a new challenge to the anesthesiologist. We presents a case of successful use of combined spinal and epidural anesthesia (CSE) for intra uterine fetal thoracentesis due to rapidly evolving pleural effusion (F) and repeat cesarean delivery of an infant with known fetal heterotaxy syndrome with AV canal defect and fixed fetal bradycardia requiring external pacing immediately after delivery.

Case Report: A 24-year-old G3P2 parturient with previous 2 cesarean section at 30 3/7 weeks gestation presents for repeat cesarean delivery as the baby has multiple cardiac congenital anomalies as a result of fetal heterotaxy syndrome (Left Atrial isomerism, AV canal defect with fixed bradycardia and a heart rate ranging from 40-55, dextro transposition, interrupted IVC with Azygous continuation) with rapidly evolving large right pleural effusion. The baby required external pacing immediately after delivery. The surgical plan was to perform intra uterine fetal thoracocentesis followed by C-section, for effective pacing and ventilation of the infant post-delivery. Our anesthetic plan was to place CSE for this combined procedure. CSE was placed at the L4/L5 level and 12 mg of 0.75% bupivacaine, 20 mcg of fentanyl and 100 mcg of morphine was initially injected into the intrathecal space. The fetus was paralyzed with 160 mcg of vecuronium for thoracentesis resulting in the removal of 30 mL of pleural fluid. Cesarean delivery was performed and baby was handed to the pediatric team. Immediate external pacing was commenced secondary to fixed fetal bradycardia. Since the procedure finished in 1hr 20 minutes, there was no need for re-dosing. The patient was discharged on post-op day 3. The infant remained in the neonatal intensive care unit status-post permanent pacemaker, and awaiting corrective surgery.



Discussion: As the field of maternal fetal medicine advances, parturients present with a number of rare and complicated fetal anomalies resulting in a plethora of invasive procedures. Epidural, CSE or continuous spinal are the preferred techniques, as repeat dosing is often necessary for intra uterine fetal procedures combined with repeat C-section. In this case we choose to place CSE as the best option for mother and infant.

Abstract #:SU-08

Major placenta previa in a cystic fibrosis patient: A challenging case

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Cystic fibrosis (CF) is a multisystem disorder with significant respiratory implications. Placentia previa is one of the major complications that can lead to catastrophic bleeding. We describe a challenging case of Primigravida (PG) who had CF and insulin dependent diabetes (IDDM) that presented with bleeding placenta previa requiring urgent Caesarean section (LSCS).

Case report: A 24 year old PG, 35+2 weeks, BMI 20 had diagnosed CF and IDDM with FEV1 of 1.1L, VC 2L, PEFR 150-200ml/min (around 50 % of predicted values). She was on long-term antibiotics for repeated chest infection, enzyme supplements and low dose heparin. On routine ultrasound scan, she was found to have placenta previa. Multi disciplinary (MDT) in put was sorted at 10 +6 weeks. Follow up plan was formulated. Patient had recurrent vaginal bleeding. In view of her repeated bleeding, Grade 3 LSCS at 35+2 weeks. Full anaesthetic assessment and detailed discussion with obstetric team was carried out. ICU team was informed and HDU bed was available on labour ward for post op recovery. Cell saver was used peroperatively. Anaesthetic and obstetrics consultant were present during the LSCS. Spinal with 2.5 mls of heavy bupivacaine + 300 micrograms of Diamorphine was used. LSCS was performed and healthy baby 2.4kg was delivered. Intrauterine balloon was placed due to excess bleeding of around 800-1000mls. Syntocinon infusion was started and patient transferred to HDU. Intrauterine balloon was removed next day and patient was transferred at day 2 with uneventful recovery.

Discussion: Incidence of CF is 9.8/100,000 deliveries and CF is 5.2/1000 pregnancies. CF increases risk of respiratory complications, infections and mortality during pregnancy. CF patients also suffer from diabetes and enzyme deficiencies. Placenta previa mostly presents with painless bleeding that could be catastrophic. LSCS, uterine artery embolization, re exploration, hysterectomy etc. may be required as preventative or curative procedures. Anaesthetic management could be particularly challenging, as avoidance of General anaesthesia is desirable but patients may not be able to lie flat awake after regional, for extended periods. Strict Intrapartum diabetic control is required. DVT prophylaxis could be challenging, as timing of antithrombotic agents could be a contraindication for regional anaestheisa; increased risk of bleeding and prompt need to restart anti thrombotic therapy post delivery. Regular physiotherapy, continuation of long-term antibiotics and low threshold for ICU/HDU care is recommended. Anxiety could be a challenging issue. Various anaesthetic options are available. We chose spinal with Diamorphine as patient was quite keen on regional and in case of prolonged surgery or heavy bleeding, we had low threshold to proceed to GA. M.D.T approach and clear planning helped us to resolve issues that arose during the course of this high-risk eventful pregnancy.

Abstract #:SU-09

Emergent cesarean delivery for fetal indications in a patient with persistent hypertension after resection of pheochromocytoma

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Introduction: We present the challenging case of a parturient who required emergent cesarean section for fetal distress in the setting of persistent, severe hypertension after surgical resection of a pheochromocytoma diagnosed earlier in pregnancy.

Case description: A 24 year-old G2P1 with a five-year history of palpitations, flushing, and headaches was referred to our institution with labile hypertension and elevated metanephrines at 17 weeks gestational age. MRI confirmed a 4.3x2.5x4.0 cm right adrenal mass consistent with pheochromocytoma. She was managed medically prior to an uneventful laparoscopic adrenalectomy at 18 weeks. Despite surgical margins suggesting complete resection, metanephrines failed to return to normal levels and the patient was readmitted for uptitration of her antihypertensives at 23 weeks. Her hypertension was refractory to a five-medication regimen and an urgent cesarean section was called at 25 weeks for nonreassuring fetal heart tones. Anesthetic management included a pre-induction arterial line and plan for a combined spinal-epidural which was converted to an intrathecal catheter after an accidental dural puncture. She received 0.3 ml of 0.75% hyperbaric bupivacaine followed by a total of 1.25 ml 0.5% bupivacaine to achieve an adequate surgical block. The patient required only intermittent doses of vasopressors for hypotension after delivery. She developed hypertension in PACU, which was treated, then became hypotensive and required a phenylephrine infusion and overnight ICU admission. The patient's antihypertensives were de-escalated to a three-drug regimen and she was discharged home on postoperative day 6. Unfortunately, her male infant expired from multi-organ failure within the first month of life.

Discussion: Pheochromocytoma, a rare catecholamine-secreting tumor of the adrenal medulla, occurs in less than 0.01% of pregnancies (1). The clinical picture is clouded by the fact that pheochromocytoma can mimic the more common preeclampsia as the cause of hypertension (2). The most serious risks involve patients with undiagnosed disease presenting late to care for emergent delivery, in which sudden hypotension and cardiovascular collapse result in fetal and/or maternal death. In this case, it was unclear whether the patient's persistent hypertension was due to preeclampsia or residual extra-adrenal disease, though her antihypertensives were only able to be de-escalated after delivery. Nonetheless, despite timely medical and surgical management, ideal outcomes were not achieved.

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Abstract #:SU-10

What? Prone Position in a Very Pregnant Patient

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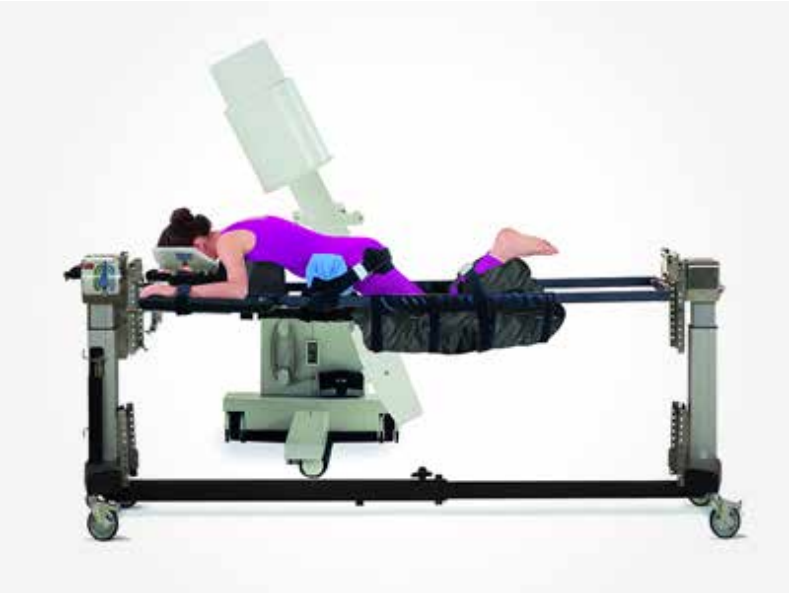
This is the case of a 42-yo G12 P8 female with a 28 week IUP and a large posterior thigh mass. This case posed unique positioning and monitoring challenges. A MRI of the left thigh showed a large hemorrhagic mass in the adductor magnus muscle. Needle biopsy was positive for leiomyosarcoma. Her life activities were greatly affected by pain and she was scheduled for an excision of the mass. She was obese (BMI 40.3) with a history of depression. She was a former Jehovah's Witness, but on discussion of her situation she accepted blood products. Alternatives for surgical positioning were discussed with the surgeon who insisted on an approach to remove the mass by the prone position. The obstetrical team recommended pre and post procedural monitoring of fetal heart tones. A separate maternal fetal medicine agreed that intraoperative fetal monitoring was not needed as well difficult to perform.. It was decided to position her prone position on an open frame modular table system. This table had a spinal surgery top to allowed for individual positioning pads. There was an open area that would accommodate her gravid abdomen freely. See picture.

General anesthesia was induced supine and the patient was turned onto the spinal frame for surgery. During operation, the patient had a rapid blood loss of 1 liter with mass removal, which the surgeon initially claimed was old blood and "Tumor Juice". However, Preoperative Hgb was 10.3 with repeat intraoperative Hgb values of 6.8/6.8/6.2. She received 1U PRBCs in the OR along with vasopressor and fluid resuscitation. Postoperatively upon resumption of supine position with LLUD, fetal heart tones (FHT) were decreased, and the patient was transferred to the labor suite PACU for prolonged fetal monitoring. A second unit PRBCs was soon given and FHT recovered to 100-110s. She also reported painful contractions in the PACU, so the decision was made to start tocolytic therapy with indomethacin and to give betamethasone for fetal lung maturity. Patient's contractions ceased and she and fetus made uneventful recovery.

Two months later she presented in labor and delivered a healthy infant with a labor epidural. However, repeat tumor scans showed recurrent soft tissue mass and a chest CT suggested metastasis. Two weeks later, she was admitted with shortness of breath, back pain, and anorexia. In hospital treatment was by palliative care, psychiatry, and hematology/oncology with planned chemotherapy of gemcitabine/docetaxel.



Abstract #:SU-11

Posterior Reversible Encephalopathy Syndrome Following Inadvertent Dural Puncture for Epidural Analgesia Treated with Epidural Blood Patch

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Introduction: Posterior reversible encephalopathy syndrome (PRES) was first described by Hinchey in 1996 (1) and describes a neuroradiological syndrome with symptoms including altered mental status, vision changes, headache, and seizures. It is characterized by symmetrical white matter abnormalities suggestive of edema on CT and MRI. It has been commonly reported in association with preeclampsia/eclampsia, hypertensive emergencies, immunosuppressive medications, autoimmune disorders, and sepsis. (2,3) There are well documented cases of PRES following dural puncture, however, none related to persistent post dural puncture headache (PDPH) symptoms. We report a patient who presented with postpartum eclampsia and imaging consistent with PRES, complicated by a PDPH. She was treated with anticonvulsant therapy and ultimately, an epidural blood patch.

Case Report: A 22 y/o G1P0 presented in labor at 39 weeks and 2 days EGA. Her labor epidural was complicated by an inadvertent dural puncture. The second attempt at a different lumbar interspace was successful. She had an uncomplicated labor and vaginal delivery. She was discharged on postpartum day 2 without complaint. The next day, she developed a postural headache (PDPH) and despite conservative treatment (caffeine, ibuprofen, acetaminophen), presented to the ED on postpartum day 6 with no relief. Upon arrival, she had a witnessed tonic-clonic seizure and was treated with magnesium (4 gm load, 2 gm/hr infusion) and lorazepam. CT and MRI revealed findings consistent with PRES. After evaluation by her anesthesia provider and a neurologist, an epidural blood patch (EBP) was deferred to allow treatment of eclampsia and improvement of PRES. On hospital day 4, neuroimaging showed resolution of PRES, and she received an EBP using 18 mL autologous blood for the persistent PDPH. Within three hours, the headache was gone; she remains asymptomatic four months later.

Discussion: PRES has been reported in patients with preeclampsia and eclampsia, but may also result from a CSF leak and subsequent intracranial hypotension. (3,4) Treatment includes strict BP control, preventing seizures and treating the underlying condition. (2) Timely recognition of symptoms associated with PRES is crucial for early diagnosis and treatment. PRES associated with PDPH has been reported, but not this remote from delivery. These two distinct disease processes complicated medical intervention in our patient. We waited to place the EBP until her eclampsia was treated and PRES resolved as recommended by Minai (5). This unique case illustrates a successful EBP after treatment of eclampsia and PRES.

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Abstract #:SU-12

Two Parturients Effectively Managed with Therapeutic Fondaparinux after Recurrent or Worsening Thrombosis on other Anticoagulation Therapy

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Introduction: Fondaparinux is a synthetic selective factor Xa inhibitor that can be used to prevent and treat venous thromboembolism (VTE) in patients that have failed or have contraindications to other therapies.(1,2) While fondaparinux use is becoming more prevalent in pregnant patients, there is still limited clinical experience.(2) We present the successful management of two parturients on fondaparinux with recurrent or worsening thrombosis on other therapies.

Case 1: A 22-year-old G1P0 at 31 weeks gestational age (GA) was diagnosed with a left lower extremity DVT and was started on enoxaparin 100mg daily. After developing worsening left leg pain, repeat imaging demonstrated extension of the DVT from the left common femoral vein to the distal iliac vein and IVC. At this time, enoxaparin 60mg BID was started, and she was transferred to our institution at 32 weeks GA. She was then transitioned to a heparin infusion. Given the worsening thrombosis she was placed on fondaparinux 7.5mg/day and a suprarenal IVC filter was placed. Fondaparinux was discontinued 4 days (5 half-lives of the drug) prior to her induction of labor at 37 weeks GA, and the heparin infusion was resumed. Prior to epidural placement, heparin was discontinued for 4 hours and a normalized PTT was verified. Heparin was resumed several hours after epidural placement; she had satisfactory labor analgesia and had an uncomplicated vaginal delivery.

Case 2: A 27-year-old G5P2 presented at 32 weeks GA with preeclampsia. She had history of right thoracic outlet syndrome and multiple right subclavian and axillary vein DVTs as well as VTE. She had recurrent DVTs while on therapeutic warfarin, enoxaparin, and rivaroxaban, and thus was placed on fondaparinux 7.5mg/day. Her fondaparinux was stopped for 4 days prior to scheduled induction of labor, and she was placed on heparin infusion during this interval. An epidural was placed 12 hours after discontinuation of heparin, and vaginal delivery was uncomplicated. Heparin infusion was restarted 6 hours PP prior to being transitioned back to fondaparinux 24 hours PP.

Discussion: The use of fondaparinux in pregnancy complicates the provision of neuraxial anesthesia and delivery; thus, careful planning is necessary to optimize patient care. Given its effects cannot be measured with lab testing, fondaparinux needs to be discontinued several days prior to neuraxial anesthesia.(2,3) In order to provide both patients with neuraxial anesthesia, current recommendations for fondaparinux were observed as it was discontinued for a 5 half-life interval in each patient, and not resumed until 24 hours after epidural removal.3 With thorough planning and close communication between providers, both patients successfully received neuraxial anesthesia and had uncomplicated deliveries after being anticoagulated with fondaparinux during pregnancy.

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Abstract #:SU-13

Peripartum Management of Stenotic Mechanical Mitral Valve Requiring Warfarin Therapy

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Case Report: A 21 year-old primiparous female at 35 weeks gestation presented with gestational hypertension in the setting of a mechanical mitral valve, requiring anticoagulation with warfarin during pregnancy. The patient underwent AV septal defect repair as an infant, followed by 2 mitral valve replacements (MVR), the last being in 1999. She now had significant MV stenosis, necessitating a 3rd MVR, however, she became pregnant before the surgery was performed. Her most recent echo showed peak MV velocity of 2.4 m/s with a 12 mmHg gradient across the valve. She was admitted for anticoagulation with IV heparin infusion, with goal heparin correlation value 0.5-0.7; warfarin was discontinued. Delivery plan was induction of labor at 36 weeks, with discontinuation of heparin during active labor. Upon normalization of aPTT, epidural analgesia would be offered. Cardiology cited a 20% risk of MV thrombosis and death during the period off anticoagulation.

Invasive BP monitoring was initiated. At 3cm cervical dilation, heparin was stopped. A fentanyl PCA was used for labor analgesia, prior to normalization of aPTT. However SVD occurred 2.5 hours later, before neuraxial anesthesia could be offered. NICU was present, but no resuscitation was needed. No fetal defects were noted. Blood loss was 400ml. Oxytocin and cytotec were given. Heparin was resumed 5.5 hours postpartum, and warfarin reinitiated PPD 1.

Discussion: Congenital heart disease in pregnancy is becoming more common, accounting for 25% of maternal cardiac deaths in the last 30 years(1). Mechanical heart valves present many challenges. Acute valvular thrombosis necessitating ECMO or emergent cardiac surgery is a feared complication. Anticoagulation with warfarin, a known teratogen, may be preferred to heparin in pregnancy due to reduced risk of catastrophic valve thrombosis and death. Anticoagulation with heparin throughout pregnancy has been associated with a 15% mortality and 10-fold higher risk of valve thrombosis compared to warfarin(2). While discontinuation of anticoagulation for delivery is necessary, this time period should be minimized, as it presents the highest risk of valve thrombosis.

In patients with mechanical heart valves, multidisciplinary antepartum consultation is imperative. Discussion should focus on type of anticoagulation and risk to fetus, mode of delivery, balancing risk of peripartum hemorrhage with that of valve thrombosis, likelihood of clinical decompensation, active vs. passive second stage of labor, how to minimize time off anticoagulation, need for invasive monitoring and labor analgesia options. Cardiac surgery and the ECMO team should be made aware of the patient. Postpartum anticoagulation should be resumed 4-6 hours after vaginal delivery, 6-12 hours after cesarean delivery(3).

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Abstract #:SU-14

Delivery of Craniopagus Conjoined Twins- The Anesthetic Management and Successful Implementation of Simulation and the Multidisciplinary Approach

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We present a case of a successful delivery of a 30 year old female with craniopagus twins at 32 weeks gestation with premature rupture of membranes. Discovery of the patient's twin gestation occurred at 21 week appointment. At this point the patient was referred to our high risk perinatal center for maternal fetal medicine obstetrical management. We present the anesthetic considerations during this case for both mother and twins during delivery, and use of a multidisciplinary approach to ensure safety for the patients. The teams involved in the planning for the delivery included: high risk obstetricians, anesthesiology, neonatology, respiratory therapy, nursing staff, and neurosurgery. A simulation session was performed and involved the different staff anticipated to be present during delivery. During this session particular consideration was given towards gentle delivery of the neonates (given concern for dural traction), hand off of the neonates, potential for airway compromise, and having adequate resources in the event of severe blood loss with uterine atony.

After careful planning the twins were delivered via cesarean section utilizing neuroaxial technique with a combined spinal epidural. Venous access included two peripheral 18g intravenous lines with a central line kit available if needed. The spinal consisted of morphine, fentanyl and hyperbaric bupivacaine. Her blood pressure was maintained between 120/70 and 140/90, requiring minimal pressor support with phenylephrine. Oxytocin was given after delivery, per protocol, with adequate uterine contraction. Packed red blood cells, fresh frozen plasma, and platelets were readily available if rapid transfusion was required, however the estimated blood loss was 1000cc and no transfusion took place. Total crystalloid given was 2000cc. The procedure lasted one and half hours. No intra-operative complications occurred and the twins were transported to the neonatal ICU for further monitoring. Both infants breathed spontaneously, and airway support was not initially required.

Conjoined twinning is a rare embryological phenomenon reported to occur once in 50,000 to 100,000 live births (1). There are limited numbers of case reports on delivery of conjoined twins, which identify concerns and suggested anesthetic management (3). We present the utility of simulation with members of the care team, to identify possible safety concerns, and the need for a multidisciplinary approach to reduce morbidity and mortality for both mother and children.

Resources:

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Athanasiadis, et.al. (2007) Donald School Journal of Ultrasound in Obstetrics and Gynecology Apr; 44(4):811-20

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Abstract #:SU-15

2 cases of chemical arachnoiditis following epidural blood patch

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Introduction: Chemical arachnoiditis is a rare complication of epidural blood patch (EBP). Although symptoms generally resolve with medical management, in some instances symptoms can be permanent (1). We report two parturients who developed arachnoiditis following EBP for post-dural puncture headache (PDPH).

Case 1: 21yr old G2P1 in spontaneous labor at 39.5 weeks with history of L3-4 radiculopathy (since resolved). Placement of combined spinal epidural (CSE) at the L4-5 interspace was complicated by unintentional dural puncture (UDP) with a 17-gauge Tuohy needle. Following NSVD, on post-partum day (PPD) 1 the patient developed positional headache and underwent an uncomplicated EBP with 20 mL of autologous blood injected into the epidural space at L4-5 with complete relief. On PPD2 she developed unrelenting "lightning-like" pain in her neck and low back radiating into her legs with movement. Neurology consultation revealed meningismus, likely from the translocation of blood into the intrathecal space, and she was started on IV dexamethasone and oral cyclobenzaprine, with slight improvement in her symptoms. On PPD4 she was discharged home with a methylprednisolone taper, cyclobenzaprine, ibuprofen and caffeine-acetaminophen-butalbital. Patient returned to the hospital on PPD6 with worsening low back pain and new lower extremity weakness and numbness, in addition to recurrent PDPH symptoms. MRI revealed mild clumping of the cauda equina roots with subtle leptomeningeal enhancement and a small amount of layering subarachnoid blood. Her symptoms were managed with IV and oral analgesics and she was discharged home the next day. By PPD 10 her symptoms had completely resolved, and MRI four months later showed radiographic resolution.

Case 2: 24yr old otherwise-healthy G1P0 in spontaneous labor at 40.3 weeks who underwent CSE at L4-5 level complicated by UDP, followed by uncomplicated NSVD. On PPD1 patient reported positional headache and had EBP at L3-4 level with 22 mL of blood with improvement in symptoms. On PPD3, patient reported recurrent PDPH symptoms as well as intermittent shooting, electric pains down her inner thigh and calf in a radicular distribution. MRI revealed variable degrees of thecal sac narrowing most pronounced at the T12-L1 level. No definite intrathecal blood products were noted, but it was felt her presentation was most consistent with arachnoiditis. She was treated conservatively with a 5-day course of oral prednisone, tramadol, and gabapentin, and discharged home on PPD6. Patient did not respond to repeated phone calls thereafter.

Discussion: Chemical arachnoiditis can occur after EBP for PDPH, and anesthesiologists should be aware of the signs and symptoms of this uncommon complication. Prompt imaging, neurologic evaluation, and medical management may prevent symptoms from becoming permanent, but further inquiry into this phenomenon is warranted.

References:

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Abstract #:SU-16

Successful Management of An Abdominal Pregnancy

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Introduction: Abdominal pregnancy is rare, occurring in 1/10,000-30,000 pregnancies, and is associated with high morbidity and mortality for both mother and fetus.[1,2] Often, this condition is not diagnosed until complications ensue. Neonatal survival is uncommon.[3] We present our successful management of an abdominal pregnancy resulting in delivery of a live healthy neonate.

Case: A 24 year-old G7P5 at 23 weeks gestational age (GA) presented with abdominal pain and tenderness to palpation. Ultrasound revealed an empty uterus, an echogenic mass representing placenta in the right lower abdominal quadrant, free fluid in the cul-de-sac, and an extra-uterine fetus in the left upper quadrant. GA was determined as 21 4/7. Fetal heart tones were present. Magnetic resonance imaging revealed minimal amniotic fluid around the fetus, adherence of the placenta to the uterus anteriorly, with abutment of the ureters, anterior abdominal wall, right rectus abdominis, and bladder, and coursing of umbilical vessels through mesentery.

Given uncertain fetal survival and risk of maternal hemorrhage, a multi-disciplinary team of maternal-fetal medicine specialists, neonatologists, obstetric anesthesiologists, and gynecologists was formed. The fetus was deemed peri-viable, thus we developed a plan to promote fetal development without compromising maternal well-being.

On presentation, the patient received betamethasone for fetal lung maturity and magnesium for neuroprotection. Given increased perinatal risk to both mother and fetus, and patient preference to avoid emergent intervention, fetal heart tone monitoring was not performed. Bi-weekly ultrasound assessed fetal growth. In absence of maternal hemorrhage, fetal indications for delivery included attainment of 34 weeks GA, or growth restriction.

Fetal growth restriction was identified at 29 weeks GA. In preparation for delivery, the patient received steroids and bowel preparation. As the surgical plan consisted of a small supra-umbilical midline incision, a thoracic epidural for post-operative pain control was placed pre-operatively. Prior to incision, ultrasound confirmed fetal positioning. Subsequently, general anesthesia was induced. Upon tracheal intubation, incision was made and fetus delivered. Umbilical cord was cut and sutured, then returned to the abdomen. To minimize maternal hemorrhage risk, the placenta was not delivered and post-operative subcutaneous heparin was not administered. Estimated blood loss was 50 mL. Neonatal Apgar scores were 6 and 8. The patient's subsequent course was uneventful.

Discussion: With multi-disciplinary input, abdominal pregnancy can be successfully managed. In the case of extensive intra-abdominal placentation, returning the umbilical cord to the abdomen and avoiding placental removal can minimize the risk of maternal peri-partum hemorrhage.

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Abstract #:SU-17

Severe Mitral Stenosis in Pregnancy: A Success Story

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Introduction: Approximately 1% of pregnancies are complicated by cardiac disease with rheumatic heart disease being one of the most common etiologies. This can lead to mitral stenosis, which is the most common clinically significant valvular abnormality in pregnancy (1). Parturients with severe mitral stenosis often do not tolerate the increased cardiovascular demands of pregnancy, and outcomes correlate with New York Heart Association functional classification and severity of the mitral stenosis (2,3). In this case report, we describe successful management of a parturient complicated by severe mitral stenosis with NYHA class III/IV symptomatology by early use of invasive monitoring and an intentional intrathecal catheter.

Case: Our patient is a 33y/o G2P1000 who presented at 35w1d for induction of labor secondary to history of a term intrauterine fetal demise and worsening heart failure symptoms. She had a bioprosthetic valve replacement 5 years prior due to rheumatic heart disease and now presents with acute on chronic valvular heart failure with restenosis. A recent transthoracic echo showed a mean gradient of 17 mmHg, severely dilated LA, and pulmonary hypertension (RVSP 42 mmHg). On presentation, she exhibited class III NYHA symptomatology with JVD present above the ear, distention of the scalp veins, a 2/6 systolic murmur, and mild pitting edema of the lower extremities. She was hemodynamically stable and on room-air.

An arterial line and intentional intrathecal catheter were placed prior to induction of labor. A sufentanil infusion was maintained throughout the first stage of labor, and the patient remained comfortable. A forceps-assisted second stage was successfully completed by creating a saddle block with hyperbaric bupivacaine. The patient was hemodynamically stable throughout. She was transferred to the cardiac ICU for post-delivery optimization, where she had an uneventful course until her discharge.

Discussion: Mitral stenosis is challenging to manage due to the hemodynamic changes of pregnancy. Epidurals are often cited as the regional technique of choice due to the ability to titrate incremental doses coupled with a slower onset that allows the maternal cardiovascular system to compensate for the sympathetic blockade. However, by placing an intrathecal catheter, we were able to ensure proper position and adequate analgesia for the assisted stage II, while maintaining hemodynamic stability. We were able to maintain an acceptable heart rate, adequate venous return, and adequate SVR, while preventing pain, hypoxemia, hypercarbia and acidosis, as well as avoid any Valsalva attempts with our technique, which was tailored to our patient's cardiovascular status.

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Abstract #:SU-18

Two EXIT Procedures at an Academic Institution: A Case Report

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Introduction: The ex utero intrapartum therapy (EXIT) procedure is becoming more frequent. In a fetus with a known compressed airway, the goal is to allow a planned, controlled cesarean delivery in order to secure the airway while the fetus remains connected to the maternal circulation, in order to avoid neurological devastation or death of the fetus. The anesthesiologist must know how to manage the parturient's anesthetic to facilitate the success of the procedure and good outcomes for both mother and neonate.

Case Description: Two EXIT procedures are performed for fetuses with large neck masses causing airway compression. Both masses are discovered upon routine prenatal ultrasound. They are scheduled for first case of the day with an entire team assembled and present prior to beginning. In the first case, the decision is made to defer obtaining large bore IV access and arterial line placement until after induction due to patient anxiety. The patient is induced under general anesthesia and intubated without issue. While intravenous and arterial catheterization are being obtained, the patient's blood pressure lowers slightly but remains within 10% of baseline. However, the fetus becomes bradycardic to 40 and lower. The case becomes a STAT cesarean. The vessel catheterizations are quickly secured while the patient is splash prepped and the obstetricians don sterile attire. Simultaneously, the patient's hypotension is treated with phenylephrine boluses and infusion. The infant is quickly delivered from the uterus, the airway is secured, and neonate is disconnected from maternal circulation and taken to the NICU. The total EXIT procedure portion lasts only 9 minutes. In the second case, all intravenous and arterial catheterizations are performed prior to induction. The patient is induced and intubated. The EXIT procedure proceeds, but the fetus's airway is not able to be secured, so the surgeon performs surgical cricothyrotomy after difficult dissection of the tumor, and the airway is secured. The rest of the tumor is removed en block while the pediatric anesthesiologist manually ventilates the fetus using a self-inflating bag while remaining connected to the maternal circulation. The total EXIT procedure portion lasts 63 minutes. The neonate is taken to the NICU. Both mothers and neonates have good outcomes.

Discussion: It is important to remember that the primary patient is the pregnant woman and therefore the surgery is done at a general hospital rather than a pediatric hospital, though the general hospital should have a neonatal ICU. There must be two anesthesiologist present, one for the mother and the neonate. A walkthrough of the procedure should be performed in the OR with the entire team. The fetus's heart rate may change quickly due to any number of reasons and the team must be prepared for emergent delivery.

Conclusion: The anesthesiologist must be prepared for EXIT procedures that may have varying course and duration.

Abstract #:SU-19

Management of a parturient with congenital heart disease and left transposition of the great arteries with congestive heart failure presenting for cesarean delivery

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Background: The management of parturients with complex congenital cardiac disease is a challenging task for the anesthesiologist. Their complex pathophysiology can lead to hemodynamic instability, arrhythmias and even cardiac arrest under anesthesia. Anesthesiologists must understand the physiology of the individual's pathology and use monitoring and clinical signs to direct care.

Case: We present a 22 year old obese (BMI 41) G4P2012 @ 35+3 with a PMH of acyanotic congenitally corrected left transposition of the great arteries and congenital complete heart block s/p pacemaker placement at the age of 12 presenting to our hospital with worsening dyspnea, intermittent chest pain and a decline in functional status. A TTE showed an EF 20-25%. The patient was admitted to the CCU for acute fluid overload and was treated with furosemide and digoxin. A multidisciplinary discussion was held to discuss optimal timing and approach to delivery.

