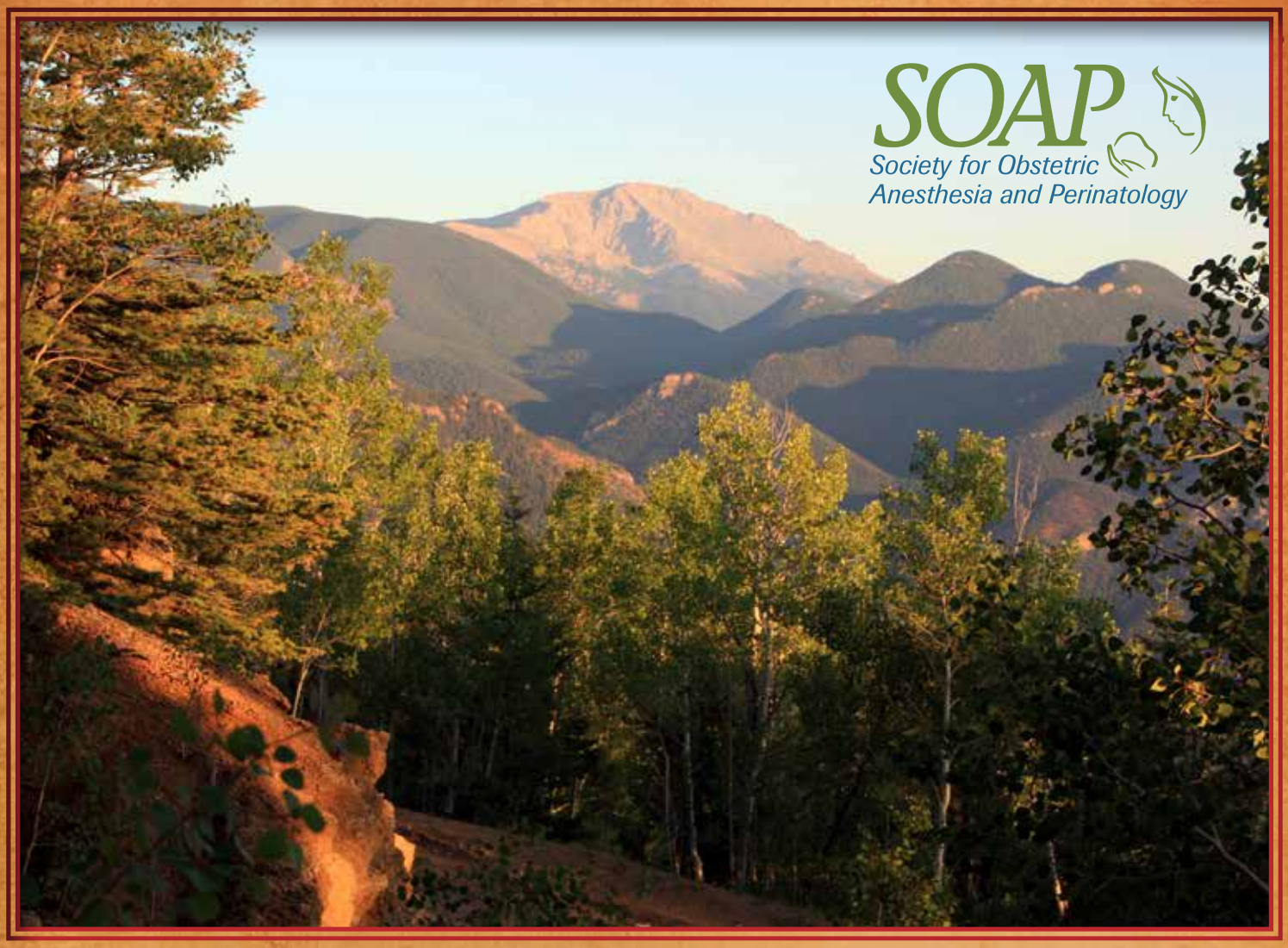

SOAP
Society for Obstetric Anesthesia and Perinatology

47TH ANNUAL MEETING SYLLABUS

The New Role of Education in Obstetric Anesthesia- Educating the Clinician, Trainees and the Public

May 13-17, 2015

The Broadmoor • Colorado Springs, Colorado

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

American Society of Anesthesiologists

SOAP
Society for Obstetric Anesthesia and Perinatology

Table of Contents

SOAP 47th Annual Meeting:The New Role of Education in Obstetric Anesthesia- Educating the Clinician, Trainees and the Public

Welcome Letter

Welcome to the 2015 Annual Meeting at The Broadmoor, in Colorado Springs, Colorado

On behalf of the SOAP Board of Directors and the SOAP 2015 Annual Meeting Program Committee we are excited to welcome you to scenic Colorado for the 47th SOAP Annual Meeting at The Broadmoor in Colorado Springs, Colorado, May 13-17, 2015.

Located on more than 3000 lush acres under the shadow of Cheyenne Mountain, The Broadmoor is the longest-running consecutive winner of both the AAA Five-Diamond and *Forbes Travel Guide* Five-Star awards and was recently named *Golf Magazine's #*1 Golf Resort in North America. Built in the early 20th century as the "Grand Dame of the Rockies", The Broadmoor offers guests a unique way to experience the beauty of Colorado. From a *Forbes Travel Guide* Five-Star rated spa as well as 19 restaurants, cafes, and lounges, your friends and family can enjoy 54 holes of championship golf, six tennis courts, indoor and outdoor pools, distinctive retail shops, and activities for all ages and interests. In addition, Colorado Springs is home to the Air Force Academy and the Olympic Training Center, as well as Pike's Peak!

The Colorado Springs Airport is serviced by major airlines with non-stop flights from more than 12 major U.S. cities including Atlanta, Chicago, Dallas, Los Angeles, Seattle, San Francisco, and Washington, D.C.. The Broadmoor is a 15-minute drive from the Colorado Springs Airport. For those traveling to Colorado Springs via Denver, Colorado Springs is 75 minutes south of Denver International Airport, which is a U.S. hub for United Airlines, a major focus city for Southwest Airlines, and provides non-stop service to destinations throughout North America, Latin America, Europe, and Asia. Direct shuttle service to The Broadmoor is available from both the Colorado Springs Airport and the Denver International Airport.

The theme of the 47th Annual Meeting is *"The New Role of Education in Obstetric Anesthesia - Educating the Clinician, Trainees and the Public*". Along with oral presentations of original research, there will be posters of interesting and challenging cases, Breakfast with the Experts, a session reviewing the Best Cases of the Year, as well as panels discussing education, patient management, and research. This is a meeting for anesthesiologists, obstetricians, obstetric medicine specialists, maternal-fetal medicine specialists, neonatologists, and members of related allied health specialties including fellows, residents, and medical students with an interest in the care of the pregnant patient. This is a rare opportunity where individuals can discuss medical problems unique to the pregnant patient as well as gain knowledge that will reinforce past learning as well as disseminate new concepts, practices, and skills to promote excellence in clinical care, research, and education. Free Wi-Fi will be available to all meeting participants in the meeting space.

Pre-meeting workshops will be held on Wednesday, May 13, 2015 including a MOCA® Part IV Course that will be available for participants and held at the University of Colorado School of Medicine in Denver. Overnight accommodations will be available adjacent to the Anschutz Medical Campus (AMC) prior to the workshop at SpringHill Suites. Direct charter bus service to Colorado Springs will be available from the AMC to Colorado Springs. Given the popularity of the ultrasound workshops presented in previous years, we will continue to offer comprehensive workshops on the use of ultrasound for obstetric anesthesia and transthoracic echocardiography. In addition, there will be a faculty development workshop. All of these workshops will be held in Colorado Springs.

Favorite SOAP sessions will include the Gertie Marx Research Competition, The "What's New" and Fred Hehre Lectures. Distinguished guest lecturers will include: Linda Barbour, M.D., M.S.P.H., FACP, Professor of Medicine and Obstetrics and Gynecology, University of Colorado School of Medicine (What's New in Obstetric Medicine); Timothy M. Crombleholme, M.D., FACS, FAAP, Professor of Surgery, University of Colorado School of Medicine and The Ponzio Family Chair for the Surgeon-in-Chief at Children's Hospital Colorado (What's New in Fetal Surgery); Elliot Main, M.D., Medical Director of the California Maternal Quality Care Collaborative (Maternal Safety: National Partnership for Maternal Safety); Fred Hafferty, Ph.D., Professor of Medical Education, Associate Director Program in Professionalism and Ethics, Mayo Clinic (Gertie Marx/FAER Education Lecture).

The SOAP Welcome Reception will be held outdoors at The Broadmoor on the Lakeside Terrace. With more than 300 days of sunshine per year and temperatures in the 70's, the reception will be an opportunity for you to reunite with friends and mingle with colleagues. Please attend the complimentary early morning yoga sessions at the hotel, as you may find that this is an activity that will energize you to fully experience your day! A 5K Walk/Run will be a fun event for all and an opportunity to exercise and meet others! Other activities will include an optional Foothills Jeep Tour, Olympic Training Center Tour, Garden of the Gods Tour and an Air Force Academy Tour. Instead of the traditional SOAP banquet, there will be a "strolling" dinner Friday evening in the Lake Terrace Dining Room at The Broadmoor. Award-winning Colorado wines, beers, and sodas will be featured.

The meeting promises to be as intellectually stimulating as The Broadmoor is memorable.

Sincerely,

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2015 SOAP Annual Meeting

Brenda A. Bucklin, M.D.
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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 34.25 *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 Pre-Meeting Workshops and Breakfast with the Experts.

Target Audience
The SOAP 47th 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 47th 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. A completed Physician Verification of Attendance form must be turned in to SOAP at the conclusion of the meeting. The form will be available on-site.

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. Decide whether nitrous-oxide should be routinely offered as a means of analgesia to the laboring patient
2. Explain the purpose of large database studies and formulate a plan for the interpretation of results from these studies
3. Identify, discuss and critically evaluate current and recent peer-reviewed research related to obstetric anesthesia, obstetrics, perinatology, and allied medical disciplines
4. Design and implement research investigations related to obstetric anesthesia, obstetrics, perinatology, and allied medical disciplines that are built upon the foundations of current and recent research investigations
5. Compare recent findings related to obstetric anesthesia to the prevailing standard of care, and adjust patient care plans accordingly
6. Discuss the role of professionalism and how it relates to education in the practice of obstetric anesthesia
7. Discuss how implementation of maternal early warning criteria can reduce maternal and fetal morbidity and mortality
8. Describe how to best teach patients about obstetric anesthesia
9. Describe the role of education in the practice of obstetric anesthesia and an evidence based approach to teaching obstetric anesthesia to medical care providers
10. Describe new and innovative clinical approaches in non-invasive fetal monitoring
11. Recognize factors related to academic success in obstetric anesthesia and apply that to career development and advancement

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 soap@soap.org.

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SonoSite: Ultrasound Systems and Probes
Blue Phantom CAE Healthcare: Manikins

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 13, 2015

7:00 a.m. - 6:00 p.m.
Registration Hours
International Center Foyer

8:00 a.m. - 12:00 p.m.
Use of the Transthoracic Echocardiogram in the Management of the High Risk Parturient
Colorado Hall AB
Course Directors: *Brendan Carvalho, M.B.B.Ch., FRCA, M.D.C.H.; John T. Sullivan, M.D., M.B.A.*

8:00 a.m. - 12:00 p.m.
Professional Development and Education Workshop
Colorado Hall E
Course Directors: *Elizabeth H. Ellinas, M.D.; Michaela K. Farber, M.D., M.S.; Klaus Kjaer, M.D.; Paloma Toledo, M.D., M.P.H.; Lawrence C. Tsen, M.D.*

1:00 p.m. - 5:00 p.m.
The Use of Ultrasound for Obstetric Anesthesia
Colorado Hall AB
Course Director: *Jose C.A. Carvalho, M.D., Ph.D., FANZCA, FRCPC*

6:00 p.m. - 8:00 p.m.
Welcome Reception at The Broadmoor Lakeside Terrace
Broadmoor Main - Lakeside Terrace

Thursday, May 14, 2015

6:00 a.m. - 6:00 p.m.
Registration Hours
International Center Foyer

6:00 a.m. - 7:30 a.m.
Continental Breakfast & Exhibits Open
International Center South

Poster Viewing - *Broadmoor Hall DE*

7:30 a.m. - 7:45 a.m.
Welcome to the 47th Annual Meeting
International Center North
Brenda A. Bucklin, M.D.; Manuel C. Vallejo, Jr., M.D., D.M.D.; Robert R. Gaiser, M.D.

7:45 a.m. - 9:15 a.m.
Gertie Marx Research Competition
International Center North
Moderator: *Richard M. Smiley, M.D., Ph.D.*

9:15 a.m. - 9:30 a.m.
Distinguished Service Award
International Center North
Recipient: *William R. Camann, M.D.*
Presenters: *Katherine W. Arendt, M.D.; Kathryn J. Zuspan, M.D.*

9:30 a.m. - 10:15 a.m.
Coffee Break & Exhibits
International Center South

Coffee Break & Poster Viewing
Broadmoor Hall DE

10:15 a.m. - 11:15 a.m.
Gertie Marx/FAER Education Lecture- Professionalism and the Hidden Curriculum
International Center North
Introduction: *Manuel C. Vallejo, Jr., M.D., D.M.D.*
Speaker: *Frederic W. Hafferty, Ph.D.*

11:15 a.m. - 12:15 p.m.
Poster Session 1
International Center North
Moderator: *Kenneth E. Nelson, M.D.*

12:15 p.m. - 1:45 p.m.
SOAP Business Meeting & Elections
International Center North
Boxed lunch will be provided.

1:45 p.m. - 3:15 p.m.
Maternal Safety Bundles
International Center North
Moderator: *Yaakov Beilin, M.D.*

- **National Partnership for Maternal Safety**
  Speaker: *Elliott K. Main, M.D.*
- **Maternal Early Warning Criteria**
  Speaker: *Jill M. Mhyre, M.D.*

3:15 p.m. - 4:00 p.m.
Coffee Break, Exhibits & Poster Viewing
International Center South

Coffee Break & Poster Viewing
Broadmoor Hall DE

3:15 p.m. - 4:00 p.m.
Poster Walk Around - Session 1
Broadmoor Hall DE
Moderator: *Richard M. Smiley, M.D., Ph.D.*

4:00 p.m. - 5:30 p.m.
Oral Presentations 1
International Center North
Moderator: *Philip E. Hess, M.D.*

6:00 p.m. - 7:00p.m.
Fellows' Reception *(By Invitation)*
Broadmoor Spa & Golf Club - Donald Ross Room

Friday, May 15, 2015

6:00 a.m. - 1:15 p.m.
Registration Hours
International Center Foyer

6:00 a.m. - 7:00 a.m.
Yoga Class *(Optional)*
Broadmoor Hall F

6:00 a.m. - 7:30 a.m.
Continental Breakfast & Exhibits
International Center South

Poster Viewing - *Broadmoor Hall DE*

7:30 a.m. - 7:45 a.m.
Opening Remarks
International Center North
Brenda A. Bucklin, M.D.; Manuel C. Vallejo, Jr., M.D., D.M.D.; Robert R. Gaiser, M.D.

7:45 a.m. - 9:15 a.m.
Best Paper Session
International Center North
Moderator: *Lawrence C. Tsen, M.D.*

9:15 a.m. - 9:30 a.m.
Gertie Marx Recipients
International Center North
2013 Recipients
Brian T. Bateman, M.D., M.Sc.; Richa Saxena, Ph.D.

9:30 a.m. - 10:30 a.m.
What's New in Obstetric Medicine? The Intrauterine Factors Fueling Trans-generational Obesity
International Center North
Introduction: *Brenda A. Bucklin, M.D.*
Speaker: *Linda A. Barbour, M.D., M.S.P.H, FACP*

10:30 a.m. - 11:15 a.m.
Coffee Break & Exhibits
International Center South

Coffee Break & Poster Viewing
Broadmoor Hall DE

10:30 a.m. - 11:15 a.m.
Poster Walk Around - Session 2
Broadmoor Hall DE
Moderator: *Richard M. Smiley, M.D., Ph.D.*

Program Schedule *continued on next page*

Program Schedule *continued*

11:15 a.m. - 12:15 p.m.
Fred Hehre Lecture: Reflections on the Evolution of the Management of Hypotension During Spinal Anesthesia for Cesarean Delivery
International Center North
Introduction: *Lawrence C. Tsen, M.D.*
Speaker: *Warwick Ngan Kee, B.H.B, M.B., Ch.B., M.D., FANZCA, FHKCA, FHKAM (Anaesthesiology)*

12:15 p.m. - 1:15 p.m.
Poster Session 2
International Center North
Moderator: *Mark I. Zakowski, M.D.*

1:15 p.m.
Open Afternoon & Poster Viewing
Broadmoor Hall DE

6:00 p.m. - 10:00 p.m.
SOAP Banquet at The Broadmoor Lake Terrace Dining Room
Broadmoor Main - Lake Terrace Dining Room

Saturday, May 16, 2015

6:00 a.m. - 5:00 p.m.
Registration Hours
International Center Foyer

6:00 a.m. - 7:00 a.m.
Yoga Class *(Optional)*
Broadmoor Hall F

7:00 a.m.
5K Fun Run/Walk
Front of Broadmoor Spa and Golf Club

6:00 a.m. - 8:00 a.m.
Continental Breakfast
International Center South

Poster Viewing - *Broadmoor Hall DE*

7:00 a.m. - 8:00 a.m.
Breakfast with the Experts *(Optional)*
Colorado Hall AB
Moderator: *David J. Wlody, M.D.*

7:45 a.m. - 8:00 a.m.
Opening Remarks
International Center North
Brenda A. Bucklin, M.D.; Manuel C. Vallejo, Jr., M.D., D.M.D.; Robert R. Gaiser, M.D.

8:00 a.m. - 9:30 a.m.
Obstetric Anesthesia Education Panel All Anesthesiologists are Educators at Heart
International Center North
Moderator: *Robert R. Gaiser, M.D.*

- **GME & Me**
  Speaker: *Rita M. Patel, M.D.*
- **Evidence Based Approach to Teaching Obstetric Anesthesia**
  Speaker: *Robert R. Gaiser, M.D.*
- **How to Best Teach Our Patients About Obstetric Anesthesia**
  Speaker: *May C.M. Pian-Smith, M.D., M.S.*

9:30 a.m. - 10:30 a.m.
Poster Session 3
International Center North
Moderator: *Vilma E. Ortiz, M.D.*

10:30 a.m. - 10:45 a.m.
Awards Presentation
International Center North

10:45 a.m. - 11:15 a.m.
Coffee Break
International Center South

Coffee Break & Poster Viewing
Broadmoor Hall DE

11:00 a.m. - 12:00 p.m.
Gerard W. Ostheimer Lecture
What's New in OB Anesthesia?
International Center North
Introduction: *Lisa R. Leffert, M.D.*
Speaker: *Katherine W. Arendt, M.D.*

12:00 p.m. - 1:00 p.m.
Lunch On Your Own & Poster Viewing
Broadmoor Hall DE

1:00 p.m. - 2:00 p.m.
What's New in Fetal Surgery?
International Center North
Introduction: *Brenda A. Bucklin, M.D.*
Speaker: *Timothy M. Crombleholme, M.D., FACS, FAAP*

2:00 p.m. - 2:45 p.m.
Oral Presentations 2
International Center North
Moderator: *Paloma Toledo, M.D., M.P.H.*

2:45 p.m. - 3:00 p.m.
Meta-Analyses
International Center North
Moderator: *Roshan Fernando, M.B., Ch.B.*

3:00 p.m. - 3:45 p.m.
Coffee Break
International Center South

Coffee Break & Poster Viewing
Broadmoor Hall DE

3:00 p.m. - 3:45 p.m.
Poster Walk Around - Session 3
Broadmoor Hall DE
Moderator: *Richard M. Smiley, M.D., Ph.D.*

3:45 p.m. - 4:45 p.m.
Research Hour: Research Applications/ Opportunities with Non-Invasive Cardiovascular Monitors
International Center North
Speakers: *Richard M. Smiley, M.D., Ph.D.; John T. Sullivan, M.D., M.B.A.*

Sunday, May 17, 2015

6:30 a.m. - 12:00 p.m.
Registration Hours
International Center Foyer

6:30 a.m. - 8:00 a.m.
Continental Breakfast
International Center South

7:45 a.m. - 8:00 a.m.
Opening Remarks
International Center North
Brenda A. Bucklin, M.D.; Manuel C. Vallejo, Jr., M.D., D.M.D.; Robert R. Gaiser, M.D.

8:00 a.m. - 9:00 a.m.
Chronic Pain Panel: Prediction, Prevention, Genetics of Obstetric Pain
International Center North
Moderator: *Pamela Flood, M.D.*
Speakers: *Inna Belfer, M.D., Ph.D.; Ruth Landau, M.D.*

9:00 a.m. -10:00 a.m.
Pro-Con Debate: Nitrous Oxide
International Center North
Moderator: *Manuel C. Vallejo, Jr., M.D., D.M.D.*

- **Pro:** Manuel C. Vallejo, Jr., M.D., D.M.D.
- **Con:** Robert S. McKay, M.D.

10:00 a.m. - 10:15 a.m.
Coffee Break
International Center South

10:15 a.m. - 11:45 a.m.
Best Case Reports Review
International Center North
Moderator: *John T. Sullivan, M.D., M.B.A.*

11:45 a.m. - 12:00 p.m.
Closing Remarks and Adjournment
International Center North

Wednesday, May 13, 2015

Use of Transthoracic Echocardiogram in the Management of the High Risk Parturient

Course Directors: *Brendan Carvalho, M.B.B.Ch., FRCA, M.D.C.H.; John T. Sullivan, M.D., M.B.A.*

Professional Development and Education Workshop

Course Directors: *Libby Ellinas, M.D.; Michaela Farber, M.D., M.S.; Klaus Kjaer, M.D.; Paloma Toledo, M.D., M.P.H.; Lawrence C. Tsen, M.D.*

Title: SOAP Focused Cardiac Ultrasound (FoCUS) Workshop Synopsis:

Brendan Carvalho, M.B.B.Ch., FRCA, M.D.C.H.; John T. Sullivan, M.D., M.B.A.

Objectives:

Following this workshop, attendees will be able to:

1. Review the basic physics principles underlying the application of ultrasound imaging
2. Demonstrate basic proficiency in obtaining 2-D transthoracic ultrasound images of the heart, lung and vena cava in live models
3. Provide qualitative assessment of cardiac contractility, chamber size and intravascular volume status
4. Recognize the applications and limitations of focused cardiac ultrasound (FoCUS)performed by the obstetric anesthesiologist and the appropriate indications for a formal cardiology consult

Summary: The use of point-of-care ultrasound is gaining recognition as a safe, non-invasive method for obtaining useful physiologic information in critically ill patients. Anesthesiologists routinely use transesophageal echocardiography in anesthetized patients and employ surface ultrasound to assist in the placement vascular access catheters and regional anesthetics. Transthoracic echocardiography (TTE) offers another opportunity for anesthesiologists to support clinical decision making, including in the domain of obstetrics where the majority of patients are conscious with neuraxial anesthetic techniques, and TEE probe placement is not feasible. As with TEE, the skill set required to effectively employ TTE encompasses both image acquisition and interpretation. The use of TTE at the bedside, as an adjunct to physical examination, to answer specific clinical questions has been referred to as Focused Cardiac Ultrasound (FoCUS) by the international cardiology community as is becoming an accepted terminology for this practice.[1]

Image Acquisition

Image acquisition of thoracic structures using surface ultrasound presents challenges. As compared with TEE, TTE probes are not stabilized and acoustic signal coupling can be compromised by the bony anatomy such as the ribs and sternum, as well as the air-filled pleura. Generally, pregnant patients are easy to image due to lateral displacement of the heart towards the chest wall. However, subcostal views can be more difficult in third trimester patients due to the enlarged uterus.

Interpretation

Competency in interpreting echocardiographic images has been categorized as emergency and levels 1-3. This range represents a continuum of escalating expertise.[2] The purpose of this workshop is to provide a basic overview of FoCUS applications in obstetrics and an opportunity for limited practical experience in image acquisition and interpretation in the domain of emergency and level 1 examination.

Lower domain echocardiography interpretation emphasizes qualitative over quantitative evaluation. Anatomic and physiologic elements examined may include left and right ventricular systolic function, myocardial wall thickness, ventricular and atrial chamber size, inferior vena cava diameter and plasticity, and bilateral pleura.[3] These findings can be correlated with the clinical context and applied immediately to decision making. As these are new and developing applications of an ultrasonography, there are limited data to link its use to improved outcomes at this time. Those who advocate for its wider dissemination cite non-invasiveness and low-cost as obvious benefits and believe that it increases the accuracy of clinical assessment and guides further diagnostic work-up.[4] Caution is warranted in recognizing the limits of one's capabilities within the construct of the tiered competencies.

Potential Applications in Obstetrics

Within the domain of obstetric s, the most obvious application of its use includes evaluating unexplained hypotension, dyspnea, chest pain and cardiac arrest. Other possible applications include evaluating suspicions of cardiomyopathy, embolism, and guiding management during hemorrhage. In addition, the ability to conduct serial FoCUS exams in high-risk cardiac patients may prove to be very beneficial in the obstetric management.

There are limited data linking the use of FoCUS with improved clinical outcomes and currently none in the setting of obstetric management. In acute care settings, however, the value of this point-of-care ultrasound application has been reported to aid in more rapid patient assessment. In a randomized, controlled trial in the setting of emergency medicine, for example, immediate evaluation of non-trauma patients that presented with hypotension with FoCUS substantially narrowed the differential diagnosis as compared with delayed use of FoCUS.[5]

Equipment

Optimizing image acquisition with FoCUS requires knowledge of the anatomical structures to be examined, basic technical aspects of ultrasound and appropriate equipment selection. Ultrasonic probes vary in size and shape of their footprints, frequency domains and special features. For FoCUS, low frequency, phased array probes are preferred as they can optimize image clarity with small acoustic windows and a deep, moving target. Phased array probes can be used with most standard ultrasound machines, and may or may not require software modification.

Machine Controls

Machine controls vary between different manufacturers. However, common features include image mode (M, 2-D, Color Flow and Doppler), focus depth, signal gain, recording and freeze functions, and a basic familiarity with these controls will help in optimizing image acquisition. Advanced features including cardiac calculations are beyond the scope of emergency and level 1 interpretation domains.

Standard TTE Views

Parasternal long axis- "Scout view"

Probe placement: Left parasternal border at approximately the 3-4th intercostal space

Index orientation: Toward right shoulder (10 o'clock)

Optimizing the window: Apex is present to the left for orientation; identify longest, widest mid-chamber view of the LV

Visible: RV, LV and septum; MV and AV in the same plane

Applications:

1. LV and RV cavity size, wall excursion
2. Good view of the pericardium, pericardial fluid
3. Screening view of the aortic and mitral valves (valve excursion)

Parasternal short axis

Probe placement: Left parasternal border at approximately the 3-4th intercostal space (rotate the probe 90 degrees from PSLA view)

Index orientation: Toward left shoulder (2 o'clock)

Optimizing the window: Level of papillary muscles; look for concentric LV chamber, not elliptical

Visible: Segments of the LV in short axis from apex to base; MV, AV, papillary muscles

Applications:

1. Global LV and RV systolic function estimation
2. Septal size and kinetics
3. Volume status

Apical 4-chamber

Probe Placement: Inferior/ lateral to nipple, point of maximal impulse (PMI)

Index orientation: Toward left shoulder or side (2 o'clock)

Optimizing the window: Center apex and septum, look for large mid-chamber cuts of LV and RV

Applications:

1. Compare chambers side-by-side
2. Doppler in-plane across valves
3. Aortic outflow track visualized (apical 5-chamber view)

Subcostal

Probe placement: Sub-xiphoid or right subcostal, aimed cephalad directly or thru the liver

Index orientation: Cephalad (12 o'clock)

Optimizing view: Identify RA and tilt the probe right for IVC (look for respiratory variation, emptying into RA, hepatic vein)

Applications:

1. Assessing volume status by applying *M-Mode* to this image, one can observe respiratory variation in the IVC diameter which is a relatively sensitive measure of volume status.
2. Although the focus of lower tiered interpretation domain remains qualitative, practitioners may find these reference values helpful:[6]

IVC Measured	% Collapse	CVP (cmH20)
<1.5cm	>50%	0-5
1.5-2.5cm	>50%	5-10
1.5-2.5cm	<50%	10-15
> 2.5 cm	Little Phasicity	15-20

Pulmonary Ultrasound

Ultrasound is reliable and convenient way of examining lung pathology and has been reported to be superior to chest radiography in detecting pneumothorax.[7]

Probe Placement: Linear, phased array or curvilinear probe placed in longitudinal (cephalad-caudad axis) perpendicular to the ribs

Index orientation: Cephalad (12 o'clock)

Optimizing the window: Observe pleura and lung parenchyma between the ribs in both 2D and M mode. Pleura are hyperechoic (sliding sign in 2D and pleural lines/seashore sign in M mode). A and B lines (increased in pulmonary edema) artifacts should be noted. With pneumothorax, there is absent sliding sign of the pleura and 'seashore' sign. Pleural effusions and hemothorax may be observed in the most dependent part of the lung.