Once the patient's fluid status was optimized, the decision was made to deliver the fetus via repeat cesarean delivery due to the likelihood of worsening cardiac status. Preoperatively, the pacemaker rate was adjusted to 100 bpm from 80 bpm to assist with expected increases in cardiac output from delivery. A central line and a pre-induction arterial line were placed. The cesarean delivery was successfully performed under graded segmental epidural catheter anesthesia. Throughout the procedure an Edward Life Science Vigileo was used to monitor cardiac output, stroke volume and stroke volume variation. Following delivery, the patient complained of chest pain - her BP dropped to 81/47. Concurrently, her cardiac index increased from 3.4L/min/m2 to 4.8L/min/m2 and then rapidly dropped to 2.7L/min/m2 with a simultaneous fall in SVV from 10% to 5%. Furosemide and additional epidural lidocaine were administered and a dobutamine infusion was added for inotropic support. The chest pain resolved and cardiac parameters returned to baseline. The subsequent surgical course was uneventful.

Discussion: Females with complex congenital heart disease undergo significant cardiovascular challenges during pregnancy and delivery. The increase in cardiac output and intravascular volume from autotransfusion following delivery may trigger cardiac failure. These same patients, however, may become hypovolemic secondary to acute blood loss and those who are pacemaker dependent may be unable to compensate. Discerning which physiological change predominates may prove to be difficult. Our intraoperative use of a non-invasive CI and SVV monitor allowed us to discern this patient was hypervolemic with acute heart failure. This information prompted us to give dobutamine for inotropic support, to bolus the epidural catheter to decrease peripheral vascular resistance and increase vascular capacitance, and to administer furosemide for diuresis.

Abstract #:SU-20

A rare case of C2 sensory blockade with preserved phrenic nerve function

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Introduction: High neuroblockade is an important cause of anesthesia-related maternal morbidity and mortality, and requires prompt recognition and management.(1,2) We present a rare case of high sensory blockade up to C2, that remarkably did not result in hypotension, bradycardia, altered mentation or need for intubation.

Case: A healthy 33 year old nulliparous patient at 40 weeks gestation presented in active labor and had uncomplicated epidural catheter placement at L3-4. She had effective labor analgesia for the next three hours, at which point the decision was made to proceed with emergent cesarean delivery due to recurrent late fetal heart rate decelerations. Her epidural was dosed for surgical anesthesia with fentanyl 50mcg and 2% lidocaine with 1:200K epinephrine 20mL, given in divided doses over 5-6 minutes. This resulted in a T10 sensory blockade, judged to be inadequate for cesarean delivery. 3% chloroprocaine 5mL was administered just prior to skin incision. She was also placed on oxygen 3 L/min by nasal cannula, and received prophylactic IV glycopyrrolate 0.2mg and ephedrine 10mg. After incision, she reported difficulty breathing, and was transitioned to hand-assisted ventilation via facemask. She was unable to move her upper extremities or turn her head. However, she was able to speak quietly, initiate breaths, weakly cough, blink her eyes, and move her facial muscles. Testing revealed a C2 sensory blockade to pinprick stimuli. She did not display any hypotension, bradycardia or loss of consciousness. She received IV midazolam 2mg for anxiolysis. Forty-five minutes after the chloroprocaine dose the sensory blockade had regressed to the C3-4 level. Respirations were assisted for a total of one hour, at which point testing revealed a C5-6 sensory level. She was able to resume unassisted ventilation on face mask oxygen 5 L/min. One hour later she had a T2-3 sensory level, demonstrated full grip strength, and was breathing comfortably on nasal cannula oxygen 2L/min. She was then transferred to the recovery area. The remainder of her admission was uncomplicated and she was discharged with her baby on postpartum day 3.

Discussion: High neuroblockade has been associated with unrecognized intrathecal administration of local anesthetic(2) and with spinal anesthesia after failed epidural block,(3) but can also occur with epidural dosing.(2) The phrenic nerve (C3-5) provides motor innervation to the diaphragm, and despite having a C2 sensory blockade she retained at least partial diaphragm function demonstrated by the ability to initiate breaths throughout the procedure. Differential nerve block in which sensory block level is several dermatomes higher than motor blockade may occur with both spinal and epidural anesthesia, though is rarely observed in clinical practice.(4)

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Abstract #:SU-21

Management of Postpartum Headache: Thinking Outside the Box

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Intro: Headache is common in the postpartum period. There are many reasons for headache following delivery, and differential diagnoses should include both anesthesia and non-anesthesia related etiologies. Thoughtful work-up is necessary to provide patients with proper treatment.

Case report: The patient is a 44 year-old G3P0 with a mono-di twin pregnancy at 33 weeks' gestation who presented for cesarean section (C/S) due to elevated dopplers in Twin B. Her history was notable for Factor V Leiden deficiency, without prior venous thromboembolic events. The patient was not receiving anticoagulation. She underwent an uncomplicated C/S under single-shot spinal anesthesia and was discharged to home on postpartum day (PPD) #2. On PPD#8, the patient returned to the hospital with a chief complaint of headache located in the frontal and parietal regions that she reported began on PPD#2. The headache was initially intermittent, but became continuous in nature. There was no associated fever, nausea, photophobia, or other neurologic symptoms. Both oxycodone and ibuprofen failed to provide significant relief. Anesthesiology was consulted for an epidural blood patch. However, the likelihood of postdural puncture headache (PDPH) was thought to be low given that the headache lacked a postural component and that spinal anesthesia had been performed with a single pass of a 27G Whitacre needle. Magnetic resonance imaging (MRI) of the brain showed no evidence of hemorrhage, intracranial mass, cerebral venous sinus thrombosis, intracranial hypotension, or dural enhancement. However, it did reveal a possible right cervical internal carotid artery (ICA) dissection, which was further evaluated with magnetic resonance angiography (MRA) of the head and neck. MRA revealed severe focal narrowing of the right cervical ICA lumen approximately 3.5 cm above the bifurcation with an intramural hematoma secondary to dissection. The patient was immediately started on low molecular weight heparin and warfarin. She was discharged to home on PPD#11 with neurology follow-up in place. Repeat MRA 3 months later demonstrated interval improvement in the right cervical ICA with normal vessel caliber above and below the dissection.

Discussion: Although rare among postpartum patients, carotid artery dissection should be considered in the differential diagnosis of postpartum headache. The typical presentation is ipsilateral head, neck, facial, or ophthalmic pain. Horner's syndrome and/or ischemic cerebral events can also occur. Diagnosis hinges on a complete neurologic examination and non-invasive neuroimaging. Physiologic changes of pregnancy are one proposed mechanism that may predispose women to spontaneous dissection. Treatment is centered on anticoagulation to prevent thrombus formation and propagation.

References:

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Abstract #:SU-22

Severe Portopulmonary Hypertension Complicated by Congenitally Interrupted Inferior Vena Cava

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Introduction: Pulmonary hypertension (PH) has been associated with maternal mortality rates of 30-50%.(1) Early targeted therapy and multidisciplinary management are essential to optimize patient outcomes. We present the management of a patient with severe PH secondary to liver disease complicated by congenitally interrupted inferior vena cava (IVC).

Case: A 24 year old G1 female presented with a history of biliary atresia status post segmental liver transplant as an infant, portal vein stenosis resulting in liver failure, and portopulmonary hypertension. She also had a history of polysubstance abuse and noncompliance with her immunosuppressants and sildenafil. She initially presented to pulmonology at 20 weeks gestational age (GA) for right heart catheterization, which revealed PAP 90/44 and PCWP 14 mmHg. Transthoracic echocardiogram (TTE) showed a severely dilated RV with moderate systolic dysfunction. She was admitted for initiation of IV epoprostenol, which was titrated based on serial TTEs. Cardiac surgery was consulted for delivery planning in case ECMO was required. Cannulation strategy was complicated by interrupted IVC, which would likely result in inadequate venous drainage. Delivery was planned at 38 weeks GA. Left internal jugular (IJ) central line was placed preoperatively. Left radial arterial line was placed prior to induction. Cesarean delivery and tubal ligation were performed under general anesthesia. She was not a candidate for neuraxial anesthesia due to platelet dysfunction associated with IV epoprostenol as well as coagulopathy due to concomitant liver failure. Intraoperatively, she was maintained on IV and inhaled epoprostenol, as well as milrinone and epinephrine infusions. These were titrated based on intraoperative TEE and maternal hemodynamics. A right femoral arterial line was placed for arterial access, with plans for femoral venous and left IJ venous cannulation if ECMO was required for refractory RV failure. She remained hemodynamically stable, was extubated in the OR and taken to the ICU postoperatively. She was discharged on postoperative day 7. She was weaned off of her IV epoprostenol over 7 months and transitioned to oral PH medications.

Discussion: Pulmonary hypertension can occur in liver transplant recipients with or without portal hypertension, possibly from microscopic portosystemic shunts or even primary PH.(2) Severe portopulmonary hypertension treatment (anticoagulation, IV epoprostenol) requires strict patient adherence.(3) The optimum timing of delivery is uncertain and involves assessment of both maternal and neonatal risk. Cesarean delivery avoids the pushing during the second stage of labor which can cause adverse hemodynamic effects, although both general and neuraxial anesthesia also require vigilance to minimize peripheral vasodilatation.(4)

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Abstract #:SU-23

Holt Oram Syndrome in a Parturient

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Introduction: Holt Oram Syndrome is a rare autosomal dominant disorder characterized by cardiac and upper extremity anomalies. We present a case of severe Holt Oram Syndrome in a parturient.
Case presentation: A 30 year old G1P0 with diagnosis of Holt Oram Syndrome, incomplete AV canal defect status post repair, mechanical mitral valve replacement (on coumadin), tricuspid valvuloplasty, complete heart block, ventricular tachycardia status post pacemaker/AICD, scoliosis with moderate restrictive lung disease s/p lumbar fusion, and bilateral radial deformities was seen in high risk obstetric anesthesia consultation at 18 weeks EGA. She was followed by adult congenital heart disease and maternal fetal medicine clinic during her pregnancy, and although both providers recommended early termination, the patient refused. Systolic function declined during pregnancy to an ejection fraction (EF) of 35%. At 24 3/7-weeks EGA she presented to the ED in acute heart failure after 3 days of fatigue and 1 day of dyspnea (last office visit was 10 days prior and the patient did not notify her cardiologist of worsening symptoms). She was intubated with some difficulty in the ED and brachial arterial line, central venous catheter, and pulmonary artery catheter were placed. EF was estimated to be 10%. Her cardiac status was optimized over the next 48 hours in the CICU on dobutamine and furosemide infusions. Cesarean delivery was performed under GETA at 24 5/7-weeks EGA, with intraoperative TEE by cardiac anesthesia. A live born infant with features consistent with Holt Oram Syndrome and coumadin facies was delivered and transferred to the NICU. The patient was extubated on POD 3 and discharged to home on POD 9. She continues to follow with heart transplant service and was without further hospitalizations to date.

Discussion: Holt Oram Syndrome is a rare autosomal dominant disorder, characterized by cardiac anomalies, restrictive lung disease, potential for difficult airway, and upper extremity anomalies. Congenital cardiac anomalies vary from asymptomatic to severe malformations, with potential for progressive heart failure as pregnancy advances. Dysrhythmias and heart block are also features of the syndrome and patients may present with prior pacemaker/AICD placement. Skeletal abnormalities typically include deformities of the upper extremities including hypoplasia of the thumb and radius, which may prove for challenging arterial and venous cannulation. Difficult airway management has also been described in this patient population; our patient required multiple intubation attempts for which Glidescope intubation was ultimately successful. Lastly, ethical issues abound in the care of some parturients. Despite poor prognosis for our patient and her newborn with repeat counseling on benefits of termination for the mother, ultimately our patient was determined to continue her pregnancy and suffered serious morbidity due to this decision.
Ioscovich 2007
Kanniah 2009

Abstract #:SU-24

Could Epidural Patch With Autologous Platelet Rich Plasma Be A Solution For Postdural Puncture Headache Refractory To Epidural Blood Patch?

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Background: The accepted treatment for confirmed severe post-dural puncture headache (PDPH) is an epidural blood patch (EBP).However, initial success rate of EBP varies from 50 to 60% which may increase up to 60-75% after 2nd EBP. In the event of incomplete recovery of the PDPH after EBP, we still need alternative solutions.
Platelet rich plasma (PRP) is a concentrated source of autologous platelets that contains and releases several different growth factors and other cytokines to stimulate healing of bone and soft tissue via degranulation of circulated platelets. Because of the potential of PRP to regenerate tissues resulting in healing through the effects of bioactive molecules, PRP therapy has gained popularity in many disciplines (1, 2).
Therefore, we aimed to present whether use of PRP for epidural patch could completely treat persistent PDPH after failed EBP via avoiding cerebrospinal fluid leakage due to healing of defect in the dura.

Case Report: A 34 year-old parturient (172 cm height and 91 kg weight) who received EBP at a different institution was admitted to our unit because of persistent severe headache localized mainly to the frontal area. She has been still suffering from severe PDPH though she recently received EBP 3 days ago at the hospital where she delivered.
The patient had an unbearable headache while she was erect, which was partially relieved in the supine position in the beginning. After evaluating the severity of the pain, we have re-confirmed the clinical diagnosis of PDPH.
Before attempting another EBP, MRI of the brain and lumbar region with contrast was performed. Brain MRI showed diffuse pachymeningeal thickening and contrast enhancement with enlarged pituitary consistent with intracranial hypotension.
After obtaining written informed consent of the patient, epidural block using loss of resistance with saline was performed between L2–3 intervertebral space at the 1st attempt in the sitting position. Meanwhile, 20 ml venous blood sample from the left arm of the patient was collected under sterile conditions to prepare PRP to use for epidural patching. Increase in platelet concentration, platelet activation and growth factor concentration of PRP was verified by platelet count (7 times), beta-thromboglobulin (8.5 times) and platelet-derived growth factor (7.6 times) levels.
Then, 10 mL of autologous PRP (PRO-PRP Kit, PNC International Co. Ltd) was injected to epidural space. She was discharged after 6 hours. Clinical improvement in the severity of PDPH with decreased pachymeningeal contrast enhancement on postoperative control MRI was observed after 3 days.

Conclusion: We have presented the first successful use of PRP for epidural patch to treat persistent PDPH refractory to conventional EBP in a multiparous patient delivered under epidural analgesia.

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Abstract #:SU-25

Spine imaging and sequential combined spinal epidural (CSE) in a parturient with acromesomelic dysplasia undergoing cesarean delivery

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Acromesomelic dysplasia is a rare genetic condition characterized by short stature, short limbs and hands, and skeletal abnormalities of the spine 1(Fig.1A). Anesthetic challenges with dwarfism have been described.2 Unlike achondroplasia, the spinal canal is proportionately short. Regional anesthesia with acromesomelia has not been reported.

A 28-year-old G1P0 (114cm, 36K) was scheduled for elective cesarean delivery (CD) at 37 weeks. She tolerated the 3rd trimester well. Her history was significant for asthma. Her airway and facies were normal. She had no past anesthetics and desired an awake delivery. MRI one year prior for sciatic pain showed vertebral dysplasia, flattened lumbar spine, bulging discs and narrowing of the spinal canal (Fig.1B).

Proper spinal dosing of patients with torso-proportional dwarfism is unknown. Spine anomalies can lead to unpredictable spread. We chose to perform an ultrasound-guided sequential CSE. Ultrasound (US) clarified the level, depth and path to the epidural space. We used a pediatric BP cuff, had size appropriate airway equipment available, and discussed the slow induction of anesthesia with the team, with external fetal monitoring (ECM) to be maintained for induction.

The CSE was done at L3-4 in the sitting position (17G Weiss, 25G Whitacre, 20G single port Arrow Flex-tip). Ligamentous feel was firm. Loss of resistance was well-defined. The epidural depth was 3cm as seen on US. Spinal drugs included 2.25mg of 0.75% hyperbaric bupivacaine, 5mcg fentanyl and 30mcg hydromorphone. The epidural catheter was threaded 3cm. The initial level after 10 minutes (5 minutes sitting plus 5 minutes reclining in the surgical position) was T10. Over the next 30 minutes, a total of 6mL of 2% lidocaine with epinephrine was administered in divided does via the epidural to achieve a level of T5. CD proceeded uneventfully with the delivery of a healthy baby (2980g).

Acromesomelia is a form of dysplasia that includes axial skeletal anomalies with proportional shortening of the spinal canal. The information obtained from the MRI and US were useful adjuncts to clarify anatomy and depth of needle insertion. The utilization of slow titration of anesthesia with sequential CSE technique, communication with the obstetric team and continued EFM allowed for a controlled, non-stressful induction of anesthesia with minimal hemodynamic and respiratory compromise.

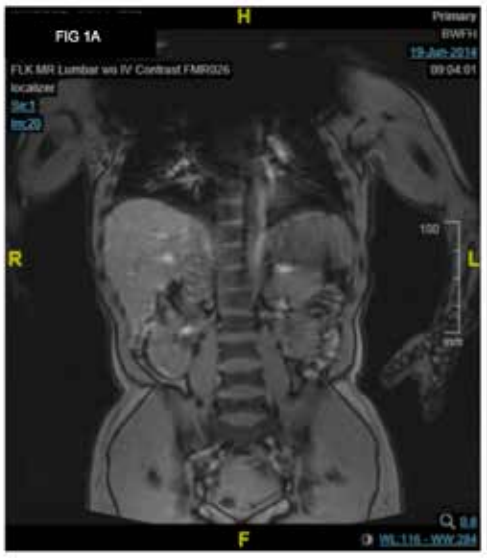

Fig 1A
-Short stature with disproportionate short limbs, metacarpals and phalanges

-Torso length proportional to height

Fig 1B
-Flat lumbar spine with spinal cord ending at L1

-Vertebral dysplasia with characteristic decreased posterior height

-Expansion of posterior disc spaces with bulging discs and narrowing of spinal canal

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Abstract #:SU-26

Thymoma Presenting as a Thoracic Mass in a Parturient

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Introduction: Thymic tumors in pregnancy are considered extremely rare, given the 0.1% incidence of cancers diagnosed in pregnancy. We present a case of a large right mediastinal thymoma in a parturient.

Case Presentation: A 25-year-old G3P2 at 14 5/7 weeks EGA presented with intermittent RUQ abdominal pain, non-productive cough and 2-pillow orthopnea. Exam revealed thyromegaly and decreased breath sounds over the right hemithorax. SpO2 was 99% on room air. Chest x-ray revealed a large right pleural effusion and lobular mass. MRI revealed a 19 cm lobulated mixed solid and cystic mass within the right hemithorax with mass effect on the right lung and diaphragm, abutting and possibly invading the pleural space and mediastinum. The patient had an IR ultrasound guided biopsy; cytology was consistent with thymoma. At 15 6/7-weeks EGA she underwent surgical resection of the mass. Day of surgery she reported new symptoms of fatigue, SOB and palpitations. She received a thoracic epidural pre-operatively as well as an arterial line prior to induction. She was placed in a semi-recumbent position and slowly induced with midazolam, fentanyl, and sevoflurane. After adequate ventilation was confirmed, propofol was administered and she was intubated with a left double lumen tube. A right internal jugular TLC was placed and the operation proceeded with a right thorocosternotomy and complete resection of the mass. The patient remained hemodynamically stable and tolerated the procedure well. Estimated blood loss was 350 mL. She was transferred to the surgical ICU and extubated 6 hours later. Fetal heart tones were confirmed pre and post-operatively. Postoperative course was uneventful and the patient was discharged on POD 6. She delivered a healthy female infant at term.

Discussion: Managing a large intrathoracic tumor in a parturient presents several unique challenges. Although parturients are considered a 'full stomach' and at risk for aspiration, we chose to maintain spontaneous ventilation and proceed slowly with induction to ensure adequate ventilation and oxygenation, given the risk of airway compromise due to acute obstruction far exceeded the risk of pulmonary aspiration. Maintenance of adequate perfusion, ventilation, and oxygenation is imperative to ensure fetal well-being. Coordination of care between thoracic surgery, maternal fetal medicine, and obstetric anesthesia were instrumental to this patient's successful outcome.

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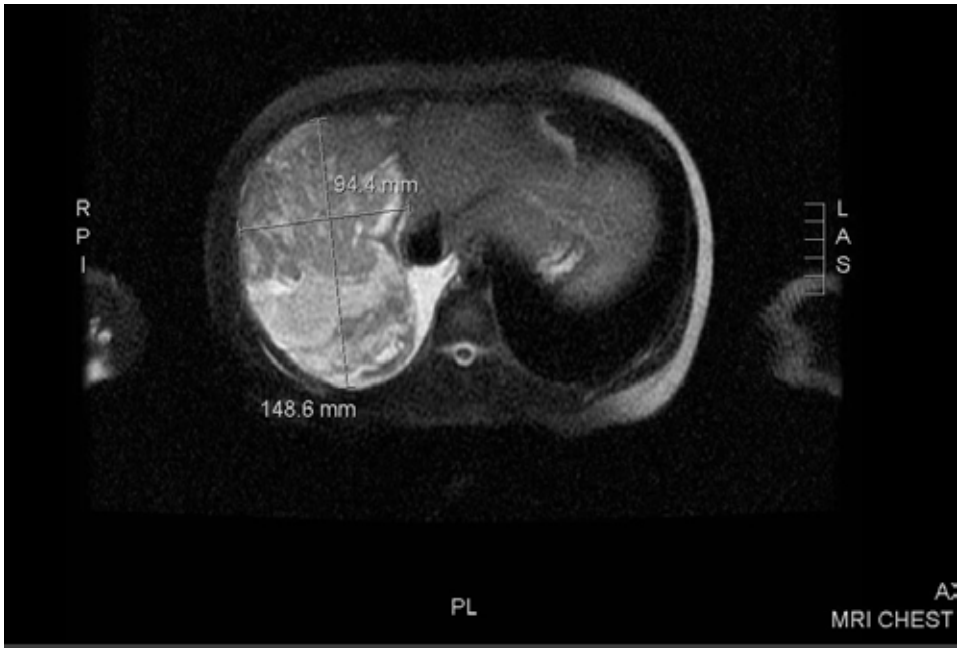

Abstract #:SU-27

Anesthetic Management of Parturient with Pituitary Macroadenoma

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Pituitary macroadenoma is a rare condition in pregnancy. Many aspects of management for the obstetrical patient with pituitary macroadenoma are unclear. Medical management is one area that has been established by the Endocrine Society (1). However, mode of delivery and anesthetic management are less clear. Successful cesarean sections and operative vaginal deliveries both have been reported (2, 3). For patients undergoing cesarean section arguments have been made for regional and general anesthesia. Both methods of anesthesia can increase intracranial pressure which has the potential for intracranial or subarachnoid hemorrhage (4).

We present a case of a 30 year old G2P1001 with enlarging and symptomatic pituitary macroadenoma treated with bromocriptine complicating her pregnancy. The patient underwent successful cesarean section at 37 weeks gestation under general anesthesia. On postoperative day one the patient was found to have worsening symptoms and imaging that demonstrated hemorrhagic changes and enlargement of the adenoma with compression of the optic chiasm and mass effect on Meckel's cave. Subsequent removal of the mass was performed on post operative day three.

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Abstract #:SU-28

Severe Preeclampsia, Platelet Count 40,000, and Spinal Anesthesia for Cesarean Delivery: Navigating Uncertainty at the Intersection of Patient Autonomy and Non-Maleficence

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A 28-year-old G2P1 at 32 weeks EGA, 73kg, 5'3", with history of term vaginal delivery complicated by postpartum preeclampsia 2 yrs prior, presented with nausea, right upper abdominal pain, headache, platelet count of 62,000, BP 188/108. Betamethasone was administered and magnesium therapy was started. Other findings: PT 10.6 sec, INR 0.95, trace urine protein, Cr 0.6, Hct 34. She was transferred to our facility, where BP was 163/82, HR 116, Plt 40,000, PT 12.9 (INR 1.0), Fibrinogen 548, Hct 35, LDH 507, AST 195, UA 5.1, Cr 0.56. The patient was scheduled for CD. Skin exam revealed no petichiae. A thromboelastogram (TEG) was normal. She strongly desired to be awake during childbirth, and demonstrated sound decision-making capacity in the detailed, candid discussion regarding anesthetic risks and alternatives. She and the anesthesiologist negotiated the plan: the most experienced proceduralist would make a single attempt to administer spinal anesthesia. If procedure failure, general anesthesia (GA) would be administered. Meticulous neurological surveillance would follow postop. Spinal anesthesia (1.8 mL hyperbaric bupivacaine, 0.2mg morphine sulfate) provided satisfactory anesthesia. CD was performed uneventfully. Uterotonics (carboporst 0.25 mg IM x 2; misoprostol 0.8 mg PR) were given prophylactically, and platelets were transfused (after skin incision, obstetrician requested). Recovery was uneventful.

Discussion: Besides the perennial question regarding thrombocytopenia and neuraxial anesthesia (i.e., "How low is too low?"), this case exemplifies clinical situations of great uncertainty, which threaten to pit patient autonomy against non-maleficence.1 Some might refuse to offer neuraxial anesthesia outright, based solely on the high-stakes, yet unquantifiable risk of epidural hematoma. But, this stance fails to consider strong patient preferences (e.g. being awake for delivery), the real uncertainties regarding risk (denial is a well described response to uncertainty, with consequences2), findings that likely mitigate risk (absence of petechiae, normal TEG, low weight/BMI), and the risks of GA in a thrombocytopenic preeclamptic patient. This stance may also inhibit creative management ideas designed to mitigate risk and facilitate early detection of the complication (e.g. single pass, experienced proceduralist, frequent neuro checks, patient/staff participation in neurologic surveillance). Finally, refusal to consider spinal anesthesia ignores the obligation to fully respect patient autonomy. Instead, acknowledging uncertainty allowed for a shared/informed decision-making process3 that included both patient goals and a comprehensive appraisal of risks. This yielded a favorable collaborative decision between the patient and physician while upholding both of the ethical principles of non-maleficence and patient autonomy.

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Abstract #:SU-29

Cesarean Delivery in Patient with Labile Recurrent Pericaval Pheochromocytoma

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Perioperative management of pheochromocytoma presents an anesthetic challenge. Unpredictable catecholamine responses despite adrenergic blockade can lead to cardiovascular instability, which can be compounded in pregnancy.

A 28 y/o G1P0 was scheduled for a cesarean delivery (CD) at 37+4/7 weeks due to a symptomatic recurrent pheochromocytoma. Her history was significant for an adrenalectomy 8 years prior. At 13 weeks, she presented with paroxysmal hypertension, tachycardia, and markedly elevated urinary metanephrines. Magnetic resonance imaging showed recurrent right adrenal bed pheochromocytoma surrounding the inferior vena cava with possible hepatic invasion. Surgery would involve caval resection and possible hepatic segmentectomy. There were three options for management: 1) surgery while pregnant; 2) await fetal maturity and resect the tumor during CD; or 3) await fetal maturity, perform CD and delay surgery until normalization of the physiologic changes of pregnancy. Given the magnitude of the surgery, stable tumor size, and difficulty conceiving, she was medically managed with phenoxybenzamine and metoprolol until term gestation.

Intravenous and arterial access was established and 100 mcg intrathecal hydromorphone was given. General anesthesia was induced with fentanyl, propofol, and rocuronium. Central venous access was obtained and a propofol infusion was started in addition to inhaled sevoflurane. After uterine incision, sodium nitroprusside was initiated to treat escalating blood pressures. The fetus was delivered with gentle uterine fundal pressure. Vacuum-assisted delivery was had been planned, to avoid tumor manipulation but the surgeon was unable to engage the fetal head. Apgar scores were 2 and 7 at 1 and 5 minutes. The neonate was monitored in intermediate care nursery overnight for hypoglycemia and blood pressure management. After delivery total intravenous anesthesia (TIVA) with propofol was initiated and inhalational anesthetic was discontinued. Uterine tone was adequate after oxytocin administration. The patient was extubated in the operating room and monitored overnight in intensive care. Her pain was controlled and her postoperative course was uneventful. She underwent resection of the pheochromocytoma 9 weeks later.

We have presented an uneventful CD in a patient with a recurrent, symptomatic pheochromocytoma. Intrathecal hydromorphone was provided for postoperative analgesia. Local anesthetic was avoided to reduce the risk of hemodynamic collapse after sympathectomy in a patient with high baseline sympathetic tone (1). Vasoactive medication infusions are integral in being able to rapidly and effectively treat significant hemodynamic compromise. Optimized preoperative alpha and beta blockade combined with general anesthesia, TIVA, and intrathecal opioid provided hemodynamic stability, prevention of uterine atony, and adequate postoperative analgesia.

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Abstract #:SU-30

Severe Cold Contact Urticaria in a Complex Parturient

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Introduction and Case Summary:

A 29-year-old G3P2 female diagnosed with placenta previa and increta presented to labor and delivery at 24 weeks 5 days gestation for antepartum admission. Medical history was pertinent for cold contact urticaria (CCU), a rare life-threatening condition. The patient described repeated episodes of hives and edema after exposure to cold environments and foods, as well as an episode of severe angioedema requiring intubation after exposure to cold winter weather.

Our obstetric anesthesia team initiated peripartum and perioperative multidisciplinary planning immediately after admission. A cesarean hysterectomy was planned for 36 weeks. Education on CCU and avoidance of cold was provided to all staff caring for the patient in the perioperative period. Intraoperatively, high-dose steroids and antihistamines were given and strict local and systemic normothermia was maintained. No signs of CCU or angioedema were observed. She was extubated in the OR and transferred to the intensive care unit (ICU). Three hours postoperatively, despite continued systemic normothermia and repeat pharmacological treatment, she developed severe lip and airway angioedema requiring emergent reintubation. Prior to onset of these symptoms she received room-temperature IV fluids and a cold mouth swab by the ICU staff who had not previously cared for the patient. She was extubated less than 24 hours later after full resolution of symptoms.

Discussion: CCU is a rare, difficult to treat form of physical urticaria with significant clinical risks. Evidence of preventative strategies for patients with CCU undergoing surgery is scarce. To our knowledge, this is the first reported case of a high-risk parturient with a known history of severe CCU. Standard prophylaxis includes high dose H1 and H2 receptor antagonists, systemic steroids, and omalizumab (1,2). Although our patient received extensive preventive measures she developed life-threatening complications of CCU in the ICU. The onset of angioedema correlates temporally with the administration of non-warmed IV fluids and cold oral swab. Historically, prior episodes of urticarial resulted from similar triggers. Obstetric anesthesia is uniquely equipped to promote a multidisciplinary approach and further obligated to ensure that comorbid conditions outside the direct focus of the surgical team are adequately communicated to all providers during both the pre and post-operative periods. This includes education of rare conditions that require the utmost vigilance to maximize outcome and minimize harm in parturients with complex pathologies.

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Abstract #:SU-31

Using Music to Overcome Elderly Parturient Stigmatization - A Case Report

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Case: A 63-year-old G2P0 at 33 weeks of an IVF pregnancy presented for Cesarean delivery (CD) of a severely growth restricted fetus. Despite severe symptomatic pre-eclampsia, the patient refused CD. She had a high level of anxiety and mistrust of the hospital. She was also nervous and afraid of the pain of the needle and wanted to maintain her dignity by keeping her dentures in. The healthcare team was so concerned about her anxiety and refusal that psychiatry was consulted.

In order to build trust with the patient, we offered the patient a chance to listen to music during the perioperative period. A selection of Mozart sonatas previously studied for their anxiolytic effects were played. [1] The patient stated that her level of anxiety surrounding the anesthesia and obstetric care was significantly reduced with the music, and she felt much more comfortable during the neuraxial technique and surgical procedure. The obstetrician, resident, and nurse in the room also stated that they felt the level of anxiety in the room was significantly neutralized by the music.