Applications:

1. Diagnosing pneumothorax, hemothorax and pleural effusions
2. Identifying pulmonary edema

References:

1. Via G: International evidence-based recommendations for focused cardiac ultrasound. J Am Soc Echocardiogr. 2014;27(7):683 e1-e33. doi:10.1016/j.echo.2014.05.001
2. Oxorn D: Con: Physician-performed ultrasound: The time has come for routine physician use in acute care medicine. Anesth Analg 2012;105(5):1004-6
3. Holm JH: Perioperative Use of Focus Assessed Transthoracic Echocardiography (FATE). Anesth Analg 2012;105(5):1029-32
4. Vignon P: PRO: Physician-performed ultrasound: The time has come for routine use in acute care medicine. Anesth Analg 2012;105(5):999-103
5. Jones AE: Randomized, controlled trial of immediate versus delayed goal-directed ultrasound to identify the cause of nontraumatic hypotension in emergency department patients. Crit Care Med 2004;32: 1703-8
6. Kircher BJ: Noninvasive estimation of right atrial pressure from the inspiratory collapse of the inferior vena cava. Am J Cardiology 1990;66(4):493-96
7. Rowan KR: Traumatic pneumothorax detection with thoracic US: Correlation with chest radiography and CT - Initial experience. Radiology 2002;225:210-4.

Back to Table of Contents

Title: Professional Development and Education Workshop

Libby Ellinas, M.D.
Medical College of Wisconsin
Associate Professor of Anesthesiology
Assistant Dean for Faculty Affairs
Chief of OB Anesthesia and Fellowship Program Director
Chair, SOAP Fellowship Committee

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Instructor of Anesthesia, Harvard Medical School
Director, Obstetric Anesthesia Fellowship
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Paloma Toledo, M.D., MPH
Assistant Professor in Anesthesiology and the Center for Healthcare Studies
Institute for Public Health and Medicine
Northwestern University Feinberg School of Medicine

Lawrence C. Tsen, M.D.
Associate Professor, Harvard Medical School
Vice Chair, Faculty Development and Education
Department of Anesthesiology, Perioperative and Pain Medicine
Brigham and Women's Hospital

Target Audience: Obstetric Anesthesia Core Faculty, Fellowship Program Directors, and Potential Program Directors.

Synopsis: Obstetric Anesthesia faculty must fulfill their program's teaching goals (clinical teaching, didactics, and evaluation and remediation), while working toward their own promotion in academic medicine. While it may seem that teaching duties leave no time for academic advancement, this workshop will discuss how to merge the two for maximum benefit. We will update your knowledge base and discuss ideas to streamline and assist the education process within the new ACGME guidelines, while showing you how to use those very activities to assist your progress up the academic ladder!

Session Objectives:

1. Discuss the developments and changes in the Obstetric Anesthesia Fellowship and the OB portion of the Core Anesthesiology Program, and how they impact faculty, fellows, and residents.
2. Evaluate the key components of your obstetric anesthesia training program, and how they can be enhanced by ACGME guidelines: defining core faculty; engaging faculty and trainees in clinical research; evaluating and remediating faculty, fellows and residents; collaborating across programs to augment curriculum and program development.
3. Discover how to use the work we D.O. as teaching faculty to get promoted as educators.

Session	Description	Presenter	Time
1	Introduction and Fellowship Update: Review and update of the ACGME changes that apply to OB Anesthesia fellows and residents in the Core Anesthesia programs. Specifically update participants on the progress of the OB Anesthesia Fellowship; the Fellow's Lecture Series, the Match, and other items.	Ellinas	45 min
2	Breakout Sessions: Roundtable discussions with no more than 10 participants per table. Participants will leave each session with ideas and action plans.	All	145 min
	Research: Scope, Start, and Motivation: Getting your fellow off to an early and successful start (getting your own research started quickly too!). What D.O. the residency and fellowship guidelines say about research requirements, and how can we encourage residents and fellows to fulfill them?	Toledo	30 min
	Core faculty: Defining and assisting core faculty: Discuss the ACGME's requirements scholarly activity. What defines scholarly activity? How much is enough per the ACGME – both for Program Directors and Core Faculty? Consider ways to engage faculty that D.O. NOT require research and publication: encouraging roles in QA/QI, curriculum development, advisory roles to fellows.	Farber	30 min
	Evaluation and Remediation: Trainees and Faculty: How to decipher the new ACGME guidelines and the Clinical Competence Committee processes. Discuss ways to provide both positive and negative feedback constructively. Suggest methods to cope with the difficult fellow in a short time frame, and/or help the faculty member that needs assistance with teaching skills or trainee interactions.	Ellinas	30 min
	Program Directors/ACGME: Fellowship programs have evolved in the 3 years since accreditation: What are other programs doing, and what can we learn from each other? Discussion and sharing of ideas from a pre-workshop survey exploring program structure, didactics, and call schedules.	Kjaer	30 min
3	Getting Promoted as an Educator: The promotion process for educators is not well defined. Your work as an educator can get you promoted, however, understanding the metrics being evaluated is essential. Make an action plan for your next promotion!	Tsen	45 min
4	Wrap up and Evaluations	Ellinas	15 min

Thursday, May 14, 2015

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

Gertie Marx/FAER Education Lecture: Professionalism and the Hidden Curriculum
Speaker: *Frederic W. Hafferty Ph.D.*

Maternal Safety Bundles
Moderator: *Yaakov Beilin, M.D.*

- **National Partnership for Maternal Safety**
  Speaker: *Elliott K. Main, M.D.*
- **Maternal Early Warning Criteria**
  Speaker: *Jill M. Mhyre, M.D.*

Oral Presentations 1
Moderator: *Philip E. Hess, M.D.*

Abstract #:GM-01

Active Warming Utilizing Forced Air and Intravenous Fluid Warming Combined Decreases Hypothermia and Shivering During Cesarean Delivery

Presenting Author: Benjamin G. Cobb M.D.
Presenting Author's Institution: Stanford University - Stanford, CA
Co-Authors: Yuri Cho M.D. - Pacific Alliance Medical Center - Los Angeles, CA
Gillian Hilton M.B.Ch.B. FRCA - Stanford University - Stanford, CA
Vicki Ting M.D. - Santa Clara Valley Medical Center - San Jose, CA
Brendan Carvalho M.B.B.Ch., FRCA, M.D.C.H. - Stanford University - Stanford, CA

Introduction: Active warming in the setting of cesarean delivery does not predictably reduce the incidence of hypothermia and shivering (1). However, studies have investigated either forced air warming or intravenous fluid warming independently. The aim of this study was to apply both forced air warming and fluid warming in an attempt to decrease the incidence of perioperative hypothermia and shivering in women undergoing scheduled cesarean delivery with spinal anesthesia.

Methods: 46 healthy patients undergoing scheduled cesarean delivery under spinal anesthesia (10-12.5 mg bupivacaine ± fentanyl) were enrolled in this randomized, double-blind, IRB-approved study. Women were randomized to receive either active warming (AW; warmed intravenous fluid and lower-body forced-air warmer) or no warming (NW; blankets only). The primary outcome was maximum perioperative core temperature change using the SpotOnTM Monitoring System. Secondary outcomes included: incidence of shivering and hypothermia (<36oC), thermal comfort score (0-100), estimated blood loss (EBL), Apgar scores, and fetal venous gases. Core and peripheral temperatures were recorded at baseline, intraoperatively (every 10 min), and for 1 hour post-operatively (every 15 min). Data presented as mean ± SD and n (%) as appropriate.

Results: Demographic, obstetric and surgical data were similar between study groups. Maximum temperature decrease was less in the AW group compared to the NW group (1.0±0.5oC vs 1.4±0.4oC; p=0.022). Key maternal outcomes are outlined in the Table. 14 (64%) women in the AW group and 20 (91%) in the NW group were hypothermic at some point during the study period (p=0.031). Temperature decrease during surgery (p=0.005) and in PACU (p=0.003) were less in the AW group (Figure). No differences in EBL, Apgar scores, or fetal blood gases were observed between the study groups.

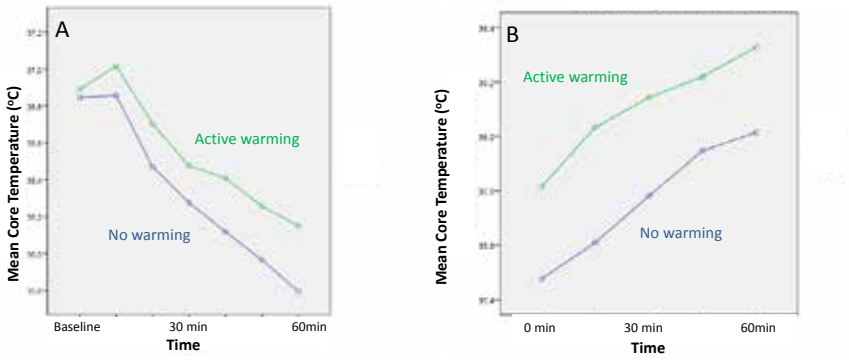
Conclusions: Forced air warming combined with fluid warming is effective in decreasing perioperative hypothermia and improving thermal comfort, but does not prevent shivering in women undergoing cesarean delivery with spinal anesthesia. However, the warming modalities were not very effective and the majority of women became hypothermic. The magnitude of difference (on average 0.4oC) achieved with warming may also not be clinically important or warrant the time and cost of using both warming modalities.

Table: Key Maternal Outcomes

Outcomes	Active Warming	No Warming	P value
Temperature entering PACU (°C)	35.9±0.5	35.5±0.4	0.006
Intraoperative shivering (yes)	5 (22%)	10 (45%)	0.112
PACU shivering (yes)	4 (18%)	4 (18%)	1.000
Meperidine use (yes)	1 (5%)	3 (14%)	0.294
Intraoperative thermal comfort score (0-100)	100 [95-100]	90 [70-100]	0.008

PACU = post-anesthesia care unit
Data presented as: number (%), mean (standard deviation), median [interquartile range]

Figure: Temperature changes during surgery (A; p=0.005) and in PACU (B; p=0.003)



References:

1. Obstet Gynecol Surv 2012;67(7):436-446

Abstract #:GM-02

PIEB (programmed intermittent epidural bolus) versus CEI (continuous epidural infusion) for labor analgesia: results of a pilot set-up and where to go from there

Presenting Author: Carlos M. Delgado M.D.
Presenting Author's Institution: University of Washington - Seattle, Washington
Co-Authors: Laurent Bollag M.D. - University of Washington - Seattle, Washington
Christopher Ciliberto M.D. - University of Washington - Seattle, Washington
Margaret Sedensky M.D. - University of Washington - Seattle, Washington
Ruth Landau M.D. - Columbia University - New York, New York

Background: Evidence that an epidural bolus provides a better spread of the injectate in the epidural space than a continuous infusion has emerged.1 Programmed intermittent epidural bolus (PIEB) results in lower local analgesia dosing, reduced motor block, instrumentation rates and physician-administered top-ups for breakthrough pain.2 In July 2014, each L&D room was equipped with a CADD®-Solis PIB Ambulatory Infusion System. We compared our continuous epidural infusion (CEI) protocol (10ml/h bupivacaine 0.0625%-fentanyl 2mcg/ml, 5ml PCEA bolus, 10min lock-out) with a PIEB setting using the exact same hourly & PCEA dose and lock-out time. The 1st PIEB was set to start 45min after initiation of analgesia with spinal dose (CSE), followed by 10ml PIEB q60min, 5ml PCEA bolus, 10min lock-out and a reset of the PIEB. The bolus rate was 250 ml/h (max speed with standard tubing). We hypothesized that PIEB would result in less physician-administered top-ups compared with CEI & PCEA.

Methods: Data was collected from April to December 2014 allowing a 'before & after' comparison. 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: Data from 240 cases were analyzed (120 PIEB vs 120 CEI). There was no difference in demographics, time from spinal analgesia to delivery, duration of 2nd stage or mode of delivery between groups (24% cesareans with PIEB vs 27% with CEI; p>0.05). There was no difference in the number of women requesting a top-up (50 with PIEB vs 45 with CEI group; p>0.05), median time until top-up or hourly top-up rate (Figure).

Conclusions: Contrary to our expectations, there was no difference in number or timing of top-up request between groups. This may be explained by the long interval between programmed boluses (60min), the 45min interval between spinal dose and 1st PIEB dose, and the low volume of PCEA bolus (5ml); this setting was chosen to keep the exact same hourly dose and PCEA settings. This pilot emphasizes the many variations in programming that need to be further tested, such as evaluating the analgesic effects of a shorter interval (45min) and larger PIEB & PCEA bolus (8ml). It also remains to be defined whether longer intervals offer other advantages besides improved analgesia such better voiding and maternal temperature profiles.

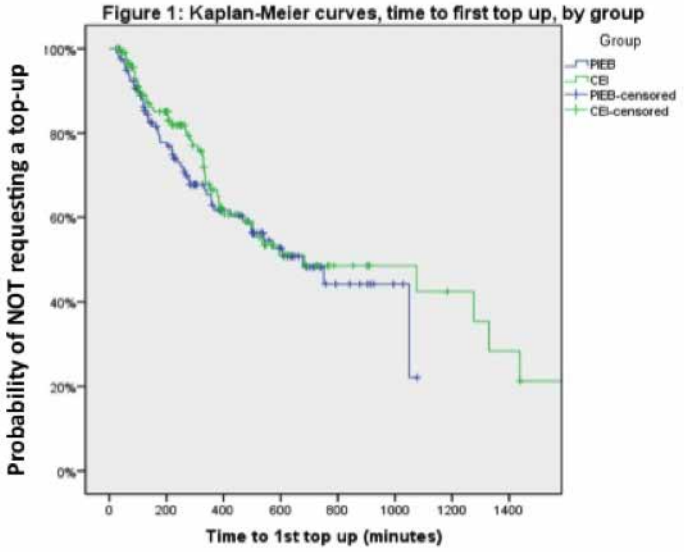


Figure. Survival curves between groups for time from analgesia initiation (spinal dose of CSE) until 1st physician-administered top-up, representing the **probability of not requesting a top-up**; the crosshatches indicate time points when women delivered before requesting a top-up. There is also no difference between groups when adjusting for parity (p= 0.74). There is no difference between groups in the top-up rates (per hour), unadjusted and adjusted for parity (p=0.30). The ratio between PIEB and CEI top-ups rates is 1.26 (95%CI: 0.86,1.85).
Means were compared by independent-samples t-tests, and proportions compared using the Pearson chi-square test. Times to 1st top-up were compared using survival analysis methods.

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Abstract #:GM-03

Recovery time of oxytocin induced desensitization in human myometrium in-vitro

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Introduction: Postpartum hemorrhage secondary to uterine atony is a leading cause of maternal morbidity. Prolonged exposure to oxytocin for labor augmentation can result in the 'desensitization' phenomenon, a decrease in the responsiveness of the myometrium to further oxytocin.[1] It is not known if following cessation of oxytocin, waiting for a specific period would allow the oxytocin receptors to 'resensitize' and recover, thereby improving oxytocin induced myometrial contractility. We aimed to investigate the effect of a rest-time of 30, 60 and 90 min, on the recovery of desensitized myometrium in vitro.

Methods: Patients undergoing elective cesarean deliveries were recruited in this in-vitro study. Myometrial tissue was dissected into four strips. Each strip was mounted in a single organ bath with physiological salt solution (PSS) under homeostatic conditions and then pretreated for 2h with 10-5M oxytocin (myometrial desensitization model [2]). Following pretreatment, each strip was washed with PSS, and allowed to 'rest' in PSS solution for either 30, 60 or 90 min. At the end of the 'rest' period, a dose-response to oxytocin 10-10M to 10-5M was performed. A control group consisted of an oxytocin dose-response without any pretreatment to oxytocin. Contractile parameters were measured. The primary outcome was motility index (amplitude x frequency) of myometrial contractions. Data were analyzed using mixed linear model using baseline contractions and tone as covariates.

Results: A total of 20 women were recruited and 55 successful experiments were performed: control (n=14); 30 min (n=14); 60 min (n=13); 90 min (n=14). The motility index of contractions (square root g.contractions/10min) was significantly higher in control group [mean (SE)] [2.91 (0.36)] as compared to 30 min [2.60 (0.24), adjusted p=0.02]; 60 min [2.58 (0.26), adjusted p=0.002] and 90 min [2.16 (0.31), adjusted p<0.001] (Fig 1).

Discussion: We found that even after a rest-period from 30-90 min, recovery of oxytocin responsiveness does not take place if the myometrium is previously desensitized with oxytocin. This implies that stopping oxytocin infusion prior to cesarean section in women with augmented labor is unlikely to improve oxytocin induced contractility after delivery.

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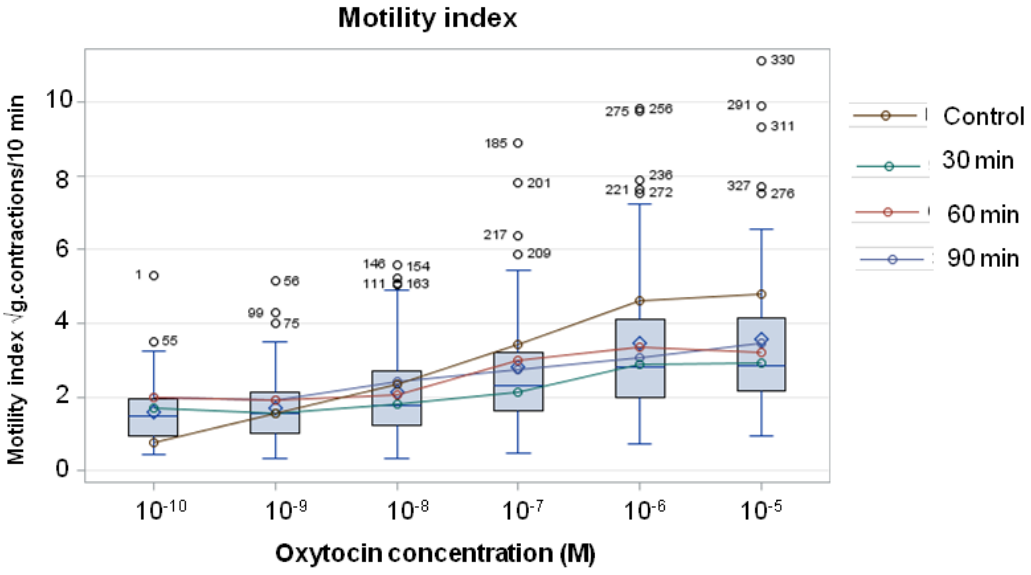

Abstract #:GM-04

Modeling recovery from pain following non-emergent cesarean delivery

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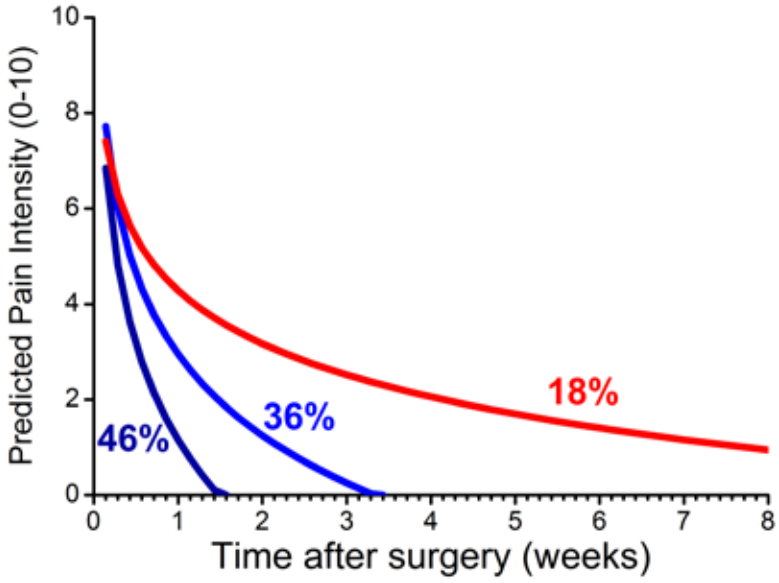
Introduction: Severity of acute pain while still in hospital following delivery is weakly associated with the risk of persistent pain and depression at 8 weeks postpartum (1). Although we know that recovery after surgery is a gradual process, there has been no high time-resolution examination of recovery from pain for the initial months after surgery, and none after cesarean delivery. Our goals were to determine the form of this time course and whether there are typical patterns of recovery.

Methods: Following IRB approval and informed consent, 346 ASA I-III parturients scheduled for non-emergent cesarean delivery were consented. Preoperative questionnaires, demographic information, and medical history were obtained. Routine anesthetic and postoperative analgesic care was provided. Pain intensity and unpleasantness scores (0-10) were recorded daily for 60 days after surgery by email or text messaging.

Results: To date, data from 155 parturients have been analyzed. Participants each provided a median [range] of 57 [1,61] daily pain scores (N = 7612). Worst daily pain scores over time were best fit by a ln(time) function, and preliminary latent class analysis identified 3 patterns of recovery (Figure 1). Consistent with previous, single time point observations, the majority of patients have no pain within one month after cesarean delivery, but a small subset of patients continue to have persistent pain 60 days postpartum.



Conclusions: These data suggest that high time resolution sampling of pain after surgery is feasible, that recovery from pain after cesarean delivery follows a ln(time) function, and that women can be divided into a small number of distinct groups of time courses. This approach has more biologic face validity than typical dichotomous definition of pain at arbitrary times and may develop as a more appropriate primary outcome measure to assess recovery from pain after surgery.

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Supported in part by R37 GM48085 to JCE

Abstract #:GM-05

Is Maternal Temperature Rise During Labor Analgesia a Physiological Process Due to Decreased Pulmonary Ventilation?

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Background: Maternal fever occurs in approximately 15-30% of laboring women after epidural analgesia. Proposed mechanisms include inflammation and thermoregulatory imbalance during labor. Though inflammation is reasonably well characterized, not much is known about altered heat balance during labor. Here, we propose a novel mechanism to potentially explain the gradual rise in temperature after epidural analgesia. Specifically, we hypothesize that a decrease in minute ventilation after effective epidural analgesia causes a decrease in heat dissipation, and therefore, promotes heat retention over time.

Methods: To investigate this hypothesis,18 parturients (age: 33.7 ± 3.4 yrs, BMI: 29.4 ± 2.8 kg/m2) who requested labor epidural analgesia were enrolled. Continuous respiratory minute ventilation (RMV) traces were recorded using an impedance-based system (ExSpiron, Respiratory Motion, Inc.) before, during, and after administration of labor epidural analgesia. A turbine spirometer (nSpire Health, Inc.) was used to calibrate the RMV system prior to epidural placement. Baseline minute ventilation (MV), tidal volume (TV) and respiratory rate (RR) were determined 20-min before epidural placement and subsequent changes during labor were recorded. Oral temperatures were obtained every 90 minutes. Unpaired 2-sided t-tests were used to evaluate changes in post-epidural respiratory measurements compared to baseline.

Results: Following the administration of the epidural analgesia, the average MV decreased by 28.1%±8.4% within 2 hours and reached a nadir of 32.6%±6.1% below baseline approximately 5 hours after epidural catheter placement ($p<0.05$ for both comparisons, Fig 1A&B). Meanwhile, average body temperature underwent a linear increase by 0.13±0.13 °F and 0.28±0.1°F (Fig 1C&D) at 2 and 5 hours, respectively ($p>0.05$ for both comparisons). The decrease in MV was driven primarily by a decrease in TV rather than RR.

Conclusions: Our preliminary results confirm part of our hypothesis that effective epidural analgesia would significantly decrease respiratory minute ventilation. Though there was a trend towards increased body temperature during labor analgesia, our current sample size does not allow meaningful interpretation of the data. Further enrollment will allow us to characterize changes in ventilation in those patients who D.O. and D.O. not develop fever.

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Abstract #:GM-05

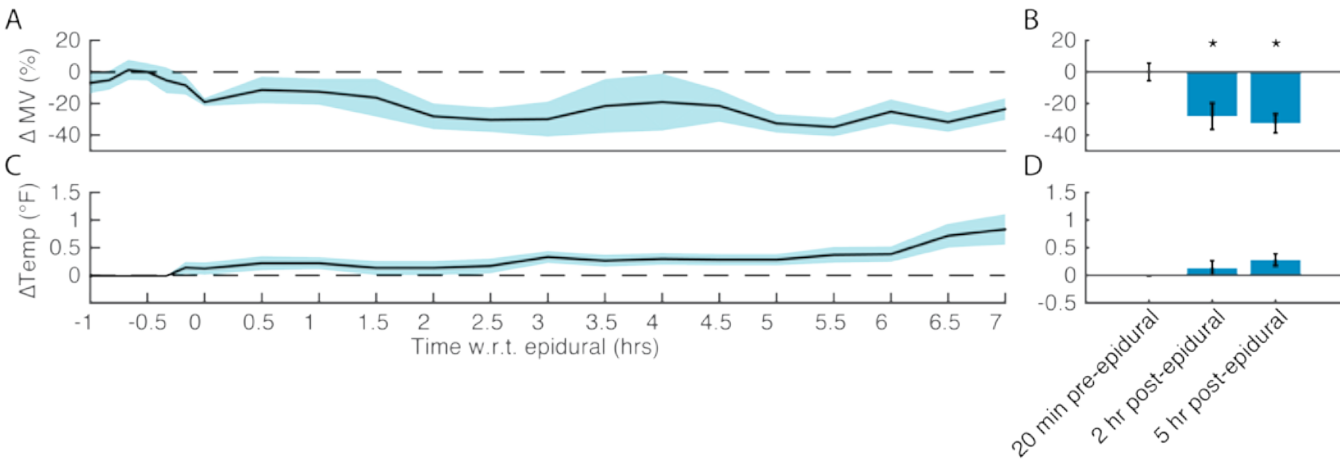

Fig. 1: Continuous measurement trends. (A) Changes in Minute Ventilation (MV) across the patient population from a baseline MV (based on the average MV at 20 ±5 minutes before the epidural). The black line shows the average trend, shaded cyan region shows standard error of the mean (SEM). Individual patient MV estimates were calculated as the average MV during a 10-min window every 10-min prior to epidural and every 30-min following epidural. **(B)** Snapshot of MV measurements at 3 time points: at baseline (20-min prior to epidural) and at 2- and 5- hours post-epidural. **(C) and (D)** Changes in Temperature measurements, presented in the same manner as panels (A) and (B).

* $p<0.05$

Abstract #:GM-06

Comparison of Continuous Intravenous Phenylephrine vs. Norepinephrine Infusions in Prevention of Spinal Hypotension during Cesarean Delivery: Assessment of Hemodynamic Parameters and Outcomes

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Introduction: Phenylephrine is currently the drug of choice in the treatment of maternal hypotension because it causes less neonatal acidosis and does not interfere with uteroplacental blood flow while maintaining blood pressure. However, phenylephrine does have dose dependent side effects such as a baroreceptor-mediated decrease in heart rate leading to a subsequent drop in cardiac output. We assessed the hemodynamic parameters throughout CD and aimed to determine which continuous infusion, phenylephrine or norepinephrine is more efficacious in the prevention of spinal hypotension.

Methods: After IRB approval, we conducted a prospective randomized clinical trial on 39 ASA I/II parturients scheduled for CD under spinal anesthesia. Subjects were randomized to Group A (continuous phenylephrine infusion 0.1 mcg/kg/min, n=16) or Group B (continuous norepinephrine infusion 0.05 mcg/kg/min, n=23) to maintain systolic blood pressure (SBP) within 100-120% of baseline under standardized spinal anesthesia [0.75% hyperbaric bupivacaine (1.6 mL) with preservative free morphine (0.2 mg) and fentanyl (20 mcg)]. Measured variables included Blood Pressure (BP), number and type of provider interventions to control blood pressure, Heart Rate (HR), Cardiac Output (CO), Cardiac Index (CI), Stroke Volume (SV), Systemic Vascular Resistance (SVR) as measured by Nexfin® (a noninvasive hemodynamic monitor), newborn APGAR scores at 1 and 5 minutes, and intraoperative maternal nausea and emesis. Results were analyzed using t-test, Mann-Whitney, or Chi-square. P values < 0.05 were considered significant.

Results: No differences were noted between study groups in demographic data (age, height, weight, gravidity, parity, and gestation). There was no difference in hemodynamic parameters (Fig), continuous infusion duration, number and total dose of vasopressor boluses between groups, APGAR scores and incidence of maternal nausea episodes. Maternal emesis was less in the norepinephrine infusion group (0.83% vs. 3.98%, $P = 0.03$).

Conclusion: A continuous intravenous phenylephrine or norepinephrine infusion produces comparable hemodynamic effects, and are both effective choices for prevention of spinal hypotension during CD. In the prevention of emesis, norepinephrine appears to offer an added benefit.

References:

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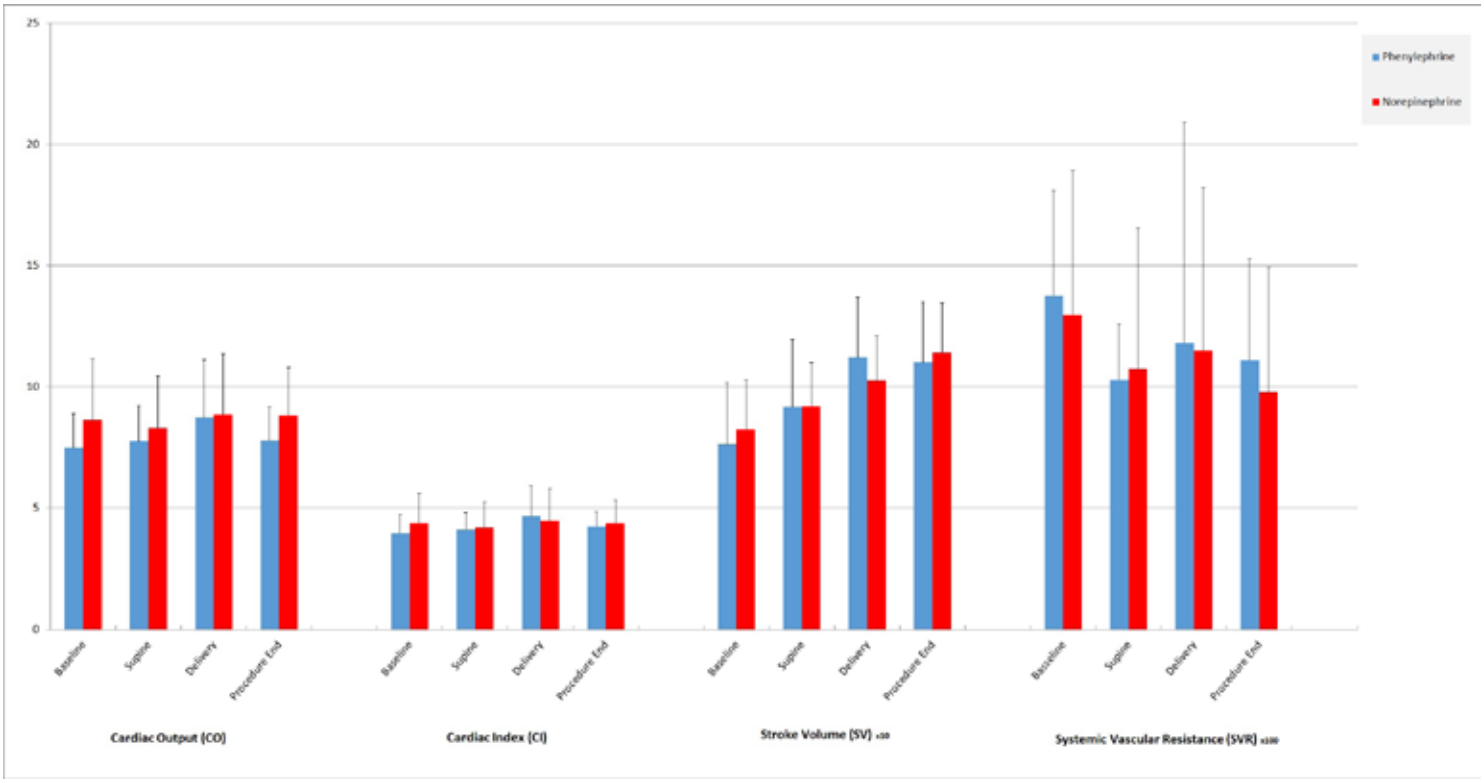
Abstract #:GM-06



Gertie Marx/FAER Education Lecture: Professionalism and the Hidden Curriculum

Speaker: Frederic W. Hafferty, Ph.D.

Issues of professionalism, including the status of physicians as professionals, the status of medicine as a profession, and the role of medical training in professional identity formation, continue to be important topics within the arenas of education and practice. These concerns, in turn, have been linked along a number of dimensions to the highly textured interplay between the formal curriculum and the broader context of the educational learning environment, which includes a variety of learning modalities such as the hidden curriculum. In this session, we will explore the evolution of medicine's modern day professional movement, examine challenges which have arisen (and are currently arising) within this movement, and, in turn, explore how understanding the tacit dimensions of medical learning and identity formation can be used to more effectively organize the preparation of tomorrow's physicians.

Maternal Safety Bundles

- **National Partnership for Maternal Safety**

Moderator: Yaakov Beilin, M.D.
Speaker: Elliott K. Main, M.D.

NOTES

Maternal Safety Bundles

• Maternal Early Warning System

Moderator: Yaakov Beilin, M.D.
Speaker: Jill M. Mhyre, M.D. – The University of Arkansas for Medical Sciences

Objectives: Upon completion of this session, the learner will be able to:

1. Recognize the value of an early warning system to detect women at greatest risk for physiologic decompensation
2. Compare and contrast the Maternal Early Warning Criteria with the Modified Early Obstetric Warning Score
3. Define implementation considerations for a Maternal Early Warning System, including potential roles for the anesthesia provider

Summary: Maternal mortality surveillance in the United States, France, and the United Kingdom suggests that 40% of maternal deaths are potentially preventable.(1-3) Timely recognition, diagnosis, and treatment are among the primary recommendations to improve outcomes for hemorrhage, hypertension, infection, and venous thrombosis.(1-3) Structured early-warning systems are designed to direct clinical attention towards those women who are most likely to be developing critical illness.

Early-warning systems have an afferent limb (monitoring protocols, pre-specified criteria for more intensive evaluation, and a structured protocol to communicate the indication for evaluation), and an efferent limb (expectations for response, evaluation and escalation of care). Because each of these components can impact the efficacy of the entire system, and because preventable adverse events are relatively rare in obstetrics, early warning systems are difficult to study and definitive evidence of their efficacy does not currently exist.

Several types of early-warning systems have been described, differentiated primarily by the evaluation criteria. (4) Single parameter systems define abnormal thresholds for a list of physiologic parameters (eg, heart rate); bedside medical evaluation is indicated when any single parameter is measured as abnormal. The Maternal Early Warning Criteria is an example.(5)

Table 1. The Maternal Early Warning Criteria

Systolic BP (mm Hg)	<90 or >160
Diastolic BP (mm Hg)	>100
Heart rate (beats per min)	<50 or >120
Respiratory rate (breaths per min)	<10 or >30
Oxygen saturation on room air, at sea level, %	<95
Oliguria, mL/hr for ≥2 hours	<35
Maternal agitation, confusion, or unresponsiveness; Patient with preeclampsia reporting a non-remitting headache or shortness of breath	

BP, blood pressure.
These triggers cannot address every possible clinical scenario that could be faced by an obstetric clinician and must not replace clinical judgment. As a core safety principle, bedside nurses should always feel comfortable to escalate their concerns at any point.

Maternal Early Warning Criteria(2, 6)

Advantages of these single-parameter lists include simplicity, ease of implementation, minimal impact on nursing workload, and better specificity. This approach assumes that vital signs become progressively abnormal as critical illness develops. As soon as a single parameter is measured as abnormal, a full set of vital signs is indicated (including temperature) along with timely bedside evaluation by a clinician with the capacity to initiate diagnostic and therapeutic interventions.

With aggregate-weighted scores, nurses assign a score based on the degree of physiologic derangement for each measured parameter; the total score for all measured parameters is used to determine the need for bedside medical evaluation. Examples include the Modified Early Obstetric Warning Score(7, 8) and the Irish Maternal Early Warning Score.(3) Aggregate weighted scores may be more sensitive to detect early deterioration because multiple minor derangements may develop before a single parameter becomes frankly abnormal. In addition, aggregate-weighted scores are believed to focus the nurses' attention on maternal overall well-being, and increase the likelihood that all parameters are actually measured (particularly the respiratory rate). Implementation can be complex, and these tools have a high false positive rate, which together markedly increase both nursing and physician workload. Some proposed solutions have included building the scoring tools into the EMR, and creating

staged escalation protocols (e.g., for progressively abnormal scores the bedside nurse would first increase the frequency of measurement, next alert the charge nurse, then request evaluation by the treating physician, and finally activate the rapid response team). Automated scoring and notification systems have the potential to decrease workload, as long as measurement error can be managed.

Regardless of which triggering system is selected, all early warning systems require structured communication protocols and established expectations for behavior. A functioning Early Warning System requires substantial multidisciplinary and intraprofessional cooperation that can both reflect and enhance unit-wide culture of safety.

The frequency of vital sign monitoring should be based on the woman's medical and obstetric condition, in accordance with existing clinical guidelines. The procedures to request bedside clinical evaluation depend on local staffing, patient acuity, and communication protocols. Critical components of an effective communication policy should define: 1) who to notify, 2) how to notify them, and 3) when and how to activate the clinical chain of command in order to ensure an appropriate response.(8-10)

The expectations for bedside evaluation and the timeliness of the response will depend on institutional staffing, resources, and acuity of the patient population served. As a general rule, all women who meet any of triggering criteria should receive prompt bedside evaluation by a physician or other clinician with the ability to activate resources in order to initiate emergency diagnostic and therapeutic interventions. As perioperative and peri-partum physicians, anesthesiologists are ideally suited to serve as the primary responder in certain contexts (e.g., in PACU) and for certain triggers (e.g., hypoventilation), but might serve to back up the obstetric providers in other circumstances (e.g., during a postpartum readmission for hypertension).

To facilitate initial clinical evaluation, the committee developed a series of differential diagnoses for each of the physiologic derangements listed in The Maternal Early Warning Criteria. These lists are divided into common conditions, and rare but serious conditions, and are available at http://links.lww.com/AOG/A551 . Occasionally, an abnormal criterion may reflect normal physiology for that patient, and the team should establish a tailored plan for subsequent monitoring, notification, and clinical review.(8)

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Abstract #:O1-01

Prevalence and Predictors of Chronic Pain in Childbirth

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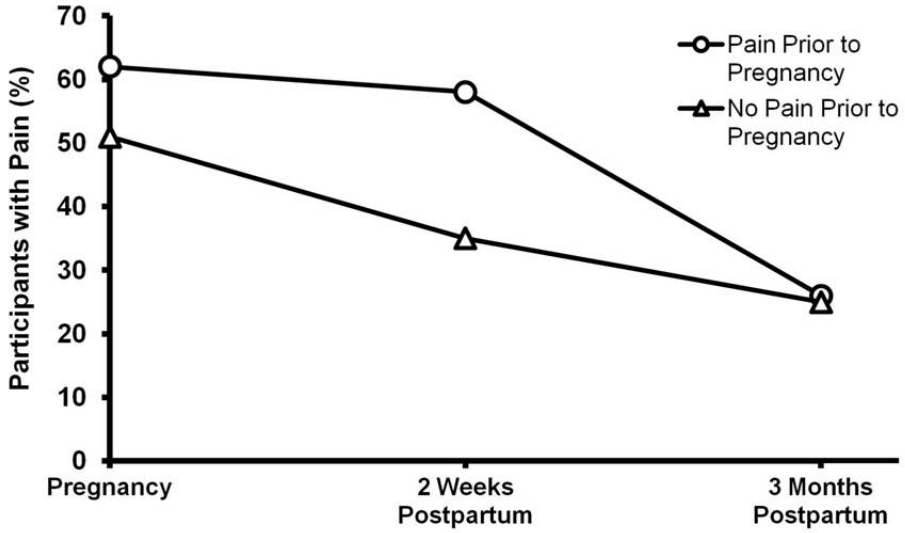
Introduction: A significant number of women experience chronic pain following childbirth. Ten percent of women report persistent pain two months after vaginal delivery and up to 18.6% after cesarean delivery.1,2 However, previous studies have not evaluated whether postpartum pain predated the delivery or even the pregnancy. The objective of this study was to identify the incidence of pain and evaluate if pre-existing pain, pain during pregnancy or pain present two weeks after delivery are associated pain occurring three months postpartum.

Methods: With institutional ethics board approval and written informed consent, primiparous women at 30-36 weeks gestational age with an uncomplicated singleton pregnancy were recruited from a large urban perinatal clinic. Participants completed questionnaires on socio-demographics and generalized pain using the McGill Pain Questionnaire. The location of pain was noted and pain intensity was quantified using a numeric rating scale. The first of three questionnaires was completed in the perinatal clinic. Questionnaires 2 & 3 were completed electronically two weeks and three months postpartum.

Results: Of the 254 women who consented to participate, 134 women completed all three surveys and were included in the analysis. Fifty patients (37.3%) had a chronic pain condition or experienced pain prior to pregnancy, while 74 patients (55.2%) described pain in the prior four weeks of their pregnancy. Following delivery, pain was persistent in 58/134 patients (43.3%) two weeks postpartum and in 34/134 patients (25.4%) three months postpartum. Of the patients that reported no pain prior or in pregnancy, 12/41 (29.3%) patients described pain two weeks postpartum and 12/41 (29.3%) three months postpartum. Patients with pre-existing pain were more likely to experience pain two weeks postpartum (p=0.009) and patients with pain two weeks postpartum were more likely to have pain three months postpartum (p=0.004).

Discussion: The percentage of women with chronic pain after delivery is greater than previous studies have indicated. In our study, women with pain two weeks postpartum were significantly more likely to have pain at three months. Further investigation is required to determine whether pre-existing pain, pain in pregnancy or pain at two weeks postpartum can adequately predict the likelihood of chronic pain.



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Abstract #:O1-02

Investigating the effect of extracellular calcium on contractility, in oxytocin induced desensitized human myometrium in-vitro

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Introduction: A significant risk factor for uterine atony is prolonged exposure to oxytocin for augmentation of labor, resulting in the 'desensitization' phenomenon, a decreased response of the myometrium to further oxytocin [1]. The importance of calcium is well-established in myometrial contractility [2], however, in the context of desensitized myometrium, its significance is unknown. We investigated the effect of low, normal and high calcium concentration on oxytocin-induced contractility, in desensitized human myometrium in-vitro.

Methods: Myometrial tissue, from patients undergoing elective cesarean deliveries, was dissected into 6 strips. Each strip was mounted in an organ bath with physiological salt solution (PSS) and then pretreated for 2-hours with either oxytocin 10-5M (to achieve myometrial desensitization [3]), or no oxytocin (control). The tissue was washed with PSS, and the calcium concentration altered to reflect low (1.25mM), normal (2.5mM) or high (3.75mM) levels, providing 6 groups. Thereafter, a dose-response to oxytocin 10-10M to 10-5M was performed. Contractile parameters were measured. The primary outcome was motility index (MI, frequency x amplitude). Analysis will be undertaken with linear regression models adjusted for repeated measures through compound symmetry covariance structure.

Results: 49 experiments (of a total of 192) have been analyzed. The control experiments show an increase in MI from baseline when analyzed as a cumulative dose-response average, in the presence of 2.5mM calcium (538%), vs 1.25mM (465%) and 3.75mM (341%). Similarly, the desensitized groups showed higher MI in the presence of 2.5mM calcium (462%), vs 1.25mM (460%) and 3.75mM (173%) (Fig.1). Following further recruitment of 17 patients (providing 101 experiments, at a rate of 18/week), the study will complete by March 2015.

Discussion: The results so far show that in both desensitized and non-desensitized myometrium, calcium at physiological levels provides superior contractility, while hypercalcemia markedly attenuates contractility. Thus, after prolonged exposure to continuous oxytocin in labor augmentation, uterine atony and PPH could be attenuated by promoting normocalcemia and preventing hypo- or hypercalcemia. Final discussion will be presented at the meeting.

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Abstract #:O1-02

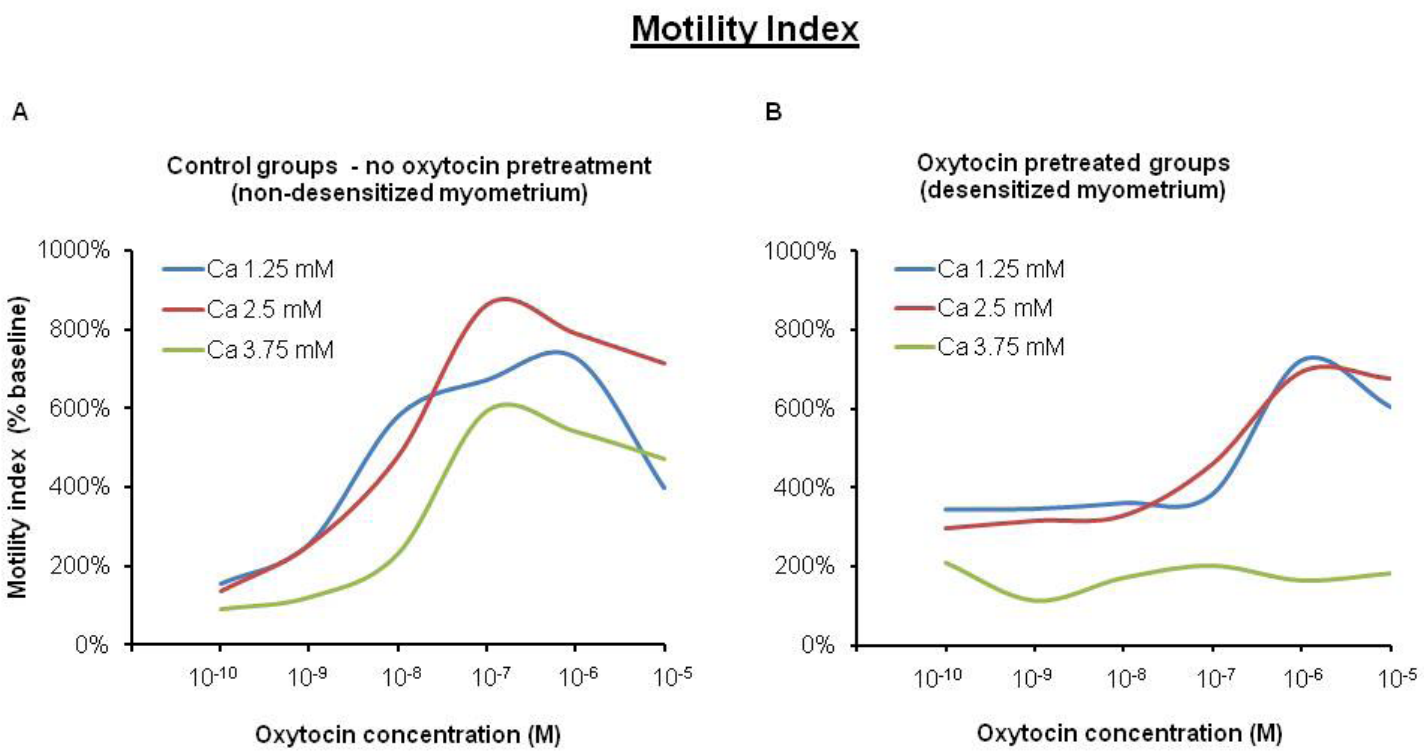

Fig. 1. The dose–response curves for motility index (% baseline) of the myometrial strips with oxytocin 10^{-10} to 10^{-5}M : **A)** after pretreatment with physiological salt solution 2 hours (control – non-desensitized myometrium); **B)** after pretreatment with 10^{-5}M oxytocin 2 hours (desensitized myometrium).

Abstract #:O1-03

Impact of Labor Analgesia Technique on Maternal Plasma Epinephrine Concentrations and Fetal Bradycardia

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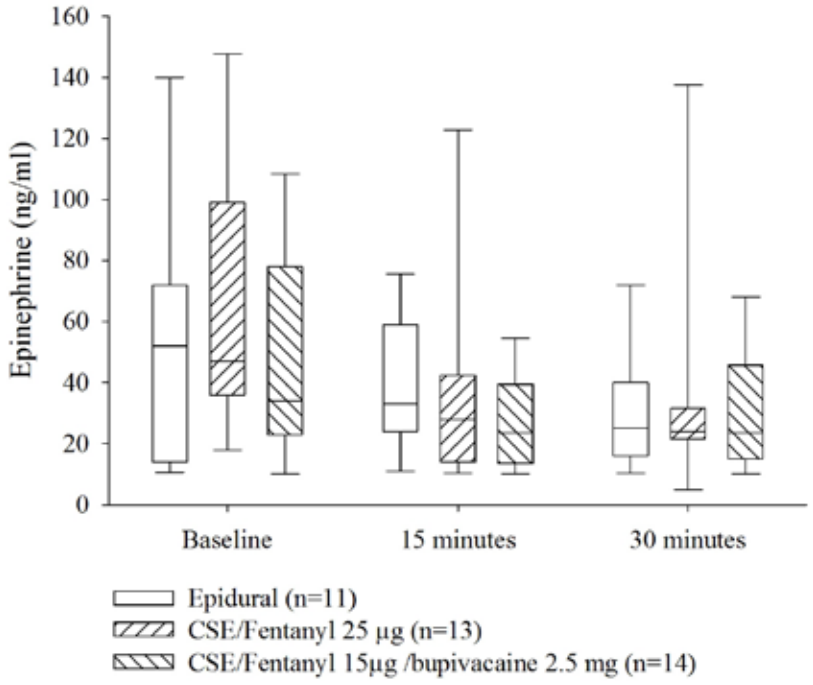
CSE labor analgesia may result in a higher rate of uterine tachysystole and fetal bradycardia possibly due to a precipitous decrease in maternal epinephrine concentrations.1,2 As part of a larger study, we performed a subgroup analysis to determine any relationship between maternal plasma epinephrine concentrations and fetal bradycardia after neuraxial analgesia.

Methods: Term, nulliparous patients in spontaneous labor whose cervical dilation was < 4 cm were recruited for the larger study. At first request for neuraxial analgesia, patients were randomized to one of three groups: 1. epidural de novo technique with fentanyl 100µg and 0.125% bupivacaine 15-20mL; 2. CSE technique with intrathecal fentanyl 25µg; or 3. CSE technique with intrathecal 0.5% bupivacaine 2.5mg and fentanyl 15µg. A second randomization was performed to select a subgroup of recruited subjects to undergo maternal plasma epinephrine concentration sampling. Patients randomized to this subgroup underwent venous blood sampling three times: immediately prior to neuraxial analgesia, and 15 and 30 minutes after intrathecal dose or start of epidural catheter dosing. Fetal heart rate (FHR) tracings from 30 minutes prior to through 60 minutes after first local anesthetic dose were collected and analyzed by a perinatologist blinded to group assignment. FHR tracings were graded based on criteria from the NIH Three-Tier FHR Interpretation System3 and analyzed for presence or absence of variable and late decelerations. Tocodynamometer tracings and maternal vital signs were also analyzed.

Results: 38 patients were randomized and analyzed. Figure 1 shows a decrease in plasma epinephrine concentrations from baseline at 15 and 30 min after first local anesthetic dose, but no difference between groups within any time period. Group 3 had a higher incidence of variable FHR decelerations after neuraxial analgesia (P=0.01), but there was no difference between the groups in incidence of late FHR decelerations, FHR classification, maternal hypotension, or uterine tachysystole.

Discussion: Changes in maternal plasma epinephrine concentrations are the same between CSE and epidural techniques. This decrease was not shown to increase rates of uterine tachysystole or late FHR decelerations. The increased rate of variable FHR decelerations in group 3 is likely multifactorial in nature.



References:

1. Anesth Analg. 2004;98:1153-9
2. Obstet. Gynecol. 2008;112:661-6
3. Obstet. Gynecol. 2009;113:41-7

Abstract #:O1-04

Onset of labor epidural analgesia with varying doses of fentanyl

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Introduction: Low concentrations of local anesthetic with opioids are commonly used for labor epidural analgesia, as they provide pain relief without much motor block. However, onset of analgesia may be delayed compared to more concentrated solutions. A comparison study was conducted using different doses of fentanyl (20, 50, 100 mcg) with low dose bupivacaine (0.08%) to investigate the onset of labor analgesia. Our hypothesis was that onset of analgesia would be faster with the higher doses of fentanyl.

Methods: Institutional REB approval was obtained as was written informed consent from all participants in the study. We conducted a prospective, randomized, double-blinded study of 105 patients with singleton pregnancy at term gestation in early labor, requesting epidural analgesia. Women were randomized to receive induction of epidural analgesia with one of three doses of fentanyl (20, 50, or 100 mcg) and 10 mL of 0.08 % bupivacaine. Numeric Rating Scale (NRS) scores for pain were monitored with each contraction; the primary outcome was the time taken to achieve a NRS score ≤3. The onset and duration of analgesia, maternal side effects and satisfaction, type of delivery, and fetal outcomes were recorded.

Results: Data from 105 patients were analyzed (Table). Demographic data were similar among groups. The 50 and 100 mcg fentanyl doses were associated with faster development of NRS ≤3 compared to the 20 mcg fentanyl group. The incidence of failure to reach NRS ≤3 within 30 minutes was higher in the 20 mcg group compared to both other groups. There was no difference in maternal satisfaction or adverse events between groups, except for a higher incidence of fetal bradycardia in the 50 mcg and 100 mcg fentanyl groups. However, APGAR scores at 1 minute and 5 minutes were not different between different groups.

Conclusion: Higher doses of epidural fentanyl speed the onset of analgesia for laboring parturients without increasing maternal adverse events.

Abstract #:O1-04

Table – Trial Outcomes

Outcome	Fentanyl 20 mcg n = 35	Fentanyl 50 mcg *n* = 35	Fentanyl 100 mcg *n* = 35	P
Primary Outcome				
Time to a Numeric Rating Scale pain score of ≤ 3 — minutes, median (IQR)	18 (11 to 30) *n* = 35	10 (8 to 19) *n* = 35	10 (6 to 16) *n* = 35	< 0.001+
Secondary Outcomes Occurring Within Thirty Minutes of the Epidural Bolus Dose				
Failed to reach Numeric Rating Scale ≤ 3 — no./total no. (%)	10/35 (29%)	2/35 (6%)	0/35 (0%)	< 0.001*
Highest sensory block dermatome achieved — median (IQR)	T10 (T10 to T9) n = 35	T10 (T10 to T8) *n* = 35	T9 (T10 to T8) *n* = 34	0.3#
Pruritus; none/mild/moderate — no.	35/0/0	34/0/1	33/1/0	0.7*
Nausea; none/mild/moderate/severe — no.	33/1/0/1	34/0/1/0	34/0/0/0	1.0*
Sedation; wide awake/mildly drowsy/very drowsy/asleep but rousable — no.	31/3/1/0	33/1/1/0	29/3/1/1	0.89*
Hypotension; systolic blood pressure ≤ 90 mmHg — no./total no. (%)	3/35 (9%)	1/35 (3%)	2/34 (6%)	0.70*
Maximum motor block; none/mild/moderate/severe — no.	31/2/1/1	31/4/0/0	30/4/0/0	0.77*
Patient satisfaction; completely dissatisfied/somewhat dissatisfied/neutral/somewhat satisfied/completely satisfied — no.	1/0/1/2/31	1/0/0/2/32	0/0/0/1/33	0.95*
Other Secondary Outcomes: Time from epidural loading dose until first patient-administered demand dose — minutes, median (IQR)	61 (20 to 165) *n* = 31	118 (66 to 176) *n* = 34	150 (66 to 214) *n* = 30	0.16+
Mode of delivery; vaginal/caesarean/forceps — no.	28/7/0	28/6/1	26/8/1	0.91*
Apgar scores at one minute — median (IQR)	9 (8 to 9) n = 35	9 (8 to 9) *n* = 35	9 (8 to 9) *n* = 35	0.59#
Apgar scores at five minutes — median (IQR)	9 (9 to 9) *n* = 35	9 (9 to 9) *n* = 35	9 (9 to 9) *n* = 35	0.31#
Fetal bradycardia at any time — no./total no. (%)	0/35 (0%)	7/35 (20%)	6/35 (17%)	0.012*
Breastfeeding at 24 hours post-delivery — no./total no. (%)	30/33 (91%)	31/34 (91%)	28/35 (80%)	0.37*

Denominators which D.O. not equal sample sizes are due to missing data. Motor block assessed using a modified Bromage score: 0 (none) = ability to move hips, ankles, and knees; 1 (mild) = inability to raise extended leg; 2 (moderate) = inability to flex knee; 3 (severe) = inability to flex ankle, foot, or knee.

+Log-rank test; *Fisher's exact test; #Kruskal-Wallis test, corrected for ties.

Abbreviations: IQR, interquartile range.

Abstract #:O1-05

Determining the effective dose of intrathecal morphine and hydromorphone when combined with multimodal analgesia for pain relief after cesarean delivery

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The effectiveness of intrathecal (IT) morphine as part of a multimodal analgesic regimen for cesarean delivery is well established. The optimal dose, however, is still debated. Drug shortages and the desire for an effective alternative to IT morphine that may be associated with fewer side effects have led to an increased use of IT hydromorphone analgesia for cesarean delivery. No prospective studies have been conducted to establish the effectiveness or optimal dose of IT hydromorphone for post-cesarean analgesia.