Discussion: Management of the very advanced maternal age population can be challenging. Primiparae aged ≥45 are more likely to have chronic health conditions, gestational diabetes, gestational hypertension and pre-eclampsia. [2] They have increased healthcare needs, including a higher risk of hospitalization during pregnancy, preterm delivery, and increased rates of CD. [2] Infants born to mothers in this population have increased rates of low birth weight and neonatal intensive care unit admission. This patient had unique concerns secondary to her advanced age including prolonged postpartum follow up for her uncontrollable hypertension.

Beyond potentially life-threatening medical conditions there is a social and psychological stigma associated with being older and pregnant. Despite reports that media attention is favorable towards older moms, our patient felt prejudiced and developed a mistrust of the healthcare system. [3] This is a very rare situation, which likely would not have happened if the patient was of a younger age. The use of music was a tool to build trust and rapport with the patient. We wanted to communicate to her and demonstrate that we would not treat her differently just because she was older and pregnant. As caregivers we must approach unique pregnant populations with sensitivity.

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Abstract #:SU-32

Posterior fossa craniotomy for brainstem glioma resection in patient at 25 weeks gestation with factor V Leiden and a patent foramen ovale

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A 27 year old G3P1011 at 25 weeks gestation with a past medical history of Factor V Leiden and patent foramen ovale (PFO) presented for neurosurgical resection of a symptomatic, enlarging tectal brain mass. Multidisciplinary management was coordinated among neurosurgery, obstetrics, obstetric anesthesiology, cardiology, and hematology. A posterior fossa craniotomy was planned.

A filter was placed by interventional radiology in the inferior vena cava prior to the day of surgery. On the day of surgery, an obstetric nurse was present in the operating room (OR) for continuous fetal monitoring. After rapid sequence induction and intubation, an arterial line and 2 large-bore peripheral intravenous catheters were placed. A central line was placed due to history of PFO. A precordial Doppler was utilized for diagnosis of air embolism. Total intravenous anesthesia was administered due to intraoperative neurophysiological monitoring. Neurosurgery placed a lumbar cerebrospinal fluid drain for management of intracranial pressures. Patient positioning was modified from sitting to left lateral to prevent aortocaval compression and venous air embolism in the setting of the PFO. Sequential compression devices on bilateral lower extremities were utilized throughout the operation. The intraoperative course was uneventful, and the patient and fetus remained stable throughout. She was extubated and recovered in the neuro intensive care unit.

Discussion: Tumors of the central nervous system occur in 6:100,000 women. Symptoms may present in pregnancy or become exacerbated with tumor growth (due to tumor estrogen and progesterone receptors), edema, increased vascularity, or immunotolerance associated with pregnancy. Symptoms of increased intracranial pressure can mimic symptoms of early pregnancy or preeclampsia/eclampsia, such as nausea, vomiting, headache, or seizures. Recommendations for neuroanesthetic management in pregnancy are mostly based on case reports or small studies. Optimal management begins with preoperative multidisciplinary planning among obstetrics, neurosurgery, and obstetric anesthesiology, and should include discussion of appropriate management of the tumor and timing of tumor resection (before or after delivery, or simultaneously with cesarean delivery). The importance of multidisciplinary management is highlighted in this case.

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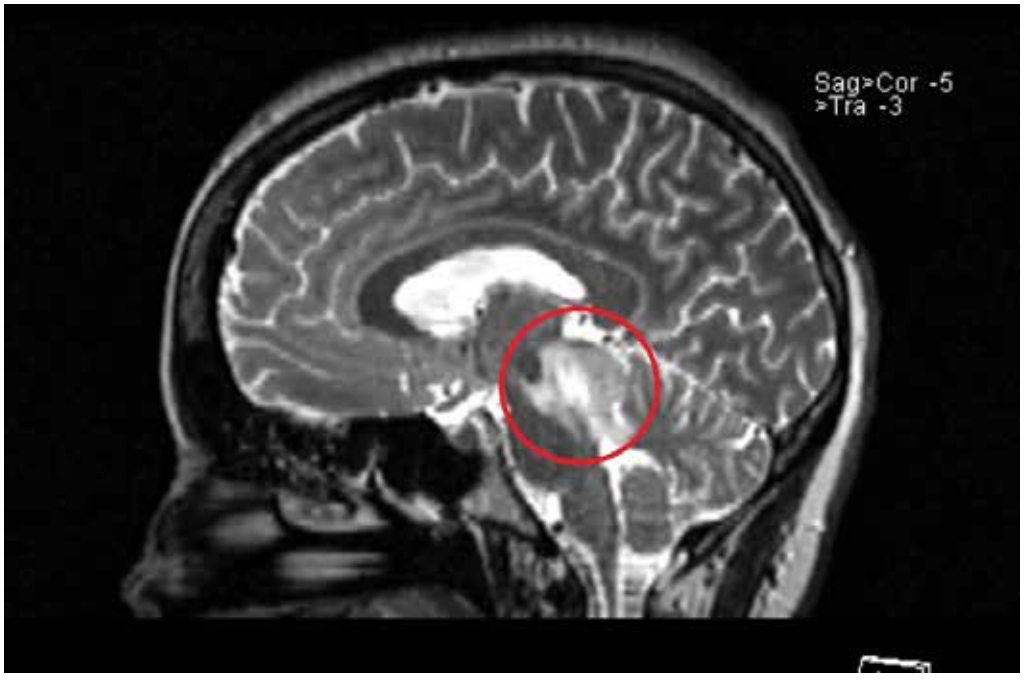

Abstract #:SU-33

Transient Lactic Acidemia Associated with Possible Intravascular Injection of Lidocaine 2% with 1:200,000 Epinephrine

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Introduction: We report a case of possible intravascular injection of 2% lidocaine with 1:200,000 epinephrine.

Case: A 27-year-old Gravida 4 Para 3 Hispanic female presented at 24 weeks gestation with active contractions and cervical dilation at 6 cm. The patient's history was significant for three preterm births and one previous pregnancy complicated by gestational hypertension. Her admission blood pressure was 126/76 and pulse rate was 80 bpm. She was admitted and placed on magnesium sulfate for neonatal protection. A combined spinal epidural was placed with 2.5 mg of bupivicaine intrathecally. A negative test dose with 45 mg of lidocaine and 15 mcg of epinephrine was negative. An epidural infusion was started with 0.125% bupivicaine and 2 mcg/mL at a rate of 10 mL/hr with a 10 mL bolus dose every 20 minutes. She experienced immediate pain relief with normal vital signs until approximately 10 hours later, when she felt 8/10 pain, and a block level to ice at the T10 level. After negative aspiration of the epidural catheter for heme or CSF, 100 mg lidocaine 2% with 25 mcg epinephrine was administered over three minutes. Two minutes later, the patient complained of shortness of breath, and started to exhibit extreme tachypnea (>40 bpm). Her heart rate was over 140 bpm, and blood pressure increased to 158/94. She was unable to speak, diaphoretic, and visibly distressed. However, she could follow commands, move all extremities, had equal bilateral handgrip, and pupils were mildly dilated. Her lungs were clear, and a bedside EKG showed sinus tachycardia. An arterial blood gas was drawn which revealed pCO2 of 16 mmHg, lactate 6.8 mmol/L, and base excess of -13 mmol/L. Within approximately 30 minutes, the patient's mental status, respiratory rate, blood pressure, and appearance all returned to baseline. The patient's lactate level two hours after the incident was down to 3.0 mmol/L and remained at that level thereafter.

Discussion: The transient increase in heart rate and blood pressure was consistent with signs of intravascular injection of epinephrine. Given the lack of active infection, sepsis, or tissue hypoperfusion, the elevated lactate can be reasonably attributed to epinephrine contained in the lidocaine solution given for her breakthrough pain. Exogenous epinephrine has been shown to cause transient lactic acidemia in critically ill patients1, possibly due to beta-2 agonist stimulation resulting in heightened levels of aerobic glycolysis2. The rapid spontaneous subsequent decrease in lactate without treatment also support this theory. The role of lactate levels in diagnosing intravascular epinephrine injection remains to be determined.

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Abstract #:SU-34

Peripartum management of antiplatelet therapy in a patient with recent myocardial infarction and drug eluding stent.

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No set guidelines exist for management of antiplatelet therapy in the peripartum period. This case report highlights current evidence on treatment of cardiovascular disease during pregnancy with emphasis on management following percutaneous coronary intervention and antiplatelet therapy. A 35 y.o. G4P0030 was treated for STEMI with DES to LAD at 3w gestation. Post STEMI course was initially complicated by ischemic cardiomyopathy, with LVEF of 20-25%, with recovery to normal within two months. Dual antiplatelet therapy with aspirin and prasugrel was continued until 34w2d, at which time the patient was admitted for concern of superimposed preeclampsia. After multidisciplinary input from obstetrics, anesthesiology and cardiology, and anticipating the need for induction of labor and delivery, prasugrel was discontinued and labor was induced 14 days later allowing for neuraxial labor analgesia. Low dose aspirin was continued during the peripartum period. An epidural was placed for labor analgesia. Arrest of dilation occurred at 4cm and fetal intolerance of labor necessitated cesarean delivery, performed under epidural anesthesia. Prasugrel was restarted 12h post cesarean delivery.

While there is general agreement that time off dual antiplatelet therapy and cardiac stress during delivery should be minimized, there is no standard protocol mitigating the potential risk factors for acute myocardial infarction (AMI) during pregnancy. The 2014 ACCAHA guidelines on management of patients undergoing noncardiac surgery state that "perioperative antiplatelet therapy should be determined by a consensus of the surgeon, anesthesiologist, cardiologist, and patient, who should weigh the relative risk of bleeding versus prevention of stent thrombosis." Recommendations on mode of delivery likewise rely on multidisciplinary consensus of the obstetrician, cardiologist and anesthesiologist.

While AMI in pregnancy is rare, occurring in 3-10 per 100,000 pregnancies, with recent mortality estimates of 5.1-7.3%, the US parturient population is becoming older and more likely to exhibit preexisting cardiac risk factors. The risk of AMI during pregnancy is strongly associated with increasing age, HTN, smoking and diabetes mellitus. Population studies identified that 38% of AMI occurred antepartum and 37% of women with AMI during pregnancy underwent angioplasty, stent placement or bypass surgery, requiring antiplatelet therapy for a period of time. Additional reports on management of AMI during pregnancy will help to devise protocols outlining effective ways to manage AMI risk factors while minimizing adverse pregnancy and labor outcomes.

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Abstract #:SU-35

Severe Bronchospasm Treated with Endotracheal Epinephrine during a Scheduled Repeat Cesarean Delivery and Tubal Ligation

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Introduction: Bronchospasm under regional anesthesia is a rare event, if unrecognized, could result in fatal outcomes. In parturients undergoing elective surgery,it is even more unusual. Bronchospasm is reported as 2% under regional anesthesia vs. 6.4% under general endotracheal anesthesia in the asthmatic population(1). When encountered, if the condition is resistant to traditional treatment modalities, endotracheal epinephrine can be a lifesaving measure.

Case: Our patient is a 28 yo F G3P2 at 39 wga who presents for a scheduled repeat cesarean delivery and tubal ligation. Her medical history consists of obesity, mild-intermittent asthma, and a vague cardiac condition without follow up (due to a lack of symptoms). Allergies include: peanut products, eggs, tetanus toxoid, and seafood. Preoperative workup and physical exam were unremarkable. A surgical CSE was performed followed by an uneventful delivery. Soon after delivery, patient became agitated, pruritic, and dyspneic. No visible rash was seen, but new bilateral expiratory wheezes were appreciated on exam.

Sudden hypotension, hypoxia and unresponsiveness prompted swift intubation and aggressive resuscitation. Despite confirmed ETT placement and patency, airway pressures of >40mmHg, hypoxia and hypotension persisted. Treatment was resistant to IV epinephrine, Albuterol, Diphenhydramine, and Dexamethasone. Ultimately,endotracheal epinephrine was given and resistance to ventilation and respiratory mechanics dramatically improved. The differential diagnosis for bronchospasm included: asthma, anaphylaxis, and amniotic fluid embolism. The patient was transferred intubated with hemodynamic support to the SICU. Despite a tumultuous intraoperative course, she was weaned off vasopressors and extubated the same day. Extensive workup in the ICU did not reveal a definitive etiology.

Discussion: Endotracheal epinephrine was an effective measure in our patient's resuscitation. Because epinephrine is a potent beta agonist, it can potentially result in better delivery to the respiratory smooth muscle resulting in bronchodilation when given endotracheally (3). Endotracheal epinephrine's efficacy has been demonstrated in a case report of a 13 yo boy with an acute refractory asthma attack as well as in the canine model (3)(4).

Though rare, bronchospasm under neuraxial may happen unexpectedly; thus, practitioners should be aware of its safe management. In cases of severe bronchospasm, endotracheal epinephrine, an often overlooked treatment modality, can be lifesaving.

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Abstract #:SU-36

Two Outlets On A One-Way Street: Successful Use of Epidural Anesthesia for Cesarean Section for a Parturient with Double-Outlet Single Ventricle

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Introduction: There is an increasing number of single ventricle parturients who are presenting for labor management. These patients are at increased risk for morbidity and mortality, and pose some unique challenges to the anesthesiologist. We herein present the successful use of an epidural-based anesthetic for cesarean delivery in a parturient who is underwent an infantile lateral tunnel Fontan repair for complex double-outlet right ventricle anomaly with severe sub-pulmonary stenosis, a restrictive, non-committed VSD, and later developed sinus node dysfunction requiring a permanent atrial pacing system.

Case report: A 30 year old G1 parturient at 31 weeks of gestation with the above cardiac anomaly was admitted for PPROM and PTL requiring a semi-urgent cesarean delivery after tocolysis failed. She was followed closely by a pediatric cardiologist who had optimized her for her procedure. The patient had mild SOB but was otherwise stable. Her only home medication was digoxin. Her preoperative echocardiogram showed preserved single ventricular function with minimal VSD flow. Based on her congenital defects, we placed an awake arterial line under local anesthesia to help maintain hemodynamic stability throughout induction. We then positioned and placed a L4-L5 epidural in the OR. After a negative test dose, we dosed the epidural to maintain hemodynamics near baseline using 3 ml increment dosing of 2% lidocaine with small dose fentanyl until a T6 sensory level was obtained. Hemodynamic support was maintained with small doses of phenylephrine, and a co-load of 500 ml lactated ringer's solution. The cesarean delivery was uneventful, and a healthy female infant was born with an APGAR of 8 and 9. She was transferred to telemetry postpartum care where she had an uneventful recovery, and was discharged home POD 3.

Discussion: Parturient with single ventricle in pregnancy has increased over the last few decades due to the advances in pediatric cardiovascular surgery. Understanding the single ventricle physiology is of utmost importance when managing these parturients. These patients are preload dependent, require normal to slightly reduced afterload in order to maintain CO, and aggravating factors that would worsen pulmonary hypertension should be avoided (hypoxia, hypercarbia, acidosis). Our anesthetic goal in this parturient was to maintain hemodynamic stability by avoiding the reduction in preload, preventing sudden decreases in afterload experienced after single shot spinal or use of volatile anesthetics, and maintain spontaneous ventilation. Slow, incremental dosing epidural allowed us to achieve these goals.

Abstract #:SU-37

Management of a parturient with Brugada Syndrome

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A 31 year old female with known history of Brugada Syndrome G1P0 at 40.2 weeks gestation presented for induction of labor. She was seen in our obstetric anesthesiology preoperative clinic during her second trimester to plan her care during labor.

Brugada syndrome is a genetic disease with a mutation in cardiac voltage gated sodium channels leading to abnormalities in cardiac action potentials, which can lead to fatal arrhythmias such as ventricular tachycardia or fibrillation. Often Brugada patients have an automatic implanted cardiac defibrillator for primary prevention of such arrhythmias. Since the use of local anesthetics via epidural is one of the primary modes of anesthesia care during labor, this creates a conundrum. A literature review on Brugada syndrome, and how it pertains to obstetric anesthesia was done. Due to the lack of specific recommendations, a plan was devised by our anesthesia team to minimize exposure to local anesthetics. The plan was to avoid early epidural if possible, and use a combined spinal-epidural for labor analgesia. Twenty micrograms (mcg) of Fentanyl and 1.25 milligrams (mg) of Bupivacaine were administered intrathecally initially. The patient had good pain relief, and an epidural infusion was started after the spinal analgesia had subsided. She was started on an epidural infusion that included 0.25% Lidocaine with 1:400,000 epinephrine and 3 mcg/mL of fentanyl. Studies have shown that lidocaine is less arrhythmogenic compared to bupivacaine in patients with Brugada Syndrome. Her labor progressed quickly, and reached 10 cm of cervical dilation two hours after the combined spinal-epidural was placed. She delivered a healthy infant. No anesthetic complications were noted. Her blood lidocaine level was 0.8 mcg/mL (reference range 1.2 - 5 mcg/mL, toxic levels >5 mcg/mL) at one hour after the epidural infusion was stopped. She remained on telemetry intrapartum and 24 hours postpartum. She had an uneventful postpartum course, and was discharged home on postpartum day 2.

Abstract #:SU-38

Peripartum Management of Severe Factor XI Deficiency – Role for ROTEM in Guiding Therapy

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Introduction: Factor XI deficiency has long presented a clinical challenge to the obstetric anesthesiologist. It has been well established that factor XI levels in these patients do not correlate with their risk of bleeding. While there is no standard of practice regarding their management, it is recommended that those with severe factor XI deficiency (activity level <15%) undergo factor replacement therapy in the peripartum period. The question of how to adequately assess the effects of this replacement therapy towards effective hemostasis remains unanswered. The adjunct of viscoelastic testing may be an important tool in providing a more complete picture of the coagulation process in these patients.

Case Report: A 34 year-old G2P1 with history of severe factor XI deficiency (baseline factor XI <1% and 2% at 35 weeks gestation) who experienced postpartum hemorrhage (PPH) after her first cesarean delivery two years prior now presents for repeat cesarean section. For her first section she received a total of 10U of FFP to normalize her factor XI level. On this admission, baseline coagulation and rotational thromboelastometry (ROTEM) were measured the night before her scheduled section. A total of 5U of FPP (15cc/kg) were then transfused. The aPTT normalized from 61.4 to 27.6 and on ROTEM, the clotting time (CT) on INTEM also normalized from 264 to 146 seconds. Additionally, on both the baseline and post-transfusion TEMograms, the rest of the parameters (A10, MCF) reflected the expected hypercoaguable changes seen with pregnancy. Given the normalization of coagulation studies with evidence of strong clot formation on ROTEM analysis, the patient received spinal anesthesia and cesarean section was performed without incident. Factor XI was measured immediately postoperatively showing an increase from 2% to 25%. The EBL was 800cc and the postoperative course was unremarkable with no evidence of PPH or spinal hematoma.

Discussion: Although previous recommendations include factor replacement therapy titrated to a level of activity of 30-40% normal, in this case, this would have required excessive plasma transfusion beyond what available studies showed the patient needed to form an effective clot. With the risk of infection, adverse transfusion reactions, and alloimmunization, therapy should be guided in a way to achieve effective hemostasis while limiting potential harm. There is great potential for using ROTEM, at least adjunctively, to demonstrate effective hemostasis following peripartum replacement therapy in patients with severe factor XI deficiency. Adapting ROTEM testing on labor and delivery units is an important tool in the assessment of global coagulation in the pregnant patient.

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Abstract #:SU-39

Laparascopic Resection of a Pheochromocytoma in a 15 week Gestational Pregnancy

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A 27 year old female G2 p1001 @ 7 week gestation was referred to our institution without obstetric services for persistent hypertension, palpitations, headache, lightheadedness, and fatigue and a family history of pheochromocytoma. Initial 24 hour urine revealed elevated dopamine, epinephrine and plasma norepinephrine levels. An abdominal MRI showed a 1.9 x 2.2 cm mass in the right adrenal gland along with several enlarged epigastric lymph nodes. The patient was started on phenoxybenzamine and labetalol. A laparoscopic adrenalectomy was planned at 15 week gestation pending stable hemodynamics. Surgery planned to have gastroenterology do an upper endoscopy with biopsy of the epigastric lymph nodes a week prior to her surgery, however, at the insistence of the obstetric anesthesiologist, the endoscopic procedure was scheduled at the time of the laparoscopy. Endocrinology was followed her vital signs on an outpatient basis prior to surgery, which required an increase in alpha and beta blockade due to continued elevations in blood pressure (BP) (140's/90's) and heart rate (HR) (90's to 100's). The gynecologic service was consulted to monitor the fetus pre- and post-operatively.

At 15 week gestation the patient underwent a laparoscopic right adrenalectomy along with an upper endoscopy and epigastric lymph node biopsy. After induction with propofol and succinylcholine, anesthesia was maintained with isoflurane and vecuronium. Post induction, an arterial line and right internal jugular line were placed. Phenylephrine and vasopressin infusions were started due to intermittent hypotension after induction with BP ranging from 66/50 to 150/90's and occasional increase in HR to 115 bpm requiring esmolol boluses. Fluid administration for the procedure included 3 liters of crystalloid and 750 ml of albumin. The patient was extubated in the operating room and transported to the ICU where an abdominal ultrasound showed fetal activity and a fetal heart rate over 140 bpm. The patient was eventually weaned off vasopressin and phenylephrine infusions and she was dischared 2 days following surgery. Pathology confirmed the presence of a pheochromcytoma with benign reactive inflammatory lymph nodes.

The patient underwent a repeat cesarean section under spinal anesthesia at 39 weeks gestation at her home institution with delivery of a viable male infant weighing 3,977g and Apgars of 8 and 9. Patient was told she had wide fluctuations in blood pressure during the procedure, but otherwise had an unremarkable course and was monitored overnight in the ICU.

Pheochromocytoma in pregnancy is very rare, and difficult to differentiate due to the more common manifestations of pregnancy-induced hypertension. If undiagnosed, maternal and fetal mortality is high, at 5 and 15% respectively. Early diagnosis and treatment, including surgery in the second trimester decrease the potential morbidity and mortality as depicted in this case.

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Abstract #:SU-40

Cesarean Delivery in Mothers with Corrected Transposition of the Great Arteries: Is a Code Cart Available?

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Introduction: Congenital transposition of the great arteries (TGA) confers >90% risk of mortality in the first year of life without corrective surgery. Two procedures are used for correction: intra-atrial baffle (atrial switch) and arterial switch. Atrial switch baffles oxygenated blood to the right ventricle, which becomes the systemic ventricle, leading to potential right (systemic) heart failure, arrhythmias, and baffle leaks. The newer arterial switch procedure transposes aortic and pulmonary trunks, and reimplants coronary arteries, to establish normal circulation. This procedure risks aortic root dilation, aortic regurgitation, and early coronary artery disease. We present anesthetic management of cesarean delivery (CD) in 3 parturients with corrected TGA.

Cases: Case details are tabulated (chart). Patient #1 developed a prolonged fetal heart rate deceleration during induction of labor, prompting a stat CD. Immediately after delivery, the mother had an episode of bradycardia with hypotension (nadir 98/52, HR 39), treated with incremental epinephrine doses (70 mcg total). Postoperatively she had persistent episodes of bradycardia, and is now being evaluated for a pacemaker. Patient #2 presented with bleeding placenta previa with abruption and underwent urgent, uneventful CD with spinal anesthesia. Patient #3 underwent scheduled CD with epidural anesthesia, after failed combined spinal/epidural anesthesia. As with patient #1, she too had immediate post-delivery bradycardia and hypotension, but much more severe (nadir 28/13, HR 8). Carotid pulse and a-line tracing were lost transiently, and epinephrine 50 mcg was administered. Just before initiating chest compressions, return of spontaneous circulation occurred. She recovered uneventfully in the cardiac intensive care unit.

Discussion: Few studies have compared pregnancy outcomes between atrial and arterial switch operations. Although arterial switch has replaced atrial switch as the corrective surgery of choice, a generation of atrial switch patients are now presenting with pregnancy. This small series demonstrates the risk of acute decompensation in atrial switch patients, with potential RV (systemic) failure immediately after delivery. Full preparation for treatment of cardiovascular collapse is warranted. A multidisciplinary team approach (including Cardiology) to planning is recommended.

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Series of Parturients with Corrected Congenital Transposition of the Great Arteries			
	Patient # 1	**Patient # 2**	**Patient # 3**
Maternal age	33	21	41
Obstetric history	G1 P0	G3 P2	G4 P2
Body Mass Index (BMI)	29	20	42
TGA repair type [Age at time of repair]	Atrial switch [10 wks]	Arterial switch [1 wk]	Atrial switch [< 1yr]
Arrhythmia history	Atrial flutter; s/p ablation x 2, now resolved	None	None
Medications (other than prenatal vitamins)	None	None	Labetalol 100mg/day Hydrochlorothiazide 12.5mg/qd
Pertinent medical & obstetric features	Migraine headaches	Placenta previa, scoliosis	Hypertension, morbid obesity, scoliosis
Pre-pregnancy METS	>4	>4	>4
Echocardiogram findings	Mod dilated RV with mildly depressed systolic function; Mild-mod TR; no baffle leaks	Mildly dilated aortic root (36-38mm); mildly dilated ascending aorta; EF 60-65%	Mild-mod dilated RV with mildly depressed systolic function; mild-mod TR; no baffle leaks; pulm baffle with mild obstruction
Gestational age at time of pre-delivery OB anesthesia consultation	38 wks	30 wks	34 wks
Mode of delivery	Cesarean delivery	Cesarean delivery	Cesarean delivery
Cesarean delivery urgency	Stat	Urgent	Scheduled
Cesarean delivery indication	Prolonged fetal bradycardia during misoprostol induction	Mild bleeding previa with concern for abruption	Repeat cesarean; 1 prior cesarean delivery
Type of anesthesia	General	Spinal	CSE: spinal injectate produced no block; epidural anesthesia used as sole anesthetic
Invasive monitors	Arterial catheter (Post-induction)	None	Arterial catheter (Pre-induction)
Intraoperative complications	Brief bradycardia and mild hypotension (nadir 98/52, HR 39) immediate post delivery requiring 10mcg boluses of epinephrine	None	Bradycardia, hypotension, right heart failure, near arrest (nadir 28/13, HR 8), immediately following delivery requiring 50mcg epinephrine bolus and norepinephrine infusion
Recovery location	Labor & Delivery	Labor & Delivery	Cardiac Intensive Care Unit
Postpartum day of discharge	4	3	4 (Left Against Medical Advice)
Post-delivery complications	Episodes of bradycardia; ongoing evaluation for pacemaker	None	None

Abstract #:SU-41

TWO DIFFICULT AIRWAYS AT ONCE: EXIT procedure for severe fetal micrognathia in a mother with Pierre- Robin syndrome

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Introduction: Pierre- Robin Syndrome (PRS) is syndrome characterized by cleft palate, retrognathia, micrognathia and glossoptosis leading to upper airway obstruction and difficult intubation. Here, we report the management of an, Ex Utero Intrapartum Therapy (EXIT), procedure for a fetus with severe micrognathia secondary to PRS in a mother with PRS.

Case: A 25 year old G2P1 female with PRS with micrognathia and a history of a tracheostomy presented at 36 weeks for evaluation for an EXIT procedure. She had a mallampati grade 4 airway with severe micrognathia, macroglossia, and a cleft soft palate. Also noted on exam is a well healed tracheostomy scar. Her fetus was noted to have severe micrognathia on ultrasound requiring an EXIT. The delivery plan was to attempt fetal endotracheal intubation with a planned tracheostomy if intubation failed while on placental circulation.

The EXIT procedure was performed under neuraxial anesthesia with a double catheter technique. A low thoracic (T10) epidural was placed, followed by a lumbar combined spinal epidural. Spinal medications included 12mg of hyperbaric bupivacaine, 15 mcg of fentanyl and 150mcg of morphine. This double catheter technique was chosen to provide anesthesia for a vertical surgical skin incision and to avoid emergent tracheal intubation in a parturient with a possible difficult airway.

An arterial line was placed to monitor hemodynamics throughout the case and a prophylactic phenylephrine infusion was used to prevent maternal hypotension. Fetal immobilization was achieved with a remifentanil infusion at a rate of a 0.2mcg/kg/min. An intravenous nitroglycerin infusion at 100 mcg/min was used to provide uterine relaxation. The fetus was monitored using doppler ultrasound and a warm saline infusion was used to maintain intrauterine volume after hysterotomy. The fetal head was delivered and pediatric ENT surgeon performed a direct laryngoscopy using a rigid bronchoscopy to successfully intubate the male fetus without the need for additional fetal anesthesia.

After the fetus was delivered, IV remifentanil and nitroglycerin were discontinued and an oxytocin infusion was initiated at a rate of 18 u/h. Post operatively, the thoracic epidural was used for analgesia, allowing mother to visit her son in the NICU.

Conclusion: An EXIT procedure requires specific anesthetic considerations for both the mother and fetus. At our institution the use of neuraxial anesthesia is the technique of choice for EXIT to airway procedures. In this case we modified our technique using a double catheter epidural technique to provide both intraoperative anesthesia and post-operative analgesia, while avoiding general anesthesia. This case provides further evidence that neuraxial anesthesia is a viable anesthetic technique for EXIT procedures even in high risk parturients.

Abstract #:SU-42

Partial Paralysis after Spinal Anesthesia

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Case: A 24 yo G2P1 pt at 26 2/7 wks EGA presented with chronic abruption. On day 3 she underwent CD for non-reassuring fetal status. Hgb was 13.6, platelet count 195, INR 1.2, fibrinogen 417. She had prior uncomplicated epidural labor analgesia. Spinal anesthesia was administered via 24-g needle at the L4-L5 interspace without paresthesia/ complications. On POD 1 pt had LLE weakness (3/5 throughout) and decreased propioception, temperature, sensation to light touch, and had bilateral LE clonus. She denied pain and bowel/ bladder problems. MRI L-spine w/wo contrast showed hyperintense area at L1-L2 consistent with small blood collection without cord/nerve root compression; MRI T-spine w/wo contrast, CT head wo contrast, MRI brain w/wo contrast, MRA brain wo contrast were normal. Pt was admitted to NICU. On POD 6 follow up MRI, L-, T- and C-spine w/wo contrast showed resolution of hyperintense signal and no pathology. Pt had minimal improvement but was able to ambulate with walker and was discharged to rehabilitation on POD 11. She is scheduled for EMG in 2 weeks.

Discussion: The etiology of this patient's neurologic deficit remains unclear. Although the majority of neurologic injuries after delivery are of obstetric origin; our patient's CD makes obstetric palsy less likely.1 Anesthesia-related etiologies include direct trauma, but it is usually preceded by paresthesia.2,3 The incidence of direct nerve trauma after spinal is ~1/10,000.3 Permanent injury is less common at 2.0-4.2/100,000 with 2/3 of initially disabling injuries resolving within 6 months.4 It is notable that blood was present at L1-L2, indicating puncture may have occurred above the estimated L4-L5 level, which may increase risk. Inaccurate interspace estimation is well-described.5 There was no evidence of a space-occupying lesion as the small amount of blood present was non-compressive; a hematoma is more common after epidural than spinal anesthesia2 and is rare in OB pts, especially in the absence of coagulopathy.6 Absence of cord or nerve root abnormality makes neurotoxic injection, chemical irritation, adhesive arachnoiditis, ischemia from vascular trauma, M.S., or infectious causes unlikely. Negative imaging ruled out intracranial pathologies (e.g., hemorrhage, thrombosis). Confusing the picture further, bilateral clonus seems to indicate a spinal cord lesion; however, presence of motor and sensory symptoms in the same leg rather than opposite legs indicates a brain or peripheral injury. EMG studies may help delineate lesion level but several weeks must pass before results are valid; an EMG is still pending. Postpartum neurologic deficits are only rarely due to neuraxial procedures but require vigilance on the part of the healthcare team.

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Abstract #:SU-43

Neuraxial anesthesia in an obstetric patient with MELAS syndrome

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Case Report: This is a case report of a 35yo G5P2 at 35 weeks gestation with MELAS syndrome (mitochondrial myopathy, encephalopathy, lactic acidosis, and stroke-like episodes) who was admitted for induction of labor secondary to pre-eclampsia. Her past medical history includes benign tachycardia, dysautonomia, Raynaud's disease, nontoxic multinodular goiter, chronic hypertension now with superimposed pre-eclampsia. The patient was diagnosed after her 16-month-old daughter presented with absence seizures and motor milestone regression. On admission, the patient presented with a blood pressure of 160/94 and heart rate of 95 beats/min. Review of systems was positive for headache, bilateral hearing loss, myalgias and leg cramps worsened by fatigue and stress. Her physical examination was notable for bilateral hearing loss.

Labor analgesia was maintained with a low dose epidural infusion of bupivacaine 0.05% and fentanyl 2 μg/mL. The patient had an uneventful spontaneous vaginal delivery. Both patient and newborn had an uneventful subsequent hospital course and were discharged home on postpartum day three.

Discussion: MELAS syndrome is a maternally inherited mitochondrial disorder affecting intracellular energy production, and may lead to complications in various organ systems. Concerns regarding the anesthetic management include the use of neuromuscular blockade, risk of malignant hyperthermia, mitochondrial dysfunction from intravenous induction agents, cardiac abnormalities, acid-base and electrolyte imbalances.1

Previous use of regional anesthetic techniques in these patients has been shown to be successful.2,3 Additionally, epidural analgesia for vaginal deliveries may avoid worsening lactic acidosis by decreasing the stress of labor.2,4 Given the concerns over medications commonly used in general anesthetics in the obstetric population, neuraxial anesthesia should be considered for both labor and cesarean deliveries. There is currently limited data regarding outcomes of these techniques in patients with MELAS syndrome, but this case report is consistent with prior cases describing the safety of neuraxial anesthesia in the obstetric population.

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Abstract #:SU-44

Anesthetic challenges and management of a parturient with Congenital Muscular Dystrophy for Cesarean Delivery

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Congenital muscular dystrophies (CMD) are characterized by progressive skeletal muscle weakness. Resultant respiratory compromise and presence of spinal fusion/instrumentation pose significant anaesthetic challenges for cesarean delivery. We present the anaesthetic management of a primiparous parturient with merosin-positive CMD presenting for Cesarean delivery at 30 weeks gestation.

A 25 year old BiPAP-dependent, wheelchair-bound parturient with congenital CMD was referred for early anaesthetic assessment. Medical history revealed posterior thoracolumbosacral fusion/instrumentation at age 10, significant restrictive lung disease with nocturnal NIV dependence since age 13, protracted ICU admission for pneumonia with difficult invasive ventilatory weaning at 15 years of age, and severe anxiety disorder. Limited central neuraxial access confirmed by radiologic imaging and ultrasonography, combined with severe dyspnea when supine, posed significant challenges for regional anaesthesia. Limited mouth opening and known difficult ventilatory weaning posed obstacles for general anaesthesia (GA). However, in view of severe anxiety disorder and poor patient cooperation, we elected to proceed with GA. Optimal pre-oxygenation was achieved in head-up position with combined Optiflow™ high-flow humidified oxygen delivery at 50L/min and BiPAP. Dexmedetomidine infusion was commenced for anxiolysis prior to induction of anaesthesia and continued intraoperatively with propofol TCI, avoiding triggers of malignant hyperthermia. Intubation was successful on third attempt, without evidence of patient desaturation. Rocuronium used to facilitate intubation was fully reversed with sugammadex at completion of surgery. Local anaesthetic infiltration of the abdominal layers by the surgeon combined with basic analgesia provided satisfactory pain relief. There were no maternal/neonatal complications. Successful extubation to BiPAP support was undertaken within the ICU setting and patient was discharged home day 5.

CMD parturients pose significant anaesthetic challenges in the obstetric setting. Inter-specialty involvement and input are paramount. Anaesthetic technique needs to be considered on an individual basis and within the limits of patient cooperation. Thorough preoperative evaluation and planning will potentiate successful outcome[1-3].

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Abstract #:SU-45

Anesthetic management of labor and delivery in patients with CSF shunt

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Due to advancements in medical care, the prevalence of women with CSF shunt surviving to the childbearing age is increasing. However, there are no clear guidelines for the anesthetic management of these high-risk parturients for labor and delivery.

Methods: We conducted a literature search of PubMed, EMBASE and Medline databases to identify studies describing the anesthetic management for labor and delivery of patients with CSF shunts. Articles from January 1985 to January 2015(30 years) were included in the study. Those published in languages other than English were excluded. A total of 23 case reports and one large case series met our criteria and were included in the analysis.

Results: We had a total of 97 patients with 131 pregnancies that resulted in 133 live births. Ventriculoperitoneal shunt (VP) (74%) was the most common type of shunt seen. Shunt malfunction was reported in 38% of the patients during pregnancy with 7 women requiring revision in the antepartum period and 25 women in the first 6 months after delivery. Seventy-four women delivered vaginally (56%) and 59 (44%) delivered by cesarean delivery. Among the patients who delivered vaginally, only 40% of the women received epidural placements for labor analgesia. About 44% of the women received general anesthesia for cesarean delivery while the others received neuraxial anesthesia. There were no maternal deaths reported in any of the patients.

Discussion: VP shunt malfunction is fairly common during pregnancy and is thought to be due to the enlarging uterus obstruction the CSF drainage (Wisoff et al). Hence, patients presenting with any neurological symptoms should be evaluated for shunt malfunction. The incidence of cesarean delivery in patients with CSF shunt was found to be higher than the national average (33%) reported by the Center for Disease Control in 2013. There was approximately a six-fold increase in the need for general anesthesia for cesarean delivery when compared to the general population. The fear of causing herniation of the brain from accidental dural puncture may have precluded the use of neuraxial block and accounted for an increase in the numbers of general anesthetics.

Conclusion: The anesthetic management of pregnant patient with CSF shunt for labor and delivery is largely dependent on the functionality of the shunt. Epidural analgesia can be safely offered to parturient with functional shunts.

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Abstract #:SU-46

HIV and Lymphoma Complicating Pregnancy:A Case Report and Review of the Literature

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A 23-year-old, gravida 2, para 0, female at 34 weeks of gestation presented to the labor and delivery unit with a chief complaint of fever and neck and groin tenderness secondary to lymphadenopathy. Her medical history was significant for untreated HIV, latent syphilis, herpes simplex virus (HSV), iron deficiency anemia, tobacco abuse, and a previous placental abruption with fetal demise at 34 weeks of gestation.

On presentation, her HIV RNA load was 88,000 copies/mL with a CD4 count of 223. Her exam revealed significant submandibular lymphadenopathy and a diffuse rash consistent with scabies. She was admitted and scheduled for surgical biopsy of the enlarged groin lymph nodes. Computed tomography (CT) images of the neck and chest revealed enlarged parotid and submandibular glands with prominent lymphadenopathy in the internal jugular, submandibular, and submental locations with no airway compromise. The patient was placed on broad-spectrum antibiotics. She left the hospital against medical advice but returned one day later due to continued pain, weakness, and fatigue. She also complained of increased neck swelling and difficulty swallowing. She was treated with dexamethasone and transferred to the ICU for close monitoring of the progression of her neck swelling.

During her hospitalization she developed delirium and was declared incompetent during a psychiatric evaluation with concern for developing neurosyphilis. The decision was made to perform a repeat caesarean delivery under spinal anesthesia due to worsening lymphadenopathy. She underwent an uneventful delivery of a viable newborn male at 36 weeks of gestation. The pathology of the biopsied lymph nodes showed EBV positive B-cell lymphoproliferative disorder. She was discharged postpartum day 10 on HAART therapy and scheduled with oncology as an outpatient for initiation of chemotherapy.

Two days following discharge, the patient presented to the emergency room with complaints of chest pain, shortness of breath, and fatigue. The patient had developed urosepsis and a pneumomediastinum, along with crepitus of right neck. She rapidly progressed into acute respiratory distress requiring intubation. She was treated with antibiotics and the pneumomediastinum was managed conservatively by following serial chest x-rays per cardiothoracic surgery recommendations. She was successfully extubated the day following admission and serial x-rays showed decreasing pneumomediastinum. She was discharged from the hospital in stable condition. However, she returned to the emergency room with a chief complaint of shortness of breath but left against medical advice. When she eventually returned, she was found to be in severe respiratory distress requiring intubation again. Imaging revealed the interval development of left lower lobe pneumonia. She developed septic shock and rapidly deteriorated into multisystem organ failure over the next few days ultimately leading to her demise one month postpartum.

Abstract #:SU-47

Modified combined spinal epidural for cesarean delivery in the setting of an acutely infarcted cervical spinal cord and right hemiparesis

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A 38 year old G4P2012 presented at 35 weeks gestation for urgent repeat cesarean delivery (CD) due to a nonreassuring fetal heart tracing on postoperative day 1 from a craniotomy for resection of an enlarging, symptomatic foramen magnum meningioma. Prior to presenting at our institution, her neurologic symptoms began with headaches and right sided neck pain at 16 weeks gestation, then progressed to right neck and arm numbness by 33 weeks. A foramen magnum meningioma was then diagnosed by magnetic resonance imaging. Steroids were administered and plans were made for tumor resection after elective CD at 37 weeks, however her symptoms progressed to right arm weakness by 35 weeks, prompting need for urgent resection.

The resection was complicated by an acute infarction in the cervical spinal cord, causing new right hemiparesis. Additionally, overnight fetal monitoring was nonreassuring, including fetal tachycardia, minimal variability, and periodic late decelerations. Decision was made for an urgent CD.

The neurosurgeons were consulted to discuss anesthetic management for the CD in the setting of an acutely infarcted spinal cord. They strongly recommended a neuraxial technique in order to maintain an awake patient for neurologic monitoring and to avoid hemodynamic instability at induction, which could worsen the infarct. The decision was made to proceed with a modified combined spinal epidural (CSE). A left radial arterial line and two 16 gauge peripheral intravenous catheters were in place upon arrival to the operating room. The patient was unable to sit upright due to her new paraplegia and neck pain post craniotomy. Modified CSE proceeded in a left lateral position. Bupivacaine 3.75 mg, fentanyl 15 mcg, and preservative free morphine 0.2 mg were given intrathecally. The epidural catheter was used to slowly build a level, accomplished with incremental dosing of 30 mL of lidocaine 2% over 45 minutes. The patient remained hemodynamically stable without neurologic changes throughout epidural dosing and CD.

Discussion: The incidence of brain tumors in women is 6:100,000. These tumors grow rapidly during pregnancy due to estrogen and progesterone, fluid retention, and increased blood volume. Optimal management begins with pre-delivery multidisciplinary planning among obstetrics, neurosurgery, and obstetric anesthesiology, and should include discussion of tumor management (conservatively or surgically), and appropriate timing for resection (before or after delivery, or simultaneously with cesarean delivery). Neuraxial anesthesia in the setting of intracranial pathology is controversial due to potential associated rapid changes in intracranial pressure. For our patient, we believed that the benefits outweighed the risks, since monitoring of her neurologic status and maintaining stable hemodynamics were important in the setting of an acute spinal cord infarct.

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Abstract #:SU-48

Symptomatic subglottic stenosis in a high-risk pregnant patient: a case report

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Subglottic stenosis can be caused by various conditions, such as prolonged intubation, trauma tracheostomy and Wegener's granulomatosis. Idiopathic subglottic stenosis, where there is no preexisting cause, is an unusual occurrence in pregnancy and there is limited data on the management of such stenosis during pregnancy.

A 37-year-old multiparous female, with three prior cesarean deliveries presented at 33 weeks with history of increasing dyspnea, cough and biphasic stridor. Her history was significant for similar symptoms a year ago. Rheumatological workup at that time was negative and the tracheal stenosis was relieved by serial dilatation of the trachea. A CT scan indicated 40% stenosis that was two centimeters below the vocal cords. The otolaryngology team evaluated her and she was scheduled to undergo repeat tracheal dilatation. Multidisciplinary meeting with otolaryngology, obstetric and anesthesia team discussed the management of this high-risk patient and the plan was to have the obstetrician and neonatologist in the OR for an urgent cesarean delivery if the situation demanded.

Before surgery, she was pretreated with H2 blocker, non-particulate antacid, dexamethasone and then nebulized with 4% lidocaine. Once she moved to the operating table, a left uterine displacement was achieved with a wedge under her hip. Uterine contractions and fetal heart rate were monitored along with the standard ASA monitors. General anesthesia was induced with propofol and mask ventilation was confirmed. Propofol infusion was started and the patient breathed spontaneously on Sevoflurane in 100% oxygen. After ensuring adequate depth of anesthesia, the otolaryngology team serially dilated the trachea using 4.5, 5.0, 6.0 and 6.5 bronchoscopes with intermittent mask ventilation in between the dilations. At the end of the surgery, anesthetic agents were discontinued and she emerged smoothly breathing spontaneously on 100% oxygen. She recovered uneventfully remained symptom free until 38 weeks. She delivered a healthy baby by cesarean delivery under epidural anesthesia.

Management of pregnant patient with subglottic stenosis poses unique anesthetic challenges. The uncertainties involved with the placement of the endotracheal tube, the risk of aspiration, premature labor and delivery and neonatal issues due to prematurity are only a few of them. The otolaryngologist wanted to do this under general anesthesia but without an endotracheal tube as the lesion was just below the vocal cords and the tube would obstruct the stenosis making the dilation difficult. We had to weigh the risks of aspiration versus the benefits of surgical accessibility for the procedure. Hence, we pretreated her with aspiration prophylaxis and proceeded with general anesthesia without endotracheal intubation. She was comfortable and sufficiently anesthetized for the procedure, which resulted in an uneventful surgical management.

Abstract #:SU-49

Mobitz type II second-degree atrioventricular block with superimposed preeclampsia: A case report of a multidisciplinary approach to a complex obstetric anesthesia management.

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Introduction: In labor and delivery, circulatory changes normally tolerated by healthy women can lead to cardiovascular decompensation in parturients with complex cardiac abnormalities. Optimal strategies for anesthetic management of these patients are not clearly defined [1,2,3,4]. In this case report, we describe the anesthetic management of a pregnant patient diagnosed with superimposed preeclampsia and multiple cardiac abnormalities including Mobitz type II second-degree arterioventricular (AV) block.

Case Report: A 37-year-old G3P2 obese patient was admitted to the labor and delivery unit for elevated blood pressure readings noted during her clinic visit. The patient had a past medical history of two prior cesarean sections (C/S), second-degree 2:1 AV block, moderate aortic stenosis, mild coarctation of the aorta, and chronic hypertension. At baseline, the patient's heart rate remained in the 20s to 40s. The patient reported dyspnea and fatigue attributed to her extended work hours. Her cardiologist recommended permanent pacemaker placement but the patient refused.
Following her admission, the patient was diagnosed with superimposed preeclampsia with severe features refractory to medical management, therefore a repeat C/S was deemed appropriate. After multidisciplinary discussions among members of the Obstetric, Cardiology, Cardiac and Obstetric Anesthesia teams, a repeat C/S was performed under epidural anesthesia. A pre-procedural arterial line was placed for continual hemodynamic monitoring. The patient received a lumbar epidural catheter, which was slowly dosed to avoid rapid hemodynamic changes. As the patient's specific arrhythmia is an indication for temporary transvenous pacing [5], a pacing electrode was introduced in the OR via a 6 French Cordis. Appropriate capture was confirmed with the assistance of the cardiac anesthesia team. The C/S was performed without incident but persistent bradycardia continued. The patient was then transferred to the cardiac ICU for postoperative monitoring and discharged home on PPD 4 after an uneventful recovery.

Discussion: Hemodynamic changes during labor and delivery can unmask or exacerbate cardiovascular symptoms leading to significant maternal and fetal morbidity and mortality in parturients with cardiac abnormalities and preeclampsia. Anesthetic management of pregnant women with cardiovascular disease requires a multidisciplinary approach and careful monitoring. We argue that placement of an arterial line and transvenous pacing electrodes with central access provided an additional safety margin in the event that the patient's persistent bradycardia progressed to a complete heart block and/or hemodynamic instability.

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Abstract #:SU-50

Reversible cerebral vasoconstriction syndrome as the cause of altered mental status in a parturient with Sickle Cell Disease

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Etiologies of altered mental status in pregnancy include those unique to the pregnant/postpartum state and those that occur in the general population with increased prevalence in the parturient. They include stroke, cerebral venous thrombosis, subarachnoid hemorrhage, reversible cerebral vasoconstriction syndrome (RCVS), infection, amniotic fluid embolism and opioid overdose. Many of these neurological diseases can lead to devastating complications if not recognized early.

We report a 33 yo G3P1 at 32 weeks with sickle cell disease (SCD) admitted with newly diagnosed oligohydramnios and sickle cell crisis. On arrival, the patient had bilateral lower extremity swelling and elevated blood pressures, concerning for development of preeclampsia (pre-E). Hypertension and pain were treated with IV Labetalol and hydromorphone. Despite escalation of antihypertensives, her BP continued to rise into HD#2 and 1 U pRBCs was given in anticipation of urgent cesarean section for worsening preeclampsia. Prior to going to the OR suite, the patient was somnolent, but arousable, and complaining of a severe headache. Cesarean section was performed under subarachnoid block without complications. In the immediate postoperative period, the patient remained somnolent and continued to complain of headache. Within the next few hours, the patient developed RUE and bilateral LE weakness concerning for a stroke. Head CT was obtained and revealed a frontoparietal intraparenchymal hemorrhage with subdural and subarachnoid extension, as well as mass effect on the lateral and third ventricles. The location of the hemorrhage, neurological symptoms, and diagnosis of pre-E suggested the cause was RCVS, though vasospasm from a subarachnoid hemorrhage was also possible, but less likely. The patient was transferred to the intensive care unit for further care. She was ultimately discharged with left sided upper extremity weakness.

Pregnancy in patients with SCD have high levels of maternal and fetal morbidity and mortality (2). Hemorrhagic or infarctive stroke should be considered patients presenting with acute neurological symptoms, and should have been considered in this patient. Stroke treatment in parturients with SCD requires urgent exchange transfusion to improve outcome, which was delayed in this patient due to the delay in diagnosis of her hemorrhagic stroke caused by RCVS. Pre-E, SCD, and pRBC transfusion were all possible triggers for RCVS in this case. Perhaps familiarity with the most common causes of acute neurological diseases in pregnant patients and those with SCD, management would have included early brain imaging and exchange transfusion, possibly avoiding long term neurologic sequelae.

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Abstract #:SU-51

Epidural Analgesia for a Parturient with Hypertrophic Obstructive Cardiomyopathy

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Introduction: Hypertrophic obstructive cardiomyopathy (HOCM) is characterized by asymmetric hypertrophy of the interventricular septum resulting in dynamic left ventricular outflow tract obstruction. Prevalence is 1 in 500 and inheritance is autosomal dominant (1). Management of the parturient with HOCM can be challenging as sympathetic stimulation leading to tachycardia and decreases in preload or afterload can worsen LVOT obstruction leading to morbidity or fatal outcomes.

Case: 18 y/o G1P0 at 38+2 weeks gestational age was transferred to our institution from an OSH due to a history of HOCM. Her vitals were within normal limits and she denied cardiopulmonary complaints. An echocardiogram showed a small LV cavity with severe asymmetric LVH, hyperdynamic systolic function with an EF >75%, systolic anterior motion of the mitral valve, late peaking LVOT velocity up to 3.4 m/sec, and a peak gradient up to 55 mmHg.

An interdisciplinary meeting consisting of maternal fetal medicine, OB anesthesia, and cardiology was held to coordinate care. She was previously non-compliant with beta blockade and presented with HRs in the 90s. Metoprolol and IV fluids were started, and she was placed on telemetry. She was induced at 39+0 weeks for HOCM and AC lag <2.5%.

During labor, an arterial line was placed for hemodynamic monitoring. An epidural catheter was placed via a CSE technique to confirm midline placement, although no intrathecal dose was administered to prevent sudden hypotension. The test dose, lidocaine with epinephrine, was not used to avoid tachycardia in the event of intravascular placement. An alternative test dose of 2ml 2% lidocaine to check for intrathecal placement was followed 3 min later by fentanyl 100mcg to check for intravascular placement. The epidural was slowly titrated in 3ml increments with 0.125% bupivacaine until a T10 level was achieved. An infusion of 0.125% with fentanyl 2mcg/ml was begun at 8ml/hr. The patient remained hemodynamically stable during epidural titration and labor. A planned vacuum assisted second stage delivery was performed to reduce maternal Valsalva expulsive effort.

The patient was monitored on L&D with an arterial line and telemetry for 24 hours postpartum for signs of heart failure. She was then transferred to postpartum and discharged home on PPD#2 without complication.

Discussion: No standards exist for anesthetic management of parturients with HOCM. Prior case series have demonstrated that neuraxial anesthesia can be performed safely and is well tolerated with minimal hemodynamic lability when slowly titrated (2). Goals of care should include avoiding tachycardia and acute decreases in preload/afterload, adequate analgesia, and maintenance of euvolemia. An interdisciplinary team approach can help formulate a safe and effective plan to improve care in high risk patients.

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Abstract #:SU-52

Multiple Failed Spinal Anesthetics via Intrathecal Catheter Followed by Successful Epidural Anesthesia

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Introduction: Failed single dose spinal anesthetics are not unusual, occurring in 3.2% of cases.(1) Failures are often attributed to needle movement during medication injection. When a catheter is positioned in the subarachnoid space and cerebrospinal fluids (CSF) is freely aspirated an unsuccessful spinal is harder to understand. We present a case of failed spinal anesthesia despite presence of spinal catheter with freely flowing CSF.

Case: A 40 yo G1 P0 woman at 33 4/7 weeks was taken to the operating room for cesarean due to breech presentation and nonreassuring fetal status. She had diabetes mellitus, hypertension, obstructive sleep apnea, and morbid obesity (BMI = 57). A 20-g catheter was placed into the subarachnoid space at L3-L4 using ultrasound guidance. Clear CSF flowed freely. Bupivacaine 9 mg and fentanyl 15 µg were injected through the catheter but there was no evidence of sensory or motor blockade after 15 minutes. CSF was still easily aspirated from the catheter so a second dose of bupivacaine (10.5 mg) from a new vial with a different lot was administered. After 15 minutes the patient still had no evidence of blockade. Consequently, the catheter was removed and a second attending placed a combined spinal epidural under ultrasound guidance at L2-3 via a needle through needle technique. After confirmation of free flow of CSF, bupivacaine 6 mg was injected through the spinal needle. Then a catheter was placed in the epidural space. Twenty minutes later the patient still had no sensory or motor block. A 3-ml lidocaine and epinephrine containing test dose was administered through the catheter followed by 15 ml of bicarbonated lidocaine 2%, given in 3 ml increments. The patient developed T6 blockade, allowing the surgical team to proceed with cesarean. The patient developed post dural puncture headache which was relieved with a blood patch, but no other complications.

Discussion: High CSF bupivacaine levels have been documented after failed single-shot spinal, disputing the notion of user error in all cases(2). The differential for a failed continuous spinal includes cysts, septae, a drug error, bad medication lot, and resistance to a specific drug(3,4). Many experts recommend continuous spinal anesthesia in very obese patients, citing greater reliability than epidural techniques (5). However, failure to establish blockade through an intrathecal catheter with freely flowing CSF is documented in the literature, albeit rarely(4,6). This case demonstrates that continuous epidural anesthesia may in fact be more reliable than continuous spinal in some patients. Controlled trials comparing the two techniques are needed.

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Abstract #:SU-53

Abdominal Re-exploration for a Missing Needle Following Cesarean Delivery: The Power of Suggestion

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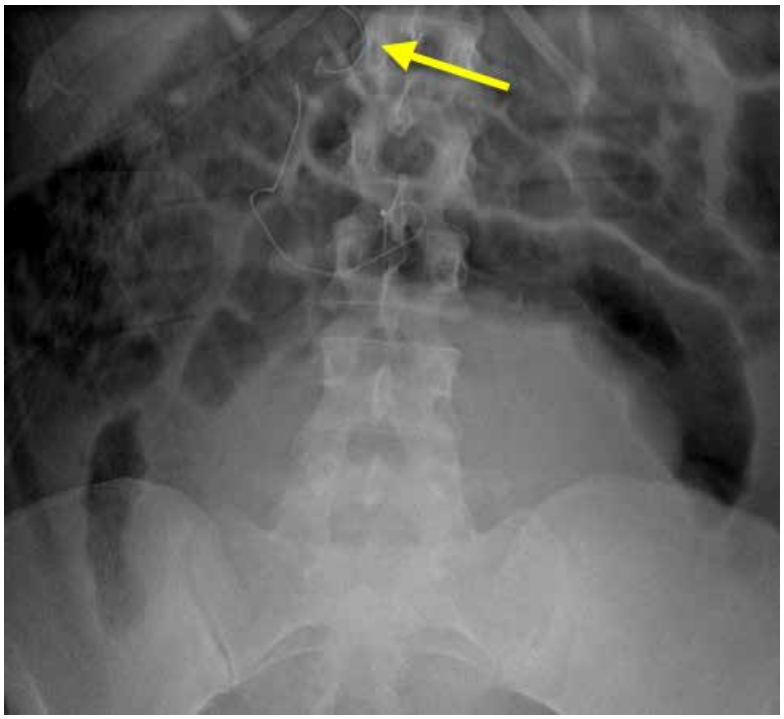
Case Description: A healthy 38-year-old gravida 3, para 1 female presented urgently to the operating room at 3 a.m. for repeat cesarean delivery for nonreassuring fetal status after a prolonged trial of labor. Surgical anesthesia was obtained with a pre-existing epidural catheter. Dissection to the uterus was difficult due to significant adhesions. After delivery of the newborn, the patient required methergine in addition to oxytocin infusion for uterine atony. After closure of fascia, the surgical instrument count was incorrect with one missing curved suture needle. An intra-operative AP X-ray was ordered (Figure). The preliminary report by the radiology resident on call identified a needle to the right of midline at the L1 vertebral body. The patient was re-explored meticulously in search of the suture needle. Upon exploration and exteriorization of the uterus, recurrent atony required a second dose of intramuscular methergine. With brisk, continued blood loss, additional intravenous and arterial access were obtained and the patient was stabilized. Re-exploration did not reveal a needle in the abdomen. A second AP X-ray was obtained to see if the needle was displaced from the original location. This more cephalad view, along with a lateral X-ray confirmed that the object had not moved and was located posterior on the back. The curved suture needle originally identified was, in fact, an epidural catheter taped to the back in a curved fashion. The abdomen was closed and estimated blood loss for the case was 1500mL.

Discussion: The risk of retained instruments after surgery significantly increases in emergency procedures.1 In this case, while there was no actual retained foreign body, the circumstances in which information was presented indicated re-exploration. Misinterpretation of an epidural catheter on X-ray as a retained foreign body after laparotomy has not been described in the literature. Unnecessary surgical re-exploration certainly leads to increased morbidity in patients. Re-exploration in this patient may have been avoided by accurate instrument count or recognition of the epidural catheter in the original X-ray. Furthermore, careful communication between surgeons, anesthesiologists, and radiologists about clinical context, including the presence of indwelling lines, is paramount.



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Abstract #:SU-54

A patient with frontal metaphyseal dysplasia for caesarean section

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Background: Frontal metaphyseal dysplasia FMD (Gorlin Cohen syndrome) is a rare x-linked disorder first described in 1969. Common features are prominent supraorbital ridges, progressive joint contractures and metaphyseal dysplasia. Other abnormalities include; hypertelorism, conductive/sensorineural hearing loss, high arched palate, dentition abnormalities and subglottic stenosis. Extra cranial features may include; vertebral fusion/abnormalities, muscle wasting, rib cage deformities, restrictive lung defects, primary pulmonary hypertension and mitral valve prolapse. Some cases may be associated with learning difficulties and genitourinary abnormalities.

Excluding paediatric cases, there is little literature available regarding the anaesthetic management of such patients as adults, particularly with reference to obstetric anaesthesia. Common problems encountered include difficult laryngoscopy and intubation, as well as positioning related to contractures.(1)

Case: A 25 year old P1 with FMD was referred to our tertiary obstetric unit for caesarean section at 34 weeks gestation. Previously she had an SVD at her local hospital with entonox and diamorphine for analgesia. USS in this pregnancy demonstrated features in keeping with FMD in the foetus. A scan at 34 weeks showed a ruptured bladder in the foetus, requiring expedited delivery. The patient was not known to our obstetric anaesthesia service. She had had no previous anaesthetics and was not known to have a congenital heart defect. Height was 165cm, mass 61kg. Contractures of the upper limbs were present, with microagnathia and a high arched palate. Mallampati score was 3. There was thoracic scoliosis. ECG and blood results were unremarkable. Ultrasound scanning of the back showed no obvious abnormality in the lumbar region. A decision was made to proceed under spinal anaesthesia. Using a 25G pencilpoint spinal needle at L3/4 interspace, CSF was yielded on first pass. 2.5ml 0.5% hyperbaric l-bupivicaine and 0.3mg diamorphine was administered. There were no difficulties with block onset or height. Cardiovascular stability was maintained using a phenylephrine infusion. Careful attention was made to positioning, in view of the contractures. Spinal block regressed after 2 hours and the patient mobilised after 6 hours.

Discussion: Endotracheal intubation was not required in this case, but a plan was made for this in case of failure of the spinal or prolonged surgery. FMD is a rare syndrome resulting in a spectrum of abnormalities. Our case report demonstrates that neuraxial blockade may be a feasible technique in such patients, reducing the need for general anaesthesia in the context of a complex airway. Bedside USS is a useful modality to assess the suitability for a neuraxial technique.

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Abstract #:SU-55

Anaesthetic management of a parturient with pityriasis rosea: first report of an uneventful use of spinal anaesthesia

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Background: Pityriasis rosea is a disease of unknown etiology presenting with characteristic skin rash. It may impose challenges on anaesthetic management of labour and delivery as neuraxial techniques need a judicious approach. To our knowledge, there are no literature reports regarding neuraxial techniques in such cases. We report the first case of caesarean section under spinal anaesthesia in patient with pityriasis rosea.

Case report: 42-years-old woman was admitted to our unit at 37 weeks of gestation. In view of twin pregnancy she was scheduled to undergo an elective caesarean section. Two weeks before her admission she developed a pink, itchy, squamopapular rash over her trunk and back which was diagnosed to be pityriasis rosea. Differential diagnosis included pruritic urticarial papules and plaques of pregnancy (PUPPPs). After discussion between anaesthetists, obstetricians and dermatologists, a plan of regional anaesthesia was made. Skin was disinfected with three repeated applications of 0.5% chlorexidine spray and it was allowed to dry between each application.

A single shot spinal with 2 ml of hyperbaric bupivacaine 0.5% and 150 mcg of diamorphine was performed. The intra-and postoperative course was unremarkable and patient was discharged home after 48 hours.

Discussion: Pityriasis rosea is a dermatological condition presenting as a truncal rash. It is usually self-limiting and lasts for around 6-8 weeks. Exact etiology is unknown, but a viral causation such as human herpes virus HHV-6 is speculated. Prevalence during pregnancy is around 18% and complications described are premature delivery with neonatal hypotonia and fetal demise (1,2).