This trial evaluated 80 women undergoing spinal anesthesia for cesarean delivery. Participants were randomized to receive either IT morphine or IT hydromorphone. Medication doses were determined by a sequential up-and-down allocation method utilizing a biased coin design to find the estimated dose at which 90% (ED90) of patients would have effective analgesia, defined as a pain score ≤3 at 12 hours after surgery (primary outcome). Secondary outcome measures included severity of nausea, pruritus, sedation, and patient satisfaction. All patients received standard postoperative multimodal analgesia which included scheduled acetaminophen and NSAIDs.

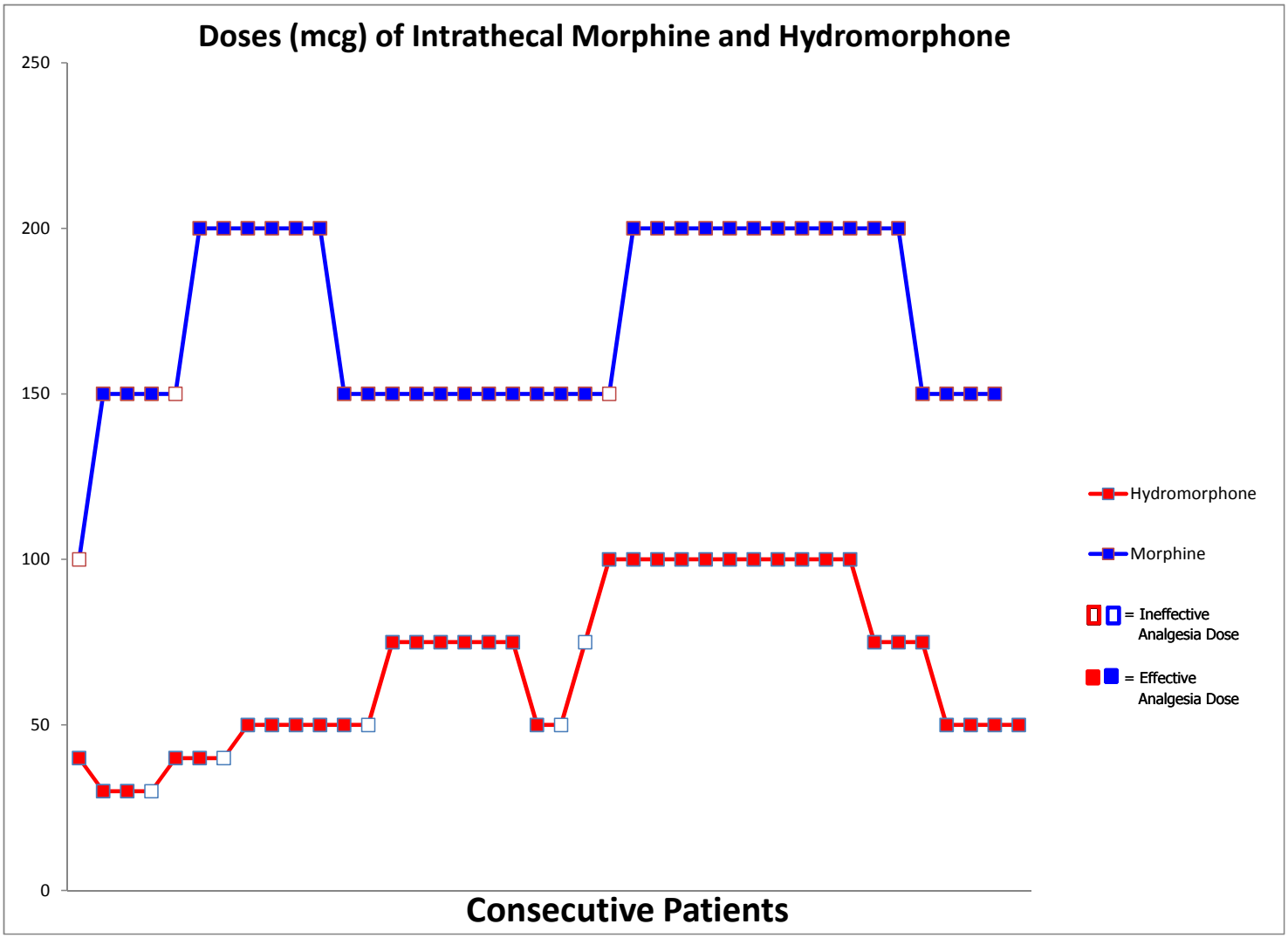
The effective analgesic dose for 90% of patients was determined to be approximately 150 micrograms for IT morphine and 75 micrograms for IT hydromorphone. There were no differences in nausea or pruritus between IT morphine and IT hydromorphone around corresponding doses. There were no instances of respiratory depression. Patients who received a dose of IT medication at or above the determined effective analgesic dose reported 95% (morphine) and 100% (hydromorphone) satisfaction with their analgesic regimen.

In this study, we have determined the effective analgesic doses of IT morphine and IT hydromorphone in 90% of women undergoing cesarean delivery to be 150 micrograms and 75 micrograms, respectively. This expands on previous knowledge attempting to elucidate the dose-response relationship of IT morphine for post-cesarean analgesia. This study is unique its use of a biased coin design to the sequential allocation protocol to determine an ED90 rather than an ED50 dose. While IT morphine combined with a multimodal regimen is considered by many to be the most evidence-based post-cesarean analgesia modality, the use of IT hydromorphone is proving to be a viable alternative.

References:

1. Verstraete S, et al. Acta Anaesth Belg 2012;63:147-67
2. Beatty NC, et al. J Clin Anesth 2013;25:379-83

Abstract #:O1-05



Abstract #: O1-06 & T-70

Use of Real Time Transthoracic Echocardiography during Cesarean Delivery for Early Detection and Reversal of Shunt Flow across an Atrial Septal Defect in a Parturient with Severe Pulmonary Arterial Hypertension

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Maya Suresh M.D. - Baylor College of Medicine - Houston, TX

Pulmonary arterial hypertension (PAH) during pregnancy is associated with increased morbidity and mortality. We report the successful management of cesarean delivery (CD) in a patient with severe PAH with real time transthoracic echocardiography (TTE) and central venous oxygen saturation (ScvO2) and using timely targeted treatments. These tools aided in early detection and treatment of cardiovascular collapse in an awake patient under regional anesthesia.

A 35 year old G2P1001 with an uncorrected atrial septal defect (ASD) of 2.7 cm with a left to right shunt (L to R) leading to severe PAH was scheduled for an elective cesarean delivery at 35(5/7) weeks due to worsening dyspnea. The estimated pulmonary arterial systolic pressure (PASP) was 120 mmHg on TTE. Her therapeutic regimen consisted of intravenous epoprostenol and oral sildenafil, digoxin and furosemide. A multidisciplinary team of MFM, obstetrics, obstetric and cardiovascular anesthesiology, cardiology and pulmonology experts was involved in patient care. The anesthetic plan included lumbar epidural catheter placement for surgical anesthesia with invasive monitoring of arterial blood pressure, an oximetric central venous catheter to monitor ScvO2 and real-time TTE and pulse contour cardiac output monitoring.

The preoperative echo showed severe right ventricle (RV) dilation with severely reduced RV global systolic function. There was mild to moderate tricuspid regurgitation and right ventricular hypertrophy. The epidural was dosed with fractionated doses of 2% lidocaine and sodium bicarbonate without epinephrine. The patient was started on a low-dose phenylephrine infusion; titrated to maintain the blood pressure prior to delivery of the fetus. The initiation of surgical anesthesia was tolerated well; however after delivery of the fetus and placenta and an estimated acute blood loss of 1000 ml resulted in severe hypotension. TTE showed a very small LV with a large dominating RV with reversal of shunt flow across the ASD. This was promptly treated with 250 ml of 5% albumin. The phenylephrine infusion was substituted with low dose vasopressin and norepinephrine infusions to maintain the blood pressure after delivery. A healthy infant was born with Apgar score of 9 and 9.

Induction of anesthesia can be a vulnerable time due to changes in vascular tone and filling pressures. A carefully titrated epidural anesthesia induction proved invaluable in successful management of this patient. Intraoperative TTE allowed early detection of shunt flow reversal across the ASD. Early treatment resulted in prompt resolution of hypotension and an improved LV filling. The shunt flow returned to baseline L to R and systemic blood pressures normalized. We demonstrate a unique application of real-time intraoperative TTE in detecting and preventing acute cardiovascular collapse in this complex parturient with severe PAH during CD.

References:

Best Practice & Research Clinical Obstetrics and Gynaecology;28(2014)579-591

Friday, May 15, 2015

Best Paper Session
Moderator: *Lawrence C. Tsen, M.D.*

What's New in Obstetric Medicine? The Intrauterine Factors Fueling Trans-generational Obesity
Speaker: *Linda A. Barbour, M.D., M.S.P.H., FACP*

Reflections on the Evolution of the Management of Hypotension During Spinal Anesthesia for Cesarean Delivery
Speaker: *Warwick D. Ngan Kee B.H.B., M.B.Ch.B., M.D., FANZCA, FHKCA, FHKAM (Anaesthesiology)*

Abstract #:BP-01

Oxytocin Enhances Proliferation and Alters Differentiation of Neural Progenitor Cells in Vitro

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Gregory Crosby M.D. - Brigham and Women's Hospital/Harvard Medical School - Boston, MA
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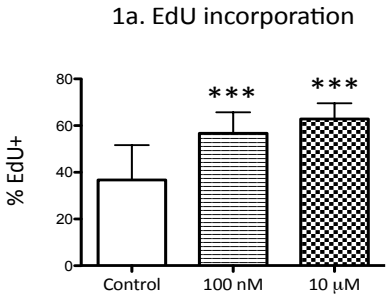
Introduction: Synthetic oxytocin (sOT) is widely used for the obstetric management of labor. Though the uterotonic and hemodynamic effects of sOT are well studied, not much is known about the direct effects of oxytocin on the fetus despite evidence that oxytocin crosses the placenta. Epidemiological evidence links sOT therapy with neurodevelopmental disorders, though the underlying mechanisms remain unexplored. Because these disorders are accompanied by changes in brain architecture, we speculated that sOT would alter the proliferation and differentiation of neural progenitor cells (NPCs), a key driver of early neurodevelopment.

Methods: NPCs were harvested from the telencephalons of Sprague Dawley rat embryos on gestational day 14 and propagated in culture. To confirm expression of OXTR, NPCs were seeded overnight on Poly-D-Lysine/Laminin coverslips, fixed, and processed for immunocytochemistry with specific primary and species-matched Alexa-Fluor® secondary antibodies. OXTR expression was also confirmed with immunoblotting. Because OXTR is a G-protein coupled receptor, we used a Gq second messenger functional assay to confirm the functional activity of these receptors (IP-One Elisa, Cisbio Assays, Bedford, MA). Finally, we investigated the effect of 24h of sOT treatment (100nM, 10μM) on NPC viability (propidium iodide), proliferation at 24h (ethynyl deoxyuridine and Ki67), and differentiation at day 10 (cell-specific markers). Imaging was done with GE In Cell Analyzer 2000, an automated high throughput epifluorescence microscope system, and analyzed with instrument-specific software. Data expressed as Mean ± S.D, and analyzed with one-way ANOVA.

Results: Both immunocytochemistry and immunoblotting revealed the presence of OXTR in NPCs. Stimulation of NPCs with 10μM sOT caused a significant increase in detectable inositol phosphate-1, a downstream product of the IP3 pathway, suggesting that the OXTR is functional. sOT increased NPC proliferation by 35% at both doses ($P < 0.005$***; Fig. 1), while treatment with 10μM sOT significantly increased neuronal but decreased oligodendrocytic differentiation of NPCs ($P < 0.005$***). Neither cell viability nor astrocytic fate was affected by sOT treatment.

Conclusion: Prolonged treatment with oxytocin profoundly affects NPC biology in vitro suggesting that it has the potential to alter neurodevelopment. Focused in vivo and behavioral studies are needed to ascertain the developmental impact of such perturbance.

Abstract #:BP-01



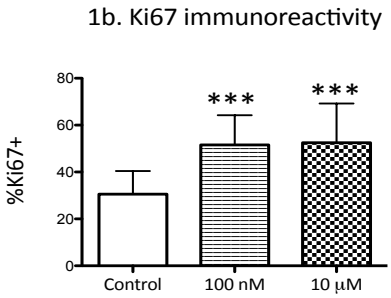
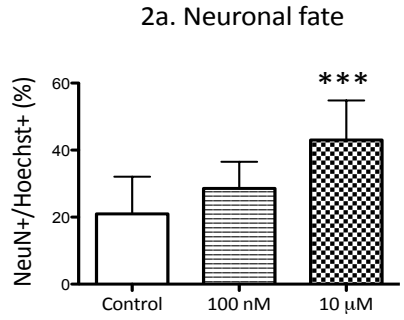


Fig 1: NPC proliferation. NPCs were plated overnight in poly-L-ornithine/laminin coated 96-well plates at a density of 5 x 10^3 cells/well before treatment with sOT for 24 h. NPC proliferation 24 h after sOT exposure was quantified with EdU (Fig. 1a) and Ki67 immunoreactivity (Fig. 1b). NPCs were fixed and processed as described above and subjected to Click-iT chemistry (Life Technologies, Carlsbad, CA). Imaging was done with GE In Cell Analyzer 2000, an automated high throughput epifluorescence microscope system, and analyzed with instrument-specific software. sOT increased NPC proliferation by approximately 35% at both 100 nM and 10 μM doses, as detected by both EdU incorporation and Ki67 immunoreactivity (9 images/ well, 18 wells/treatment, data expressed as Mean ± S.D, and analyzed with one way ANOVA; P < 0.005***).



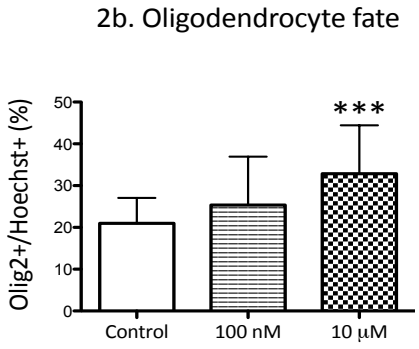


Figure 2: NPC Differentiation. For differentiation experiments, NPCs were plated overnight in poly-L-ornithine/laminin coated 96-well plates at a density of 1.5 x 10^3 cells/well. Subsequently, the NPCs were exposed to varying doses of sOT or control medium for 24 h. After completion of treatment, the medium was immediately replaced with maintenance B27 medium without growth factors to induce spontaneous NPC differentiation. The maintenance medium was subsequently replaced every other day for 10 days to ensure optimal NPC differentiation. On day 10, the NPCs were fixed with 4% PFA for 15 min, washed three times with PBS, and stored at 4°C for ICC. Incubation with relevant primary antibodies (NeuN, Olig2) and subsequent processing were as described previously. Compared to control treatment, treatment with sOT significantly increased neuronal but decreased oligodendrocytic differentiation of NPCs (Fig. 2a and 2b, respectively; 9 images/ well, 18 wells/treatment, data expressed as Mean ± S.D, and analyzed with one way ANOVA; P < 0.005***)

Abstract #:BP-02

Patient Preoperative Choice of Intrathecal Morphine Dose Anticipates Post-Cesarean Delivery Pain and Opioid Requirement Independent of Actual Dose Received

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Pamela Flood M.D. - Stanford University Medical Center - Stanford, CA

Introduction: Traditional postoperative pain management entails physician selecting doses to optimize pain relief and limit side effects (1). The objective of the study was to determine if patient input would be useful to guide dosing of intrathecal morphine (ITM) for post-cesarean delivery (CD) analgesia.

Methods: 120 healthy women for CD with spinal anesthesia were enrolled in this randomized, double-blind, IRB-approved study. Patients were randomly assigned to a group given a choice between a 100 or 200 mcg ITM dose based on their analgesic and side effect preference, or a group to whom dose was randomly assigned. However the study involved deception; the choice group was actually randomly assigned to receive their chosen ITM dose or not (Fig. 1A). The primary outcome was impact of patient choice on pain (verbal NRS 0-10 at rest and sitting) and opioid use (for breakthrough pain) evaluated at 3, 6, 12 and 24 h after CD. Secondary outcomes included the effect of actual dose given on pain, analgesia, and side effects. Data [95% CIs] was prepared and analyzed in R programing language. Incidence data was compared with Pearson's Chi-squared test, and time series analysis and mixed effects modeling conducted in NONMEM.

Results: Subjects who chose the lower 100 mcg ITM dose reported less pain with movement (1.2 [0.5-1.9], Fig. 1B vs. 1C) compared to women who chose 200 mcg irrespective of the actual dose received. The effect of patient choice on pain NRS was equivalent to a half-life of 15.6 [5.4-80] hours. Women who were offered a choice of ITM dose required 28 [20-35]% less opioid, for breakthrough pain at each observation period, compared to those not offered a choice. There was no analgesic pharmacological effect observed for the ITM dose actually given. Nausea (42% vs. 15%, P=0.0005) and vomiting (20% vs. 8%, P=0.007) was higher in those given 200 vs. 100 mcg ITM. There was no difference in side effects by dose chosen.

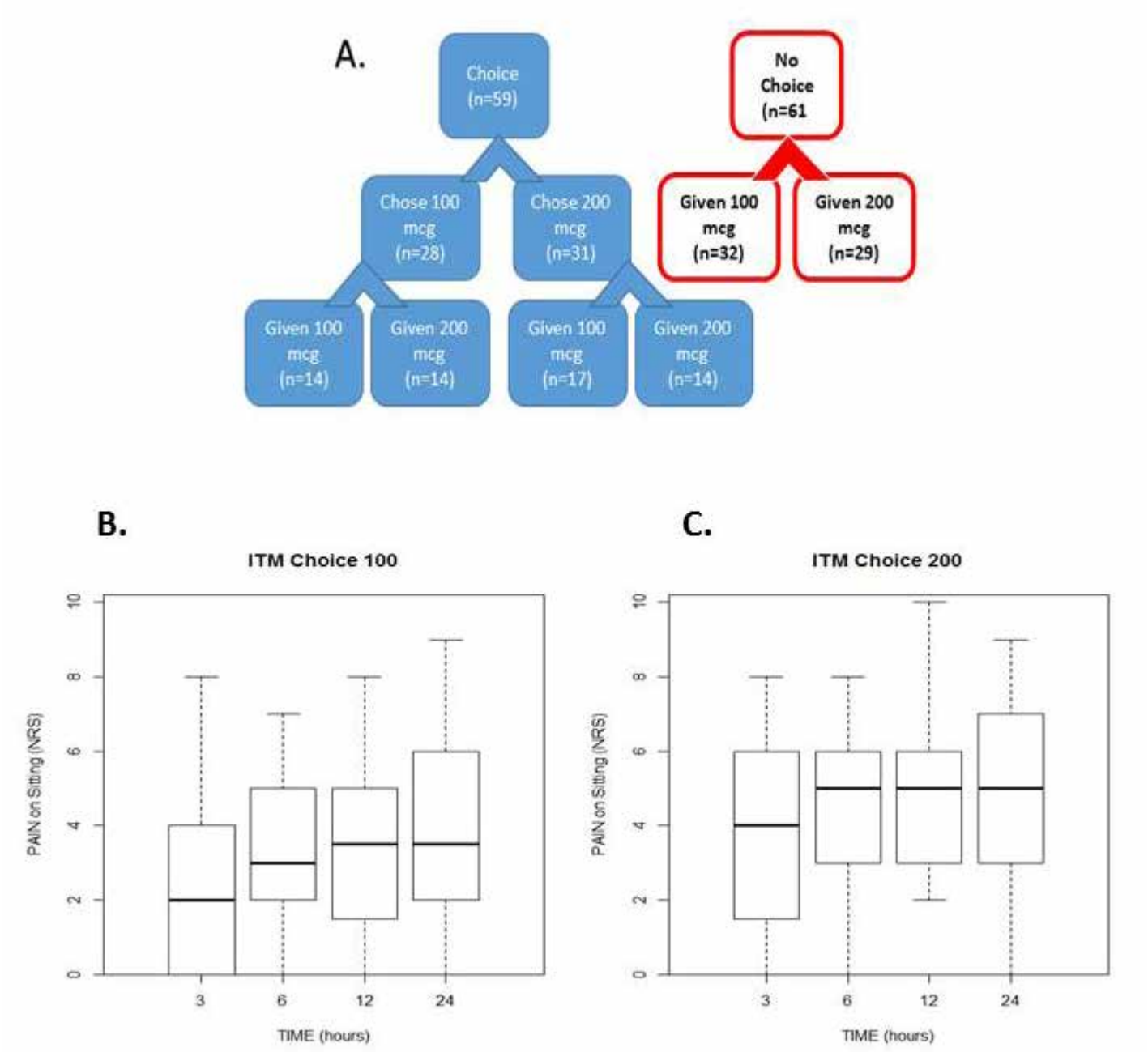
Discussion: Women who selected a larger analgesic dose correctly anticipated greater pain and analgesic requirement after CD. These novel results demonstrates the importance of considering patient's anticipated pain and analgesic needs in conjunction with the known pharmacological dose response relationship, and establishes the feasibility of patient involvement in selecting appropriate analgesic protocols as part of patient-centered care.

Reference:

1. Clin Perinatol 2013; 40: 443-455.

Abstract #:BP-02

Figure 1



Abstract #:BP-03

Labor Induction and Offspring Risk of Autism Spectrum Disorder

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Introduction: Recently, a large population-based study identified an association between induction/augmentation of labor and the risk of autism spectrum disorder (ASD) in the offspring [1]. However, the study has been criticized for being unable to control for all relevant confounding factors. We therefore sought to examine the association between labor induction and ASD in Swedish register data, with ability to include a sibling comparison. This approach controls for all confounders shared by full siblings, including shared genes, early environment, and stable maternal factors thus providing a more valid causal estimate of the effect of induction.

Methods: Linkage between population registers in Sweden facilitated a nation-wide cohort study of all live singleton births in Sweden (recorded in the Medical Births Register) from 1991 to 2001. Exposure was defined by the presence or absence of induction of labor prior to delivery. The outcome was identified by specialist diagnosis of ASD in offspring through the end of 2009. In the initial analysis, we assessed the association between labor induction and offspring ASD using Cox proportional hazard regression, with age as the underlying time scale and allowing censoring at age of migration, death or end of follow-up. We adjusted a baseline model for factors that always vary between pregnancies (mother's age, parity and birth year), then added stable maternal characteristics and factors unique to each pregnancy. Finally, we accounted for all factors shared by full siblings using a fixed effects model in which the underlying hazard is allowed to vary between mothers (so that the contrast is made within siblings), while maintaining adjustment for unique pregnancy level covariates.

Results: The full cohort included 978,981 births, of which 10,329 were diagnosed with ASD (1.1%). In complete case analysis, labor induction was significantly associated with offspring ASD in the baseline model (Hazard ratio [HR], 1.27; 95% CI, 1.19 to 1.35). After adjustment for all measured factors, the association to both ASD was still present, albeit attenuated (HR, 1.17; 95% CI, 1.09 to 1.27). However, when further adjustment was made using a fixed-effects model (comparing outcomes in siblings discordant with respect to induction) to account for all factors shared by full siblings, labor induction was no longer associated with offspring ASD (HR, 1.04; 95%CI, 0.85 to 1.27). Analysis using a fixed-effects model in first cousins showed commensurate results.

Conclusion: In this nation-wide sample of live births we observed no meaningful relationship between induction of labor and the risk for ASD. Our findings suggest that concern about this outcome should not factor into the clinical decision about whether to induce labor.

Reference:

1. JAMA Pediatr. 2013 Oct;167(10):959-66.

Abstract #:BP-04

Impact of Three Neuraxial Analgesia Techniques on Labor Duration in Nulliparous Parturients

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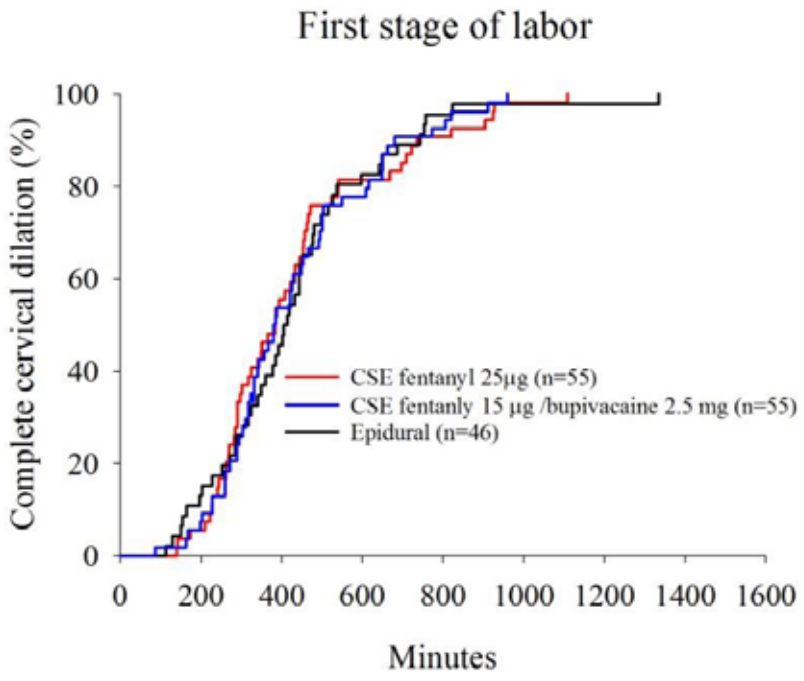
Cynthia A. Wong M.D. - Northwestern University Feinberg School of Medicine - Chicago, IL

Although never assessed as a primary outcome, the impact of neuraxial labor analgesia on the duration of the first stage of labor has been assessed as a secondary outcome in several studies, with conflicting results.1-3 We performed a randomized control trial investigating the impact of type of neuraxial labor analgesia on the duration of the first stage of labor.

Methods: Term, healthy, nulliparous patients with cervical dilation less than 4 cm were recruited. At first request for neuraxial analgesia, patients were randomized to one of three groups: 1. epidural de novo technique with fentanyl 100µg and 0.125% bupivacaine 15-20mL; 2. CSE technique with intrathecal fentanyl 25µg; or 3. CSE technique with intrathecal 0.5% bupivacaine 2.5mg and fentanyl 15µg. Epidural analgesia was maintained with PCEA technique of bupivacaine 0.0625% and fentanyl 1.95µg /mL. Breakthrough pain was managed with manual epidural boluses of bupivacaine 1.25mg/mL, 10-15mL. Primary outcome was duration of first stage of labor, defined as the time period from first dose of neuraxial local anesthetic to complete cervical dilation. Cervical exams were performed by an OB provider immediately prior to neuraxial analgesia, and then q2 h once patient was 80-100% effaced until complete dilation. Secondary outcomes included demographic data, mode of delivery, duration of second stage of labor, overall duration of labor, VPRS at 15, 30, and 60 minutes after first analgesic dose, VPRS at each cervical exam, number of manual redoses, total amount of bupivacaine and fentanyl, nausea/vomiting, and pruritus. Data from subjects who underwent cesarean delivery were censored.

Results: 239 patients (spontaneous = 121, induction = 119) were recruited and included for analysis. Figure 1 shows no difference between the three groups for the primary outcome. Group 1 had higher pain scores at 15 and 30 minutes after first analgesic dose ($p<0.001$) and lower rates of pruritus ($p<0.001$) compared to groups 2 and 3. There was no difference between the three groups for all other secondary outcomes.

Discussion: The type of neuraxial analgesia may have no effect on the duration of first stage, second stage, or overall length of labor. As expected, CSE technique was associated with lower pain scores immediately after placement, but with a higher incidence of pruritus compared to epidural technique.



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Abstract #:BP-05

Perinatal progesterone decreases the hyperalgesic response to surgery in the adult: a study on female rats

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Background: There recently has been a substantial increase in survival of preterm infants and an increase of in utero fetal surgeries. Noxious stimulation in the newborn alters the pain response to injury in adult life. Progesterone, an effective antihyperalgesic agent in the adult is in high concentration in the pregnant mother and preterm infants are prematurely withdrawn from this high progesterone environment. Therefore, we investigated the effects of early life progesterone on later life pain perception.

Methods: Female rat pups were administered progesterone or vehicle during the first 7 days postpartum (P1-P7). A second control group had no injections. Half of each of these groups received an incision of the hind paw at P3, the other half not. At P60 all groups of these now adult rats received a second incision. Tactile sensitivity, measured by thresholds to von Frey hair stimulation, and thermal sensitivity, measured by withdrawal latencies from a radiant heat source, were measured weekly at P14-P42 (Period I), at P60 (just before an incision), and every 2 days of P61- P70 (Period II). At P60 rats were fixed by systemic paraformaldehyde perfusion and spinal cords taken for staining and immunohistochemical analysis of activated p-p38 MAP kinases.