Diagnosis and management of dermatological conditions in parturients may represent a challenge for anaesthetists. We report for the first time an uneventful use of spinal anaesthesia in patient with an active pityriasis rosea.

Learning points: Infection at the site of needle insertion is still considered a contraindication to neuraxial techniques. We suggest to reconsider the long-standing belief that regional techniques are contraindicated in patients with active local skin infection, especially if it is not bacterial in nature, as in case of pityriasis rosea. However further reports are necessary to make definitive conclusions on patients' safety.

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Abstract #:SU-56

High block after epidural: subarachnoid injection or subdural?

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High/total spinal is a known complication of neuraxial block. Unintentional subdural blockade, still remains a less recognized complication, often mistaken as inadvertent subarachnoid injection or epidural catheter migration. We present a case of a parturient where an unexpected, delayed high block was achieved, following administration of medications through the epidural catheter.

Case: 26 years female admitted for induction of labor for severe IUGR and pre-eclampsia. Patient was started on Magnesium for seizure prophylaxis. CSE was performed uneventfuly. One hour later, patient required additional analgesia but there was no relief. Decision was made to repeat the epidural block. Epidural catheter was placed successfully. Catheter aspiration and test dose were negative. A slow bolus of 20ml of 0.125 bupivacaine was administered over 20 minutes at which time patient stated relief. Epidural infusion was started. Patient then became nauseous, blood pressure stable, but fetal bradycardia was noted. Phenylephrine bolus and supplemental oxygen were administered. Minutes later fetal bradycardia was again noted. We positioned the patient on her lateral side, her response was sluggish, still responding to command, but extremely lethargic. Epidural infusion was immediately stopped. Catheter aspirated and was positive for CSF. Bradycardia did not improve and decision was made to perform STAT C-Section. Upon arrival to the OR patient was unresponsive and started to desaturate. We immediately intubated her and C-Section was performed. Spontaneous ventilation returned within a minute and vital signs remained stable throughout the case. Patient was extubated at the end of the case without sequela. On POD#2, patient complained of positional headache, not responding to conservative management and epidural blood patch was performed. Headache resolved and patient went home.

Discussion: Accidental subdural block can occur during the performance of either epidural or spinal block, incidence varying from 0.82% to 7%. Subdural drug deposition can result in unpredictable, varying sympathetic,sensory and motor block and often involves cranial nerves. Hence, it remains a poorly understood and diagnosed clinical entity. Awareness, strict vigilance and timely intervention is essential to avoid potentially critical complications.

Lubenow et al described 2 major and 3 minor clinical criteria for the diagnosis of subdural block. Major criteria included a negative aspiration and extensive sensory block; minor criteria included delayed onset by 10 minutes, minimal motor block and disproportionate sympatholysis.

A subdural catheter can easily perforate the thin arachnoid membrane and become an intrathecal catheter. Understanding the complexity and presentation of a subdural block is crucial in identifying an accidental subdural catheter placement and treating the patient accordingly.

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Anesthesia and Intensive Care 2010,Vol 38,No1

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Abstract #:SU-57

Multidisciplinary Management of Pregnancy in a Parturient with Congenitally Corrected Transposition of The Great Arteries: Case Report

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Introduction: Congenitally Corrected Transposition of The Great Arteries (ccTGA) is a rare congenital cardiac disorder. There is normal atrial arrangement with atrioventricular and ventriculoarterial discordance. Additional cardiac lesions such as ventricular septal defect and valvular abnormalities often co-exist. Many women with this disorder will tolerate pregnancy but the associated hemodynamic changes can predispose to ventricular failure, worsening valvular dysfunction and arrhythmias. In addition to the increased risk of maternal cardiac morbidity and mortality, there is increased fetal risk (including the possibility of intra-uterine death). There are limited publications to guide anesthetic management in pregnancy.

Case: 39 y/o G1P0 parturient with ccTGA presented to the multidisciplinary (cardiology, obstetric, anesthesia) clinic at 12 weeks gestation. She was born with ccTGA, ventricular septal defect (VSD) and pulmonary stenosis. In childhood she had a Blalock-Taussig shunt, and later closure of the VSD with pulmonary ventricle to pulmonary artery conduit. Prior to pregnancy she was managed by a Grown-Up Congenital Heart (GUCH) specialist; She had mild SOB on exertion (NYHA I-II) with occasional palpitations. Bisoprolol 5mg OD was her only medication. Cardiac MRI prior to pregnancy demonstrated mesocardia, dilated systemic (morphologically right) ventricle with an ejection fraction (EF) 46% and normal pulmonary ventricle. Moderate pulmonary valve stenosis and regurgitation. The PV: PA conduit was not significantly obstructed.

Cardiology followed up with monthly ECHOs and clinical review. Additional medication commenced included isosorbide mononitrate, hydralazine, dalteparin and folic acid. During pregnancy, an M.D.T meeting was held and a detailed cardiac/obstetric/anesthestic plan formulated. At 36+6/40 a LSCS was undertaken for fetal IUGR under CSE (low dose spinal) anaesthesia. Invasive monitoring was used (arterial and central venous lines). Post-operatively, the patient was transferred to ICU for 2 days and was discharged home day 8 post LSCS. Follow-up 2/52 and 7/12 post LSCS did not demonstrate any significant cardiovascular changes. We had a successful maternal and fetal outcome.

Discussion: Cardiac disease in pregnancy is a leading cause of maternal death. Awareness of the anatomy, physiology and the potential for complications in parturients with ccTGA is vital. Baseline function (clinical and imaging) is an important determinant of pregnancy outcome. Long-term outcome of parturients with ccTGA is unknown, although some authors suggest that a premature deterioration in systemic ventricular function is observed. A multidisciplinary approach is crucial both pre-pregnancy to assess suitability but also during pregnancy and peripartum to minimise materno-fetal risk.

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Abstract #:SU-58

Management of Newly Diagnosed Severe Mitral Stenosis in Pregnancy

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Cardiovascular disease is a leading cause of pregnancy-related mortality in the United States, and is increasing as a proportion of total maternal deaths. Mitral valve stenosis (MS) is the most common acquired valvular abnormality encountered in pregnant women, and is often first diagnosed in pregnancy due to worsening symptoms.

A 32 y/o G5P3 at 23 wks gestation who recently moved from Pakistan presented with palpitations. Examination and EKG revealed supraventricular tachycardia at 214 bpm. Blood pressure was 110/70 and after failed vagal maneuvers she spontaneously converted to sinus tachycardia at 109 bpm. Echocardiography showed severe M.S. (mean gradient 34 mmHg) with trivial regurgitation, severe pulmonary hypertension, RV systolic pressure (RVSP) 95 mmHg, severe RV enlargement, severe tricuspid regurgitation, normal LV function, severe bi-atrial enlargement, and no evidence of left atrial thrombus. Immediate treatment focused on heart rate reduction with metoprolol as she was otherwise stable without symptoms of dyspnea or volume overload.

The next day she underwent percutaneous mitral balloon valvuloplasty (PBMV) under MAC. Repeat echocardiogram showed reduction of mitral valve (MV) gradient to 8 mmHg, RVSP of 51 mmHg, and reduction in tricuspid regurgitation. She continued on metoprolol 50 mg b.i.d and subQ heparin 7500 units b.i.d., had no further episodes of SVT, was asymptomatic, and delivered a healthy boy vaginally at 36 wks with epidural analgesia.

Overall maternal morbidity relates both to the severity of M.S. and degree of prepregnancy symptoms. The physiologic burden presented by pregnancy worsens symptoms. As cardiac output increases, the gradient across the MV increases. Untreated, this creates pulmonary hypertension, RV failure, and pulmonary edema. Heart failure occurs frequently in parturients with moderate-severe M.S., even in previously asymptomatic women. It usually presents in the second and third trimesters, and is often progressive. Atrial arrhythmias are common and increase the risk for heart failure and thromboembolic events. Medical treatment centers on heart rate reduction with beta blockers, physical rest, and anticoagulation. Despite correction of her M.S., our patient remained on anticoagulation because of left atrial enlargement, pulmonary hypertension, and concern for paroxysmal atrial tachyarrhythmias. Diuretics may be used for symptomatic management of volume overload, but were not needed in this case described above.

For women with severe or progressive disease, PBMV improves maternal outcomes. This is ideally performed after 20 weeks gestation in patients with severe and/or refractory symptoms despite optimal medical treatment. MV surgery carries increased fetal and maternal risk and is reserved for those who are not suitable candidates for PBMV or when the mother's life is in danger without an immediate corrective procedure.

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Abstract #:SU-59

An Unusual Cause of Thrombocytopenia in a Patient Undergoing Fetal Therapy

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Introduction: Mid-gestation minimally invasive fetal procedures are becoming increasingly common. Although frequently performed with local anesthetic infiltration of the abdominal wall, procedures involving prolonged or more intense manipulation may compromise maternal comfort and necessitate other techniques such as epidural anesthesia. We present a patient with thrombocytopenia for whom epidural anesthesia was requested.

Case Discussion: A 39 year old at 19.1 weeks with a mono-di twin pregnancy presented with Stage 3 twin-to-twin transfusion syndrome for an endoscopic laser ablation. The surgical team requested epidural anesthesia. The patient denied symptoms of bleeding or bruising or a history of hematologic disease.

The day of presentation platelet count was 88,000 per mcL. An additional sample was sent and platelets were unable to be quantified as platelets were in clumps. A thromboelastogram was within normal limits.

An L3-4 epidural catheter was placed and was utilized intraoperatively. Postoperatively, the catheter remained in place for planned cerclage. The day of planned cerclage, platelets were again in clumps. Repeat platelet count in a citrate tube was 42,000 per mcL. Repeat showed a count of 62,000 per mcL. Hematology consult was obtained.

Workup included a platelet count in a heparinized tube, which revealed clumping. A peripheral smear was reviewed, with an estimated platelet count of 200-300,000 per mcL. The patient was diagnosed with pseudothrombocytopenia. Cerclage was performed and then her epidural catheter was removed without adverse consequence.

Discussion: Pseudothrombocytopenia is an in vitro phenomenon that has been reported in 0.1-0.2% of hospitalized patients and 15-17% of outpatients evaluated for isolated thrombocytopenia(1, 2). Thus, it has obvious implications for the obstetric population desiring neuraxial anesthesia.

Pseudothrombocytopenia is caused by anti-platelet antibodies that react with platelets in blood anticoagulated with calcium chelating agents, most commonly EDTA. The diagnosis can be confirmed with microscopic examination(3). Rarely, as with our patient, it can also be seen with citrate and heparin(4). It has not been found to have pathological significance and has not been associated with age, sex, comorbidities, or drugs(5). Given that the thrombocytopenia is an in vitro, not in vivo phenomenon, parturients can safely receive neuraxial anesthesia.

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Abstract #:SU-60

Pheochromocytoma in a woman with monochorionic twin pregnancy complicated with twin to twin transfusion syndrome: a case report

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Case: A 25-year-old primigravida at 16 weeks gestation of monochorionic diamniotic twin presented with intractable high blood pressure. Urinary vanillylmandelic acid and normetanephrine revealed elevated norepinephrine. Abdominal ultrasonography identified right adrenal tumor. Diagnosis of pheochromocytoma was confirmed at 19 weeks gestation. Magnetic resonance imaging indicated the possibility of the adhesion between the mass and inferior vena cava. Laparoscopic resection of the tumor was considered, but her large uterus and the location of the mass precluded the laparoscopic surgery. Our plan was to delay surgical resection until the postpartum period. Doxazosin 1mg per day was started, but switched to prazosin due to pruritus one week later. The dose of prazosin was increased to the maximum after 5 weeks. Her blood pressure ranged from 110/70 mmHg to 130/90 mmHg at that time. At 28 4/7 weeks gestation, twin-to-twin transfusion syndrome developed. Urgent Cesarean section was planned. Because her hemodynamics was well controlled, we selected combined spinal-epidural anesthesia with arterial line and central line monitoring. When she changed her position before regional block, her blood pressure went up to 190 mmHg. Phentolamine was administered against sudden hypertension. During operation her heart rate increased to 110 bpm. Landiolol hydrochloride, short acting beta blocker was injected continuously. Neonates, weighting 845g and 945g were delivered in good condition. The patient stayed in the ICU overnight for hemodynamic monitoring and pain control with PCEA. She resumed prazosin the next day. Her hemodynamics was almost stable postpartum, and she was discharged home after 18 days. Resection of pheochromocytoma is planned at months postpartum.

Discussion: Pheochromocytoma in twin pregnancy is extremely rare. Since there is no established course of treatment with regard to the timing of resection and delivery, and surgical procedure, we should provide optimum anesthetic management according to each case. A close co-ordination among multidisciplinary team is the key to safer management. Prenatal diagnosis is sometimes difficult, as its symptoms often resemble those of severe preeclampsia. The timing of surgery is controversial. There are case reports of laparoscopic resection before 24weeks' gestation, followed by vaginal delivery at term. In our case, although pheochromocytoma was detected before 24 week gestation, we chose conservative management due to larger uterus with twin. The massive tumor was located in adjacent to IVC, thus we chose not to resect the tumor right after CS. Early diagnosis and preoperative preparation, as well as strict intraoperative hemodynamic control results in good maternal and fetal outcomes.

Abstract #:SU-61

Intracranial Neoplasm and the Parturient: Case Report Examining the Risks, Benefits, and Outcomes in Performing a Craniotomy and Tumor Resection from the Anesthetic Perspective

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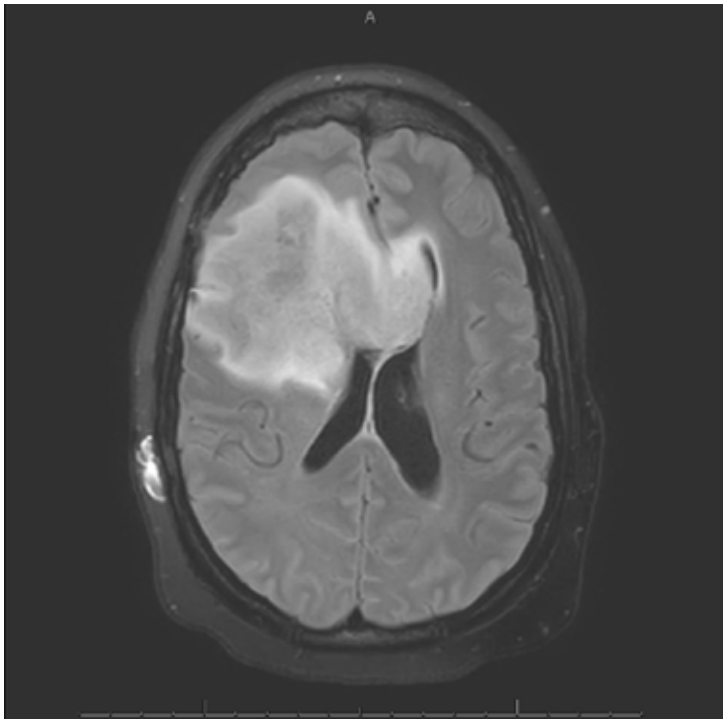
30 y/o G4P3 at 32 weeks gestation with history of Grade 2 Oligoastrocytoma status post primary resection in 2014, hepatitis B, hypertension, and morbid obesity presented with episodic seizures and worsening chronic headaches with pregnancy progression. Imaging confirmed the previously resected Oligoastrocytoma had regained its original mass. Neurosurgery recommended urgent secondary resection. High-risk obstetrics recommended betamethasone, continuing levetiracetam and lacosamide per Neurology, and continuous fetal monitoring (CFM) during Intensive Care Unit admission and surgery.

Anesthesia was consulted for the Right Frontal Craniotomy. Recommendations included optimization of seizure medication, arterial line placement prior to induction with general anesthesia, intraoperative CFM, and Neonatal Intensive Care presence in case of emergent cesarean section (CS). Induction of anesthesia was with propofol, succinylcholine, and remifentanil followed by endotracheal intubation, mannitol, and sedation with minimal sevoflurane and remifentanil infusion. Craniotomy was performed with minimal blood loss and proactive blood replacement with Packed Red Blood Cells. The procedure was completed and did not require CS.

Intracranial neoplasm incidence in parturients is reported as 6.9/100,000 with surgical resection even less (1). Parturients with brain cancer typically demonstrate worse symptoms than non-pregnant patients due to water retention, vessel engorgement, and most importantly the hormonal effects of progesterone worsening malignancy growth and causing urgent presentation (2). In this case remifentanil was used instead of longer acting opioids to avoid respiratory depression in the neonate in case of CS. Although remifentanil rapidly crosses the placenta, it is eliminated almost entirely from both maternal and neonatal circulation by nonspecific plasma esterases (3). Mannitol was used to decrease brain bulk and intracranial pressure. Although it has been shown to cause fetal hypovolemia and electrolyte imbalance in animal studies, mannitol has been used safely in pregnant women for urgent situations such as this (4). This case report seeks to highlight the anesthetic management of parturients with intracranial neoplasms undergoing craniotomy.



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Abstract #:SU-62

Anesthetic Management of Cesarean Delivery for a Parturient with Ornithine Transcarbamylase Deficiency

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Case Report: This is a case report of a 29yo G1P0 at 37 weeks gestation with ornithine transcarbamylase deficiency (OTCD) who presented for a scheduled cesarean delivery due to gestational hypertension. She was diagnosed with OTCD early in childhood due to lethargy associated with elevated ammonium. Other medical history includes sinus tachycardia attributed to pregnancy. Home medications include L-carnitine, citrulline, and glycerol phenylbutyrate. A multidisciplinary team developed a plan to admit the patient 24 hours prior to her scheduled cesarean section for medical optimization.

On admission, two 18-gauge intravenous catheters and a 20-gauge arterial catheter were inserted for medication administration and frequent blood draws, respectively. She was made NPO and started on an infusion of dextrose in normal saline. She was administered ammonia scavenging therapy – infusions of sodium phenylacetate/sodium benzoate and arginine. Her starting ammonia level was 14 (normal range 9-35 umol/L) and remained within normal limits throughout her hospitalization.

Spinal anesthesia was performed for her uneventful cesarean delivery. Pre-delivery arterial blood gas (ABG) showed pH 7.44, pCO2 27.2, pO2 105, HCO 20.5. Post-delivery ABG showed pH 7.40, pCO2 31.2, pO2 98, HCO 20.8. Her compensated metabolic acidosis was attributed to administration of ammonia scavenging treatment. Dextrose in normal saline infusion was continued post-op for 48 hours. The remainder of the hospital stay for the patient and newborn was uncomplicated.

Discussion: OTCD is an X-linked recessive condition affecting the urea cycle, and is the most common urea cycle enzyme deficiency. Patients are unable to convert ornithine to citrulline, which is necessary for the removal of ammonia. Accumulation of toxic levels of ammonia can lead to altered mental status, lethargy, emesis, hypotonia, seizure, coma, neural tissue injury, and death.

In pregnancy, the placenta may ameliorate symptoms, but the metabolic stress of pregnancy carries risks of inducing a hyperammonemic crisis. A primary goal in management is to minimize the catabolic state, thus lowering the risk of a hyperammonemic crisis. Perioperative treatment includes lowering protein intake, providing dextrose to enhance anabolism, ensuring adequate hydration, correcting electrolyte imbalances, administering ammonia scavengers, and preventing infection. Neuraxial anesthesia may be beneficial in mitigating the sympathetic stress for OTCD patients undergoing cesarean delivery; and as this case report shows, can be done safely with a multidisciplinary team approach.

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Abstract #:SU-63

HSV Hepatitis in Pregnancy

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Introduction: Pregnant patients are at high risk of developing hepatitis/disseminated infection after acute HSV infection due to relatively impaired T-cell functioning. This is a very rare occurrence but can be life threatening, with mortality risk reported as high as 39%.1 We present a case of a previously healthy 21 y/o who developed HSV 2 hepatitis at 24 weeks of pregnancy.

Case presentation: A 21 y/o G4P2 at 24 weeks EGA presented to an outside hospital with lower abdominal and flank pain. She was febrile, tachycardic, and hypotensive and was transferred to our care for suspected sepsis secondary to pyelonephritis. After two days of ceftriaxone with no improvement, she was evaluated by Infectious Disease who recommended meropenem and vancomycin. Liver function tests showed mild transaminitis (AST/ALT 150/64). Workup for HIV and Influenza, hepatitis panel, and blood cultures were negative. General surgery was consulted but no evidence of cholecystitis or appendicitis was found. On day 6, patient's blood work showed new onset thrombocytopenia and worsening anemia. Transaminitis continue to worsen with peak AST/ALT at 2197/498 associated with hyperbilirubinemia (3.0) and elevated LDH (2572). Diagnosis of HELLP versus HSV hepatitis was entertained. The patient was started on IV Acyclovir therapy. Despite this management, the patient's septic shock continued to worsen. Based on her declining clinical picture, decision was made to proceed with cesarean delivery. General endotracheal anesthesia was induced with etomidate and succinylcholine. A male neonate with Apgars of 5/8 was transferred to the NICU. The patient was extubated on POD 1. HSV 2 PCR was positive. Additionally, workup for Varicella zoster, Parvovirus, Toxoplasma, Cytomegalovirus, Chlamydia, Gonorrhea, and ANA were all negative. On postpartum day 2 she developed altered mental status and remained febrile, with concern for delirium vs HSV encephalitis. Head CT and MRI were normal. Lumbar puncture was not performed due to patient's elevated INR (peak 1.8). Her mental status continued to improve and she was discharged on post-op day 9 with plan for total of 2 weeks of IV Acyclovir, followed by high dose oral maintenance for HSV hepatitis.

Discussion: The clinical presentation of febrile abdominal pain and anicteric hepatic dysfunction in pregnancy should prompt consideration of the diagnosis of herpes hepatitis.2 Since 1969, at least 35 cases of herpes hepatitis in pregnancy have been reported in the literature.1The risk seems to be higher during the third trimester of pregnancy.3 Our patient presented with fever and tachycardia which put an infectious process high up in the differential. With the onset of hepatic dysfunction, herpes hepatitis was considered and treatment with acyclovir immediately started.

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Abstract #:SU-64

Anesthetic Management of a Pregnant patient with a Mediastinal mass

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Introduction: Mediastinal masses pose unique challenges for the anesthesiologist and are rare in pregnancy (1:1000-6000); most commonly due to Hodgkin's Lymphoma. We present an unfortunate case of end stage breast cancer with metastatic involvement of the mediastinum.

Case Report: A 32 yo G1P0 at 25.3 WGA presented with stage IV breast cancer. Metastasis to the manubrium, lungs, brachial plexus, and mediastinum involved compression of the great vessels, bronchi and left atrium. Notably, there was 50% compression of the left and right main stem bronchi and 90% compression of the bronchus intermedius requiring palliative stenting due to post obstructive pneumonia. The patient was therapeutically anticoagulated on a heparin infusion for a pulmonary embolus. She required high doses of opioids for extreme pain from metastasis to her sternum and brachial plexus. On ICU admission, the patient was tachypneic and orthopneic on 2L O2, unable to recline more than 30 degrees. She was tachycardic with normal range blood pressures. Continuous fetal monitoring was reassuring. However, at 26.4 WGA the patient developed increasing O2 requirements, worsening dyspnea, elevated blood pressures and proteinuria. The baby had intermittent spontaneous repetitive decels and a non-urgent cesarean delivery was planned. The patient's heparin drip was held and coagulation studies normalized. A radial arterial line and upper and lower extremity 16 gauge IVs were placed. A 19 gauge spinal catheter was positioned after intentional dural puncture. Graduated doses of both hyperbaric and isobaric bupivacaine were given to obtain a T4 sensory level and the patient tolerated a semi-recumbent position for delivery of a 0.78kg female. The patient's postop course was complicated by pain management and palliative measures and she passed away two weeks post-partum.

Discussion: Presenting symptoms of mediastinal mass often include dyspnea, orthopnea, chest pain, cough, SVC syndrome, hoarseness or syncope. OB literature supports delivery by cesarean in a planned setting whenever possible. Maintenance of spontaneous ventilation is advocated when GETA is required, although cardiopulmonary collapse has been described despite spontaneous ventilation. Epidural and CSE techniques have been reported and we present a continuous spinal as another anesthetic option. A multidisciplinary approach to the care of these patients is crucial; availability of rigid bronchoscopy and preparation and/or cannulation for potential cardiopulmonary bypass may be warranted for some cases necessitating early consultation with pulmonary and cardiothoracic surgical colleagues.

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Abstract #:SU-65

Doppler Ultrasound For Perioperative Fetal Heart Rate Monitoring

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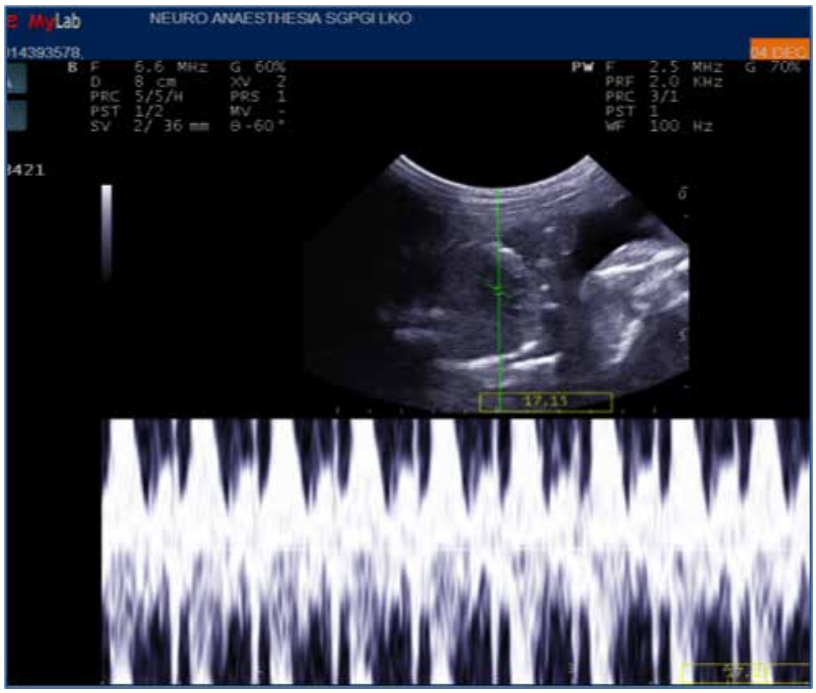
Introduction: Brain tumours during pregnancy is a complicated scenario which can jeopardise the lives of both the mother and foetus. Anaesthetic management of pregnant patient with intracranial space occupying lesion (SOL) requires modification of anaesthetic techniques(1) . Physiological changes during pregnancy necessitates heightened monitoring standards to ensure maternal and fetal safety (2).

Case summary: A 19 year old pregnant woman, (35kg, ASA I) presented with an intra cranial mass lesion suggestive of a central neurocytoma. Fetal heart rate (FHR) monitoring (Doppler ultrasonography) was initiated before induction, continued intraoperatively throughout till 48hrs postoperatively. Anesthetic management included thiopentone,fentanyl, rocuronium, sevoflurane and oxygen .Intraoperative monitoring included invasive blood pressure and central venous pressure . Intraoperative and recovery periods were uneventful and after regular followup patient had a normal antenatal course.

Discussion:
American College of Obstetricians and Gynaecologists (ACOG), recommends fetal monitoring and includes :
For previable fetus, ascertaining the fetal heart rate by Doppler before and after the procedure is sufficient. Selectively can be used for facilitating positioning .
For viable fetus is , simultaneous electronic fetal heart rate and contraction monitoring should be performed before, intraoperatively and after the procedure to assess fetal well-being and the absence of contractions.
• During surgery attention should be paid to fetal perfusion[1] ,detection of foetal hypoxia and metabolic acidosis.[2]
• Before 26 weeks of gestation , continuous FHR monitoring using Doppler USG may help in early detection of fetal hypoxia in the peri operative period.

Conclusion
• Each case warrants an individualized team approach (anesthesia and obstetric care providers, surgeons, pediatricians, and nurses).
• In this case, FHR monitoring with Doppler ultrasonography was found to be as useful as the standard electronic fetal monitoring (CTG). Craniotomy could be performed safely during the second trimester of pregnancy.



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Abstract #:SU-66

An interesting case of postpartum seizure and headache – A diagnostic challenge

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Introduction: Eclampsia most commonly occurs between 20 weeks of gestation and the first 48 hours postpartum. However, it may be delayed and present 3 to 4 weeks following delivery (1-2). The differential diagnosis of headache and seizure in the parturient should include post dural puncture headache (PDPH), venous sinus thrombosis, lupus cerebritis, meningitis, encephalitis and, rarely pneumocephalus (PC) from neuraxial anesthesia. Most cases of PC during epidural anesthesia have been associated with air loss of resistance (LOR) technique (3-4).

Case Presentation: A 33-year-old G3 P2 obese parturient developed severe headache following epidural placement using saline LOR technique for labor analgesia. The epidural placement was challenging due to the patient's size and required three attempts. Following delivery, the patient was evaluated for a positional headache and received an epidural blood patch with good relief of her headache. On the 5th postpartum day, the patient was re-admitted to the hospital complaining of severe headache, emesis, hypertensive emergency and seizures. The patient was intubated for airway protection. Head CT scan showed a small amount of air in the frontal horn of the right lateral ventricle (Figure 1). Magnetic resonance venogram (MRV) was negative for thrombus and initial laboratory data were not suggestive of eclampsia.

Discussion: This patient's presenting symptoms and initial studies posed a diagnostic challenge for both the obstetric and anesthesia teams. The delayed onset of the seizures following this patient's delivery, as well as the initial negative laboratory data for preeclampsia/eclampsia encouraged the medical teams to look for a diagnosis beyond eclampsia. PC and PDPH following neuraxial anesthesia have also been associated with seizures. The Head CT and MRV of the brain showing PC initially led to PC and PDPH being placed high on the differential diagnosis as the etiology of her seizures and headache. However, repeat laboratory testing revealed elevated liver enzymes and the patient subsequently developed pulmonary edema. Intravenous magnesium therapy was initiated with excellent response and eclampsia became the consensus primary diagnosis. She was discharged on hospital day 4 without complication or sequelae.

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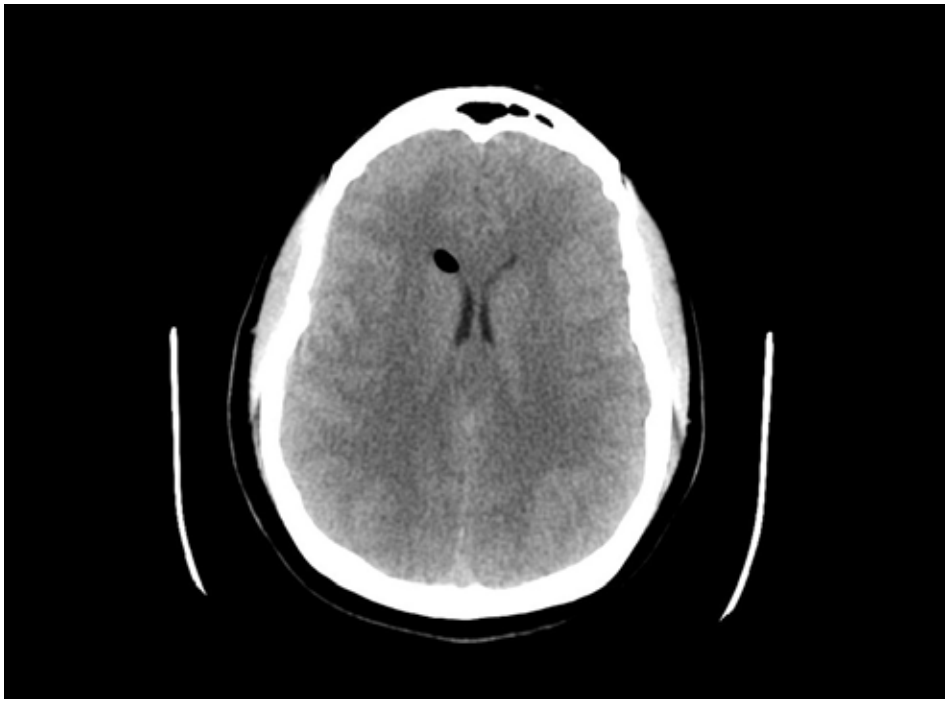
4. Int J Obstet Anesth. 2006; 15 (3): 237-9.