Results: Rats that were incised at P3 had greater tactile and thermal hyperalgesia in Period I than the non-operated rats, a difference that was abolished by progesterone treatment. P3 incision also resulted in longer lasting tactile and thermal hyperalgesia after the P60 incision (Period II), all of which were markedly smaller in degree and faster to resolve in rats receiving early progesterone. Remarkably, even in rats that were not operated in Period I, neonatal progesterone lessened the tactile hyperalgesia in Period II. More spinal cells showed p-p38 staining in vehicle-treated rats as a result of the early life incision, but not in those treated with progesterone.

Conclusion: Progesterone treatment of the early neonate not only diminishes the adult post-operative sensitization that is caused by early neonatal injury, but also lessens the degree of acute post- operative hyperalgesia in the intact adult. This suggests that endogenously high progesterone in utero may have a similarly protective action, and, furthermore, that development of nociceptive circuitry can be strongly influenced by neonatal progesterone.

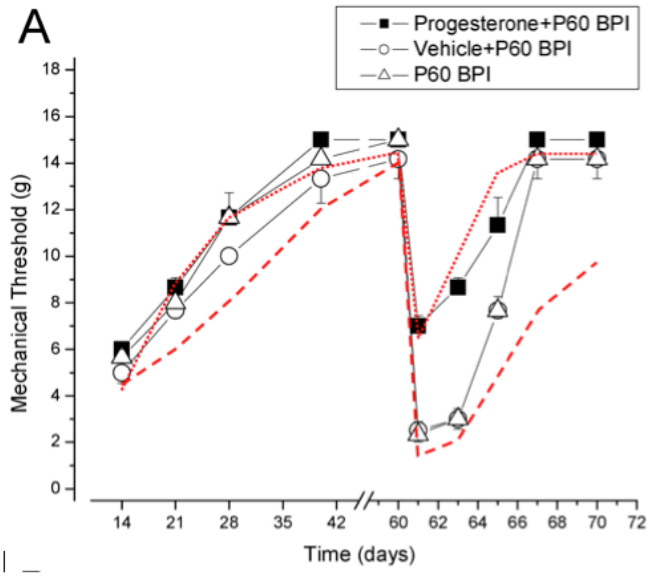

Figure A: Changes in mechanical sensitivities in female rats receiving neonatal progesterone (■), or vehicle (o) or no injections (Δ), and then subjected to a Brennan Paw Incision (BPI) in adult life (P60). The dashed red line represents animals that received a P3 neonatal hind paw incision and vehicle injection, followed by a P60 BPI. The dotted red line shows the animals that received a neonatal hind paw incision (P3) and progesterone injections, followed by a P60 BPI.

Abstract #:BP-06

A Non-Opioid Adjunct Equally or More Potent than Fentanyl for Labor Epidural Analgesia With Less Side Effects

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Introduction: Addition of opioid to epidural local anesthetic (LA) reduces LA dose by 20%, but at the expense of side effects & regulatory compliance. Epidural neostigmine (N) also reduces LA dose(1). Here we compared in a double-blind RCT the dose dependent effect of N to a standard dose of fentanyl (F) added to bupivacaine (B) for labor PCEA.

Method: After IRB approval, 215 ASA 1-2 & laboring parturient (cervix dilation≤5cm & Wt<115Kg) requesting labor epidural analgesia were consented & randomized to receive 1 of 4 epidural drug solutions. All 4 gps received 0.125% B with addition of either F (2μg/ml) or N (2, 4, or 8 μg/ml). A lumbar epidural catheter was inserted & tested with 3mL 1.5% lidocaine with 5 μg/mL epinephrine. Study solution (15mL) was administered as initial epidural loading dose, followed by PCEA with the same study solution at 6 mL/hr, a demand of 5 mL & 10-min lock-out. Top ups for breakthrough pain were provided at patient's request as routine. The primary outcome was the total LA consumption, defined as the total PCEA use and top-ups (expressed as 0.125% B equivalents) divided by the infusion duration. A priori analysis determined a group size of 35 was needed in order to have 80% power at α=0.05 to detect a 20% difference in the primary outcome. Data are presented as mean±SD, median[IQR] or % as appropriate, with $P<0.05$ as significant.

Results: Of 215 subjects consented 151 were evaluable after 64 excluded due to delivery before study began or failed inclusion criteria. Demographics, maternal & fetal outcomes & labor characteristics were similar among gps. Total LA consumption, PCEA use & top ups did not differ among gps(Table 1). APGAR scores, mode of delivery & time from analgesia initiation to complete cervical dilation or delivery were similar among gps. Average maximum scores for Bromage motor scale, nausea & sedation were similar among gps but pruritus score was higher($P<0.001$) in the gp with F than the gps with N.

Conclusion: Addition of neostigmine from 2 to 8 μg/mL reduces epidural B requirement comparable to 2 μg/mL of fentanyl in labor PCEA. The lack of significant dose response difference from 2 to 8 μg/mL of N suggests that lower doses should be examined. These data confirm the lack of increased nausea and less pruritus from epidural N in this setting & offer guidance to the clinical application of neostigmine as a non-opioid adjuvant to labor analgesia.

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Supported in part by NIH GM48085

Abstract #:BP-06

Table 1. Local Anesthetic (LA) Consumption, Demographics and Labor Characteristics

	2ug/mL Fentanyl	2ug/mL Neostigmine	ug/mL Neostigmine	8ug/mL Neostigmine	P-value
Sample Size (n)	35	38	40	38	
Total LA Consumption (ml/hr)	16.0, [13-21]	15.3, [13-19]	14.6, [12-18]	16.2, [12-23]	0.550
PECA Volume Consumption (mL/hr)	14.8, [12-18]	13.3, [11-17]	12.6, [11-15]	13.0, [11-17]	0.252
Total Study Analgesia Duration (min)	410±309	424±290	480±295	406±322	0.688
Percent required Break Thru Top Up	57%	53%	60%	55%	0.930
Pain Score@20min after epidural(0-10)	0.0, [0-2]	0.0, [0-2]	0, [0-1]	0, [0-2]	0.584
Percent of subjects with hypotension & treated with ephedrine	20%	24%	15%	21%	0.987
Epid placed to Cervix Complete (min)	235, [192-373]	268, [167-452]	330, [221-517]	258, [154-366]	0.262
To Delivery (min)	322, [242-484]	415, [202-579]	396, [286-703]	303, [193-520]	0.285
Percent Required Cesarean Delivery (%)	14%	24%	15%	21%	0.671
Patient Satisfaction Score (1-5)	4.0, [3.0-5.0]	4.0, [3.0-4.5]	4.0, [4.0-4.8]	4.5, 3.0-5.0]	0.818
Cervix Dilation prior to Epidural (cm)	3.8, [2.3-4.0]	3.0, [2.1-3.9]	3.0, [2.0-3.8]	3.0, [2.0-3.5]	0.234
Age (years)	27±6	28±6	27±6	28±5	0.682
BMI (Kg/m^2)	31±5	31±5	30±5	30±4	0.891
Parity	1, [0-1]	0, [0-1]	0, [0-1]	0.5, [0-1]	0.885
Estimated Gestational Age (weeks)	40±1	40±1	40±1	40±1	0.999
Neonatal Weight (grams)	3424±383	3437±485	3403±449	3448±430	0.972
APGAR @ 1 min	7.4±1.9	7.6±1.7	7.5±2.0	7.7±1.8	0.927
APGAR @5 min	8.9±0.2	8.8±0.9	8.8±1.0	9.0±0.2	0.829
Average Maximum Bromage Score(0-3)	0.9±1.3	1.0±0.9	1.1±1.4	0.7±0.7	0.334
Average Maximum Nausea Score (0-10)	1.2±2.2	1.8±3.0	1.8±3.0	1.3±2.5	0.662
Average Maximum Sedation Score(0-10)	4.1±3.2	3.3±2.9	3.4±3.0	3.3±3.0	0.639
Average Maximum Shivering Score(0-10)	0.20±0.41	0.32±0.47	0.25±0.44	0.16±0.37	0.396
Average Maximum Pruritus Score (0-10)	0.86±1.80	0.03±0.16	0.03±0.16	0.05±0.32	0.001

Total LA Consumption and PCEA consumption are expressed as mL/hour of 0.125% bupivacaine equivalents.

PCEA = Patient Controlled Epidural Analgesia ; IQR =Interquartile Range

Bromage Motor Scale (0-3); Nausea, Sedation , Shivering and Pruritus Score (Verbal analog score from 0 to 10, with 0 being none and 10 being most severe)

Descriptive statistics were calculated for all variables such that mean ± SD were used for normally distributed variables; median [inter-quartile range] for data that were not normally distributed or for data with outliers or ordinal data; and number or percentage for categorical data. ANOVA, Chi-square analysis and Fisher Exact test were applied as appropriate. For all analyses, P was set at 0.05 for statistical significance.

Title: What's New in Obstetric Medicine? The Intrauterine Factors Fueling Trans-generational Obesity

Linda A Barbour, M.D., M.S.P.H., Professor Endocrinology and Maternal-Fetal Medicine, Univ CO SOM

The Developmental Origins of Health and Disease (DoHAD) hypothesis, now substantiated by extensive animal and human research, supports that both maternal nutrient deficiency as well as nutrient excess results in an acquired susceptibility to metabolic disease later in life which is programmed in utero and in early infancy. The prevalence of childhood obesity is 2.5times higher in offspring of obese women compared to women with normal BMIs. Importantly, the majority of LGA babies are not born to mothers with diabetes or GDM but to overweight and obese mothers. Maternal obesity is also an independent risk factor for excess neonatal fat, a more important predictor of childhood adiposity, and a stronger risk factor than GDM in predicting offspring obesity by DXA at 9 years of age 16. According to the 2011–2012 National Health and Nutrition Examination survey, ~60% all US women of childbearing age are overweight or obese. Obesity rates in children have paralleled the growth in maternal obesity rates, with about a quarter of 2–5 year olds and one-third of school-age children now overweight or obese in the US. Furthermore, half of childhood obesity occurs among children who have already become obese by age of 5 years and according to WHO estimates, there will be 70 million obese children globally by 2025. Given the strong associations between maternal diabetes and obesity and the risk of childhood obesity and glucose intolerance, the metabolic milieu of the intrauterine environment is now considered to be a critical risk factor for the genesis of adult diabetes and cardiovascular disease.

Key Points:

1. The evidence of this fetal programming effect has become one of the most compelling reasons why optimizing maternal glycemic control, identifying other nutrients contributing to excess fetal fat accretion, improving maternal insulin resistance and inflammation, emphasizing weight loss efforts before pregnancy, ingesting a healthy low-fat diet, and avoiding excessive weight gain are so critical and carry long-term health implications to both the mother and her offspring.

2. Epigenetics provides a conceptual framework of how metabolic factors (glucose, lipids, amino acids, growth factors, cytokines, and diet) in the intrauterine environment could alter DNA methylation and histone modification to change gene expression. Such changes may modify number, growth, and function of many cells, promote adipogenesis, and later impact hypothalamic appetite regulation, pancreatic function, and alter mitochondrial and kidney function in the offspring.

3. Maternal insulin resistance shunts all nutrient excess to the fetus including glucose, triglycerides, free fatty acids, and amino acids, all of which can be used for fetal fat accretion and excess fetal growth. Recently, our group demonstrated that newborns of obese GDM mothers also have evidence of increased intrahepatic fat at birth using NMR spectroscopy possibly due to increased FFA flux across the placenta that is deposited in the liver, potentially increasing the risk for NAFLD later in childhood.

4. Postnatally, the effect of the environment and breastfeeding on the infant microbiome may play a significant role in the further predisposition to childhood obesity and the metabolic syndrome.

5. This scenario creates enormous potential on a public health level for the incidence of T2DM to escalate as these children with impaired glucose tolerance become mothers themselves, perpetuating the cycle.

Objectives:

1. Review for the obstetric anesthesiologist how the intrauterine environment characterized by maternal obesity, excess glucose and lipids, and insulin resistance relate to excess fetal fat accretion and risk for subsequent childhood obesity.

2. Explain why the maternal diet may be a powerful driver for excess fetal fat accretion and why the optimal diet for mothers with obesity and GDM is hotly contested.

3. Highlight new findings on how postnatal factors, including the development of the infant microbiome and the effect of breastfeeding, can modify the growth trajectory and predispose the offspring to metabolic disease.

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Title: Reflections on the Evolution of the Management of Hypotension During Spinal Anesthesia for Cesarean Delivery

Warwick D. Ngan Kee B.H.B., M.B.Ch.B., M.D., FANZCA, FHKCA, FHKAM (Anaesthesiology), The Chinese University of Hong Kong

Objectives: The objectives of this presentation are to enable the audience to:

1. Understand the development of methods for prevention and treatment of hypotension during spinal anesthesia for cesarean delivery.
2. Understand currently recommended practices for the management of blood pressure during spinal anesthesia for cesarean delivery.
3. Be familiar with new developments and current research into hemodynamic control during spinal anesthesia for cesarean delivery.

Summary: Factors accounting for increased susceptibility of pregnant women to hypotension include (1) greater sensitivity to local anesthetic drugs, (2) surgical requirement for a relatively high block, (3) decreased sensitivity to both endogenous and exogenous vasopressors secondary to endothelium-dependent alteration of vascular smooth muscle function, (4) increased production of vasodilator substances such as prostaglandins and nitric oxide, (5) hemodynamic effects of aortocaval compression, and (6) generalized increased dependence on sympathetic tone.[1] Early theories for the mechanism of hypotension in obstetric patients were centered around the effects of vena caval compression and encouraged non-pharmacological methods including intravenous fluids and tilting maneuvers which have limited efficacy.

An early study showed large doses of prophylactic ephedrine depressed fetal pH.[2] Historically, alpha agonists were avoided for fear of detrimental effects on uteroplacental perfusion but studies were often performed in an experimental context with limited clinical relevance. We showed that, compared with ephedrine, metaraminol was more effective at preventing hypotension without adverse effects on uterine artery pulsatility index and better cord gases.[3] A meta-analysis showed that phenylephrine was associated with *greater* values for umbilical artery pH compared with ephedrine.[4] Subsequent studies showed the efficacy of prophylactic phenylephrine infusions,[5,6] and the benefits of aggressive blood pressure control.[7] We showed that that ephedrine crosses the placental to a much greater extent than phenylephrine and probably has a direct stimulatory effect on fetal metabolism.[8] Prophylactic infusions of phenylephrine rapidly became standard practice in my unit over a decade ago. Our latest development has been automated computer-controlled delivery.[9]

A problem with phenylephrine is a refexive propensity to slow maternal heart rate which has been associated with a decrease in cardiac output. To address this we are now investigating alternative vasopressors with beta activity and have recently published the first study investigating norepinephrine, a drug which we believe has great potential.[10]

Key Points:

1. Hypotension during spinal anesthesia is more common in obstetric patients.
2. Although the effects of aortocaval compression on venous return is important, modern techniques focus on maintaining systemic vascular resistance.
3. Alpha agonists such as phenylephrine are more effective, cross the placenta less and are associated with better fetal pH compared with ephedrine.
4. Prophylactic infusion of phenylephrine is highly effective although large doses can decrease maternal heart rate and cardiac output.
5. Norepinephrine is as effective as phenylephrine for maintaining blood pressure but with better maintenance of heart rate and cardiac output.

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Saturday, May 16, 2015

Obstetric Anesthesia Education Panel: All Anesthesiologists are Educators at Heart
Moderator: *Robert R. Gaiser, M.D.*

- **GME & Me**
  Speaker: *Rita M. Patel, M.D.*
- **Evidence Based Approach to Teaching Obstetric Anesthesia**
  Speaker: *Robert R. Gaiser, M.D.*
- **How to Best Teach Our Patients About Obstetric Anesthesia**
  Speaker: May C.M. Pian-Smith, M.D., M.S.

Gerard W. Ostheimer Lecture: What's New in OB Anesthesia?
Speaker: *Katherine W. Arendt, M.D.*

What's New in Fetal Surgery?
Speaker: *Timothy M. Crombleholme, M.D., FACS, FAAP*

Oral Presentations 2
Moderator: *Paloma Toledo, M.D., M.P.H.*

Meta-Analyses
Moderator: *Roshan Fernando, M.B., Ch.B.*

Research Hour: Research Applications/Opportunities with Non-Invasive Cardiovascluar Monitors
Speakers: *Richard M. Smiley, M.D., Ph.D; John T. Sullivan, M.D., M.B.A.*

Title: Obstetric Anesthesia Education Panel: All Anesthesiologists are Educators at Heart - GME & Me

Rita M Patel, M.D., University of Pittsburgh, School of Medicine and UPMC Med Ed

- Describe the role of faculty (teachers) in the accreditation system, including participation in milestones assessment, CCC, PEC and CLER visits
- Identify leadership and teamwork skills that contribute to the teaching role
- Discuss methods for faculty development and participate in a few interactive exercises
- Answer the question – "Where D.O. I fit in GME?"

Summary: Graduate Medical Education in the US exists in the context of accreditation, regulation and guidelines/standards from many entities. In the past 5 years, there have been changes that impact upon the most basic relationships in the spectrum of medical education, that of teacher-learner, at all levels including medical student, resident, fellow and faculty. This presentation will focus on the faculty in their roles as they interact with residents and fellows. Descriptions of the newer elements of the accreditation system – CCC, PEC, Milestones, CLER – and pertinence to the individual teacher will be considered. Features of faculty development programs that emphasize teamwork, managing change, and individual development will be discussed.

Key Points: There are numerous, overlapping accrediting and regulatory bodies for GME, which results in many requirements, guidelines, standards for programs and institutions and individual performance measures of residents, fellows and faculty.

The newer elements of the accreditation system include increased emphasis on professionalism, personal responsibility, patient safety and quality; transitions of care and teamwork; and supervision, management of fatigue and duty hours regulations.

Faculty are required to participate in teaching competencies other than those of patient care and medical knowledge, including skills related to teamwork and leadership.

Faculty development is an important component of GME that has not been emphasized previously.

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Title: Obstetric Anesthesia Education Panel: All Anesthesiologists are Educators at Heart - Evidence Based Approach to Teaching Obstetric Anesthesia

Robert Gaiser, M.D., M.S.Ed.
Professor of Anesthesiology and Critical Care
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Basic Principles of Learning

1. Students' prior knowledge can help or hinder learning
2. How students organize knowledge influences how they learn and apply what they know
3. Students' motivation determines, directs, and sustains what they D.O. to learn
4. To develop mastery, students must acquire component skills, practice integrating them, and know when to apply what they have learned
5. Goal-directed practice coupled with targeted feedback enhances the quality of students' learning
6. Students' current level of development interacts with the social, emotional, and intellectual climate of the course to impact learning
7. To become self-directed learners, students must learn to monitor and adjust their approaches to learning

Teaching of Obstetric Anesthesia

The teaching of obstetric anesthesia involves the conveying of concepts that fall into six categories: basic knowledge, secondary comprehension, application, analysis, synthesis, and evaluation. The first two categories D.O. not require critical thinking skills unlike the last four categories.

1. Basic Knowledge and Secondary Comprehension

There is a certain amount of knowledge that is required to become an obstetric anesthesiologist. This information consists of basic principles in obstetrics and in anesthesia. There are several means for the conveying and assessing of this information. The most commonly used method for this knowledge is lectures and an examination.

The American Board of Anesthesiology has assumed the role of dictating the knowledge that is required for a practicing anesthesiologist with the creation of the Content Outline. The content outline identifies topics that will be tested for board certification. Many residencies organize the didactic program around the content outline as the written board examination will prepare questions based upon the content outline. The content outline may be found at:

http://www.theaba.org/pdf/Basic-and-Advanced-ContentOutline.pdf

The question is how these concepts should be conveyed to learners. Traditionally, it has been through textbooks and lectures. However, there has been a recent increase in computer based learning. There is no question that computer based learning provides a greater audience for learning. Is it better?

Chumley-Jones HS, Dobbie A, Alford CL. Web-based learning: Sound educational method or hype? A review of the evaluation literature. Acad Med 2002;77:S86. The authors searched the literature concerning web-based learning. Web-based learning is as effective as other educational methods.

Cook DA, Levinson JA, Garside S. time and learning efficiency in Internet-based learning: a systematic review and meta-analysis. Adv in Health Sci Educ 2010;15:755. There is no difference in the time required to learn. However, there was a direct correlation with time spent and amount learned; the longer one studies, the more one learns.

Tam M.D.BS, Hart AR, Willliams S, Heylings D, Leinster S. Is learning anatomy facilitated by computer-aided learning? A review of the literature. Med Teacher 2009;31:e393. Computer-assisted learning was NOT superior to the traditional method (lecture and dissection) for learning anatomy.

Wong G, Greenhalgh T, Pawson R. Internet-based medical education: a realist review of what works, for whom and in what circumstances. BMC Med Educ 2010;10:12 Learners will benefit from internet-based medical education if it is perceived as an advantage over other non-internet alternatives, was easy to use, and had interactivity with virtual tutorials.

Toledo P, McCarthy RJ, Burke CA, Goetz K, Wong CA, Grobman WA. The effect of live and web-based education on the accuracy of blood-loss estimation in simulated obstetric scenarios. Am J Obstet Gynecol 2010;202:400.e1-5. Education improves estimation of blood-loss with no difference between web-based and live education.

Philip J, Whitten CW, Johnston WE. Independent study and performance on the anesthesiology in-training examination. J Clin Anesth 2006;18:471. If residents studied an average of 10 hours per week, they were likely to achieve a passing score on the ITE.

2. Manual Skills

The most important skill to have mastered before an obstetric anesthesia rotation is the placement of neuraxial analgesia/ anesthesia. Unfortunately, this skill is also the most difficult to learn.

Konrad C, Schuepfer G, Wietlisbach M, Gerber H. Learning manual skills in Anesthesiology: Is there a recommended number of cases for anesthetic procedures? Anesth Analg 1998;86:635-9. The number of procedures until success with epidural catheter placement in the left lateral decubitus position was determined in 11 first year anesthesia residents. Success was defined as requiring no help from the staff. The recommended number to achieve this level of success was 90.

Drake EJ, Coghill J, Sneyd JR. Defining competence in obstetric epidural anaesthesia for inexperienced trainees. Brit J Anaesth Advance Access published March 23, 2105. Success was defined as providing good analgesia throughout labor. For the 105 novice trainees, successful analgesia occurred in 76.8% of analgesics. To achieve a competence of 65%, trainees will require 46 attempts.

Friedman Z, Siggiqui N, Katznelson R, Deviot I, Bould M.D., Naik V. Clinical impact of epidural anesthesia simulation on short- and long-term learning curve: High- versus low-fidelity model training. Reg Anesth Pain Med 2009;34:229-232. A simple model is as useful for learning how to place an epidural catheter as an expensive anatomically correct simulator.

Friedman Z, Siddiqui N, Katznelson R, Devito I. Davies S. Experience is not enough. Repeated breaches in epidural anesthesia aseptic technique by novice operators despite improved skill. Anesthesiology 2008;108:914-20. Teaching must include aseptic technique in addition to manual skills of epidural insertion.

Friedman Z, Katznelson R, Deviot I, Siddiqui M, Chan V. Objective assessment of manual skills and proficiency in performing epidural anesthesia – video-assisted validation. Reg Anesth Pain Med 2006;31:304-310. One is able to assess an individual's skills by video and skills improve with number of times done.

Vaughan N, Dubey VN, Wee MYK, Isaacs R. A review of epidural simulators: Where are we today. Med Engineering and Physics 2013;35:1235-50. There are many types of simulators available, ranging from actuators to haptic. The ability to adapt to patient variation such as obesity is not possible with the maniken. The disadvantage to computer-based is that it is limited to only a fixed needle insertion point.

Grau T, Bartusseck E, Conradi R, Martin E, Motsch J. Ultrasound imaging improves learning curves in obstetric epidural anesthesia: a preliminary study. Can J Anesth 2003;50:1047-50. Ultrasound imaging for teaching epidural anesthesia was associated with a higher rate of success.

3. Judgment

It turns out that knowledge and technique are easy to teach. Judgment is more difficult to teach. Judgment will be influenced by knowledge and personal experience. The ABA designed the Part 2 Examination to test the candidate's judgment, application of knowledge, clarity of expression, and adaptability to the changing circumstances that are often encountered.

Daniels K, Arafeh J, Clark A, Waller S, Druzin M, Chueh J. Prospective randomized trial of simulation versus didactic

teaching for obstetrical emergencies. Sim Healthcare 2010;5:40-45. Residents and nurses were taught management for shoulder dystocia and eclampsia. One group received three hours of lectures while the other received three hours of training in simulation laboratory. There was no difference in written test scores while the simulation group did better on a labor and delivery drill.

Osman H, Campbell OMR, Nassar Ah. Using emergency obstetric drills in maternity units as a performance improvement tool. Birth 2009;36:1. Drills on the labor floor identified issues, but the standard of care was no different with practice drills.

Daniels K, Lipman S, Harney K Arafeh J, Druzin M. Use of simulation based team training for obstetric crises in resident education. Sim Healthcare 2008;3:154-160. Simulated obstetric crises was used to identify performance deficiencies of labor floor teams and allowed for focused teaching. The three top areas requiring more focused teaching were poor communication with the pediatric team, not assuming a leadership role during the code, and poor distribution of workload.

Minehart RD, Pian-Smith MCM, Walzer TB, Gardner R, Rudolph JW, Simon R, Raemer DB. Speaking across the drapes. Communication strategies of anesthesiologists and obstetricians during a simulated maternal crisis. Anesthesiologists are good at stating what is going on but not very good at asking. Obstetricians D.O. a good job at both.

Jha V, Bekker HL, Duffy SRG, Roberts TE. A systematic review of studies assessing and facilitating attitudes towards professionalism in medicine. Med Educ 2007;41:822-829. There is no evidence that any intervention that effects attitudes towards professionalism.

Lingard L, Reznick R, Espin S, Regehr G, DeVito I. Team communications in the operating room: Talk patterns, sites of tension, and implications for novices. Acad Med 2002;77:232-237. If the attending misbehaved in the operating room, the resident misbehaved similarly when the attending left the operating room.

Haizlip J, May N, Schorling J, Williams A, Plews-Ogan M. The negativity bias, medical education, and the culture of academic medicine: Why culture change is hard. Acad Med 2012;87:1205-1209. Negative events, emotions, and interpersonal interactions have a great influence. Learning from negative experiences dominate over those related to positive experiences.

Pratt SD. Simulation in obstetric anesthesia. Anesth Analg 20012;114:186-90. The development of simulations for teaching management and judgment is labor intensive in terms of obtaining appropriate equipment, writing scenarios, and organizing personal.

Robertson B, Schuymacher L, Gosman G, Kanfer R, Kelley M, DeVita M. Simulation-based crisis team training for multidisciplinary obstetric providers. Sim Healthcare 2009;4:77-83. Simulation of various teams which includes preparation improves attitudes toward competence in handling obstetric emergencies as well as confidence. The team performance improved.

Conclusion: While many efforts are made to teach judgment, judgment is learned through interactions in the labor suite and personal experience. A small amount of judgment is learned through simulation

4. Assessment

Scavone BM, Sproviero MT, McCarthy RJ, Wong CA, Sullivan JT, Siddall VJ, Wade LD. Anesthesiology 2006;105:260-6. A scoring system was developed for the evaluation of resident performance when doing general anesthesia for cesarean section. The scoring system was valid and reliable.

Summary: The teaching of obstetric knowledge is extremely evidence based and mainly involves the amount of time the learner spends on the subject. The technical aspects may be taught on the job or with a simulator but the achievement of success (both epidural placement and labor analgesia) require a lot of encounters. Research should focus on means to decrease this number. The teaching of judgment is relatively non-existent, depending upon experience and the outcomes of these experiences. While simulation may form judgment, the impact of simulation on judgment still remains to be defined.

Title: How Best to Educate Our Patients about OB Anesthesia

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Objectives

1. Attendees with be introduced to a **patient teaching model (learner-centric)** that is based on models used for teaching of trainees; the utility of the Kolb Learning Cycle and Kirkpatrick's 4-level evaluation model will be illustrated
2. Attendees will receive examples of **easy techniques and language** that facilitate patient engagement and learning; how **mindfulness techniques can improve performance and professional satisfaction** will be incorporated.
3. Attendees will be introduced to valuable **resources for patient education**

SUMMARY

Educating patients is hard when pre-procedure time is limited as in the OB anesthesia setting. These challenges also present specific opportunities for teaching and enhancement of the patient-provider interaction. Deliberately incorporating patient education in our work can improve the success of our interventions, improve patient satisfaction, and even improve our own satisfaction and resiliency as care-providers. Myths, misconceptions and knowledge gaps contribute to fear and mistrust among patients. Effective patient education can help us partner with patients for better clinical outcomes and can help enhance public understanding of the important role anesthesiologists play as perioperative and perinatal consultants.