Abstract #:SU-67

Perioperative management of a twin gestation parturient with preeclampsia complicated by acute bilateral adrenal hemorrhage

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Introduction: Acute adrenal hemorrhage (AH) is a potentially life-threatening condition that is difficult to diagnose due to its rarity and nonspecific presentation.[1] The incidence of AH in pregnancy is unknown but there may be increased risk due to adrenal cortex hyperplasia and hypertrophy during pregnancy.[2] Delayed recognition can lead to maternal circulatory collapse and mortality.

Case: A 33 yo G4P2A1L2 with di-di twins at 33+1 weeks presented to the assessment unit with 12 h of acute onset, constant, 10/10 epigastric pain radiating to bilateral flanks, back and left shoulder. Her pregnancy had been complicated by gestational diabetes treated with insulin, significant emotional stress due to her son's recent diagnosis of leukemia and most recently preeclampsia diagnosed by elevated blood pressure and proteinuria. Initial ultrasound (US) investigations, fetal heart rates, complete blood count, liver and coagulation panels were all normal. Antenatal corticosteroids were initiated for fetal lung maturation. With a working diagnosis of musculoskeletal pain, IV fentanyl up to 600 mcg provided inadequate analgesia so lumbar epidural analgesia was initiated using 0.125% bupivacaine infusion. Despite a bilateral T4 sensory block to ice, intermittent boluses of 2% lidocaine were required for pain control. Without a clear diagnosis after 24 h, the epidural was discontinued and patient was transferred to another hospital for general surgery consultation. There, a repeat US revealed bilateral AH (up to 4.2 cm in diameter) not captured on initial imaging. Random serum cortisol was 2.8 mcg/dL and hydrocortisone 50 mg IV q6h was initiated. Given the diagnosis of bilateral AH in the face of progressive preeclampsia with SBP reaching 180 mmHg and severe ongoing pain, an emergency cesarean delivery was performed under general anesthesia with general surgery on standby. Both neonates were delivered without complication and admitted to NICU for observation. A transversus abdominis plane block was performed prior to emergence and IV hydromorphone PCA was used for postoperative pain control. The patient continued magnesium and nifedipine for hypertension and a tapering regimen of oral hydrocortisone postpartum. Repeat MRI on day 4 showed stable bilateral adrenal hematomas with no further expansion. The patient was discharged home on postpartum day 7.

Discussion: During pregnancy, AH has been associated with severe emotional stress, preeclampsia, sepsis and trauma.[2] Awareness of these risk factors may aid in early detection of AH. We propose that AH be listed in the differential diagnosis of a parturient with abdominal pain. Bilateral AH in this patient may reflect the severity of her preeclampsia. The pain associated with bilateral AH was seen to break through epidural analgesia despite adequate sensory blockade, with significant improvement following delivery.

References:

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2. Bockorny et al. Obstet Gynecol 2012

Abstract #:SU-68

Preeclampsia induced cardiomyopathy - measurement using a novel noninvasive cardiac output technique

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A 22 year old previously 35 week healthy primipara was admitted with shortness of breath. Echocardiography showed moderate left ventricular dysfunction with diastolic dysfunction and moderate mitral regurgitation. The patient was given a loading dose of magnesium 4 gram and taken for a cesarean section. The parturient was assessed using noninvasive cardiac system (NICaS, NI Medical, Petach Tikva, Israel).) during the peripartum period: preoperatively, immediately after anesthesia, two minutes after baby delivered, one hour after surgery in the postoperative care ward. The NICaS ,a whole body plethysmography system measuring cardiac output and its derivatives (mean arterial pressure (MAP), heart rate (HR), stroke volume (SV), cardiac output (CO), and total peripheral resistance (TPR), was found to be highly accurate compared to themodilation (1). Anesthesia was performed by combined spinal epidural, using 9 mg heavy bupivicaine , 20 ucg fentanyl and 100 ucg morphine intrathecally and nothing in the epidural . Oxytocin slow bolus of three units was given immediately after the baby was delivered.

Preoperatively the patient had a MAP 101mm Hg, HR 53, CO 3.9 liter/min, SV 53 milliliters (ml)and TPR 2100 dyn*sec/cm5. When compared to a group of healthy parturients undergoing similar anesthesia, this woman had a lower HR, SV and CO and higher TPR (figure). Immediately postanesthesia, MAP was 128mm Hg, HR 70, CO 5.0 l/min, SV 71 ml, and TPR 2069 dyn*sec/cm5. Compared to healthy parturients undergoing similar anesthesia, MAP and TPR were higher and SV and CO lower (figure). Post delivery, MAP was 93 mm Hg, HR 82, CO 4.7l/min, SV 57 ml, and TPR 1616 dyn*sec/cm5. Compared to healthy parturients undergoing similar anesthesia, MAP and TPR were higher and SV and CO lower (figure). One hour postoperatively, MAP was 106 mmHg, HR 98, CO 4.1 L/min, SV 42 ml, and TPR 1230 dyn*sec/cm5. Compared to healthy parturients, the same hemodynamic differences occurred (figure).The patient was transferred to the cardiac intensive care where she received intravenous hydralazine because of high TPR. Echocardiography on the following day showed improvement in left ventricular function with an ejection fraction of 55. The patient was released 4 days later with a normal echocardiography and a diagnosis of preeclampsia induced reversible cardiomyopathy.

References:

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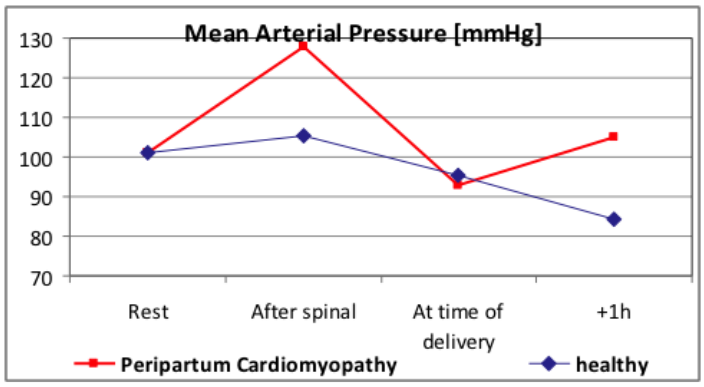
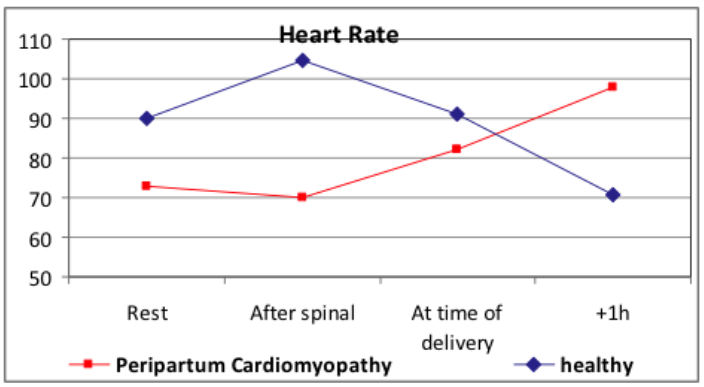
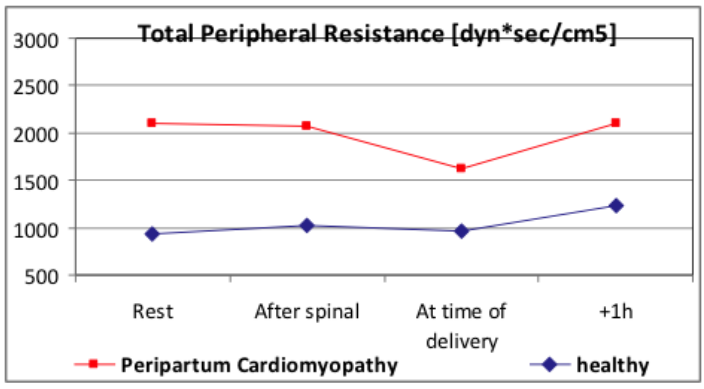
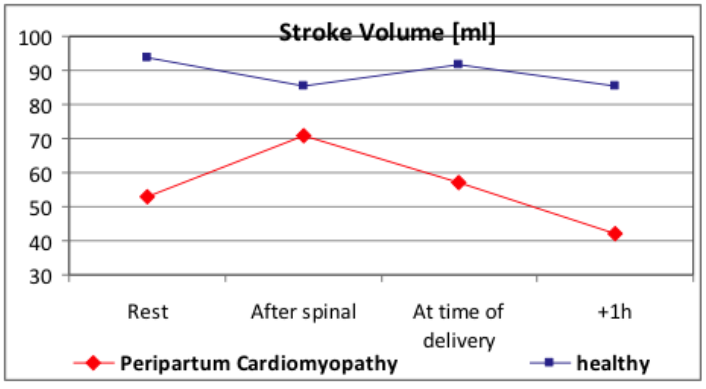
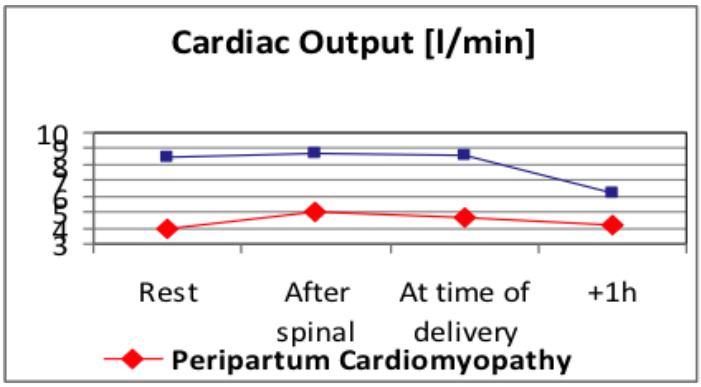

Mean Arterial Pressure [mmHg]
130
120
110
100
90
80
70
Rest
After spinal
At time of delivery
+1h
Peripartum Cardiomyopathy
healthy


Heart Rate
110
100
90
80
70
60
50
Rest
After spinal
At time of delivery
+1h
Peripartum Cardiomyopathy
healthy


Total Peripheral Resistance [dyn*sec/cm5]
3000
2500
2000
1500
1000
500
Rest
After spinal
At time of delivery
+1h
Peripartum Cardiomyopathy
healthy


Stroke Volume [ml]
100
90
80
70
60
50
40
30
Rest
After spinal
At time of delivery
+1h
Peripartum Cardiomyopathy
healthy


Cardiac Output [l/min]
10
Rest
After spinal
At time of delivery
+1h
Peripartum Cardiomyopathy

Abstract #:SU-69

Cesarean Section and Congenital Pulmonary Artery Stenosis: A Case Report of the Anesthetic Management

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Lesley Gilbertson M.D. - University of Cincinnati Medical Center - Cincinnati, Ohio

Pulmonary hypertension (PH) in pregnancy can compromise the health of both mother and fetus. Despite advances in medical therapy, reported maternal mortality is 30-56%. (1) Patients with PH are often counseled against pregnancy given this high mortality risk. We present the case of a pregnant woman with congenital pulmonary artery stenosis and pulmonary hypertension. A 22 year-old G2P1 presented with a history of congenital bilateral branch pulmonary artery stenosis. She had stenting of her right and left PA as a child with residual stenosis of the LPA. Her first pregnancy was complicated by symptomatic increased right ventricular systolic pressure (RVSP) requiring IV treprostinil. She delivered by c-section at 37 weeks under epidural anesthesia without complications. During her second pregnancy, she remained asymptomatic but her RVSP increased throughout the pregnancy. She was electively admitted at 34 weeks for medical optimization with IV epoprostenol. Admission echocardiogram revealed LVEF of 65-70%, RVH, RVSP 70 mmHg, and normal RV function. After optimization, she had a cesarean section under combined spinal-epidural (CSE). She received intrathecal opioids (15 mcg fentanyl and 0.2 mg morphine). Her epidural was dosed incrementally with 2% lidocaine with 1:200,00 epinephrine and bicarbonate. An arterial line and central line were placed for monitoring. During surgery, she was hemodynamically stable, required no vasoactive medications and had approximately 600 cc of blood loss. She received TAP blocks for post-operative analgesia. She was transferred back to the ICU in stable condition. Management goals for PH patients include avoiding hypercarbia, hypoxia, acidosis, and fluid overload. After delivery, large fluid shifts may cause right heart failure and decreased cardiac output. Uteroplacental blood flow shifts to the intravascular space, causing an increase in both cardiac output and stroke volume. (1)There is a high potential for decompensation at this point. Hemodynamic effects of the chosen anesthetic technique should be carefully considered. Risks of spinal anesthesia include decreased preload and hypotension. Epidural or CSE allow careful titration of the anesthetic level and provide excellent anesthesia.(2) General anesthesia can depress cardiac contractility and increase pulmonary vascular resistance, leading to increased pulmonary artery pressure. (3) Extracorporeal membrane oxygenation (ECMO) is proposed as an option in a decompensated mother, but evidence is limited. Medical therapies include prostacyclin analogs, inhaled nitric oxide, Bosentan, and PDE-5 inhibitors. We describe a c-section performed with a high-risk maternal co-morbidity. With careful titration of anesthetic and appropriate hemodynamic monitoring, these patients can be successfully managed during c-section.

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2. Bonnin M et al. Anesthesiology 2005;102:1133-7
3. Bedard E et al. European Heart Journal 2008;30:256-265

Abstract #:SU-70

Management of Pulmonary Hypertension in Pregnancy Using Nitric Oxide

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Case Presentation: A 26 y/o G3P1011 at 36w2d with medical history significant for HFpEF, sickle cell disease, HIV, and pulmonary hypertension (pHTN) presented with diffuse pain typical of a vaso-occlusive crisis; and worsening dyspnea concerning for heart failure exacerbation. A CT chest PE protocol ruled out pulmonary embolus, but noted enlargement of the pulmonary artery. A TTE done on admission estimated RVSP of 62mmHg with an enlarged RV. The patient was started on inhaled nitric oxide (NO) at 40 ppm via NC. A diagnostic right heart catheterization (RHC) was done while the patient was on NO the following day showing moderate pHTN with mean PAP of 41mmHg. The patient's hospital course was also complicated by preeclampsia without severe features, with delivery planned once the patient was medically optimized. Given results of the RHC, the decision to proceed with a planned C-section was made.

The patient was transported to the OR with NO at 40ppm, which was continued throughout the case. A right IJ cordis with a continuous cardiac output Swan–Ganz catheter was still in place from the RHC. In discussing the anesthetic options, a lumbar epidural was planned and placed in the L3-4 space with no complications. The PAP, SVO2 and CI/CO were monitored while the epidural was placed in the sitting position. A radial arterial line was placed for continuous BP monitoring prior to testing and dosing the epidural. The lumbar epidural was slowly titrated to a T4 level. A norepinephrine drip was started and patient's baseline BP maintained. The patient's intraoperative course was uneventful, with delivery of a baby girl with APGARs of 5 and 9 at 1 and 5 min. Blood loss was estimated to be 500ml with 550ml of crystalloid administered.

Discussion: pHTN is defined as a mean PAP of greater than 25mmHg at rest in the absence of any demonstrable cause. pHTN is tolerated very poorly in pregnancy and carries a high risk of mortality ranging from 30-56%(1). Prior studies have shown the use of NO in the pre and post delivery management of pHTN in pregnancy with reductions in PAP(2). The primary goals in the anesthetic management of pregnant patients with pHTN includes: avoiding increases in pulmonary vascular resistance, avoiding a marked decrease in venous return, avoiding a reduction in SVR, and avoiding myocardial depression(4). Our case demonstrates the use of NO through the perioperative period to reduce PAP; in combination with epidural anesthesia in the management of a pregnant patient with pHTN.

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Abstract #:SU-71

A Ticking Time Bomb Living on the Antepartum Floor

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A 21 year old G3P0 initially presented at 26w5d with a chief complaint of vague abdominal pain. The patient's history is complicated by 2 previous uterine ruptures. The first rupture occurred at 30w0d due to a motor vehicle accident leading to fetal demise. The operative report from the initial uterine repair after the motor vehicle accident described an "approximately 10 cm long rupture of the uterine fundus extending around the top of the uterus to the posterior fundus." The rupture was closed in 3 layers at that time.

The second rupture occurred spontaneously at 31w5d. The patient presented at that time in significant distress and abdominal pain and demonstrated hemodynamic instability. This incident led to fetal demise also. The rupture was surgically repaired at this time as well. After each pregnancy, the patient was advised to not become pregnant for at least a year. Each time she became pregnant less than a year later.

PMH was otherwise uncomplicated in this patient with no comorbidities noted.

The patient was admitted for close monitoring due to her presentation and history. The patient's pain subsided and no indication of uterine rupture was noted via vital signs or ultrasound. Given the patient's history of rupture and the significant risk this posed to the mother and the fetus, the high risk obstetric service made the decision to admit the patient with the plan of pursuing elective cesarean delivery at 31w0d. This would allow the parturient and the fetus to be closely monitored for any signs/symptoms of uterine rupture more closely than could reasonably be achieved as an outpatient. The timing of the delivery was chosen based on the timing of her most recent rupture. From an anesthesia standpoint, she was evaluated at the beginning of her hospital admission and was monitored by our service in addition to the obstetricians. Our main focus was ensuring good IV access was maintained in case an emergency were to develop and the patient required significant resuscitation. In addition to vascular access, an active type and screen was kept on the patient at all times throughout her hospital stay.

The patient's hospital stay was uncomplicated and no further episodes of abdominal pain occurred. Once the patient reached 31w0d, she was taken to the operating room for elective cesarean section. Anesthesia was administered via combined spinal epidural. Intrathecal medications included 12 mg of hyperbaric bupivacaine, 10 mcg fentanyl, 150 mcg morphine. An epidural catheter was placed at the L3/L4 interspace. A T4 sensory level was achieved and the patient delivered a single viable male newborn with Apgars of 3, 3, and 9 at one, five, and ten minutes, respectively. An extremely thin portion of the uterine fundus was noted intraoperatively which was consistent with the previous uterine ruptures and subsequent repairs. The remainder of the hospital course was uncomplicated and the patient was discharged home on post-operative day 3.

Abstract #:SU-72

Epidural placement for cesarean delivery in a patient with congenital arthrogryposis

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Richard Smiley M.D., Ph.D. - Columbia University Medical Center - New York, NY

Arthrogryposis multiplex congenita encompasses a spectrum of syndromes characterized by progressive joint contractures and motor neuron degeneration. Etiology, inheritance, and pathogenesis are largely idiopathic with most cases being sporadic with a difficult to predict prognosis. It is rarely seen in the pregnant population but its effects, specifically on anatomy and cardiopulmonary physiology, pose significant challenges when administering anesthesia for cesarean delivery. Cardiorespiratory complications include alveolar hypoventilation, atelectasis, restrictive respiratory pattern, dyspnea, V/Q mismatch, and hypoxemia leading to cor pulmonale. Neuraxial anesthesia is difficult because of scoliosis and contractures making positioning challenging, furthermore there is an increased incidence of spina bifida occulta and sacral agenesis which can negatively impact the spread of local anesthetic in the epidural space impeding adequate analgesia and anesthesia.

Our patient is a 30 year old G4P0212 female presenting for scheduled cesarean delivery at 37 weeks gestation. She is 145cm and 37.2kg with a Mallampati class one airway with small mouth opening and micrognathia. She has severe dextroscoliosis associated with restrictive lung disease requiring BiPAP while asleep. Her two previous deliveries included a spontaneous vaginal delivery at 27 weeks gestation and a classical cesarean delivery at 25 weeks gestation. Her cesarean delivery required general anesthesia after failed neuraxial anesthesia. Her postoperative course was complicated by carbon dioxide retention requiring prolonged hospitalization.

The anesthetic plan for this cesarean delivery is an ultrasound assisted combined spinal-epidural (CSE) with BiPAP for respiratory support. Ultrasound was used to map out the patient's anatomy in order to find midline and sacrum given her severe dextroscoliosis. CSE was initially attempted at the L4-5 interspace however was unsuccessful. Another attempt was made at the L3-4 interspace and loss of resistance to saline occurred at a depth of 7cm. Placement of the Whitacre needle demonstrated free flowing CSF and a low dose of anesthetic was injected intrathecally. An epidural catheter was easily threaded and taped at 12cm at the skin. The patient achieved an adequate sensory level for surgery to commence. The epidural catheter was bolused intermittently throughout the case and was supplemented with intermittent IV boluses of ketamine. Postoperative pain control was managed via PCEA and non-opioid IV medication to prevent respiratory depression.

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Cabrini L, Nobile L, et al. Intraoperative prophylactic and therapeutic non-invasive ventilation: asystematic review. BJA. 2015;43(4):880-888.

Abstract #:SU-73

Management of Parturient with Subaortic Stenosis

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In the past, concerns about the hemodynamic fluctuations of neuraxial anesthesia curtailed its use in patients with aortic stenosis physiology (AS). Presently, careful titration of epidural catheters are successfully utilized in the labor management of patients with AS. We discuss the case of a patient with LVOT obstruction presenting for a cesarean delivery due to a deteriorating category II tracing remote from delivery.

18. y.o. primigravida at 37weeks referred from the Congenital Heart Disease Program due to the presence of a congenital subaortic membrane. Her chronic SOB had been erroneously attributed to asthmatic exacerbations during the past years. Pt denied syncopal episodes or history of chest pain. Patient had been poorly compliant with follow up Cardiology Clinic visits and, it was unclear if surgical repair was offered in the past. Echocardiogram revealed a mean gradient of 110 mmHg across stenotic subvalvular area, normal LV function, mild atrial dilatation and moderate pulmonary hypertension. A pre-procedural arterial line was placed for continuous BP monitoring. An epidural catheter was placed uneventfully at the L3-L4 interspace with a 17G Touhey, 11 cm from the skin. After negative aspiration, the epidural catheter was tested with 3 ml of 0.25% Bupivacaine and 100 mcg of Fentanyl to avoid possible intravascular injection of epinephrine containing solutions. The epidural catheter was incrementally loaded with 15ml of 2% Lidocaine. Hemodynamic fluctuations were attenuated with a phenylephrine infusion targeted to maintain baseline BP, prevent hypotension and avoid tachycardia (25-100mcg/min). Obstetrical Anesthesia Team had discussed and was ready to proceed with a rapid sequence induction using Etomidate and Remifentanyl (2-3mcg/min), in case of neuraxial technique failure.1 CT surgery service was alerted for the possible need of emergent intervention. A viable male infant with Apgars of 9/9 was delivered with no complications. Post operatively patient was transferred to the CCU for recovery.

Controversies exist regarding the best technique, general vs. neuraxial anesthesia, when managing patients with AS physiology. Our and other case reports have demonstrated that it is possible to manage these patients with neuraxial anesthesia and invasive monitoring, if the block is achieved slowly to the desired level to prevent rapid decreases in the SVR2. Interdisciplinary peripartum management is essential as AS continues to carry a high risk of maternal morbidity and mortality.

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2. Ioscovich A, et al. IJOA 18: 379-86, 2009.

Abstract #:SU-74

Implementing skin-to-skin contact following cesarean section improves cerebral hemoglobin saturation levels measured by Near Infrared Spectroscopy.

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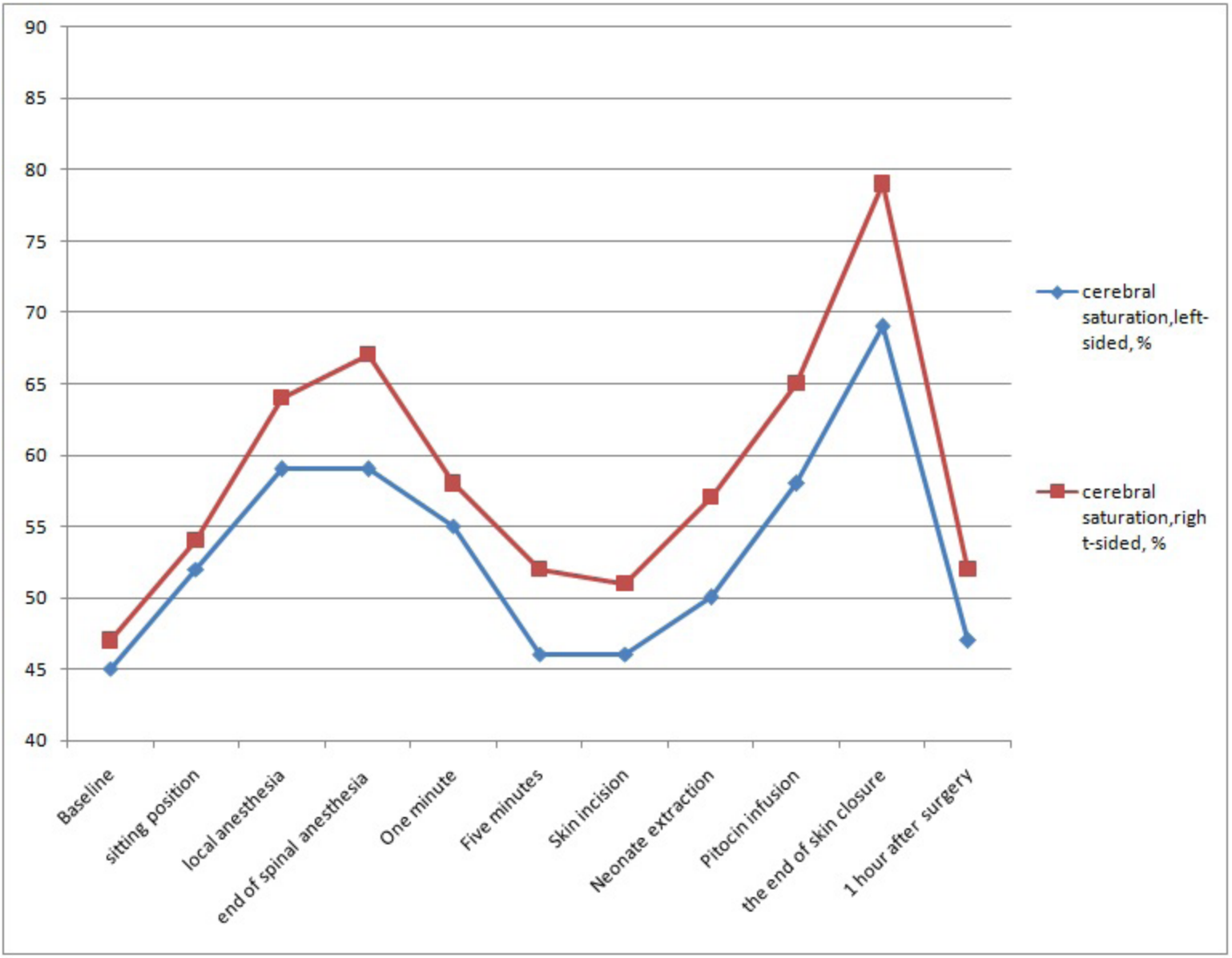
Co-Author: Sharon Orbach-Zinger M.D. - Rabin Medical Center - Petah Tiqwa, Israel
Shlomo Fireman M.D. - Rabin Medical Center - Petah Tiqwa, Israel
Leonid Eidelman M.D. - Rabin Medical Center - Petah Tiqwa, Israel

A 33 years old previously healthy parturient, G4P3CS0, was admitted for a scheduled cesarean delivery. The parturient was taken to the operation room, connected to standard ASA monitoring. Spinal anesthesia (SA) was performed, using bupivacaine 12 mg, fentanyl 20 µg and morphine 0.1 mg with a prophylactic phenylephrine infusion of 50 µg/min from beginning of SA to the end of surgery. Immediately after delivery, oxytocin 20 units was injected into a liter of Ringer Lactate and infused. No other uterotonics were given. Following the delivery an immediate skin-to-skin contact was implemented until the end of surgery. In addition right and left-sided brain saturation measurement was used via Near Infrared Spectroscopy (INVOS Cerebral/Somatic Oximeter|Covidien)- a direct non-invasive measurement of blood oxygenation in the brain microvasculature that has shown a high level of accuracy and can be used to detect an index of brain oxygenation (1). The measurements were made at the following points: baseline in supine position, in the sitting position, during local anesthesia, at the end of SA, 1 minute, 5 minutes after anesthesia, at the skin incision, after neonate extraction, 1 minute after beginning of oxytocin infusion, at the end of skin closure, 1 hour after surgery. The surgery was uneventful and took 36 minutes. After the surgery the parturient was monitored at PACU for another 2 hours (hospital protocol). After the spinal block there was no decrease in cerebral saturation, right and left-sided, compared to the baseline. After implementation of skin to skin, there was a gradual increase in cerebral saturation on both sides, with a maximum level at the end of surgery (69% versus 45% baseline left-sided; 79% versus 47% baseline right-sided). One hour after surgery there was decrease in cerebral saturation, but not below the baseline (see figure 1). The changes of brain saturation were not correlated with blood pressure changes that remained within normal limits through the perioperative period.

Discussion: It seems that spinal block causes a decrease in cerebral saturation. This effect is also seen in a prospective study which is now being done in our hospital. A decrease is partially reversed by parturient's excitation because of contact with baby. More researches are required to further investigate this phenomenon.

References:

1. Near-infrared spectroscopy as an index of brain and tissue oxygenation.Murkin JM, Br J Anaesth.,2009


90
85
80
75
70
65
60
55
50
45
40
Baseline
sitting position
local anesthesia
end of spinal anesthesia
One minute
Five minutes
Skin incision
Neonate extraction
Pitocin infusion
the end of skin closure
1 hour after surgery
cerebral saturation,left-sided, %
cerebral saturation,right-sided, %

Abstract #:SU-75

Multidisciplinary Approach to Ethical Management in Terminal Parturient

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Introduction: The American College of Obstetrics and Gynecology and ethicists have come to a consensus that decisions regarding fetal care are dependent upon maternal decision making and autonomy. 1 While clinicians are obliged to advise patients in accordance with their clinical acumen, they are not entitled to overrule the decisions of competent patients, even in terminal cases. In the case of parturients with AIDS, there is the added prerogative to prevent vertical transmission of HIV.

Case Presentation: Our patient was a 21 year old G2P0010 at 30.5 weeks with end stage AIDS, acquired via perinatal transmission, who initially presented with symptoms concerning for Pneumocystis Jiroveci pneumonia (PJP). She was started on empiric therapy for PJP but quickly deteriorated requiring 100% oxygen via non-rebreather mask. Discussions were held regarding goals of care for herself and her unborn child. The obstetric team advised her that immediate cesarean delivery would be best for her child to prevent vertical transmission; however, patient was adamant only in case of severe fetal intolerance or impending cardiac arrest would she consent to cesarean delivery. Her clinical condition continued to decline, eventually developing acute respiratory distress syndrome requiring intubation, continuous infusion of muscle relaxant and 100% oxygen to maintain saturations. Intravenous zidovudine was started to prevent vertical transmission. On hospital day 8, fetal tracing showed deep and prolonged decelerations prompting decision to move towards delivery. Cesarean delivery was initially planned; however, fetus was at low station and was delivered via low-outlet forceps in the general operating rooms. The patient was actively treated for another month before terminal extubation in accordance with her family's wishes. Her child is currently healthy and HIV negative.

Discussion: Patient decision making that contradicts clinical advice must be met with thoughtful consideration and flexibility in management. In our case, the patient had a known terminal diagnosis and she made clear her wishes to avoid surgical delivery of her fetus unless fetal or maternal death was imminent, despite the risk of perinatal transmission of HIV given her high viral load. Once the mother is no longer capable of voicing her decisions, physician preference does not suddenly prevail. Our patient and her clinical course highlight the fact that a multidisciplinary approach to patient management is vital when approaching maternal fetal decision making that contradicts medical advice. In this case, obstetrics, critical care, obstetric anesthesiology, ethics and palliative care were all in daily contact to ensure that the mother was aggressively treated not only for her well-being, but to provide the safest intrauterine environment possible to facilitate further fetal development.

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Abstract #:SU-76

Neuraxial anesthesia for the parturient undergoing an Ex-Utero Intrapartum Treatment (EXIT Procedure).

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Introduction: An EXIT procedure is aimed at increasing survival rates for life threatening fetal congenital malformations during the peri-partum period. This is achieved by partially delivering a fetus through cesarean delivery and performing the necessary treatment with the maintenance of maternal-placental-uterine circulation. Classically, the anesthetic approach for this obstetric population has been general endotracheal tube anesthestia with inhalational agents, to allow for uterine relaxation. We present a case report of a parturient that underwent a successful EXIT procedure under combined spinal-epidural anesthesia with a natural airway. Considerations for this specific anesthetic setting are being discussed.

Case: A 24-year-old G4P1021 at 38w1d presented for a cesarean for severe fetal congenital diaphragmatic hernia (CDH). Perinatal ultrasounds revealed fetus at 96th percentile, moderate polyhydramnios, liver displacement into the right sided chest, and displacement of both the heart and stomach. A multidisciplinary team from Boston Children's and Brigham and Women's Hospitals conducted several meetings prior to the date of surgery. A combined spinal-epidural technique was used for the procedure. Intravenous nitroglycerin infusion was administered for uterine relaxation. Upon unsuccessful intubation by the ENT team, cardiac surgical team quickly proceeded and established ECMO.

Discussion: Providing anesthesia for an EXIT procedure involves optimizing placental perfusion, uterine relaxation, and minimizing untoward fetal drug effects. Classically, the use of a general endotracheal anesthesia with sevoflurane maintenance is described. However, equal consideration must be given to the cardiovascular depressant effects of these inhalational agents as it relates to hypotension and decreased placental perfusion. The implementation of a combined spinal-epidural neuraxial technique in our EXIT procedure provided a very stable hemodynamic profile throughout the case. Risks of a failed CSE include inadequate analgesia/anesthesia, intolerance to being awake and aware, and the possibility of a total spinal. To ease the anxiety of undergoing this procedure awake, the patient was offered headsets for music, was accompanied by the father of the baby, and had a social worker present in the room as well. However, with proper planning and in experienced hands, the CSE can prove to be a very valuable tool in providing a safe, effective anesthetic for the parturient undergoing EXIT procedure. A multidisciplinary approach across two institutions contributed to not only the complexity of the case, but also to the success.

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Abstract #:SU-77

PDPH Management in Patient with Ebstein's Anomaly

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Introduction: Ebstein's anomaly is a rare congenital heart disease (CHD). As medical advances continue, we expect a growing population of CHD patients living to reproductive years, presenting unique management considerations for the obstetric anesthesiologist. We report the case of post-dural puncture headache (PDPH) in the Ebstein's anomaly parturient and decision for early epidural blood patch (EBP).

Case Description: A 32-year-old G1P0 at 40w with history of Ebstein's anomaly presented in active labor. Most recent echocardiogram demonstrated normal left ventricle (LV) systolic function, atrialization of the right ventricle (RV) and apical displacement of the septal leaflet of the tricuspid valve, and globally reduced RV systolic function. The patient complained of past palpitations, mostly associated with caffeine consumption, which correlated with sinus tachycardia on a Holter monitor. The patient was a New York Heart Association (NYHA) class I. Upon presentation, the patient was placed on telemetry with defibrillator nearby. The Cardiology team was consulted. An epidural was placed at the L3-4 interspace using an 18-g Tuohy needle. Unintentional intrathecal puncture occurred and Tuohy was removed immediately. An epidural was then placed at the L2-3 interspace. The patient was started on a low continuous rate of 6mL/hr of 0.055% bupivacaine-1mcg/ml sufentanil. The patient remained on telemetry during her hospital admission. Postpartum day 3 the patient reported a severe, unremitting, positional headache concerning for PDPH. An early EBP was chosen, avoiding fluid boluses and caffeine. Her headache improved immediately and post-EBP day 3 she remained without headache.

Discussion: The peripartum management of Ebstein's anomaly includes the following three hemodynamic goals: maintaining cardiac output, minimizing right to left shunt, and avoidance of atrial tachyarrhythmias (1). Early epidural placement to blunt the sympathetic response to pain is helpful in decreasing right heart strain (2). A Cochrane review and Pubmed search did not yield any data regarding risk: benefit profile for therapy of PDPH in the parturient with Ebstein's anomaly. Due to the risk of supraventricular tachycardias and Wolff-Parkinson-White, caffeine can be dangerous. These patients often have RV dysfunction as well, especially after delivery-associated autotransfusion, therefore large fluid boluses to treat a PDPH may not be tolerated. We conclude that PDPH should be managed early with epidural blood patch while caffeine and fluid boluses should be minimized.

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Abstract #:SU-78

Anesthetic management of parturient with HELLP syndrome and post liver transplant with chronic rejection.

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Introduction: Approximately 14,000 women of childbearing age within the United States have received liver transplants (1). Those receiving pediatric liver transplants make up only 15% of all female liver transplant patients and approximately 70% of those go on to reproductive age (2). With the increase in successful liver transplants, health care providers must deal with increased pregnancy related pathologies in post liver transplant patients. We present a case of a parturient post liver transplant with chronic rejection and HELLP syndrome for cesarean section.

Case: 25 yr old G3P1 at 27 weeks gestation with a past medical history of orthotopic liver transplant at age 3 months due to giant cell hepatitis and chronic liver rejection due to medication non-compliance. Immunosuppression included prednisone and tacrolimus daily. The patient was admitted due to possible worsening liver rejection. Transplant team was immediately consulted on patient admission and followed for the remaining hospital course adjusting immunosuppressive therapy as needed. The possibility of HELLP syndrome on top of liver rejection was entertained due to precipitous drop in platelet count - 65 x10/L in addition to elevated liver enzymes. She was then brought to OR for caesarean section. General anesthesia was planned due to her thrombocytopenia. A rapid sequence induction was performed with propofol and succinylcholine. Intraoperatively, packed RBCs transfusion were administered due to low pre-operatic hematocrit (28%) and moderate surgical blood loss. A male infant was delivered weighing 960g with Apgar score of 1&6. During her postoperative course she received additional packed RBCs, platelets, FFP, and cryoprecipitate. The patient was discharged on post op day 5 with stable hematocrit, platelets and Liver Function Test (LFT). Subsequently, she was readmitted five days later due to elevated LFTs found on routine follow-up. Liver biopsy was performed which showed worsening chronic liver rejection.

Discussion: Pregnancy in post liver transplant patients is increasingly common. Post liver transplant patients have higher rates of preeclampsia, preterm birth and cesarean section (1). This case demonstrates the need for better understanding of the management of pregnancy complications in these increasingly common complex patients. It also underscores the importance of preoperative, operative and postoperative communication between healthcare providers along with careful follow-up.

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Abstract #:SU-79

Morbidly adherent placenta of twin A in a surrogate gestational carrier with dichorionic-diamniotic twins

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A 28 year old G4 P2103 presented at 29 weeks gestation as a surrogate gestational carrier of an in vitro fertilization pregnancy with findings of complete posterior placenta previa and increta of twin A on ultrasound. Follow up magnetic resonance imaging was concerning for placenta percreta. She had a history of one previous cesarean delivery. After a multidisciplinary meeting, an elective cesarean hysterectomy at 32 weeks was scheduled to maximize the fetuses' gestational ages while being precautious of the maternal risks associated with preterm labor and/or antepartum hemorrhage and the subsequent need for emergency cesarean delivery by prolonging the pregnancy.

On the day of surgery, our massive transfusion protocol was on standby, as well as both trauma and vascular surgeons. Cell salvage and a rapid infuser were available. Prior to induction and intubation, a radial arterial line and a peripheral 7 French rapid infusion catheter were placed. Interventional radiology placed bilateral occlusion balloons in the internal iliac arteries. After rapid sequence induction and intubation, a 9 French double-lumen central venous catheter was placed in the right internal jugular vein. The twin fetuses were delivered by cesarean and the hysterotomy was closed with the placentas in situ. After delivery, hemorrhage was suspected, and although a source was not readily apparent, blood transfusion was started as the surgeons began the hysterectomy. Bleeding from the vagina finally became evident, likely due to the placenta previa. Bilateral occlusion balloons were inflated, and the dissection proceeded quickly. At the end of surgery, estimated blood loss was 4 liters and transfusion included 10 units packed red blood cells, 8 units fresh frozen plasma, 1 adult dose of platelets, and 125 milliliters of blood from cell salvage. Laboratory analyses was satisfactory, vital signs were stable, thus she was extubated and taken to recovery.

Discussion: The incidence of twin gestation has increased due to increasing advanced maternal age and assisted reproductive technology. Twin pregnancies are associated with increased risks of placental abnormalities, including a 40% higher incidence of placenta previa compared to singleton pregnancies. Data is limited surrounding the diagnosis and management of morbidly adherent placenta in twin pregnancies, but most cases report uterine rupture and emergency hysterectomy in the second trimester. The surgical management in our case was for elective preterm cesarean delivery followed by closure of the hysterotomy with both placentas in situ and then hysterectomy. This case was complicated by significant bleeding requiring transfusion, mostly from the vagina, and likely due to partial separation of the adherent placenta.

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Abstract #:SU-80

Multimodal Labor Analgesia and Surgical Anesthesia in a Patient with Complex Regional Pain Syndrome in Remission

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A 37 year old G1P0 presented at 36 weeks gestation for pre-delivery anesthesiology consultation. Her past medical history was significant for resolved Type I Complex Regional Pain Syndrome (CRPS). Her major concern was that labor may cause a recurrence of her CRPS. The patient reported a history of significant disability and failure of multiple treatment modalities. Ultimate resolution of her CRPS occurred in Germany, after she was treated with a 7-day course of high-dose ketamine, also known as a "Ketamine Coma." The patient had been disease free for 8 years at the time of her presentation.

After a thorough literature review, plans for both vaginal and cesarean delivery (CD) were decided after multidisciplinary meetings between obstetric anesthesiology, regional anesthesiology, chronic pain, and obstetrics. A novel approach was taken, with the ultimate goal of providing multimodal analgesia for the treatment of labor pain, as well as prophylaxis against the recurrence of CRPS.

Labor was induced at 41 weeks due to late term gestation. Before labor became painful, Dexamethasone 8mg was administered intravenously to help prevent inflammation, followed by an early combined spinal epidural at initiation of labor induction. Fentanyl 15 mcg was given intrathecally, followed by continuous infusion of Ropivacaine 0.2% with Fentanyl 2.5 mcg/mL at 6 mL/hr with patient controlled epidural analgesia. Labor pain was adequately managed. Several hours later, the patient required urgent CD for arrest of descent. A low-dose ketamine infusion was started upon arrival to the operating room. The labor epidural was utilized to provide surgical anesthesia. The obstetricians infiltrated lidocaine 1% subcutaneously prior to incision. The CD proceeded uneventfully. A Jackson-Pratt drain was left in the incision site for delivery of a subcutaneous ropivacaine infusion postoperatively. The epidural catheter was utilized for postpartum analgesia. The patient remained free of CRPS on follow-up 2 months postpartum.

CRPS continues to be a medical challenge due to its chronic nature, potential for life-altering disability, and high likelihood of relapse. The disease predominantly affects females of child-bearing age and pregnancy is a known risk factor for CRPS. There is a paucity of literature to guide the treatment of parturients with CRPS, and only one case of recurrence of CRPS following CD is reported (1). It has been postulated that the underlying mechanisms of CRPS involve peripheral stimulation and central sensitization; therefore, peripheral nociceptive stimulation should be minimized (2). While there is no established standard for the treatment of CPRS in the parturient, this case is an example of a successful multimodal approach to prevent the recurrence of CRPS.

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Abstract #:SU-81

Conservative management of invasive placental disease: Potential problem?

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Incidence of invasive placental disease is rising with increasing number of cesarean deliveries. Antenatally diagnosed placenta accreta, increta and percreta have traditionally been managed by scheduled preterm cesarean hysterectomy. Significant maternal morbidity and mortality is associated with acute hemorrhage and its complications. Multidisciplinary approach to management has been shown to have better outcomes. Conservative management with uterine preservation is attempted in patients who desire future fertility. We report a successful conservative management of a patient with complete placenta previa and placenta increta.

34 y/o G2P1 at 18.5 wga with one prior low transverse cesarean scar was found to have fetal occipital encephalocele and herniated cerebellum. There was complete placenta previa with entirely effaced anterior uterine wall at the level of the old cesarean scar adjacent to the bladder and a morbidly adherent placenta on antenatal ultrasound. The patient had a strong desire for future fertility and it was discussed that although a cesarean hysterectomy may be necessary, an attempt would be made to preserve the uterus. General anesthesia with intubation was performed. Radial arterial catheter was placed. Pfannenstiel incision was followed by midline vertical fundal hysterotomy with delivery of the fetus. On inspection of lower uterine segment, placenta percreta was noted. The entire placental tissue was left in situ and the hysterotomy was closed. EBL was 500 ml. Inpatient stay was 7 days for antibiotics and methotrexate. Beta HCG levels and LFTs were closely monitored. Outpatient follow-up was scheduled. HCG level decreased progressively, placental tissue size decreased on ultrasound and no bleeding episodes reported to-date.

Several case reports describe conservative strategies to preserve uterus for future fertility by leaving placental tissue in situ. In a case series, upto 22% patients required either primary or delayed hysterectomy. Primary hysterectomy was required due to acute hemorrhage; whereas delayed hysterectomy was necessary secondary to infection, hemorrhage or DIC. These patients may present emergently upto 22 weeks after delivery and anesthesiologists face the challenge to care for a patient with hemorrhage, sepsis or DIC in less than optimal conditions. Prolonged close followup is required and patients need to be educated to report to hospital earlier with symptoms of bleeding and fever. A planned procedure allows for adequate preparation, however, if these patients arrive in emergent situations the opportunity for adequate preparation is lost. Conservatively managed patients have been shown to have recurrent invasive placental disease in their future pregnancies. So, are we really avoiding the problem long term?

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Abstract #:SU-82

Myasthenia gravis in a parturient: postpartum cholinergic crisis followed by myasthenic crisis

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Myasthenia gravis (MG) is an autoimmune disorder occurring frequently in women in second and third decades of life. MG has not been shown to adversely affect course of pregnancy. Assisted second stage of vaginal delivery is recommended with epidural analgesia. The neonate should be monitored for muscle weakness. We report an interesting case of suspected cholinergic crisis followed by myasthenic crisis in a parturient with preeclampsia.

18 y/o G1P0 at 36.1 wga, BMI of 37 with history of MG for past 7 years was scheduled for induction of labor for pre-eclampsia with severe features. She had mild range blood pressures, normal lab values and persistent headache. Relevant history included a thymectomy 5 years ago and compliance with pyridostigmine ER 180mg TID and IR 60mg TID. Induction of labor proceeded with cervical ripening and oxytocin. Lumbar epidural catheter provided analgesia with 0.1% ropivacaine with fentanyl 2mcg/ml. After 36 hours of labor, the obstetricians decided to perform a cesarean delivery due to arrest of cervical dilation and fetal intolerance to labor. Cesarean delivery proceeded without complications under epidural anesthesia with lidocaine 2% and epinephrine. Epidural PF morphine was given for analgesia. IV azithromycin was given per institutional protocol to prevent postcesarean endometritis. One hour into recovery and shortly after receiving 2 mg IV morphine, patient became tachypneic, tachycardic, aggressive, with altered mental status and excessive oral secretions. Severe respiratory acidosis was noted. After administration of IV propofol and succinylcholine, she was intubated. SBP of 230 was treated with labetalol and furosemide. Magnesium sulfate was avoided. Pyridostigmine was held as cholinergic crisis was suspected and glycopyrolate was scheduled. CTPE protocol was negative for embolus, but showed opacities consistent with aspiration/ pneumonia. She was treated with antibiotics and extubated after 2 days. Post extubation, she failed a swallow test and had to be reintubated 24 hours later due to desaturations and respiratory failure. EMG revealed myasthenic crisis. She was started on IVIG, prednisone and restarted on pyridostigmine. She was successfully extubated a few hours later. Elevated BP was treated with hydralazine, clonidine and enalapril. She was discharged on POD 11, neonate was discharged from NICU on day 15.

The course of myasthenia gravis in pregnancy is unpredictable. It may be hard to differentiate between muscle weakness caused by cholinergic crisis and myasthenic crisis without edrophonium test. Our patient presumably had a cholinergic crisis initially and then developed a myasthenic crisis after the pyridostigmine was held. Beta blockers, calcium channel blockers, certain antibiotics, magnesium sulfate, phenytoin, non-depolarizing muscle relaxants, opioids and/or respiratory infections can trigger myasthenic crisis.

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Abstract #:SU-83

Neoplastic Intracranial Lesion in a Parturient

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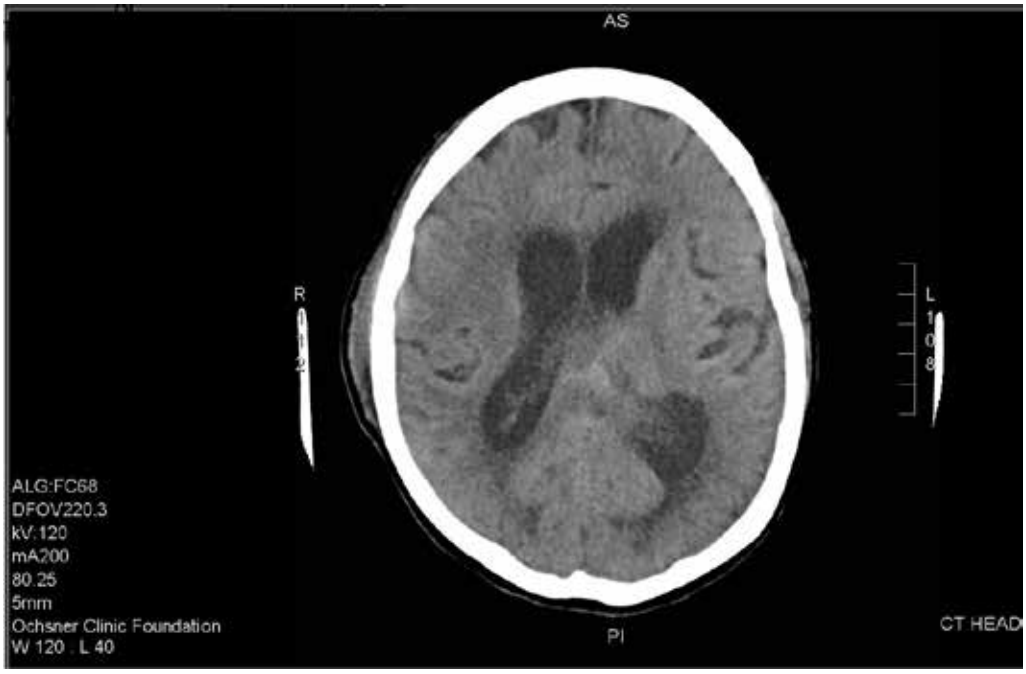
Introduction: Intracranial tumors during pregnancy are rare, with an estimated incidence of malignant brain tumors in 3.6/1 million live births. We present a case of a neoplastic intracranial lesion in a parturient.

Case Presentation: A 22-year-old G4P3 female at 26 5/7-weeks EGA presented with persistent nausea/vomiting unresponsive to oral therapies. She was admitted to the obstetric service for hyperemesis gravidarum. Upon further questioning, the patient reported a 40-pound unintentional weight loss and persistent headache, with double vision. The MRI revealed a mass-like lesion in the left ambient cistern 1.8 x 1.9 cm in size with mass effect on the midbrain and associated obstructive hydrocephalus. There was also multifocal leptomeningeal enhancement involving cerebellum and cerebral hemispheres, and a plaque-like configuration of the medullary brainstem and cervical cord.

The patient was transferred to Neurocritical Care (NCC) with Neurosurgery, Hematology-Oncology, Maternal Fetal Medicine and Obstetric Anesthesia consults. She underwent a suboccipital craniectomy with laminectomy for biopsy. We placed an arterial line prior to a rapid sequence induction and maintained the patient with propofol, remifentanil and a phenylephrine infusion to maintain adequate perfusion. The operation proceeded in the prone position and was tolerated well with 150 ml of blood loss and extubation in the operating room. Fetal heart tones were confirmed prior to and following the procedure.

She had a decline in neurologic status over the next two weeks, requiring an emergent cesarean delivery under general anesthesia secondary to non-reassuring fetal heart tones. A 29 3/7-week male infant was delivered. The patient returned to NCC where she rapidly declined. She did not have a histopathologic diagnosis, with the final report describing an unusual spindle cell and epithelioid cell neoplasm of indeterminate type. Following an 82-day hospital course, it was determined the patient would not withstand chemotherapy or radiation and the family decided upon hospice care.

Discussion: Intracranial tumors presenting in pregnancy are rare, requiring much forethought and coordination for imaging, diagnostics, and treatment. As demonstrated in this case, care must be taken not to confuse nausea and vomiting due to an intracranial lesion with hyperemesis gravidarum.



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Abstract #:SU-84

Decision Making at the Extremes of Airway Management

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Case: A 30yo G2P1001 woman with a BMI of 51.7 arrived via EMS at 30 weeks estimated gestation after being found at home unresponsive. She had no prenatal care and later reported that she had not been aware she was pregnant. With a working diagnosis of eclamptic seizure, the FHR remained reassuring, but the decision was made for a Cesarean delivery due to maternal condition. She was postictal with marked tongue and oropharyngeal edema accompanied by blood and secretions. In addition to her baseline morbid obesity, her tongue was protuberant, bloody, and edematous, making visualization of any part of her oropharynx impossible.

Airway Management: Fiberoptic intubation was first considered, however several factors posed significant potential challenges. The distortion of her upper airway made glossopharyngeal nerve blocks unobtainable, and the presence of concurrent thrombocytopenia (32,000/uL) introduced an increased risk of bleeding after superior laryngeal nerve blockade or transtracheal puncture. In addition, adequate topicalization would have been extremely difficult due to the lack of access to the posterior pharynx, inability of the patient to cooperate, and the degree of mucosal edema. Due to the fact that she had not yet received her magnesium bolus, which might have prolonged the action of succinylcholine, and that her SAO2 remained 100% with the use of a non-rebreather face mask, the decision was made to proceed with a RSI and Glidescope facilitated intubation, with confidence that she would be able to resume spontaneous ventilation if intubation were unsuccessful. A #4 Glidescope was utilized with immediate availability of a fiberoptic scope, AirQ, and Fastrach LMA. After induction she was successfully intubated on the first attempt with the Glidescope, but substantial tissue distortion was observed along with blood and secretions throughout the oropharynx. The epiglottis was visualized and part of the cords identified for a Cormack-Lehane grade 2a view. Four minutes after intubation a 1230g neonate was delivered with Apgar scores of 2 and 8. Post-operatively she was transported to the ICU, where she was extubated on post-op day 6 and discharged home post-op day 8.

Discussion: This case represents the nightmare scenario of a potentially extremely difficult airway, and the management decisions required when Cesarean delivery is planned. Although awake fiberoptic intubation is very commonly advocated as the first choice in this scenario1, prior experience (unpublished) with attempts to topicalize the swollen, bloodied airway in a morbidly obese postictal parturient has proven to be almost impossible. With this case report, we have demonstrated that video laryngoscopy after RSI might also be a reasonable choice under these circumstances.

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Abstract #:SU-85

Cesarean Delivery in a Parturient with Severe Pulmonary HTN secondary to congenital PAPVR

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Intro: Pregnancy in patients with adult congenital heart disease is increasingly common and outcomes are typically favorable.(1) When a congenital lesion remains uncorrected, pregnancy can be especially risky for the mother.(2) Our case of unrepaired partial anomalous pulmonary venous return (PAPVR) highlights the importance of patient counseling, a multidisciplinary approach, and continuous delivery planning.

Case: A 36 yo G6P4 with severe PH and RV dysfunction secondary to PAPVR presented at 11 wks gestation. Her OB history included 4 prior cesarean deliveries (CD) with her last CD in 2006. In 2012, she presented with SOB and was diagnosed with severe PH and RV failure. Prior to her current pregnancy, she was managed with Tadalafil, Mecitentan, Treprostinil, Lasix, Digoxin, and O2 therapy. At that time she was being evaluated for a transplant, however she became pregnant. A 1st trimester ECHO showed normal LV size and function and severe RVE with severely reduced function RVFAC 9%, RVSP 94mmHg (RAP=15). She tolerated early pregnancy well and remained NYHA Class II-III. Delivery was tentatively planned for 32 wks, however she required admission at 31 wks for worsening SOB. Over the course of her pregnancy, she was continually discussed at meetings including MFM, cardiology, CT surgery and anesthesia. Given her worsening clinical status the above teams urgently met to prepare a more immediate delivery plan. Her symptoms improved with diuresis and we proceeded with a CD under regional anesthesia. On arrival to the OR, an arterial line and pulmonary artery catheter (PAC) were placed. She was also started on high flow iNO. After the PAC was placed, she began having short runs of VT and amiodarone was administered. Given the concern for decompensation during her anesthetic induction and CD and the inability to medically resuscitate her if decompensation were to occur, the decision was made to place femoral ECMO cannulas prior to surgical incision. Due to the need for heparin anticoagulation for cannulation, her epidural had been placed 2 hrs prior to presenting to the OR. Femoral ECMO cannulas were placed while the epidural was slowly dosed with lidocaine 2%/bicarbonate/epinephrine. Low-dose epinephrine, vasopressin, and phenylephrine were used to balance the decreased SVR. Incision was made after achieving a T5 level. Delivery was uneventful. Estimated blood loss was 1L and she received 500mL of crystalloid post-delivery. She was stable throughout the procedure and transferred to ICU postoperatively following ECMO decannulation. Her postoperative course was uncomplicated.

Discussion: Our case highlights the importance of a multidisciplinary approach and careful peripartum planning including a plan if decompensation occurs. We believe the constant communication among team members throughout pregnancy played a critical role in the positive outcome.

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Abstract #:SU-86

A case of obstetric disseminated intravascular coagulation (DIC) that was successfully treated using Dry-hematology system (DRIHEMATO®)

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A case of obstetric disseminated intravascular coagulation (DIC) that was successfully treated using Dry-hematology system (DRIHEMATO®)

Background: The importance of fibrinogen replacement in the treatment of obstetric disseminated intravascular coagulation (DIC) has been well recognized. However, it takes more than thirty minutes to measure the serum fibrinogen concentration with a conventional measurement device in a laboratory. Hence, it used to be difficult to reflect the measured fibrinogen concentration in the treatment of obstetric DIC, which progresses very quickly, and in the assessment of the efficacy of the treatment. Recently, a point of care measurement device of fibrinogen (DRIHEMATO®) has been developed and offered commercially in Japan. We present a case of successful treatment of obstetric DIC with DRIHEMATO®.

Case: Thirty-six years old, nulliparous woman, who underwent Caesarian section due to arrested labor, was transferred to our hospital because of uncontrollable postpartum hemorrhage. The total blood loss until arrival was reported to be 4120ml, and the fluid resuscitation had been performed with 2500ml of crystalloid, 2500ml of colloid, 8U of RBC (1120ml) and 4U of FFP (480ml). Because of this massive infusion, her shock index at arrival was 0.85 (blood pressure 115/65 mmHg, heart rate 98 bpm). Immediately after her arrival, fibrinogen concentration was found to be 23mg/dl by DRIHEMATO®, and diluted coagulopathy was suspected. Hence 3g of the concentrated fibrinogen preparation was administered. After the administration, fibrinogen concentration was found to be 46mg/dl by DRIHEMATO®, and consumption coagulopathy was suspected. Hence, 10U of cryoprecipitate was administered. These aggressive fibrinogen replacements resulted in the withdrawal from the emergency state of the obstetric DIC, and elevated fibrinogen concentration (110mg/dl) was confirmed by ordinal laboratory measurement.

Discussion: DRIHEMATO® has been invented in Japan and been on the market for two years. Although the efficacy of DRIHEMATO® has already been established in the stable state, the reliability of the device has never been studied in the unstable state such as obstetric DIC. In our case, DRIHEMATO® was effectively used as a tool for the decision making in the unstable state of obstetric DIC. However, further study is needed to confirm its reliability in unstable status.

Dry-hematology system (DRIHEMATO®)

Abstract #:SU-87

Non-fatal Amniotic Fluid Embolism

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Background: Amniotic Fluid Embolism (AFE) may be the most feared complication in obstetric anesthesiology. Traditional teaching suggested mortality of 60-80%, with near universal neurologic compromise among survivors. More recent population data has suggested that most women (4/5) actually survive. Similarly, cardiopulmonary resuscitation and coagulopathy requiring cryoprecipitate may be required in fewer than half of cases. It is thus very much worthwhile to present and study these cases to facilitate early recognition and effective treatment. The most consistent risk factors are advanced maternal age and induction of labor, though fetal distress and cesarean section also appear frequently. Prostaglandin use may confer a 6-fold increase in risk. Presentation often involves shortness of breath, respiratory failure, and hypotension. The mechanism is poorly understood, but is thought to involve a reaction to amniotic fluid or fetal tissue in maternal circulation. This is thought to precipitate a cascade of immunologic or anaphylactoid events precipitating pulmonary hypertension and cardiovascular collapse, often followed by severe coagulopathy in survivors.

Case Description: A 37 week gravida 3 para 2 was brought to the OR for emergent cesarean section for profound late fetal decelerations during induction of labor for gestational hypertension. Induction of general anesthetic was uneventful and baby delivered with APGAR's of 8 & 9. Immediately thereafter, there was a sudden drop in ETCO2 to 10 mm Hg, accompanied by profound hypotension and mild bronchospasm. Carotid pulse was barely palpable. Manual bag ventilation was easily done with slightly lowered compliance. There was no response to phenylephrine and ephedrine, so epinephrine was aggressively administered. A norepinephrine drip was required to achieve systolic pressures of 90. The table was tilted sharply left and head down. Two units of packed red cells were transfused for uterine artery bleeding. The patient was brought to intensive care intubated, but weaned off pressors and extubated that evening. She was discharged a week later without any further complications.

Discussion: This case illustrates the more recent understanding that AFE's may present a spectrum of severity that may indeed be treatable. Although this patient became acutely unstable, she ended up not requiring CPR. Although her D-dimer was sharply elevated and fibrinogen low, she also did not progress to frank coagulopathy.

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Abstract #:SU-88

Atypical Presentation of HELLP Syndrome Resulting in Spontaneous Rupture of Subcapsular Hematoma

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This is a case report of a 35-year-old G1PO female with an atypical presentation of HELLP syndrome requiring emergent caesarean delivery at 27 wga following spontaneous rupture of a subcapsular liver hematoma.