Drawing from well-established educational models from other domains, OB anesthesiologists can quickly assess learners' needs, reduce knowledge gaps, and gauge improvements in understanding. Having informed patients improves cooperation during procedures as well as in the setting of untoward complications. Incorporating teaching into our interactions with patients is respectful of patients and positively supports patient autonomy.

Techniques of "mindfulness", with deliberate moment-to-moment attentiveness to the present, have been shown to improve performance. Data from other domains can be used to demonstrate how these techniques can be used to improve teaching, even in very brief OB anesthesia encounters.

Educating patients is part of our professional responsibility. Doing it well is good for patients and for providers, and is an important function that should be modeled expertly for our other learners- our trainees.

Gerard W. Ostheimer Lecture Syllabus: *What's New in Obstetric Anesthesia* – 2014

Katherine W. Arendt, M.D.
Hans P. Sviggum, M.D.
Rebecca Johnson, M.D.

Objectives: This syllabus reviews papers published from January 2014 through December 2014 which are significant in their scientific and clinical contribution to the field of obstetric anesthesiology.

Methods: Over 75 journals, websites and newsletters published from January 2014 through December 2014 were searched. These journals were chosen based upon prior Ostheimer journal lists as well as their scientific and clinical relevance to the fields of obstetric anesthesiology, obstetrics, and perinatology. Articles were selected for this syllabus based upon the authors' opinion regarding their current or eventual potential to influence the field of obstetric anesthesiology.

List of Journals:

Anesthesia

Acta Anaesthesiologica Belgica, Acta Anaesthesiologica Scandanavica, Anaesthesia, Anaesthesia & Intensive Care, Anesthesia & Analgesia, Anesthesiology, Anesthesiology Clinics of North America, ASA Newsletter, British J Anaesthesia, Canadian J Anaesthesia, Critical Care Medicine, Current Opinion in Anesthesiology, European J of Anaesthesiology, European J of Pain, International Anesthesiology Clinics, International J Obstetric Anesthesia, J Clinical Anesthesia, J of Pain, Obstetric Anesthesia Digest, Pain, Regional Anesthesia & Pain Medicine.

Obstetrics & Gynecology Journals

Acta Obstetrica et Gynecologica Scandinavica, American J of Maternal/Child Nursing, American J of Obstetrics and Gynecology, The Australian and New Zealand J of Obstetrics and Gynaecology, Birth, British J of Obstetrics and Gynecology, Clinical Obstetrics and Gynecology, Current Opinion in Obstetrics and Gynecology, European J of Obstetrics & Gynecology & Reproductive Biology, Fertility and Sterility, Gynecologic and Obstetric Investigation, International J of Gynecology and Obstetrics, J of Maternal-Fetal and Neonatal Medicine, J of Midwifery and Women's Health, J of Women's Health, Obstetrical and Gynecological Survey, Obstetrics and Gynecology, Obstetrics and Gynecology Clinics of North America, Pregnancy, Placenta.

Perinatology and Pediatric Journals

American J of Perinatology, BMC Pediatrics, Early Human Development, J of Paediatrics and Child Health, J of Pediatrics, J of Perinatology, Pediatrics.

General Medical Journals

American J of Epidemiology, Annals of Internal Medicine, Blood, British Medical J, Chest, Circulation, European Heart J, Heart, Intensive Care Medicine, J of American College of Cardiology, J of Clinical Epidemiology, J of the American Medical Association, J of Thrombosis and Hemostasis, Lancet, Morbidity and Mortality Weekly Report, New England Journal of Medicine, Nature –Medicine, PNAS - Proceedings of National Academy of Sciences of USA, Resuscitation, Science, Thrombosis Research, Transfusion, PLOS one, PLOS medicine.

Health Services Research Journals

Health Affairs, Quality and Safety in Health Care

Table of Contents

Syllabus

What's New in Obstetric Anesthesia?

1. Palanisamy A: **What's new in Obstetric Anesthesia? The 2013 Gerard W. Ostheimer lecture**. Anesthesia and analgesia 2014; 118: 360-6

2. Palanisamy A**: The 2013 Gerard W. Ostheimer Lecture: What's New in Obstetric Anesthesia?** International journal of obstetric anesthesia 2014; 23: 58-65

3. Hawkins JL: **The 2013 SOAP/FAER/Gertie Marx Honorary Lecture 2013. From print to practice: the evolving nature of obstetric anesthesia.** International journal of obstetric anesthesia 2014; 23: 376-382

This article reviews the recent literature related to obstetric anesthesia practice including research and practice guidelines. Dr. Hawkins encourages obstetric anesthesiologists to work hard to stay up-to-date with the latest research and guidelines and to be willing to change practice when indicated.

Labor analgesia

Labor pain

4. Carvalho B, Hilton G, Wen L, Weiniger CF: **Prospective longitudinal cohort questionnaire assessment of labouring women's preference both pre- and post-delivery for either reduced pain intensity for a longer duration or greater pain intensity for a shorter duration**. British journal of anaesthesia 2014; 113: 468-73

   This prospective cohort study surveyed 40 women scheduled for induction of labor both before and after labor (37 women completed both surveys). The surveys asked binary questions such as, "Which scenarios would you prefer? Pain intensity of 2 for 9 hours, or pain intensity of 6 for 3 hours?" Women rated that they preferred lower pain intensity for a longer duration than higher intensity for a shorter duration. This was true for both before ($p<0.0001$) and after ($p<0.0001$) their labor experience.

5. Carvalho B, Zheng M, Aiono-Le Tagaloa L: **A prospective observational study evaluating the ability of prelabor psychological tests to predict labor pain, epidural analgesic consumption, and maternal satisfaction.** Anesthesia and analgesia 2014; 119: 632-40

   This prospective observational study administered 39 women undergoing induction of labor four validated psychological tests as well as three tests rating anxiety, confidence and analgesic expectations. These psychological outcomes were then related to the analgesic outcomes of *time to analgesic request, pain at request for epidural analgesia, area under the pain x time curve, epidural local anesthetic use per hour* and *maternal satisfaction with analgesia*. The authors attempted to statistically achieve a linear relationship between a predictor (the tool used) and the response (the analgesic outcomes). Many of the tests were significantly correlated with at least one analgesic outcome by p values unadjusted for multiple testing, but none remained significant after adjusting for multiple testing. A multivariate linear regression analysis found many of the tests to contribute to a predictive model. Interestingly, an Anxiety Sensitivity Index (ASI) modeled well to the analgesic outcome of *labor pain x time, area under the curve*. From the Eysench personality traits, *lying* contributed to the modeling of *time to request labor analgesia*. Also, *extroversion* and *psychoticism* modelled to *labor pain x time area under the curve. Pain catastrophizing* related to *epidural local anesthetic use*; the *Fear of Pain* (FPQ III) related to a lower *maternal satisfaction with labor* score.

6. Costa-Martins JM, Pereira M, Martins H, Moura-Ramos M, Coelho R, Tavares J: **Attachment styles, pain, and the consumption of analgesics during labor: a prospective observational study.** The journal of pain 2014;15: 304-11

   This observational study assessed 81 women during third trimester with the Adult Attachment Scale - Revised. *Attachment style* is thought to be determined in infancy via one's relationships with primary caregivers, remain unchanged throughout life, and describes how an individual relates to others, especially under stress. It is measured in two dimensions: *Anxiety* (the extent to which one worries about being unloved and abandoned) and *avoidanc*e (the extent to which one avoids the closeness of others). In labor, women with secure attachment styles (low anxiety and low avoidance) reported significantly less labor pain ($p < 0.001$) and consumed significantly lower amounts of analgesics via their PCEA ($p < 0.001$) than women with insecure attachment styles (high anxiety and/or high avoidance) even though baseline obstetric and demographic data were similar in both groups.

7. Dehghani M, Sharpe L, Khatibi A: **Catastrophizing mediates the relationship between fear of pain and preference for elective caesarean section.** European journal of pain 2014; 18: 582-9

   This prospective study asked 300 pregnant women between the gestations of 4 and 36 weeks if they preferred delivery via elective cesarean delivery or vaginal delivery. These women were administered a series of questionnaires including the Childbirth Attitude Questionnaire, Fear of Pain Questionnaire, Depression-anxiety-stress Scale, Pain Catastrophizing Scale, and the Catastrophic Cognition Questionnaire. *Fear of childbirth* and *fear of pain* each were independent predictors of women preferring an elective cesarean delivery. Interestingly, *catastrophizing* fully mediated the relationship between *fear of pain* and desire for cesarean, but not the relationship between *fear of childbirth* and desire for cesarean. This study poses the possibility of obstetric anesthesia analgesic services influencing elective cesarean choice for women who have a tendency to catastrophize and/or fear the pain of childbirth.

Epidural labor analgesia

8. Ding T, Wang DX, Qu Y, Chen Q, Zhu SN: **Epidural labor analgesia is associated with a decreased risk of postpartum depression: a prospective cohort study.** Anesthesia and analgesia 2014; 119: 383-92

   Accompanied by the editorial:

   Wisner KL, Stika CS, Clark CT: **Double duty: does epidural labor analgesia reduce both pain and postpartum depression?** Anesthesia and analgesia 2014; 119: 219-21

This prospective cohort study followed 214 women in a Chinese hospital, 107 of whom requested and received epidural analgesia, and assessed them for postpartum depression at 3 days and 6 weeks. The authors found that women who requested and received epidural analgesia for labor had a lower risk of postpartum depression at 6 weeks as assessed by the Edinburgh Postnatal Depression Scale (OR 0.31, 95% CI 0.12-0.82). The article is accompanied by an editorial which discusses the links between epidural analgesia, diminished postpartum persistent pain and the risk for depression. It also discusses the possibility that the baseline psychological characteristics of women who chose epidural may be different from those who did not in the study. The editorial also acknowledges the difficulty in studying the association in a future randomized controlled trial.

9. Sng BL, Leong WL, Zeng Y, Siddiqui FJ, Assam PN, Lim Y, Chan ES, Sia AT: **Early versus late initiation of epidural analgesia for labour.** The Cochrane database of systematic reviews 2014; 10: CD007238

   This Cochrane Systematic Review updated in 2014 evaluated the effectiveness and safety of early versus late initiation of epidural labor analgesia. Nine randomized, controlled studies were included (n=15,752) which showed no difference in risk of cesarean delivery (RR 1.02, 95% CI 0.96-1.08), no difference in risk of instrumented vaginal birth (RR 0.93, 95% CI 0.86-1.01), no clinically meaningful difference in length of second stage (Mean Difference -3.22 minutes, 95% CI -6.71-0.27), no difference in APGAR scores less than 7 at 1 minute (RR 0.96, 95% CI 0.84-1.10), umbilical arterial pH (Mean Difference 0.01; 95% CI 0.01 – 0.03), or umbilical venous pH (Mean Difference 0.01, 95% CI 0.00-0.02).

10. Boogmans T, Vertommen J, Valkenborgh T, Devroe S, Roofthooft E, Van de Velde M: **Epidural neostigmine and clonidine improves the quality of combined spinal epidural analgesia in labour: a randomised, double-blind controlled trial.** European journal of anaesthesiology 2014; 31: 190-6

This randomized controlled trial of 112 laboring women evaluated whether epidural neostigmine combined with clonidine decreased breakthrough pain, decreased hourly ropivacaine use, and improved patient satisfaction after a CSE technique. All participants received a CSE with an intrathecal dose of 2.5mL of a solution containing 0.175% ropivacaine and 0.75 mcg/mL sufentanil. The study group then received an epidural bolus of 10ml of a saline solution containing 75mcg clonidine and 500mcg neostigmine. The control group received 10mL of epidural saline. The clonidine/neostigmine group used 32.6% less epidural ropivacaine by PCEA than the placebo group throughout labor (11.6 ± 4.2 versus 17.2 ± 5.3 mg/hour, $p < 0.05$). Also, only 3% of the clonidine/neostigmine group had breakthrough pain, compared to 36% of the placebo group ($p < 0.05$). Patient satisfaction after one hour of epidural analgesia was superior in the clonidine/neostigmine group ($p < 0.05$) but not after 24 hours. The authors conclude that the administration of epidural clonidine and neostigmine as an adjuvant after CSE, improves the quality of epidural labor analgesia.

Labor epidural and second stage of labor

11. Cheng YW, Shaffer BL, Nicholson JM, Caughey AB: **Second stage of labor and epidural use: a larger effect than previously suggested.** Obstetrics and gynecology 2014; 123: 527-35

    Followed by letters to the editor:

    San Roman G: Comment on Second stage of labor and epidural use: a larger effect than previously suggested. Obstetrics and gynecology 2014; 123: 1358-59

Cheng YW, Shaffer BL, Nicholson JM, Caughey AB: In reply. Obstetrics and gynecology 2014; 123: 1359

Hochner-Celnikier D, Solnica A, Lavy Y: Comment on Second stage of labor and epidural use: a larger effect than previously suggested. Obstetrics and gynecology 2014; 123: 1359-60

Cheng YW, Shaffer BL, Nicholson JM, Caughey AB: In reply. Obstetrics and gynecology 2014; 123: 1360

This retrospective cohort study compared the length of second stage labor (median lengths and 95th percentiles) in women with and without epidurals. The dataset involved 42,268 women stratified by parity who were undergoing vaginal delivery at University of California, San Francisco between 1976 and 2008. The authors found that for nulliparous women who labored without an epidural, the 95th percentile length of second stage was 197 minutes while the length of second stage for women with an epidural was 336 minutes ($p<0.001$), which was a difference of over 2 hours. Likewise, for multiparous women, the 95th percentile was 81 minutes for those without an epidural and 255 minutes for those with an epidural ($p<0.001$), a difference of nearly 3 hours. The authors question whether obstetricians should lengthen the current "recommendations for intervention during the second stage of labor (which) have been based on a 1-hour difference in the setting of epidural use." Although the authors don't claim that their study demonstrates causation, this study has been viewed by some to be controversial. Because of its retrospective design, it has the biases of retrospective labor analgesia studies such as cross-over, drop-out, lack of blinding of providers and patients, etc. The epidural labor analgesia techniques utilized at the institution between 1976 and 2008 are not described. The length of time over which data was collected could further bias the study—for example, as the prevalence of epidural analgesia increased, the practice of forceps and vacuum-assisted deliveries could have decreased which also could have resulted in longer second stages over time.

12. Wassen MM, Hukkelhoven CW, Scheepers HC, Smits LJ, Nijhuis JG, Roumen FJ: **Epidural analgesia and operative delivery: a ten-year population-based cohort study in The Netherlands.** European journal of obstetrics, gynecology, and reproductive biology 2014; 183: 125-31

This population-based retrospective cohort study using data from the Perinatal Registry of the Netherlands between 2000 and 2009 found that among nulliparous women (n=616,063) epidural labor analgesia use tripled over the time period from 7.7% to 21.9%, while rates of cesarean delivery increased only by 2.8% and instrumented vaginal delivery decreased by 3.3%. In multiparous women (n=762,395), epidural analgesia use increased from 2.4% to 6.8% while rates of cesarean delivery increased only by 0.8% and instrumented vaginal delivery decreased by 0.7%. Although, in multivariate analysis, there was a positive association between epidural analgesia and cesarean delivery, this weakened over time for both nulliparous (Year 2000-- OR 2.35 [95% CI, 2.18 – 2.54] VERSUS Year 2009-- OR of 1.69 [95% CI 1.60-1.79], $p<0.001$) and multiparous women (Year 2000-- OR 3.17 [95% CI, 2.79 – 3.61] VERSUS Year 2009-- OR 2.56 [95% CI 2.34-2.81], $p<0.001$). From these results, the authors conclude that because there was a triplication of epidural labor analgesia in the Netherlands with relatively stable rates of operative deliveries, "epidural analgesia is not an important causal factor of operative deliveries."

13. Loewenberg-Weisband Y, Grisaru-Granovsky S, Ioscovich A, Samueloff A, Calderon-Margalit R: **Epidural analgesia and severe perineal tears: a literature review and large cohort study**. The journal of maternal-fetal & neonatal medicine 2014; 27: 1864-9

This retrospective cohort study evaluated 61,308 vaginal deliveries that occurred at an Israeli hospital between 2006 and 2011 and studied the association between epidural labor analgesia and the risk of severe perineal tears. Within the cohort, 31,631 (51.6%) of women received epidural analgesia. Epidural labor analgesia was associated with higher rates of primiparity, induction and augmentation of labor, prolonged second stage, instrumented vaginal birth and episiotomy. Therefore, it is not surprising that univariate analysis showed an association between the use of epidural analgesia and severe perineal tears (OR 1.78, 95% CI 1.34 to 2.36). However, in multivariate analysis, the association disappeared (OR 0.95, 95% CI 0.69 to -1.29). The authors conclude that this suggests that the "factors that lead to a woman's request for epidural analgesia, such as poor labor and primiparity, may be similar to those that lead to severe perineal tears."

14. Jango H, Langhoff-Roos J, Rosthoj S, Sakse A: **Modifiable risk factors of obstetric anal sphincter injury in primiparous women: a population-based cohort study.** American journal of obstetrics and gynecology 2014; 210: 59 e1-6

This population-based retrospective cohort study using the Danish Medical Birth Registry looked for the incidence of obstetric anal sphincter injury in 214,256 primiparous women undergoing vaginal delivery between 2000 and 2010. Although epidural analgesia was a risk factor in univariate analysis, (OR 1.12, 95% CI 1.01-1.17, $p< 0.0001$) when adjusting for birthweight and vacuum extraction, epidural analgesia became a protective factor for sphincter injury (OR 0.94 [95% CI 0.9 - 0.98] $p=0.0028$). In multivariable analysis that also included multiple fetal and obstetric factors (besides BMI), epidural became *even more* protective (OR 0.84 [95% CI 0.81-0.88] $p=0.0001$). In this study, confounding factors masked the potential benefits of epidural analgesia to the perineum.

15. Laughon SK, Berghella V, Reddy UM, Sundaram R, Lu Z, Hoffman MK: **Neonatal and maternal outcomes with prolonged second stage of labor.** Obstetrics and gynecology 2014; 124: 57-67

This retrospective cohort study evaluated electronic medical records of 43,810 nulliparous and 59,602 multiparous women from 19 U.S. hospitals who delivered 36 week or greater, singleton, vertex babies between 2002 and 2008. They defined *prolonged second*

stage in nulliparous women with an epidural as greater than 3 hours, and without an epidural as greater than 2 hours. They defined *prolonged second stage* in multiparous women with an epidural as greater than 2 hours and without an epidural as greater than 1 hour. Prolonged second stage occurred in 9.9% of nulliparous women with an epidural; 13.9% of nulliparous women without an epidural; 3.1% of multiparous women with an epidural and 5.9% of multiparous women without an epidural. Prolonged second stage was associated with increased rates of chorioamnionitis, third and fourth degree lacerations, neonatal sepsis, neonatal asphyxia, and perinatal mortality. Among all babies born to women with epidurals who had a prolonged second stage (3,533 nulliparous and 1,348 multiparous women), there were no cases of hypoxic-ischemic encephalopathy or perinatal death.

Epidural Fever

16. Sharma SK, Rogers BB, Alexander JM, McIntire DD, Leveno KJ: **A randomized trial of the effects of antibiotic prophylaxis on epidural-related fever in labor.** Anesthesia and analgesia 2014; 118: 604-10

    Accompanied by letter to the editor:

    Goetzl L. **Epidural Fever in Obstetric Patients: It's a Hot Topic**. Anesthesia and analgesia 2014; 118: 494-5

    This double-blinded trial randomized 400 healthy primiparous women to either receive 2 grams of intravenous cefoxitin or placebo immediately prior to epidural labor placement with intrapartum fever as its primary outcome. Antibiotics did not reduce fever rates: 38% (75/200) and 40% (79/200) of women in the cefoxitin group and placebo group respectively developing fever defined as a tympanic membrane temperature of 38.0 C or greater (p=0.68). The antibiotics did not reduce neutrophilic inflammation of the placental membranes: 49% (74/150) of the cefoxitin group and 55% (84/152) of the placebo group (p=0.30). Notably placental inflammation and fever were linked with 69% (73/106) of women who developed fever had placental neutrophilic inflammation, compared to 43% (85/196) of women who remained afebrile ($p < 0.001$). The relationship remained significant in reverse with 73/157 women who had placental inflammation developed fever while in women with no inflammation only 33/144 developed fever ($p < 0.001$). These authors concluded what other studies on epidural fever have supported—that infection is not likely to be the cause of epidural fever development and that epidural fever is associated with placental inflammation. This article is accompanied by an editorial by Laura Goetzl. She summarized the study by saying, "prophylactic antibiotic treatment does not alter the subsequent rate of fever… (which) provides very strong evidence against an infectious etiology for epidural fever in obstetric patients." She goes on to state that the association of fever and neutrophilic placental inflammation (which was not reduced by antibiotics) supports previous research which "demonstrated an association between intrapartum fever and noninfectious histologic placental chorioamnionitis." She encourages future researchers to focus new research efforts on "interventions that block the maternal inflammatory response to epidural analgesia without increasing maternal or fetal risks."

Combined Spinal Epidural

17. Ngan Kee WD, Khaw KS, Ng FF, Ng KK, So R, Lee A: **Synergistic Interaction between Fentanyl and Bupivacaine Given Intrathecally for Labor Analgesia.** Anesthesiology 2014; 120: 1126-36

    This randomized study gave 300 nulliparous women in first stage of labor 1 of 30 different combinations of intrathecal fentanyl and bupivacaine via a CSE technique. Pain scores via visual analogue scale were recorded with response defined as percentage decrease in pain score from baseline at 15 and 30 minutes. Hyperbolic dose-response models were calculated using nonlinear regression, and drug interaction was evaluated by comparing observed effects to effects that would be predicted by additivity. Combinations of fentanyl and bupivacaine produced greater effects than that predicted by additivity at 15 minutes ($p < 0.001$) and 30 minutes ($p=0.015$) indicating a synergistic interaction between the two drugs when dosed intrathecally in labor.

18. Heesen M, Van de Velde M, Klohr S, Lehberger J, Rossaint R, Straube S: **Meta-analysis of the success of block following combined spinal-epidural vs epidural analgesia during labour.** Anaesthesia 2014; 69: 64-71

    This meta-analysis included 10 randomized controlled trials (n = 1722 women) that compared the success of an epidural catheter after a CSE versus an epidural technique. They found that the risk of a unilateral block was decreased with a CSE technique (RR 0.48, 95% CI 0.24-0.97) although heterogenicity was present between studies ($I^2 = 69\%$, $p = 0.01$). Unlike what previous observational studies have suggested, this meta-analysis found no difference in rates of epidural replacement or epidural top-up. Therefore, this meta-analysis does *not* support the thought that epidural catheters placed by a CSE technique are more reliable.

19. Wang K, Cao L, Deng Q, Sun LQ, Gu TY, Song J, Qi DY: **The effects of epidural/spinal opioids in labour analgesia on neonatal outcomes: a meta-analysis of randomized controlled trials.** Canadian journal of anaesthesia 2014; 61: 695-709

    Accompanied by editorial:

Hawkins JL. **Can we keep our mothers happy and our babies safe?** Canadian journal of anaesthesia 2014; 61: 691-4

This meta-analysis included 21 trials with 2,859 laboring women who were randomized to epidural/spinal local anesthetics *with* opioids versus epidural/spinal local anesthetics *without* opioids. The various studies each contained different doses and concentrations of opioids in both intrathecal doses and epidural solutions/rates, and multiple studies did not calculate doses of opioids for either the entirety of labor or in amounts per hour. Between the groups, however, there were no differences in the incidence of APGAR scores < 7 at one minute (Risk difference 0.0%, 95% CI -3.0 – 2.0; p= 0.78; I^2=0%, 95% CI 0 - 50), or at 5 minutes (Risk difference -1.0%, 95% CI -2.0 – 1.0, p=0.31; I^2 = 0%, 95% CI 0 – 50), and no significant differences in the Neurologic and Adaptive Capacity Scores at 2 hours (Mean difference -0.35, 95% CI -1.70 – 1.01, p = 0.62; I^2 = 0%, 95% CI 0 – 79), or at 24 hours (Mean difference -0.45, 95% CI -1.36 to 0.46, p=0.33; I^2 = 3%, 95% CI 0 - 26), and no difference in umbilical artery pH (Mean difference -0.02, 95% CI -.0.6 – 0.03, p = 0.48, I^2 80%, 95% CI 46 - 92) or umbilical vein pH (Mean difference -0.03, 95% CI 0.07 – 1.00, p=0.08; I^2 = 77%, 95% CI 36 – 91). The authors conclude that fentanyl and sufentanil in common neuraxial doses are safe for neonates during the first 24 hours of life.

20. Patel NP, El-Wahab N, Fernando R, Wilson S, Robson SC, Columb MO, Lyons GR: **Fetal effects of combined spinal-epidural vs epidural labour analgesia: a prospective, randomised double-blind study.** Anaesthesia 2014; 69: 458-67

Followed by letter to the editor:

Swini KA, Jain K, Makkar JK, Bagga R. **Intrathecal opioids and fetal heart rate abnormalities**. Anaesthesia 2014; 69: 458-67

This trial assessed for fetal heart rate changes in women randomized to initiation of labor analgesia with either a combined spinal epidural with intrathecal administration of 2.5mg bupivacaine and 5mcg fentanyl (n = 62) or an epidural without dural puncture loaded with a 20mL epidural bolus of 0.1% bupivacaine with 2mcg/ml fentanyl (n = 53). Fetal heart rate tracings were analyzed for the 30 minutes before and 60 minutes after initiation of labor analgesia and were categorized as normal, suspicious, or pathological. There were no significant differences between groups in the incidence of abnormal fetal heart rate patterns before or after analgesia. In both the CSE and the epidural groups, there was a significant increase in the incidence of abnormal fetal heart rate patterns following the initiation of analgesia (p<0.0001). In the CSE group there were 2 patients who had abnormal fetal heart rate patterns before analgesia and 8 after, and in the epidural group there were 0 before and 11 after. Apgar scores and arterial and venous cord gasses were not different between groups. The authors conclude that initiation of labor analgesia with CSE instead of epidural during the first stage of labor does not increase the risk of FHR abnormalities.

Neuraxial technique

21. Antibas PL, D.O. Nascimento Junior P, Braz LG, Vitor Pereira Doles J, Modolo NS, El Dib R: **Air versus saline in the loss of resistance technique for identification of the epidural space.** The Cochrane database of systematic reviews 2014; 7: CD008938

This Cochrane Systematic Review updated in 2014 evaluated the safety and efficacy of air and saline in the loss of resistance technique. Seven studies involving 852 participants found no significant differences between those that utilized air versus saline in the inability to located the epidural space (RR 0.88, 95% CI 0.33-2.31), intravascular catheter placement (RR 0.90. 95% CI 0.33-2.45), intrathecal catheter placement (RR 2.95, 95% CI 0.12 -71.90), CSE failure (RR 0.98, 95% CI 0.44 – 2.18) unblocked segments (RR 1.66, 95% CI 0.72 – 3.85), pain measured by VAS (Mean difference -0.09, 95% CI -0.37 – 0.18), paresthesias with catheter placement (RR 0.89, 95% CI 0.69 – 1.15), difficulty advancing the catheter (RR 0.91, 95% CI 0.32 – 2.56), and catheter replacement (RR 0.69, 95% CI 0.26 – 1.83). All evidence was considered to be of low quality.

22. Sviggum HP, Farber MK: **The incidence and management of inability to advance Arrow FlexTip Plus epidural catheters in obstetric patients**. International journal of obstetric anesthesia 2014; 23: 113-7

This prospective observational study surveyed anesthesiologists who had epidural catheter advancement difficulty among 2148 epidural catheter placements. The authors found that the inability to advance the Arrow FlexTip Plus occurred in 97 cases (4.7%, 95% CI 3.7 – 5.5%). The incidence of accidental dural puncture was 3.1% if an inability to advance occurred, compared to 1.2% for other placements (p = 0.12). Nine different corrective maneuvers were performed by the anesthesiologists with injection of saline through the epidural needle beneficial. Removing the needle and performing a new placement was the most successful maneuver.

Asepsis

23. Campbell JP, Plaat F, Checketts MR, Bogod D, Tighe S, Moriarty A, Koerner R: **Safety guideline: skin antisepsis for central neuraxial blockade: Association of Anaesthetists of Great Britain and Ireland Obstetric Anaesthetists' Association Regional Anaesthesia UK Association of Paediatric Anaesthetists of Great Britain and Ireland.** Anaesthesia 2014; 69: 1279-86

This guideline for asepsis for neuraxial blocks was published by the Association of Anaesthetists of Great Britain and Ireland, the Obstetric Anaesthetists' Association, Regional Anaesthesia UK, and the Association of Paediatric Anaesthetists of Great Britain and Ireland. This statement is similar in some ways to those published by The Royal College of Anaesthetists, the ASA, and ASRA. However, in contrast, in this guideline the use of a sterile gown by the proceduralist is recommended. They D.O. recommend skin asepsis with chlorhexidine in alcohol; however, they specifically recommend the use of a 0.5% chlorhexidine solution over a 2% solution because of the neurotoxicity of chlorhexidine. They give multiple recommendations regarding keeping chlorhexidine from getting accidentally injected into the neuraxis in a drug error, and state that chlorhexidine should be allowed to dry prior to palpating or puncturing the skin. They state that if chlorhexidine gets on the gloves of the proceduralist, the gloves should be changed and recommend chlorhexidine being minimized in its dose on the skin for patients less than 2 months old.

24. Siddiqui NT, Davies S, McGeer A, Carvalho JC, Friedman Z: **The effect of gowning on labor epidural catheter colonization rate: a randomized controlled trial.** Regional anesthesia and pain medicine 2014; 39: 520-4

This study randomized 240 obstetric patients (214 completed the study) to getting an epidural placed with their anesthesiologists either sterilely gowned or not gowned at all. In the un-gowned group 10 patients (9.2%) grew positive cultures from their epidural catheter tip upon removal versus 8 patients (7.6%) in the gowned group (p = 0.807). Although this study showed that there were increased colonization of the forearms of exposed skin versus the gowned forearm (mostly coagulase negative staph and bacillus species), there was no clear advantage in gowning for epidural procedures.

25. Siddiqui NT, Arzola C, Ahmed I, Davies S, Carvalho JC: **Low-fidelity simulation improves mastery of the aseptic technique for labour epidurals: an observational study.** Canadian journal of anaesthesia 2014; 61: 710-6

This simulation study trained 21 trainees the aseptic technique for epidural placement via a lecture and a video demonstration after which the residents scored an average of 6.0 on a 15 point checklist when performing an epidural placement. The residents were then given a one-on-one hands-on demonstration using a Styrofoam model and their score increased to 10.8 (difference = 4.8, 95% CI 3.3 to 6.2, p < 0.001). Likewise, the fellows went from a score of 7.9 to 11.2 (difference = 3.3, 95% CI 0.05-6.6, p= 0.047) with the hand-on simulation. The authors encourage a low-fidelity simulation modality to improve learning when teaching sterile technique for epidural placements.

Anticoagulation

26. Butwick A, Hass C, Wong J, Lyell D, El-Sayed Y: **Anticoagulant prescribing practices and anesthetic interventions among anticoagulated pregnant patients: a retrospective study.** International journal of obstetric anesthesia 2014; 23: 238-45

This retrospective review evaluated the anticoagulant prescribing patterns and the anesthetic interventions among women who delivered at the Lucile Packard Children's Hospital, Stanford University between 2003 and 2009. The authors identified 101 patients on anticoagulation of which 90.1% (91 patients) received enoxaparin. Of these, 42.8% (39 patients) received enoxaparin only, and 45.1% (41 patients) received enoxaparin and were converted to subcutaneous unfractionated heparin, while 12.1% (11 patients) received enoxaparin and were converted to intravenous unfractionated heparin. There was wide variation in the prescribing patterns of enoxaparin and unfractionated heparin even among patients with similar indications for anticoagulation. Amongst all of these anticoagulated patients, 80.2% received a neuraxial anesthetic. The time period between enoxaparin dose and neuraxial placement was significantly shorter in patients transitioned from enoxaparin to unfractionated heparin than those who remain on enoxaparin (54 hrs [12-192 hrs] (n = 26) vs 216 hrs [39 – 504 hrs] (n=230), p =0.04). The authors discuss the ACOG Practice Bulletin for VTE prophylaxis and thrombophilia and the ASRA recommendations which both recommend bridging patients from enoxaparin to unfractionated heparin during the last month of pregnancy which happened in 45.1% of patients in this study.

27. Rodger M.A., Hague WM, Kingdom J, **Antepartum dalteparin versus no antepartum dalteparin for the prevention of pregnancy complications in pregnant women with thrombophilia (TIPPS): a multinational open-label randomized trial.** Lancet 2014; 384: 1673–83

Between 2000 and 2012, 292 women with a history of thrombophilia were randomly allocated in a 1:1 ratio to either antepartum prophylactic dose dalteparin (5000 international units once daily up to 20 weeks' gestation, and twice daily thereafter until at least 37 weeks' gestation) or to no antepartum dalteparin (control group). Dalteparin did not reduce the incidence of the primary composite outcome which was severe or early onset pre-eclampsia, small-for-gestational-age infant, pregnancy loss, or venous thromboembolism (dalteparin 25/146 [17.1%; 95% CI 11.4–24.2%] versus no dalteparin 27/143 [18.9%; 95% CI 12.8–26.3%]; risk difference −1.8% [95% CI –10.6% to 7.1%]). Minor bleeding was more common in the dalteparin group (28/143 [19.6%]) than in the no dalteparin group (13/141 [9.2%]; risk difference 10.4%, 95% CI 2.3–18.4; p=0.01). Because of this study, obstetric anesthesiologists may be less likely to see patients presenting in labor with dalteparin prophylaxis, after which the ASRA guidelines recommend waiting 12 to 24 hours (depending on the dose) prior to neuraxial techniques.

Ultrasound guidance for neuraxial placement

28. Ansari T, Yousef A, El Gamassy A, Fayez M: **Ultrasound-guided spinal anaesthesia in obstetrics: is there an advantage over the landmark technique in patients with easily palpable spines?** International journal of obstetric anesthesia 2014; 23: 213-6

This controlled trial randomized 150 healthy women with a BMI $\leq$ 35kg/m^2 undergoing cesarean delivery to either ultrasound-guided spinal needle placement or a traditional landmark technique. The proceduralists were experienced in both landmark and ultrasound technique. The authors found that the average procedure time (Landmark 52.5 $\pm$ 55.8sec versus Ultrasound 41.4 $\pm$ 44.7sec, p =0.18), the number of skin punctures (Landmark 1.31 $\pm$ 0.7 versus Ultrasound 1.12 $\pm$ 0.4, p =0.07), the number of needle passes (Landmark 1.99 $\pm$ 1.5 versus Ultrasound 1.67 $\pm$ 1.2, p =0.20), and the success of spinal anesthesia after one needle pass (Landmark 62% versus Ultrasound 65%, p = 0.175) were not different between groups.

29. Chen GS, Chang YC, Chang Y, Cheng JS: **A prototype axial ultrasound needle guide to reduce epidural bone contact.** Anaesthesia 2014; 69: 746-51

These authors report the development of an ultrasound probe through the center of which an epidural needle passes. This probe can identify the difference between lumbar interspaces versus bone using A-mode ultrasound. After testing in a plastic model and a porcine model, the authors found that in epidural placements in humans, the echo variation between the interspace and L3 was 48%, and the maximum bone echo was at least three times stronger than the interspace echo. They concluded that their new device could offer a method for reducing bone contact during epidural placement.

Systemic opioid labor analgesia

30. Wee MY, Tuckey JP, Thomas PW, Burnard S: **A comparison of intramuscular diamorphine and intramuscular pethidine for labour analgesia: a two-centre randomised blinded controlled trial.** British journal of obstetrics & gynaecology 2014; 121: 447-56

This prospective randomized controlled trial compared the analgesic efficacy of 150mg intramuscular meperidine (n=240) to 7.5mg intramuscular diamorphine (medical heroin) (n=244) for women in labor. After two hours, women were able to get a second dose of their study medication, but no more than 2 doses total were allowed. There was no difference in the neonatal primary outcome which was the need for resuscitation or APGAR score <7 at one minute. Diamorphine provided better pain relief at 60 minutes (mean difference on VAS 1cm, 95% CI 0.5-1.5). Interestingly, the average length of labor (measured as first dose of analgesia to delivery) was, on average, 82 min (95% CI 39-124min) longer in the diamorphine group than the meperidine group in spite of all obstetric baseline characteristics being similar. Because labor was longer in the diamorphine group, in an area-under-the-curve assessment, women experienced labor pain over a longer period of time in the diamorphine group and therefore had "greater total pain." The authors conclude that "this study does not support the use of diamorphine versus meperidine for labor pain." The significant difference in length of labor between drugs is curious and begs the question whether there is a systemic opioid that speeds the labor process.

Remifentanil

31. Liu ZQ, Chen XB, Li HB, Qiu MT, Duan T: **A comparison of remifentanil parturient-controlled intravenous analgesia with epidural analgesia: a meta-analysis of randomized controlled trials.** Anesthesia and analgesia 2014; 118: 598-603

This systematic review and meta-analysis was designed to compare analgesia amongst parturients receiving either remifentanil intravenous patient-controlled analgesia (IV-PCA) or epidural analgesia. Five RCTs (n= 886 healthy parturients with 443 receiving remifentanil IV-PCA) were analyzed. Validity assessment reported overall quality as moderate amongst the included trials. Epidural anesthesia was shown to provide superior analgesia with parturients reporting lower VAS pain scores at both 1 hour (5 RCTs) and 2 hours (3 RCTs) after administration than scores reported by women receiving remifentanil IV-PCA. There were no significant differences in secondary outcomes of nausea, pain, and pruritus and no statistically significant differences in umbilical artery pH values in the included trials. No trials reported significant differences in Apgar scores or neonatal outcomes between remifentanil and epidural analgesia. Wide confidence intervals with potentially clinically-significant differences were shown for pruritus, nausea, and vomiting between the remifentanil and epidural groups suggesting that further study is necessary before more definitive conclusions are drawn on these secondary outcomes.

32. Hinova A, Fernando R: **Systemic remifentanil for labor analgesia.** Anesthesia and analgesia 2014; 109: 1925-9.

This concise article reviews the efficicacy, dose, and safety of remifentanil in obstetric anesthesia. The authors state that "although neuraxial blockade is the "gold standard" for labor analgesia, systemic analgesia is useful in those cases in which neuraxial analgesia is contraindicated, refused or simply not needed by the parturient, or when skilled anesthesia providers are not available."

33. Leong WL, Sng BL, Sia AT: **A comparison between remifentanil and meperidine for labor analgesia: a systematic review.** Anesthesia and analgesia 2014; 113: 818-25

This systematic review compared included 7 studies with 349 patients that compared remifentanil and meperidine intravenous analgesia in reducing pain scores in laboring women. Only 3 studies including a total of 233 women met the authors' criteria to be included. In the meta-analysis, remifentanil reduced the mean VAS score at 1 hour by 25mm (95% CI 19-31mm) more than meperidine ($P < 0.001$).

34. Stocki D, Matot I, Einav S, Eventov-Friedman S, Ginosar Y, Weiniger CF**: A randomized controlled trial of the efficacy and respiratory effects of patient-controlled intravenous remifentanil analgesia and patient-controlled epidural analgesia in laboring women.** Anesthesia and analgesia 2014; 118: 589-97

    Accompanied by editorial:

    Birnbach DJ, Ranasinghe JS: **Is remifentanil a safe and effective alternative to neuraxial labor analgesia?** It all depends. Anesthesia and Analgesia 2014; 118:491-493

This unblinded, randomized controlled non-inferiority trial at a single center compared remifentanil intravenous patient controlled analgesia (IV-PCA, 20mcg to maximum bolus dose of 60 mcg every 1-2 minutes) to epidural analgesia (1% bupivacaine with 2mcg/ml fentanyl) among 40 healthy women in active labor with term, cephalic singleton pregnancies. The methodology in this study was critiqued in the accompanying editorial for allowing for crossover of interventions after 30 minutes (4 crossed over; 3 from remifentanil group, 1 from epidural group), as well as the fact that this study did not control the dose or regimen of remifentanil IV-PCA administration. Results of this study indicated that remifentanil IV-PCA is effective, albeit inferior to, epidural analgesia as measured by NRS pain scores (pain score at 30 minutes was 3.7 +/-2.8 for remifentanil and 1.5 =/-2.2 for epidural analgesia, p=0.009) with data robust at all measured time points (notably worse analgesia provided by remifentanil as labor progressed). Maternal satisfaction, the other primary outcome, was not significantly different between groups. Notably, statistically significant more episodes of respiratory depression (SpO_2 monitoring) despite continuous oxygen supplementation and maternal apnea (end-tidal CO_2 monitoring) were recorded in the remifentanil IV-PCA group (total 9 apnea events; all occurred in 5/19 women receiving remifentanil). Apgar and neonatal respiratory outcomes were similar between the groups. Capnography data showed maternal apnea without episodes of oxygen desaturation suggesting the importance of combining capnography with pulse oximetry monitoring for high-risk OB populations in the peripartum period receiving remifentanil.

35. Lin R, Tao Y, Yu Y, Xu Z, Su J, Liu Z: **Intravenous Remifentanil versus Epidural Ropivacaine with Sufentanil for Labour Analgesia: A Retrospective Study.** PloS one 2014; 9: e112283

This retrospective cohort study compared analgesia with remifentanil intravenous patient controlled analgesia (IV-PCA) to epidural analgesia among primiparous parturients at term. Medical records of 370 parturients were reviewed for pain and sedation scores, overall satisfaction, maternal side-effects and neonatal outcomes. Analgesia was greater in the epidural group throughout the study period compared with remifentanil IV-PCA; and women receiving epidural analgesia rated satisfaction higher than those receiving IV opioid therapy. Also, those parturients who received remifentanil IV-PCA had worsening pain relief scores as labor progressed to the later stages. Additionally, parturients receiving remifentanil IV-PCA had lower oxygen saturations (despite continuous oxygen supplementation) and more sedation than patients receiving epidural analgesia.

Alternative labor analgesia

Water immersion

36. **Immersion in water during labor and delivery.** Pediatrics 2014; 133: 758-61

    Committee opinion no. 594: **Immersion in water during labor and delivery.** Obstetrics and gynecology 2014; 123: 912-5

This Committee Opinion from the American College of Obstetricians and Gynecologists as well as the American Academy of Pediatrics states that although immersion in water during the first stage of labor may be associated with decreased pain or use of anesthesia, immersion in water during the second stage has not been associated with maternal or fetal benefit, and has been associated with case reports of rare but serious adverse newborn effects. The committee, therefore, states that "the practice of immersion in the second stage of labor (underwater delivery) should be considered an experimental procedure that only should be performed in the context of an appropriately designed clinical trial with informed consent." The committee then goes on to state that facilities that offer immersion in water during the first stage of labor should have rigorous protocols and procedures in place to prevent infection and injury and provide appropriate monitoring.

Nitrous oxide

37. Likis FE, Andrews JC, Collins MR, Lewis RM, Seroogy JJ, Starr SA, Walden RR, McPheeters ML: **Nitrous oxide for the management of labor pain: a systematic review.** Anesthesia and analgesia 2014; 118: 153-67

    Accompanied by editorial:

    King TL, Wong CA: **Nitrous oxide for labor pain: is it a laughing matter?** Anesthesia and analgesia 2014;118:12-4

This systematic review identified 58 publications about the effectiveness, patient satisfaction and adverse effects of nitrous oxide for labor pain management. These authors published the 2011 comparative effectiveness review for the U.S. Agency for Health Care Research and Quality (AHRQ). This systematic review reports that only 2 studies were of good quality, 11 fair and 46 poor. The outcomes were heterogeneous. Nitrous oxide was less effective than epidural labor analgesia. Reported adverse effects included nausea, vomiting, dizziness and drowsiness. Apgar scores were no different between mothers who used nitrous oxide and those who used other or no pharmacologic labor analgesia. This review is accompanied by an editorial that emphasizes the "paucity of good data" regarding nitrous oxide for labor analgesia and states that the results of the systematic review are "frustratingly inconclusive." These authors discuss previous reviews published on the topic and point out that nitrous oxide use is decreasing outside of obstetric units because of concerns about "neurologic and hematologic toxicity, adverse immunologic effects, genotoxicity, risk of myocardial ischemia, expansion of air-filled body cavities, and increased risk for postoperative nausea and vomiting." Because of concerns with chronic occupational exposure to healthcare workers, and nitrous oxide's potential effects on DNA synthesis and neuroapoptosis, the authors state that "if we want to use nitrous oxide in the childbirth environment, additional rigorous study is necessary.

Cesarean Delivery

Decision to delivery time for emergent cesarean delivery

38. Weiner E, Bar J, Fainstein N, Ben-Haroush A, Sadan O, Golan A, Kovo M: **The effect of a program to shorten the decision-to-delivery interval for emergent cesarean section on maternal and neonatal outcome.** American journal of obstetrics and gynecology 2014; 210: 224 e1-6

Followed by letter to the editor:

Sholapurkar SL: American journal of obstetrics and gynecology 2014; 211: 311-2

This retrospective observational study examined maternal and neonatal outcomes after implementation of an initiative to shorten the interval from decision-to-incision (DDI) for emergent cesarean delivery performed for nonreassuring fetal heart rate at a single, academic center in Israel. 593 deliveries were evaluated over 54 months. The programs focused not only on achieving the 30-minute ACOG/RCOG time standard, but also, to shorten DDI as much as possible through continuous protocol evaluation. General anesthesia was preferred in all cases unless regional anesthesia was already in place. Results indicate a statistically significant decrease in mean DDI (12.3 +/-3.8 min epoch 2 compared to 21.7 +/- 9.1 min epoch 1) following this program audit. Notably, general anesthesia occurred significantly more often and was found to be an independent predictor (by stepwise analysis) of shorter DDI in the second epoch. This study did not report on airway management including failed intubation and was not adequately powered to examine low-incidence complications such as aspiration. Composite neonatal outcomes were improved in epoch 2 with no change in composite maternal complications following introduction of this management protocol.

39. Tolcher MC, Johnson RL, El-Nashar SA, West CP: **Decision-to-incision time and neonatal outcomes: a systematic review and meta-analysis.** Obstetrics and gynecology 2014; 123: 536-48

This systematic review and meta-analysis identified 34 studies (22,936 women) reporting decision-to-incision time or delivery time intervals for nonelective (both emergent and urgent deliveries). Differences in neonatal outcomes accomplished within 30 minutes and beyond 30 minutes were also compared. Anesthesia-related outcomes (e.g., general or regional anesthesia type) were not assessed. Only 5 of 34 studies were considered to be high quality with most papers failing to control for the level of urgency or indication for delivery. Overall, delivery within 30 minutes was not achieved in a substantial proportion of cases [79% of category I (emergent) deliveries; 36% of category 2 (urgent) deliveries were achieved within the 30-minute standard). Neonatal outcomes (5-minute Apgar scores and umbilical pH levels) were overall worse when delivery occurred within 30 minutes; however, the authors stressed the importance of confounding as in these most emergent situations, it was more likely for infants to be delivered under non-reversible situations (e.g. cord prolapse) and would therefore have poorer short-term neonatal outcomes. Analyses limited to category 1 deliveries did not differ by delivery interval.

Anesthesia for cesarean delivery

40. Lee J, Ko S: **The relationship between serum progesterone concentration and anesthetic and analgesic requirements: a prospective observational study of parturients undergoing cesarean delivery.** Anesthesia and analgesia 2014; 119: 901-5

This study drew venous blood and measured progesterone levels from 90 women > 36 weeks gestation undergoing elective cesarean delivery under general anesthesia induced with thiopental and rocuronium and maintained with sevoflurane and nitrous oxide titrated to blood pressure, heart rate and a BIS value. A patient controlled analgesic device was given to all patients that contained a solution of morphine, ketorolac and ondansetron. Interestingly, there was a negative correlation between sevoflurane consumption and serum progesterone levels (Pearson correlation r = -0.26; 95% CI -0.44 to -.0.05, p=0.01), and an inverse correlation between analgesic consumption at 2 (r=-0.20, p=0.05), 24 (r=-0.25, p=0.02), and 48 (r = -0.28, p=0.01) hour and progesterone levels. Women with progesterone levels greater than the median value had lower sevoflurane consumption per hour (p=0.02) and lower 48-hour postoperative cumulative analgesic consumption (p=0.02). The authors conclude that the "decreased anesthetic and analgesic requirements of near full-term parturients might partially depend on serum progesterone concentration."

41. Cheesman K, Massey S, Preston R, Albert A, Douglas J: **Effects of a head elevated ramped position during elective caesarean delivery after combined spinal-epidural anaesthesia.** International journal of obstetric anesthesia 2014; 23: 106-12

This trial randomized women to one of three positions after the intrathecal placement of fentanyl, morphine and 1.5mL of 0.75% hyperbaric bupivacaine: 1- a head elevated ramped position (pillow under the torso); 2- A control position with the patient lying flat with a small pillow under the head; and 3- Initially placing the patient in the control position and then moving the patient to the head-elevated ramped position. The authors found that there was no difference in their primary outcome which was the time to a T4 block height among the groups (p=0.14), however, there was a significantly lesser number of patients who reached a block height of T4 at 12 minutes , and a greater need for epidural supplementation in the head-elevated ramped position group (p=0.21). The authors conclude that "cautious use of this novel position can provide a more comfortable experience and provide a better airway position" for patients.

The obstetric airway

42. Long N, Ng S, Donnelly G, Owens M, McNicholas M, McCarthy K, McCaul C: **Anatomical characterisation of the cricothyroid membrane in females of childbearing age using computed tomography.** International journal of obstetric anesthesia 2014; 23: 29-34

This study compared 18 females aged 15 to 55 years to 22 male CT scans of the neck and found that in both populations, the cricothyroid membrane was not necessarily a superficial structure that could be easily palpated. The vertical height (9.9 [7-17]mm versus 11.4[8-15]mm, p = 0.04) and maximum width (12.5 [10-15]mm vs 14.5 [10-17]mm, p<0.01) of the cricothyroid membrane was greater in males. The authors conclude that because the external diameter of commercial trochar devices and tracheal tubes may exceed 7mm, smaller than recommended cricothyrotomy devices may be required for women of childbearing age.

43. Leboulanger N, Louvet N, Rigouzzo A, de Mesmay M, Louis B, Farrugia M, Girault L, Ramirez A, Constant I, Jouannic JM, Fauroux B: **Pregnancy is associated with a decrease in pharyngeal but not tracheal or laryngeal cross-sectional area: a pilot study using the acoustic reflection method.** International journal of obstetric anesthesia 2014; 23: 35-9

This prospective observational study followed 36 women through pregnancy and measured their pharyngeal cross sectional area using the upper airway acoustic reflective method. The authors found that the mean pharyngeal cross-sectional area decreased (p<0.001) and Mallampati scores increased (p<0.001) between the first and third trimesters of pregnancy. Although there was a mean weight gain throughout pregnancy, there was not a statistically significant change in neck circumference.

44. Marshall SD, Mehra R: **The effects of a displayed cognitive aid on non-technical skills in a simulated 'can't intubate, can't oxygenate' crisis.** Anaesthesia 2014; 69: 669-77

This simulation study randomized 64 participants into either having or not having a cognitive aid to simulate a 'can't intubate, can't oxygenate' scenario. All categories had higher Anaesthetists' Non-Technical Skills (ANTS) scores when a cognitive aid was supplied (10.4 $\pm$3.1 vs 13.2 $\pm$2.4, p<0.001) and the number of times that the cognitive aid was used was associated with higher ANTS scores. There was a trend toward faster establishment of an infraglottic airway in the cognitive aid group as well (55.3% of controls and 76.9% of cognitive aid group established airway under 3 minutes, p=0.076).

Aspiration

45. Bataille A, Rousset J, Marret E, Bonnet F: **Ultrasonographic evaluation of gastric content during labour under epidural analgesia: a prospective cohort study.** British journal of anaesthesia 2014; 112: 703-7

This prospective study used ultrasound to determine gastric volume changes in women laboring with epidural analgesia. First, the authors determined a cross sectional area (CSA) cut-off number by giving 6 pregnant non-laboring women 250mL of non-clear liquid and found that the antral CSA went from 90 (80-15)mm^2 to 409 (317-463)mm^2. From this data they determined that "increased gastric content" was associated with a CSA of 320mm^2 in the term pregnant women. Then, the authors measured antral CSA in 60 parturients in labor both at the time of epidural placement and at complete dilation and found that CSA decreased from a median of 319 (158-469)mm^2 to 203 (123-261)mm^2 during this time ($p=2x10^{-7}$). Although antral CSA was >320 mm^2 in 29/58 (50%) of women at epidural insertion, only 7/52 (13%) had antral CSA measurements >320 mm^2 at full cervical dilation. The amount of decrease in antral CSA was associated with the time interval between epidural placement and full cervical dilation. This study shows that gastric emptying occurs in women laboring under epidural analgesia.

46. Arzola C, Cubillos J, Perlas A, Downey K, Carvalho JC**: Interrater reliability of qualitative ultrasound assessment of gastric content in the third trimester of pregnancy.** British journal of anaesthesia 2014; 113: 1018-23

This prospective study randomized 32 women at greater than 32 weeks gestation to have an ultrasound performed by one of three anesthesiologists either while fasting, after drinking clears only, or after eating solid food. The overall proportion of correct diagnoses was 87.5% (84 of 96 tests). The interrater reliability showed a kappa statistic of 0.74 (bias corrected 95% CI 0.68-0.84) which the authors conclude shows the consistency of gastric ultrasound assessment for gastric contents in third trimester women.

47. Paranjothy S, Griffiths JD, Broughton HK, Gyte GM, Brown HC, Thomas J**: Interventions at caesarean section for reducing the risk of aspiration pneumonitis.** The Cochrane database of systematic reviews 2014; 2: CD004943

This Cochrane Systematic Review updated in 2014 evaluated interventions at cesarean delivery to reduce the risk of aspiration pneumonitis. Overall, 22 studies involving 2658 women who underwent general anesthesia for cesarean delivery were included. Antacids reduced the risk of intragastric pH < 2.5 compared with no treatment or placebo (2 studies, 108 women; RR 0.17, 95% CI 0.09 – 0.32), as did H_2 antagonists (2 studies, 170 women; RR 0.09, 95% CI 0.05-0.18) and proton pump inhibitors (1 study, 80 women; RR 0.26, 95% CI 0.14 – 0.46). H_2 antagonists were superior to proton pump antagonists at reducing pH to <2.5 at intubation (1 study, 120 women; RR 0.39. 95% CI 0.16 – 0.97). Antacids combined with H_2 antagonists were associated with a significant reduction in the risk of intragastric pH < 2.5 at intubation in comparison to placebo (1 study, 89 women; RR 0.02, 95% CI 0.00 – 0.15), or in comparison to antacids alone (1 study, 119 women; RR 0.12, 95% CI 0.02 – 0.92).

Intraoperative awareness

48. Pandit JJ, Andrade J, Bogod DG, Hitchman JM, Jonker WR, Lucas N, Mackay JH, Nimmo AF, O'Connor K, O'Sullivan EP, Paul RG, Palmer JH, Plaat F, Radcliffe JJ, Sury MR, Torevell HE, Wang M, Hainsworth J, Cook TM: **5th National Audit Project (NAP5) on accidental awareness during general anaesthesia: summary of main findings and risk factors.** British journal of anaesthesia 2014; 113: 549-59

    Pandit JJ, Andrade J, Bogod DG, Hitchman JM, Jonker WR, Lucas N, Mackay JH, Nimmo AF, O'Connor K, O'Sullivan EP, Paul RG, Palmer JH, Plaat F, Radcliffe JJ, Sury MR, Torevell HE, Wang M, Cook TM: **The 5th National Audit Project (NAP5) on accidental awareness during general anaesthesia: protocol, methods and analysis of data.** Anaesthesia 2014; 69: 1078-88

    Jonker WR, Hanumanthiah D, O'Sullivan EP, Cook TM, Pandit JJ: **A national survey (NAP5-Ireland baseline) to estimate an annual incidence of accidental awareness during general anaesthesia in Ireland.** Anaesthesia 2014; 69: 969-76

These papers report the findings of the 5th National Audit Project (NAP5) of the Royal College of Anaesthetists and the Association of Anaesthetists of Great Britain and Ireland. This prospective study involved 269 coordinators in 329 UK hospitals and 41 coordinators in 46 Irish hospitals who provided reports of accidental awareness under general anesthesia at their hospitals. The NAP5 panel then met monthly, reviewed cases and classified them according to likelihood of true awareness under general anesthesia. The denominator was obtained during the 4th national audit project and was 2.8million general anesthetics. In the NAP5 the incidence of awareness was about 1 in 19,000 general anesthetics, with the most pessimistic estimate being about 1 in 6000 general anesthetics. Interestingly, the most over-represented surgical speciality was obstetrics with 12 cases of certain, probable or possible accidental awareness out of 8000 cesarean deliveries under general anesthesia resulting in an incidence of 1:670 (1:380-1300). The authors attribute this high incidence during cesarean delivery to multiple risk factors potentially being present in OB anesthesia that were identified elsewhere in the NAP5 data to contribute to accidental awareness including: rapid sequence induction, omission of opioids at induction, almost always using thiopental and sometimes at inappropriately low doses, difficult airway management, obesity, use of neuromuscular blocking agents, brief period between anesthetic induction and surgical incision, high incidence of emergent surgery, and high rates of off-hours surgery resulting in higher rates of non-consultant care.