This patient first presented to the ED at 25wga with epigastric pain and was found to have elevated liver enzymes. She was normotensive and her workup was negative with the exception of a 3cm hyperechoic right lobe liver lesion diagnosed as a hemangioma. The patient was seen in clinic the following day with resolution of symptoms and improvement in liver enzymes.

Two weeks later, the patient was admitted complaining of RUQ and epigastric pain. Patient remained normotensive but was thrombocytopenic and had an elevation of liver enzymes. Patient was hospitalized for three days while labs were monitored and workup completed. Abdominal ultrasound revealed an increase in the hyperechoic right lobe liver lesion to 9cm. Follow up with MRI did not reveal a hepatic mass and the sonographic abnormalities were attributed to fatty infiltration. Over the course of three days, all lab values began to normalize. Based on the lab values, radiographic findings and resolution of symptoms, the patient was discharged home with close follow up.

She presented back to the hospital the next day with increased abdominal pain. AST and ALT were again elevated but her platelets remained stable at 151,000/uL. Repeat abdominal ultrasound showed the right lobe liver lesion to be stable. CT of the abdomen was negative. 10 hours after admission, the patient began complaining of chest, back, and right shoulder pain accompanied by an episode of epistaxis. STAT labs revealed PLT of 20,000/uL. The patient became hypotensive, tachycardic, and the fetal heart rate dropped into the 60's. She immediately went to the OR for emergent caesarean section under general anesthesia.

The patient was placed under general endotracheal anesthesia with a rapid sequence induction utilizing propofol and succinylcholine. She then underwent an emergent primary classical caesarean section with delivery of a viable 27 wga male. She had a hemoperitoneum of about 2 liters with a rupture of her right hepatic lobe. Once hemostasis was achieved, her abdomen was packed and she was transferred to the ICU intubated in stable condition. Intraoperatively, the patient received 13 units of packed red blood cells (PRBCs), 7 units of fresh frozen plasma (FFP), and 4 units of pooled platelets to achieve hemodynamic stability. An additional 4 units of FFP were given in the ICU. Labs were closely monitored and revealed evidence of shock liver. AST and ALT peaked on postop day 2 then gradually trended down, while platelets normalized over the first few days postpartum.

The patient returned to the OR on post operative day (POD) 3 to have packing removed. The patient was extubated on POD 5 and returned to the OR for wound closure on POD 8. She was discharged home 14 days following her caesarean delivery.

Abstract #:SU-89

Novel use of intracardiac echography for fetal monitoring during maternal cardiac surgery

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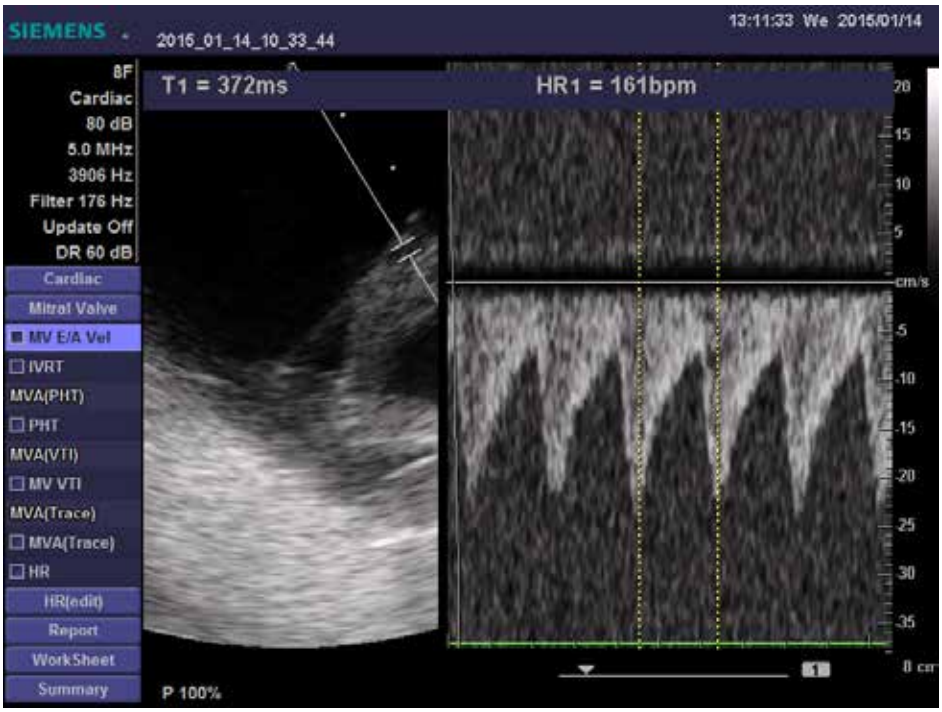
Case description: A 43-year-old nulliparous woman presented scheduled Sinus of Valsalva aneurysm (SVA) surgery at 18 weeks of gestational age after treatment of infertility. Patient has been had SVA before pregnancy and the size of the aneurysm extended to 49 mm diameter at 17 weeks. A heart surgery became mandatory and Surgical repair of SVA under cardiopulmonary bypass (CPB) was scheduled. An intracardiacechography (ICE) was inserted via the left femoral vein before start surgery. The fetus umbilical artery Doppler wave was monitored entire surgery (Figure 1). Aesthesia and Hemodynamic was managed base on the Doppler wave information. The mother and fetus kept in good condition during and after the surgery.

Discussion: The early gestational period and use of CPB during pregnancy were associated with high feto-neonatal mortality. The fetal mortality rate during cardiac surgery with CPB still remains high, the maternal mortality rate range from 1.5% to 5% and the fetal mortality rate range from 9.5% to 29%. Fetal bradycardia is known to develop frequently during the initiation of CPB. Monitoring of fetal heart rate and the uterus has been reported to reduce fetal mortality rate to 9.5% by enabling early recognition of potential problems during CPB and timely provision of the required treatment.
Thus, fetal monitoring is important especially during CPB. We used ICE via femoral vein to monitor Doppler signals of fetal umbilical artery in a patient who underwent repair of sinus of SVA. There was no interference during the entire surgery.
ICE is a technique for imaging of intracardiac structures, and may serve as an alternative for the transesophageal approach.The mechanical ultrasound transducer tipped catheter can be used for both intravascular and intracardiac imaging. For intracardiac use,a 9 MHz single element transducer is incorporated in an 8 French catheter.
We used ICE via the femoral vein to monitor Doppler signals of the fetal umbilical artery in a patient who underwent repair of her SVA. During the CPB, ICE detected fetal bradycardia, which was corrected after keeping maternal blood pressure higher. This is the first reported case of ICE being used for fetal monitoring.



Abstract #:SU-90

Neuraxial Analgesia for Labor and Delivery of Parturient with Osler-Weber-Rendu Syndrome

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Introduction: Hereditary Hemorrhagic telangiectasia (HHT) or Osler-Weber-Rendu Syndrome is a rare, autosomal dominant disease, characterized by multisystem Arterio Venous Malformations (AVMs) and bleeding. Physiologic and hormonal changes of pregnancy in the presence of multisystem AVMs may increase maternal morbidity and mortality. We describe a case in which the risk of spinal AVMs present unique challenges and anesthetic considerations for neuraxial placement in an obstetric patient with HHT (1, 2).

Case Report: A 28 year old G2P1 with a history of HHT presented at an estimated gestational age of 38 weeks in spontaneous labor. The patient was diagnosed with HHT at the age of 8y and has a family history of HHT. Prior to pregnancy, she had intracranial AVMs treated with gamma knife radiosurgery. Patient had a normal Echocardiogram and MRI (MRA and MRV) of chest during current pregnancy. She did not have any imaging studies of her spine. Upon request and evaluation, an epidural catheter was placed uneventfully. Analgesia was obtained with a continuous epidural infusion of 0.125% Bupivacaine and 2mcg/ml fentanyl titrated to provide a bilateral T10 sensory blockade without significant motor blockade. The patient had an uncomplicated vaginal delivery. Neurochecks were performed throughout labor and continued for 12 hours after epidural catheter removal.

Discussion: The incidence of spinal AVMs in HHT is low but hormonal changes in pregnancy can further weaken abnormal small vasculature. Therefore, neuraxial technique in an obstetric patient with HHT presents concern for epidural and spinal hematoma with resulting spinal cord compression and potentially long-term neurological sequelae. It is prudent to screen for epidural and spinal AVMs prior to neuraxial, however there is no evidence to support mandatory screening. When the presence or absence of epidural or spinal AVMs is unknown, as in our case report, we recommend the following:
1. Avoidance of medications that can impair coagulation such as NSAIDs.
2. Low concentration local anesthetic to minimizing motor blockade while providing adequate analgesia.
3. Careful monitoring for neurologic deficits after neuraxial placement into the postpartum period after the epidural catheter has been removed.

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Abstract #:SU-91

Atypical presentation of HELLP syndrome with large subcapsular liver hematoma

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A 43 y.o. G2P0111 at 32w5d with history of IVF pregnancy and myomectomy for fibroid removal presented to a local hospital with RUQ pain. Upon presentation, blood pressure was noted to be mildly elevated. An ultrasound revealed a large subcapsular liver hematoma. The patient was then transferred to our tertiary care facility for further management.

On arrival, liver enzymes were mildly elevated: AST 103 and ALT 72. Platelets were somewhat depressed at 115, while hemoglobin/hematocrit was normal at 12.3/37.7. Magnesium infusion was initiated immediately for seizure prophylaxis. Given the large size of the hematoma, ~15cm and surrounding the entirety of the right hepatic lobe, decision was made to proceed with cesarean delivery. This was the patient's planned mode of delivery given her history of myomectomy.

In the operating room, an arterial line was placed and anesthesia was induced with combined spinal epidural using 10mg bupivacaine and 20mcg fentanyl. After a successful delivery, uterine closure and hemostasis, general surgery evaluated her liver hematoma. A large subcapsular hematoma was confirmed. There was no evidence of bleeding from the liver and the abdomen was closed without other intervention. The patient was taken to the surgical ICU for post-op care. She remained in the ICU for monitoring for 48 hours with the plan for VIR embolization if bleeding from her liver occurred.

Liver enzymes peaked at AST 119 and ALT 105 on POD 1. Platelets fell to a nadir of 108 on POD 1. A CT scan done on POD 1 showed stable subcapsular liver hematoma. The patient remained stable and was transferred out of the ICU on POD 3 and discharged home on POD 5. On follow up at 2 weeks, CT scan showed reduction in size of the hematoma. Liver enzymes and platelets had also returned to normal.

Subcapsular liver hematoma is a very rare complication of pregnancy, occurring in 1 in 67,000 pregnancies and 1 in 2000 pregnancies complicated by HELLP syndrome. The presentation in our patient was somewhat unusual in that liver enzymes did not rise to levels typically seen with subcapsular hemorrhage and platelet levels never fell below 100. There was no evidence of hemolytic anemia. Blood pressure was only mildly elevated on admission and never rose higher than SBPs of 140s.

This case highlights the importance of investigating complaints of epigastric and RUQ pain in pregnancy, even when laboratory values may not suggest severe preeclampsia or HELLP syndrome.

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Abstract #:SU-92

Unexpected airway malformation during neonatal resuscitation

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Pedram Aleshi M.D. - UCSF - San Francisco, CA

Numerous methods of antenatal testing allow early detection of congenital abnormalities and allow for appropriate planning by the perinatal team, including obstetrics, neonatology, surgery, and anesthesia. Presence of undiagnosed life threatening congenital anomalies is rare. We report a case of undiagnosed tracheal agenesis (TA) and subsequent fetal demise.

Our patient was a 43 year old G3P2 with a prior cesarean delivery who transferred her care to us at 29 weeks gestation. Fetal sonography showed duodenal atresia and polyhydramnios, and fetal echocardiogram demonstrated a persistent left SVC with a connection to the coronary sinus. She was admitted at 35 weeks gestation for severe pre-eclampsia and elective repeat cesarean. Operative delivery was without complication, and a 2.5 kg male infant was delivered with a nuchal cord, which was easily reduced. The infant initially had poor tone and no respiratory effort despite stimulation. His nares were suctioned and a repogle was placed without improvement in respiratory effort, and positive pressure ventilation via mask was administered. Chest compressions were initiated and intubation was attempted, during which the vocal cords were visualized, but the endotracheal tube was unable to be passed beyond this point. Video laryngoscopy was attempted with the same difficulty. During laryngoscopy, a membrane was noted past the vocal cords. An LMA was placed while the pericardial and mediastinal spaces were needle decompressed without improvement in respiratory status. Sixteen-minute umbilical artery gas showed a pO2 of <20 and oxygen saturation of 19. Resuscitation continued until the family decided to discontinue efforts at 60 minutes of life. The autopsy report states the larynx ends in a blind pouch. No trachea was identified, just esophagus in its usual anatomic position. Distally there was a 0.1 cm diameter connection from esophagus to trachea approximately 1 cm above the carina.

Tracheal agenesis is a very rare congenital malformation, with an incidence of 1:500,000. Prenatal diagnosis is difficult when a tracheoesophageal fistula (TEF) is present, as pulmonary fluid passes through the fistula to the stomach or amniotic sac, keeping pulmonary fluid pressures normal and giving the lungs a normal appearance. Post-natal airway management poses an extreme challenge. There are reports of successful EXIT procedures as well as ventilation via the esophagus in the presence of a TEF, which may be the only life saving measures in this dire situation.

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Abstract #:SU-93

Migration of epidural catheters and emergency cesarean section: A case for test dose!

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Case report: A 27 y/o G9P6 morbidly obese female requested epidural for trial of labor, after cesarean x1. Patient had 5 prior functioning lumbar uneventful epidurals for vaginal deliveries. Multi-orifice epidural catheter was placed when patient was 2cm dilation without incidence. Analgesia was maintained with 0.0625% bupivacaine + 3mcg/mL fentanyl at a rate of 12mL/hr. Ten hours later the infusion rate was reduced to 5mL/hr to allow rest before restarting augmentation 12 hours later. Nine hours later, at 7cm dilation, an emergency section was called for FHR in 70s. She had adequate BL T10 analgesia. Patient moved herself to OR table from bed. After a negative aspiration, epidural block was augmented with 5+10 mL 3% 2-chloroprocaine (2CP) given over 3 minutes. After 5 minutes block level tested with cold was assessed to be at T4. Two minutes later patient started to complain of dyspnea and difficulty speaking with weak handgrip. Block level was reassessed above C3, necessitating mask ventilation. General anesthesia was induced for apnea. Patient remained hemodynamically stable through RSI. After intubation, patient became hypotensive, requiring pressors to keep SBP above 80 mmHg. Aspiration of the epidural catheter at this time was positive for over 15 ml of free flowing CSF. Surgery, delivery, and GA were uneventful. Neonatal APGAR scores were 6 and 8 at 1 and 5 minutes. Contrary to our concern for a prolonged intubation, patient had spontaneous ventilation 40 minutes after 2CP. Her minute ventilation was 11.6L/min. Patient was extubated. Catheter aspiration now was negative, but considered IT and left in site for 24 hrs, to reduce incidence of PDPH. Forth aspiration before removal was positive for CSF, confirmed with glucose of 68 on ABG run with the sample.

Conclusions: Migration of epidural catheters is uncommon but well documented. As patient was comfortable even with 5 mL/hr infusion rate, we propose this catheter was initially epidural and migrated to subdural space. Catheter may have later migrated into intrathecal space, after 15 mL of 2-CP was given. 3% 2-CP injected intrathecally should act much faster than 5 minutes. An intermediate timing with out of proportion high sensory level, possible intercostal muscle weakness, and severe hypotension suggest subdural migration initially. We believe that sudden expansion of subdural space led to arachnoid rupture allowing us to aspirate free-flowing CSF intermittently. Leak into subdural space alternating with reabsorption of fluid from space may have resulted in this phenomenon. We think that limiting test dose to 3 mL prior to next dose 5 minutes later would have helped in this particular scenario.

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Abstract #:SU-94

Hemoglobin-Based Oxygen Carriers: Not Enough for a Pregnant Jehovah's Witness Patient and the Lessons Learned

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Introduction: Jehovah's Witnesses are a subset of the Christian religion whose interpretation of lines from the bible lead them to prohibit the use of whole blood products and major blood fractions including red blood cells, white blood cells, platelets, and plasma. Studies report varied rates of maternal death from postpartum hemorrhage in Jehovah's Witnesses to be somewhere between 44 (1) and 130 (2) times that of women who accept blood products. After the death of a Jehovah's Witness obstetric patient, our institution undertook an analysis of points of prevention and created a more proactive prenatal and intrapartum care pathway for patients declining blood products.

Case: A G2P1 Jehovah's Witness patient with morbid obesity and anemia (hemoglobin of 10.4mg/dl) who had a prior cesarean section presented to labor and delivery at 40 and 5/7th weeks gestation with spontaneous rupture of membranes. Her prenatal care had been provided by a certified nurse midwife and the patient was non-adherent to ferrous sulfate supplementation. The decision for cesarean section was undertaken based on a low-predicted success rate of a vaginal birth after cesarean. Preoperatively, the patient refused all blood products. Intraoperatively, significant adhesions and inability to deliver the baby necessitated a high transverse and vertical uterine incision leading to an estimated blood loss of 2L. Due to ongoing post-partum hemorrhage with a hemoglobin of 6.9mg/dl, a left uterine artery embolization was performed. Post intervention, the patient was transferred to the surgical intensive care unit and found to have a hemoglobin of 1.6mg/dl. Intensive care strategies included decreasing oxygen consumption and iatrogenic blood loss and the compassionate use of experimental hemoglobin-based oxygen carriers. However, the patient ultimately experienced marked acidosis with vasopressor-resistant cardiovascular collapse and death.

Discussion: A root-cause analysis was undertaken and while there were multiple aspects of the patient's care that were beyond our control, a number of recommendations were made for future care. A 10-point plan was developed with an understanding of the Jehovah's Witnesses' principles of blood usage and with a goal of improving their understanding of the risks of potential acute, large volume blood loss that is inherent in obstetrics. Six points focus on the prenatal period with an early multidisciplinary team approach to patient education, optimization and decision making. Two additional points focus on intraoperative techniques to mitigate blood loss. The two final points focus on the availability of Radiology and the use of Anesthesiology to monitor and stabilize the patient in the immediate postoperative period. Our hope is that with the implementation of this plan, future morbidity and mortality can be reduced.

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Abstract #:SU-95

Anesthesia management of a rare mitochondrial disorder in a high risk pregnancy: clinical skills and human factors

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Introduction: Mitochondrial diseases result from maternally-inherited nuclear and mitochondrial DNA mutations that disrupt the mitochondrial electron transport chain (ETC). MELAS syndrome (mitochondrial encephalomyopathy, lactic acidosis and stroke-like symptoms) is one of the most common of these disorders where reduced ETC protein synthesis results in inadequate ATP production to meet metabolic demands.(1) We present a case of MELAS syndrome in pregnancy in which anesthetists played a key role in a multidisciplinary approach to a rare disorder.

Case: A 36 year old G2P0 with MELAS syndrome presented at 22 weeks gestational age with preeclampsia on a background of Type I diabetes, short stature, exertional dyspnea, bilateral hearing loss and anxiety. At 24 weeks she was transferred to Labor & Delivery (L&D) for management of hypertension and metabolic derangement including hyponatremia, hyperkalemia, erratic blood glucose, lactic acidosis and oliguria. The obstetric team counselled towards induction of labor for absent fetal growth and progressive placental insufficiency and the anesthetic team took a leadership role providing acute high dependency level care. We observed the potential for overlap, conflicting clinical care and error with multiple contributing teams and proposed an allocation of responsibilities and clearer communication whilst developing a plan for labor analgesia and anesthesia. Later the same day the patient had a sudden neurological event with headache, hypertension, lip tingling, dysphasia and hypertonic hyperreflexic limb weakness. A differential diagnosis of eclampsia or stroke was managed with oxygen, hydralazine and magnesium and symptoms resolved over 20-30 minutes. There was no acute pathology seen on CT head but chronic cerebral and cerebellar atrophy was noted. Induction of labor began in ICU and after 2 days she delivered a stillborn fetus with IV fentanyl analgesia and a postpartum hemorrhage. Manual removal of the placenta was performed under spinal anesthesia to avoid a potentially difficult airway secondary to widespread edema. She required 2 units of red blood cells and returned to ICU postoperatively for an increasing FiO2 requirement secondary to pulmonary edema, effusions and atelectasis. Her postpartum course was complicated by slow to resolve acute kidney injury, brittle glucose control with an episode of severe hypoglycemia and loss of consciousness, and endometritis. She spent 25 days in hospital.

Discussion: This is to our knowledge the first case report of anesthetic management of obstetric complications in MELAS syndrome with metabolic derangement similar to perioperative changes in a non-obstetric case series.(2) We demonstrated the role of anesthetists in L&D to manage rapidly changing physiology and utilize situational awareness and crisis management skills to identify and mitigate the risks of multidisciplinary care.

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Abstract #:SU-96

Spine imaging to assist in an approach to neuraxial block in a parturient with a history of spina bifida and lipomyelomenigocele

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Patients with significant congenital spine defects are often not considered good candidates for neuraxial anesthesia. Parturients with these conditions pose significant challenges to obstetric anesthesiologists. While there is a desire to be awake and comfortable for delivery, there is sparse literature on the feasibility and safety of neuraxial techniques in parturients with spina bifida. We report a strategy of regional anesthesia for such a patient.

A 34-year-old G1P0 at 39 weeks with a history of spina bifida and lipomyelomeningocele (LMC) who is scheduled for an induction strongly desires an awake delivery with neuraxial analgesia. She states that she had an epidural for a femoral osteotomy 6 years prior (L1-2 epidural and GA LMA). The epidural was utilized for postoperative analgesia. Her neurological history is significant for excision of LMC and closure at 3 months of age, cord untethering at age 10 years and revision untethering 5 years ago. An MRI 2 years prior showed postoperative changes from L2-L3 down to the sacral area. A thin intrathecal spinal cord was seen at L1. An enlarged thecal sac is seen at S3, 4.5 cm from the surface of the skin (Figure 1). She self-catheterizes, has baseline proximal weakness in her lower extremities, and mild foot numbness. A multidisciplinary discussion with the obstetrician, neurologist, and patient was done to clarify feasibility, safety, and expectations for delivery.

We believe that epidural analgesia can be safely placed at a level T12-L1 or L1-L2. The area above appears clear and we believe Stage 1 analgesia can be achieved. If epidural spread is not sufficient to cover Stage 2, an approach to administer a small amount of intrathecal medicine at S3 is possible. Previous case reports have utilized surface anatomy or plain films to assist approach.2 We report the utilization of MRI to assist in a reasonable strategy for neuraxial labor analgesia. Induction is scheduled February 7 and we hope to report our experience at the SOAP meeting.

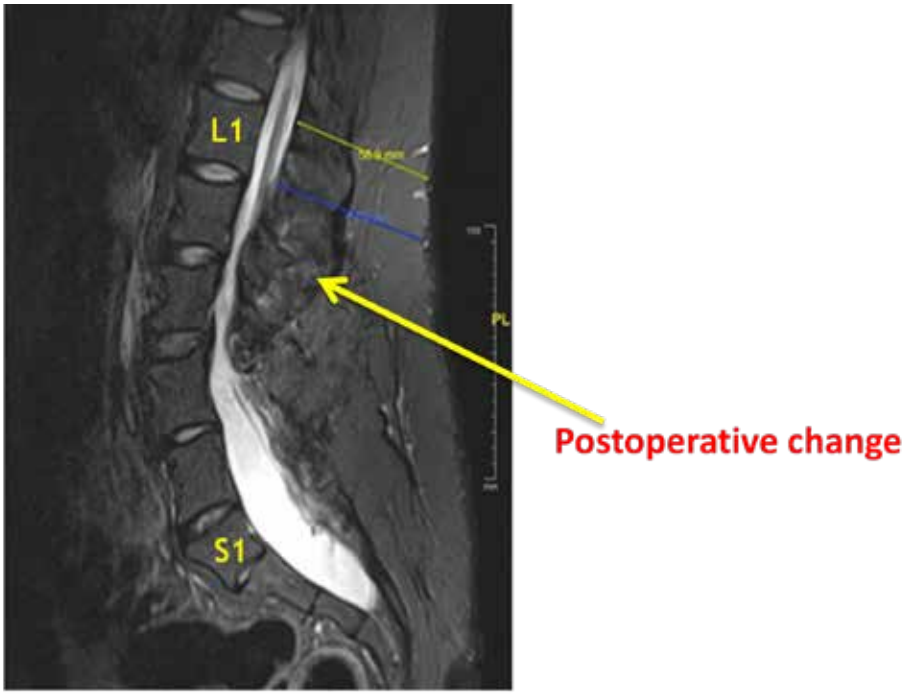

Figure 1.
MRI demonstrated postoperative effect of lumbar and sacral area

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2. Murphy IJOA 2015;(24):252-63

Abstract #:SU-97

Multi-Disciplinary Team Approach to Parturient with Significant Cardiac Failure

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The incidence of heart disease in pregnant women is an important cause of maternal mortality and morbidity.

Case Report: A 31-year-old woman, G6P2032, with history of intravenous drug use leading to two bicuspid and tricuspid valve replacement and repair after M.S.SA endocarditis, stroke, hepatitis C, cirrhosis, pulmonary hypertension with pulmonary artery systolic pressure of 70+ mmHg, deep vein thrombosis, thrombocytopenia, bipolar disorder, and methadone maintenance was transferred to our hospital because of worsening cardiac status, NYHA class IV heart failure. Echocardiograph demonstrated severe mitral regurgitation, moderate tricuspid regurgitation and suspected perforation of posterior mitral leaflet. Patient was admitted to the cardiac surgery intensive care unit. A multi-disciplinary team consisting of maternal fetal medicine, cardiac surgery, thoracic surgery, cardiology, interventional radiology (IR), anesthesia and psychiatry were assembled. Given her complicated cardiac conditions, prophylactic accesses for potential venous arterial extracorporeal membrane oxygenation (ECMO) were placed which will be activated should she go into congestive heart failure. Given the need for anticoagulation in this setting, IR has been contacted for potential uterine artery embolization via left femoral access (right femoral access for ECMO) if excessive bleeding is encountered. Because of maternal request of non-dismemberment of the demised fetus, induction of labor was initiated after placement of labor epidural. Daily communication and frequent updates of the patient's conditions were communicated among the team. Two days later, after the successful delivery of the fetus, placenta failed to decent. Manual attempt to extract the placenta was unsuccessful. Patient continued to complain of pain despite of multiple top-ups through the lumbar epidural. An urgent dilation and evacuation procedure was conducted for the retained placenta with ECMO and IR standby. A combined spinal epidural anesthesia was placed and level was brought up slowly until patient has adequate level for surgical coverage for the procedure. Patient tolerated the procedure very well with continuous cardiac output monitoring. The total EBL was 1000 ml. She got replacement of the similar amount of the fluid with a mixture of crystalloid and colloid. The femoral line was removed on the second day post-operation. There were no intraoperative or postoperative complications.

Discussion: This is a report of multi-disciplinary team care approach to a complicated patient. The leading role for anesthesiologist is obviously important in such a procedure-centered operation and should be strongly advocated for safety.

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Abstract #:SU-98

Management of a Parturient with Aplastic Anemia and Cerebral Arteriovenous Malformation

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Introduction: Aplastic anemia is a rare complication of pregnancy and places the parturient at increased risk for bleeding at delivery. Cerebral arteriovenous malformation (AVM) places patients at risk for cerebral hemorrhage, however a further increase in risk in the setting of pregnancy is unclear. This case describes a patient diagnosed with aplastic anemia and cerebral AVM during pregnancy, and delivered via scheduled cesarean section (C/S) with a subarachnoid block.

Case: A 26 year old G1P0 presented at 26w6d gestational age (GA) as a transfer from outside hospital with newly diagnosed aplastic anemia. She was initially evaluated at 19 weeks GA due to new onset ecchymosis and thrombocytopenia. A bone marrow biopsy revealed hypocellular marrow (<10%) without evidence of malignancy. She was transferred due to exhaustive use of blood products at the outside hospital.

Upon transfer, she continued to received serial packed red blood cell and platelet transfusions with goal hemoglobin >8 g/dL and platelets >20 10*9/L. At 30 weeks GA she developed acute, transient left sided vision changes. Ophthalmologic exam was notable for papilledema. A brain MRI revealed a R-sided occipital-parietal AVM. Per Neurosurgery, further evaluation with angiogram was postponed until after delivery. EEG was reassuring for the absence of seizure activity.

A multidisciplinary team meeting, including representation from Anesthesiology, Maternal Fetal Medicine, Hematology, Transfusion Medicine and Neurosurgery, took place to plan for delivery. The patient was delivered at 34 1/7 weeks via scheduled cesarean section. She was transfused the morning of surgery to a hemoglobin of 10.7 (goal > 10) and platelets 118 (goal > 80). A subarachnoid block was placed using hyperbaric bupivacaine 0.75% 13.5mg, morphine 0.1mg and fentanyl 15mcg. She received 1g of tranexamic acid prior to incision. The patient underwent cesarean section and bilateral tubal ligation without complication. Estimated blood loss was 800ml. Platelet count was maintained at >/= 60 for 24 hours postoperatively.

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Abstract #:SU-99

Delivery of the parturient with Marfan syndrome following aortic root replacement and multiple spinal fusions

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Introduction: Marfan syndrome presents a number of challenges in the parturient, with implications involving cardiovascular function and spinal anatomy among others.

Case Presentation: A 31 year-old nulliparous woman at 37 2/7 weeks EGA presented to our labor and delivery unit for primary cesarean delivery secondary to breech position. Past medical history was significant for Marfan syndrome. Surgical history included valve-sparing aortic root replacement, pes excavatum repair, spinal fusion and reoperation, and intraocular lens replacement. She reported excellent functional capacity, demonstrating 6-10 metabolic equivalents without dyspnea. BMI at term was 36.6 kg/m2. Airway exam was reassuring. Cardiac exam revealed Grade III/VI systolic heart murmur at right upper sternal border. CTA performed one year prior to pregnancy revealed an aortic root diameter of 3.3 cm and midthoracic decending aorta of 2.1 cm. 2DE performed during her 3rd trimester revealed aortic root diameter of 3.5 cm, normal LV function, and mild to moderate AI. On presentation, a left radial arterial line was placed for close hemodynamic monitoring. After 2 failed epidural catheters, the block was allowed time to wear off and subsequently spinal anesthesia was performed and adequate surgical level was achieved. Cesarean delivery proceeded without incident and a healthy male infant with Apgar scores of 9/9 was delivered. Her postopertive course was uneventful; both mom & baby were doing well at 3 month follow up.

Discussion: Marfan syndrome is an autosomal dominant connective tissue disorder with prevalence estimated at 1:10,000. This diagnosis presents a number of anesthetic implications in the parturient, with risk for pectus deformity, difficult airway management due to high arched palate and cervical spine pathology, kyphoscoliosis with or without prior surgical repair, cardiovascular complications including risk of aortic dissection and rupture.

80% of parturients with Marfan syndrome have cardiac involvement, with the greatest risk for morbidity and mortality being secondary to aortic aneurysm rupture and dissection. Although estimated risk of cardiovascular complications in parturients with aortic rood diameter < 40 mm is 1%, this risk is less clear in the parturient with history of aortic root replacement. Regardless of the risk, careful hemodynamic monitoring and management is imperative in this patient population, and slow induction of neuraxial anesthesia via epidural or sequential CSE may be preferred. Scoliosis is reported in 60% of patients, with up to 50% requiring surgical correction. Further, dural ectasia is more common in this patient population. These parturients who have undergone prior spinal fusion therefore may present a challenge for both epidural and spinal anesthesia. Multidisciplinary planning is crucial for risk stratification and delivery planning for this patient population.

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