49. Zand F, Hadavi SM, Chohedri A, Sabetian P: **Survey on the adequacy of depth of anaesthesia with bispectral index and isolated forearm technique in elective Caesarean section under general anaesthesia with sevoflurane**. British journal of anaesthesia 2014; 112: 871-8

This prospective study evaluated the relationship between the bispectral index (BIS) values and responses to the isolated forearm technique to evaluate depth of anesthesia. The isolated forearm technique involves inflating a forearm blood pressure cuff to 200mmHg during and after induction to isolate the forearm from the effects of neuromuscular blocking agents. Earphones were placed in the patient's ears and the patient was told to 'open and close your right hand' every 30 seconds for 20 minutes during and after induction. Hand movement was recorded. Interestingly, after an induction of 4-5mg/kg thiopental and 1-2mg/kg succinylcholine followed by 50% nitrous and 1.8-2.2% end tidal sevoflurane, 41%, 46% and 23% of parturients had positive isolated forearm test results at laryngoscopy, intubation, and skin incision. BIS could not reliably differentiate the forearm test responders and non-responders during these times. No patients had evidence of recall during a structured interview performed 12-24 hours postoperatively.

Oxygen administration

50. Huen I, Morris D, Wright C, Sibley C, Naish J, Johnstone E: **Absence of PO_2 change in fetal brain despite PO_2 increase in placenta in response to maternal oxygen challenge**. British Journal of Obstetrics and Gynecology 2014; 121: 1588-94.

These authors studied nine healthy pregnant women at 21-33 weeks of gestation and five nonpregnant adults. They studied how fetal brain oxygenation changed as maternal oxygen administration was increased with magnetic resonance imaging through the theory that oxygen administration changes the magnetic longitudinal relaxation time T1 in the brain. During MRI, the air supply to mothers was changed from medical air (21% oxygen) to medical oxygen (100% oxygen) and T1 was monitored over time in both the placenta and fetal brain using a periodically repeated magnetic resonance imaging sequence. The nonpregnant adults showed the MRI change in their brain with oxygen administration. However, although a significant placental change was seen with the maternal oxygen administration, the authors found no significant change in the fetal brains. The authors conclude that short-term maternal oxygen administration does not improve fetal brain oxygenation.

51. Hamel M.S., Anderson BL, Rouse DJ: **Oxygen for intrauterine resuscitation: of unproved benefit and potentially harmful.** American journal of obstetrics and gynecology 2014; 211: 124-7

This review article discusses that only two randomized trials have investigated the use of maternal oxygen supplementation in laboring women and they D.O. not support that supplementation is beneficial to the fetus. The authors state that, "by increasing free radical activity, maternal oxygen supplementation may even be harmful. Based on a review of the available literature, we conclude that until it is studied properly in a randomized clinical trial, maternal oxygen supplementation in labor should be reserved for maternal hypoxia, and should not be considered an indicated intervention for nonreassuring fetal status."

Spinal anesthesia hypotension

52. Moore A, Bourrassa-Blanchette S, El Mouallem E, Kaufman I, El-Bahrawy A, Li-Pi-Shan W, Hatzakorzian R: **The median effective seated time for hypotension induced by spinal anesthesia at Cesarean delivery with two doses of hyperbaric bupivacaine: a randomized up-down sequential allocation study**. Canadian journal of anaesthesia 2014; 61: 916-21

This trial randomized women (n=50) to the either 11.25mg or 15mg intrathecal hyperbaric bupivacaine for cesarean delivery, and then determined how long the patient remained in the sitting position after intrathecal injection via an up-down sequential allocation design with the goal of preventing a >20% drop from baseline systolic blood pressure pre-delivery. The median effective sitting time for 11.25mg was 130sec (95% CI 117 - 150sec) and for 15mg was 385 sec (95% CI 381 to 396). Interestingly, the onset and maximum cranial spread of the anesthetic block was similar in both groups as well as between those who did and did not experience hypotension. There were seven patients in the 11.25mg group and four patients in the 15.0mg group who required additional analgesia for peritoneal closure.

53. Ortiz-Gomez JR, Palacio-Abizanda FJ, Morillas-Ramirez F, Fornet-Ruiz I, Lorenzo-Jimenez A, Bermejo-Albares ML: **The effect of intravenous ondansetron on maternal haemodynamics during elective caesarean delivery under spinal anaesthesia: a double-blind, randomised, placebo-controlled trial.** International journal of obstetric anesthesia 2014; 23: 138-43

This prospective, double-blind , placebo-controlled study randomized women (n=128) scheduled for elective cesarean to either 0mg, 2mg, 4mg, or 8mg intravenous ondansetron administered prior to spinal anesthesia induction. Among the groups there were no differences in the number of patients with systolic hypotension (p=0.77), the percentage of time points with hypotension (p=0.32), ephedrine administration (p=0.11) or phenylephrine administration (p=0.89).

54. Sun S, Huang SQ: **Role of pleth variability index for predicting hypotension after spinal anesthesia for cesarean section.** International journal of obstetric anesthesia 2014; 23: 324-9

The pleth variability index (PVI) represents how much the perfusion index changes during the respiratory cycle. The perfusion index (PI) is determined by the plethysmographic waveform amplitude. This study measured the PVI and PI in 85 women undergoing elective cesarean delivery under spinal anesthesia and found that although the PI was not different, the PVI was higher in patients who experienced hypotension than in those who did not ($p<0.05$). Further, although PVI was related to the incidence of hypotension ($p=0.017$), it was not related to the magnitude of the decrease in systolic blood pressure. The optimal threshold value of PVI was 23.5 at which level the sensitivity would be 47.5% and the specificity 87.5% which resulted in a positive predictive value of baseline PVI predicting hypotension to be 80.0% and the negative predictive value 61.4%.

Fluid Administration

55. Powell M, Mathru M, Brandon A, Patel R, Frolich M: **Assessment of endothelial glycocalyx disruption in term parturients receiving a fluid bolus before spinal anesthesia: a prospective observational study.** International journal of obstetric anesthesia 2014; 23: 330-4

This study administered 750mL of warm Lactated Ringers to healthy parturients in the preoperative holding area and then measured known endothelial glycocalyx biomarkers via a venous blood draw as well as cardiac parameters via thoracic impedance cardiography. From before to after the bolus, there was a significant increase in the endothelial glycocalyx biomarkers heparan sulfate ($p = 0.0098$) and syndecan-1 ($p=0.045$) indicating that a prophylactic fluid bolus disrupts the endothelial glycocalyx. Of note, atrial natriuretic peptide underwent a non-significant increase ($p=0.293$) with the bolus, and cardiac parameters changed only slightly: cardiac index increased by 0.1 L/min/m^2 ($p=0.0005$), and systemic vascular resistance decreased by 30.7 dyn.s/cm^5 ($p=0.0025$). The authors conclude that "because of the endothelial glycocalyx's importance in modulating transvascular fluid exchange, the potential disruption of (it)… may be counterproductive with respect to maintaining intravascular volume in normovolemic parturients."

56. Mercier FJ, Diemunsch P, Ducloy-Bouthors AS, Mignon A, Fischler M, Malinovsky JM, Bolandard F, Aya AG, Raucoules-Aime M, Chassard D, Keita H, Rigouzzo A, Le Gouez A: **6% Hydroxyethyl starch (130/0.4) vs Ringer's lactate preloading before spinal anaesthesia for Caesarean delivery: the randomized, double-blind, multicentre CAESAR trial**. British journal of anaesthesia 2014; 113: 459-67

This multicenter double-blind study involved women undergoing spinal anesthesia for elective cesarean delivery with phenylephrine-bolus-based hypotension prophylaxis. Women were randomized to receive a preload of either 500mL of 6% hydroxyethyl starch (n=82) or 1000mL of lactated Ringer's (n=85). The primary outcome was the incidence of systolic arterial pressure less than 80% of baseline. Although there was no significant difference in total phenylephrine requirements, the incidence of hypotension was significant lower in the hydroxyethyl starch group (36.6% versus 55.3% ($p=0.025$) as was the incidence of symptomatic hypotension (3.7% versus 14.1%). Six umbilical cord blood samples did not detect any hydroxyethyl starch in the neonatal blood, and neonatal outcomes were comparable.

57. Tawfik MM, Hayes SM, Jacoub FY, Badran BA, Gohar FM, Shabana AM, Abdelkhalek M, Emara MM: **Comparison between colloid preload and crystalloid co-load in cesarean section under spinal anesthesia: a randomized controlled trial.** International journal of obstetric anesthesia 2014; 23: 317-23

This double-blind study involved women undergoing spinal anesthesia for elective cesarean delivery with ephedrine-based treatment for hypotension. Women were randomized to receive a *preload* of 500mL of 6% hydroxyethyl starch (n=103) or a *co-load* of 1000mL Ringer's acetate solution (n=102). Although trends were in favor of the colloid preload, there were no significant differences in the incidence of hypotension ($p=0.18$), severe hypotension ($p=0.31$), median ephedrine dose ($p=0.035$), maternal nausea or vomiting, or neonatal outcome. The authors concluded that "neither technique can totally prevent hypotension and should be combined with vasopressor use."

Prophylactic phenylephrine infusions

58. Heesen M, Kolhr S, Rossaint R, Straube S: **Prophylactic phenylephrine for caesarean section under spinal anaesthesia: systematic review and meta-analysis**. Anaesthesia 2014; 69: 143-65

This systematic review included 21 randomized controlled trials (n = 1504) which compared either a prophylactic phenylephrine infusion to a placebo infusion; a prophylactic phenylephrine infusion to an ephedrine infusion; or a prophylactic phenylephrine infusion combined with ephedrine versus ephedrine alone for women undergoing cesarean delivery under spinal anesthesia. The primary outcome was the rate of maternal hypotension (defined as SBP <80% baseline in all but 5 studies). The authors found evidence that prophylactic phenylephrine infusions reduced the risk of hypotension induced by spinal bupivacaine before cesarean delivery [Relative Risk of hypotension with phenylephrine infusion was 0.36 (0.18-0.73) versus placebo, $p=0.004$; 0.58 (0.39-0.88) versus an ephedrine infusion, $p=0.009$; and 0.73 (0.55-.96) when phenylephrine was added to an ephedrine infusion, $p=0.02$]. Prophylactic phenylephrine infusions also reduced the risk for nausea and vomiting. Pooled data indicated that intrathecal bupivacaine doses of 10mg, 12mg and 14mg were more likely to induce hypotension than doses less than 9mg decreasing

phenylephrine's effect at the lower doses. The authors state that there was no evidence that a phenylephrine infusion reduced other maternal or neonatal morbidities. Therefore, the authors recommend the efficacy of prophylactic phenylephrine infusions be explored with a "large double-blind randomized controlled trial with sufficient power… with an emphasis on important maternal and neonatal outcomes."

59. Siddik-Sayyid SM, Taha SK, Kanazi GE, Aouad MT: **A randomized controlled trial of variable rate phenylephrine infusion with rescue phenylephrine boluses versus rescue boluses alone on physician interventions during spinal anesthesia for elective cesarean delivery.** Anesthesia and analgesia 2014; 118: 611-8

    Accompanied by editorial:

    Ngan Kee WD: **Phenylephrine infusions for maintaining blood pressure during spinal anesthesia for cesarean delivery: finding the shoe that fits**. Anesthesia and analgesia 2014; 118: 496-8

This prospective trial randomized 80 patients to either a variable-rate phenylephrine infusion (titrated to arterial blood pressure and heart rate) with rescue phenylephrine boluses, or no phenylephrine infusion and just rescue phenylephrine boluses. Their primary outcome was the number of rescue phenylephrine boluses. All patients received a 15mL/kg crystalloid co-load. The phenylephrine infusion group was initiated at 0.75mcg/kg/min phenylephrine and reduced or increased by 0.25mcg/kg/min if hypertension or hypotension greater than 20% from baseline was noted respectively. When the infusion was increased, a 100mcg bolus phenylephrine infusion was also administered. The group that did not get a phenylephrine infusion followed this same protocol, but administered saline, instead of phenylephrine via the phenylephrine pump. If bradycardia <50 bpm developed, the infusion was stopped until the bradycardia resolved and atropine was administered if the patient was hypotensive. In the phenylephrine infusion group, the median number of phenylephrine rescue boluses was 0 (range 0 to 6) and in the no-infusion group was 3 (range 0-9), therefore there was a median difference of 3 [95% CI 2-4] in the number of phenylephrine rescue boluses. Further, the phenylephrine infusion group had a lesser incidence of hypotension [8/40 (20%) vs 35/39 (90%), p<0.001], a greater incidence of hypertension [6/40 (15%) vs 0/30 (0%), p=0.026], and a lesser incidence of nausea and vomiting [4/40 (10%) vs 17/39 (44%), p=0.001]. The authors conclude that "prophylactic variable rate phenylephrine infusion and rescue phenylephrine bolus dosing is more effective than relying on rescue phenylephrine bolus dosing with respect to limiting clinician workload and maternal symptoms during spinal anesthesia for cesarean delivery." This article is accompanied by an insightful editorial by one of the pioneers of phenylephrine infusions for cesarean delivery, Dr. Warwick Ngan Kee. It discusses how, for cesarean delivery under spinal anesthesia, the "debate has now shifted from *whether* we should use phenylephrine to *how* we should use it." Regarding the mode of delivery, Dr. Ngan Kee states that "one shoe will never fit all." He states that practices, patients, clinical scenarios and providers are all different and that in normal clinical practice strict protocols as are performed in studies are likely not necessary. Instead, he recommends an initial rate at the time of intrathecal injection of 50mcg/min or 0.75mcg/kg/min and then titration of the infusion based on both blood pressure and heart rate. He concludes his editorial stating, "Ultimately anesthesia providers should be able to develop a phenylephrine regimen based on their local experience that provides an acceptable balance between the elimination of maternal symptoms and the risks of hypertension and bradycardia."

Cesarean delivery and hypothermia

60. Horn EP, Bein B, Steinfath M, Ramaker K, Buchloh B, Hocker J: **The incidence and prevention of hypothermia in newborn bonding after cesarean delivery: a randomized controlled trial.** Anesthesia and analgesia 2014; 118: 997-1002

This study evaluated whether newborns get hypothermic when placed on their mother's chest during the cesarean delivery surgical closure. They enrolled 40 women who were scheduled for a term elective cesarean delivery. Women were randomized to either a forced-air active warming cover (n=21) covering their naked baby on their bare chest or a prewarmed cotton blanket (n=19) covering their naked baby on their bare chest. All women had spinal anesthesia, all fluids were warmed, and all operating rooms were kept at 23 degrees Celcius. Maternal and neonatal temperatures were checked at the beginning and end of the 20 minute skin to skin session. In the active warming group, at the end of the 20 minutes, maternal core and skin temperature was higher and their rating of thermal comfort was superior. Most importantly though, in the active warming group, only 1 out of 19 (5%) neonates became hypothermic, while in the cotton blanket group, 17 out of 21 (81%) neonates became hypothermic (p< 0.0001). This study emphasizes the need to assess one's institutions skin-to-skin practice in regards to neonatal hypothermia. If neonatal hypothermia is a problem, then forced air warming may be a solution.

61. Chakladar A, Dixon MJ, Crook D, Harper CM: **The effects of a resistive warming mattress during caesarean section: a randomised, controlled trial.** International journal of obstetric anesthesia 2014; 23: 309-16

In this prospective randomized control trial, 116 women were randomized to either intraoperative warming with a warming mattress or control. The authors found that the incidence of hypothermia (defined as a temperature less than 36.0 C) in the control group was 19.0%. The incidence of hypothermia in their warming mattress group was significantly lower at 5.2% (p = 0.043). Interestingly, there was a significantly lesser mean hemoglobin change in the mattress –warmed group (-1.1 $\pm$ 0.9 g/dL versus -1.6 $\pm$ 0.9 g/dL, p=0.007). Between the two groups, there was no difference in shivering, Apgar scores, time to breastfeeding, or length of hospital stay.

Oxytocin

62. Lee AI, Wong CA, Healy L, Toledo P: **Impact of a third stage of labor oxytocin protocol on cesarean delivery outcomes.** International journal of obstetric anesthesia 2014; 23: 18-22

This retrospective study reported estimated blood loss, vasopressor administration, and supplemental uterotonic use before and after an oxytocin infusion protocol was initiated during cesarean delivery. Before the protocol, a free-flowing infusion of oxytocin at a concentration of 10U/500mL was initiated through a 16 or 18 gauge IV catheter after cord clamping. The concentration was doubled (20U/500cc) and additional bags were hung per the obstetrician's and anesthesiologist's discretion. The protocol involved the initiation of an oxytocin infusion of 18U/hour after cord clamping which was titrated upward as needed. This could be doubled to 36U/hour in the event of atony. After completion of the first hour of the infusion, a maintenance infusion of 3.6U/hour was continued until discharge from the postpartum unit. Data from 901 cesarean deliveries revealed that total intraoperative oxytocin pre-protocol was 20U (20-30U) and post-implementation was 12.5U (9-18U), which was a median difference of 8.4 U (95% CI 7.4 to 9.4 U). There were no statistical differences in vasopressor administration, estimated blood loss, or supplemental uterotonic use. These authors concluded that "an oxytocin management protocol reduced the amount of intraoperative oxytocin without increasing the rate of postpartum hemorrhage or need for additional uterotonics."

63. Khan M, Balki M, Ahmed I, Farine D, Seaward G, Carvalho JC, **Carbetocin at elective Cesarean delivery: a sequential allocation trial to determine the minimum effective dose**. Canadian journal of anaesthesia 2014; 3: 242-248

These authors worked to determine the intravenous dose of carbetocin required to produce effective uterine contraction in 90% of females (ED90) undergoing elective cesarean delivery under spinal anesthesia through a double-blind dose-finding study. The initial dose was 10 mcg, with increments/decrements of 5 mcg. The ED90 of carbetocin was 14.8 mcg (95% CI 13.7 - 15.8) which the authors state is less than one-fifth the currently recommended dose of 100mcg.

Postoperative pain and recovery

64. Ortner CM, Turk DC, Theodore BR, Siaulys MM, Bollag LA, Landau R: **The Short-Form McGill Pain Questionnaire-Revised to evaluate persistent pain and surgery-related symptoms in healthy women undergoing a planned cesarean delivery**. Regional anesthesia and pain medicine 2014; 39: 478-86

This prospective, observational cohort study utilized a revised Short-Form McGill Pain Questionnaire to evaluate the incidence of persistent pain and chronic pain in more than 300 women after Cesarean Delivery. The subjects were given a spinal anesthetic (bupivacaine/fentanyl/morphine), received a standardized surgical protocol, and received multi-modal postoperative analgesia. Data were collected by scripted telephone interview at 8 weeks, 6 months, and 12 months post-delivery. The incidence of chronic pain at 6 months (3%) and 12 months (0.6%) is much lower than previous reports. Although the authors found a low incidence of chronic pain, as many as 22% of patients did report other symptoms such as "numbness" and "tenderness" at 12 months when specifically asked. The authors confirmed previous work on the impact of acute pain on chronic pain by showing that acute postoperative pain in this study was associated with persistent pain symptoms 8 weeks after cesarean delivery.

65. Youssef N, Orlov D, Alie T, Chong M, Cheng J, Thabane L, Paul J: **What epidural opioid results in the best analgesia outcomes and fewest side effects after surgery?: a meta-analysis of randomized controlled trials.** Anesthesia and analgesia 2014; 119: 965-77

This meta-analysis aimed to evaluate which epidural opioid, when used in a continuous infusion, results in the best outcomes for postoperative analgesia. They included a total of 24 trials, with most of the studies looking at abdominal or orthopedic surgery; only two studies were of cesarean delivery. Most of the 24 trials focused on morphine versus fentanyl or fentanyl versus sufentanil. Their primary outcome was VAS scores for pain. There was no difference in VAS scores for pain at any time from 0-72 hours post-op when looking at pooled data. The authors concluded that there were no convincing or clinically meaningful differences in analgesia or opioid consumption among the opioids studied. Fentanyl caused less PONV than morphine (OR 1.91; 95% CI 1.14-3.18) and perhaps less pruritus (OR 1.64; 95% CI 0.98-2.76; not statistically significant). There was significant heterogeneity among the 24 trials reviewed.

66. Craciunas L, Sajid M.S., Ahmed AS: **Chewing gum in preventing postoperative ileus in women undergoing caesarean section: a systematic review and meta-analysis of randomised controlled trials**. British journal of obstetetrics gynaecology 2014; 121: 793-9

This systematic review and meta-analysis evaluated the effectiveness of chewing gum after Cesarean delivery in preventing postoperative ileus. Seven RCTs involving 1462 (728 in chewing gum groups, 734 in control) women were included. Of the 3 trials looking specifically at postoperative ileus, chewing gum was associated with significantly fewer occurrences of ileus (OR 0.36; 95% CI 0.19-0.69, p <0.002). There were also reductions in time to first flatus, time to first bowel sounds, and time to first defecation. There was significant heterogeneity in the clinical and methodological conduct of the studies. The authors recommend chewing gum for 30-60 minutes at least 3 times a day because this was studied by a majority of the trials. This appears to be effective in reducing the incidence and consequences of ileus following cesarean delivery, although the authors admit that the strength of supporting evidence is weak.

TAP block and wound infiltration

67. McKeen DM, George RB, Boyd JC, Allen VM, Pink A: **Transversus abdominis plane block does not improve early or late pain outcomes after cesarean delivery: a randomized controlled trial.** Canadian journal of anaesthesia 2014; 61: 631-40

This double-blind trial randomized women (n=73) undergoing cesarean delivery with a multimodal analgesic regimen which *included* intrathecal morphine to either bilateral ultrasound-guided TAP blocks with 20cc of 0.25% ropivacaine per side, or a sham procedure with saline. At 24 hours, there were no significant differences between the groups in postoperative pain (pain at rest, p=0.4; pain after movement, p= 0.08;) the Quality of Recovery-40 questionnaire (p=0.17) or opioid consumption (p=0.61). Interestingly, although not statistically significant, there were *trends* in the Ropivacaine TAP block group for lower pain scores at 2 hours, but higher postoperative pain scores at 24 hours and 48 hours in comparison to the saline group. Similar health and functioning scores (SF-36) at 30 days and 6 months were also reported between groups.

68. Chandon M, Bonnet A, Burg Y, Barnichon C, DesMesnards-Smaja V, Sitbon B, Foiret C, Dreyfus JF, Rahmani J, Laloe PA, Fischler M, Le Guen M: **Ultrasound-guided Transversus Abdominis Plane block versus continuous wound infusion for post-caesarean analgesia**: a randomized trial. PLoS one 2014; 9: e103971

This trial randomized women undergoing cesarean delivery under spinal anesthesia *without* intrathecal morphine to either postoperative analgesia with bilateral ultrasound-guided transversus abdominis plane block with 20mL of 0.375% levobupivacaine on each side (total 150mg), or continuous wound infiltration with a total of 150mg levobupivacaine infused into the wound over the first 24 hours then 12.5mg/hour thereafter. The trial was prematurely terminated secondary to a patient in the TAP block group experiencing a generalized tonic-clonic seizure which was successfully treated with intralipid and supportive care. Therefore, the study was underpowered (n=65) but showed no differences in pain at rest (p=0.4) or during mobilization (p=0.5), no difference in opioid consumption (p=0.09), and no difference in persistent pain at one month (p=0.73).

69. Weiss E, Jolly C, Dumoulin JL, Meftah RB, Blanie P, Laloe PA, Tabary N, Fischler M, Le Guen M: **Convulsions in 2 patients after bilateral ultrasound-guided transversus abdominis plane blocks for cesarean analgesia.** Regional anesthesia and pain medicine 2014; 39: 248-51

This case report describes 2 cases of generalized tonic-clonic seizures in patients who had ultrasound guided transversus abdominis plane blocks. One patient had 20mL of 0.375% levobupivacaine on each side (total 150mg) and experienced a seizure 10 minutes after injection, and the other had 20mL of 0.75% ropivacaine (total 300mg) on each side and experienced a seizure 25 minutes after injection. The authors state that these cases "cast a cautionary note for the use of TAP blocks after cesarean delivery" because the "risk of local anesthetic toxicity after the procedure remains unknown." They also state, "to limit the risk, a low concentration of local anesthetic solution should be chosen when a '20mL bilaterally' regimen is necessary to achieve the required spread for a successful block."

70. Simavli S, Kaygusuz I, Kinay T, Akinci Baylan A, Kafali H: **Bupivacaine-soaked absorbable gelatin sponges in caesarean section wounds: effect on postoperative pain, analgesic requirement and haemodynamic profile.** International journal of obstetric anesthesia 2014; 23: 302-8

This double-blind trial randomized women who were scheduled for cesarean delivery under general anesthesia to a bupivacaine-soaked absorbable gelatin sponge placed subcutaneously and supra-fascially in the wound (n=81) or a control group (n=83). All women received multimodal analgesia which included scheduled NSAIDs and acetaminophen, as well as meperidine as needed for breakthrough pain. Pain scores (primary outcome) were lower in the study group at all assessment times—1, 4, 12, 18, 24, 36 and 48 hours (all p <0.001). Secondary outcomes included cumulative analgesic consumption which was lower in the study group (p<0.001) as was the frequency of postoperative nausea, vomiting, antiemetic drug requirement and sedation at both 4 hours and 8 hours (all outcomes p <0.001).

71. Reinikainen M, Syvaoja S, Hara K: **Continuous wound infiltration with ropivacaine for analgesia after caesarean section: a randomised, placebo-controlled trial.** Acta anaesthesiologica Scandinavica 2014; 58: 973-9

This double-blind trial randomized women undergoing cesarean delivery under spinal anesthesia (without intrathecal morphine) to a suprafascial, subcutaneous multi-orifice surgical wound catheter which administered either 0.75% ropivacaine (n=33) or saline (n=34). The study drug was administered as a 10mL bolus after skin closure followed by 2mL/hr infusion. All women received multimodal analgesia which included scheduled NSAIDs and acetaminophen. The mean amount of oxycodone administered during the first 48 hours (primary outcome) was not significantly different (47.5 $\pm$ 20.9mg in the ropivacaine group versus 57.8 $\pm$ 29.4mg in the placebo group, p=0.10). There were also no significant differences in pain scores or patient satisfaction scores.

Co-Existing Disease

Obesity

72. Ross VH, Dean LS, Thomas JA, Harris LC, Pan PH: **A randomized controlled comparison between combined spinal-epidural and single-shot spinal techniques in morbidly obese parturients undergoing cesarean delivery: time for initiation of anesthesia.** Anesthesia and analgesia 2014; 118: 168-72

This randomized controlled study (n = 41) compared the time to perform a single shot spinal (SSS) with the time to perform a combined spinal epidural (CSE) technique in patients weighing greater than 100kg undergoing elective cesarean delivery. The mean body mass was not different between groups (48.7 $\pm$ 7.6 kg/m^2 for SSS *versus* 49.9 $\pm$ 8.6 kg/m^2 for CSE) nor was the difference in the median time to perform the techniques [210 (116-592)seconds for SSS *versus* 180 (75-450)seconds for CSE; p = 0.36]. Total number of attempts was greater in the SSS technique [5 (4-10) SSS attempts *versus* 3 (1-4) CSE attempts; p = 0.007]. The authors conclude that "the CSE technique is non-inferior to the SSS technique in morbidly obese parturients for time of initiation… and may be accomplished with fewer attempts with experienced residents."

73. Eley VA, Donovan K, Walters E, Brijball R, Eley DS: **The effect of antenatal anaesthetic consultation on maternal decision-making, anxiety level and risk perception in obese pregnant women**. International journal of obstetric anesthesia 2014; 23: 118-24

This study showed that obese parturients had reduced decisional conflict scores (indicating they were more likely to implement a decision) after antenatal consultation. The authors collected data on decisional conflict, anxiety, and risk perception *prior to* and *two weeks after* antenatal anesthetic consultation. The mean gestation age at time of consultation was 32.8 weeks. Decisional Conflict Scale (DCS) (30.0 +/- 20.4 vs. 16.5 +/-12.4, p<0.001) and anxiety (9.4 +/- 3.1 vs. 8.5 +/- 2.8, p = 0.002) scores were significantly lower after the consultation. A DCS score goes from 0 (no conflict) to 100 (highest decisional conflict) and a score of <25 is associated with implementing decisions while a score of >37.5 is associated with decisional delay. Nulliparous women and those who had never before experienced neuraxial anesthesia showed higher baseline DCS scores and were more likely to change their analgesia preference after consultation. While most women found the consultation reassuring, 11% described the consultation as a negative experience a majority of which remained unaware of the anesthetic risks of obesity in pregnancy. The content of the consultation and the person performing the consultation were not standardized. The authors conclude that their results support the practice of referral of parturients with high BMI for anesthetic consultation.

74. Tonidandel A, Booth J, D'Angelo R, Harris L, Tonidandel S: **Anesthetic and obstetric outcomes in morbidly obese parturients: a 20-year follow-up retrospective cohort study.** International journal of obstetric anesthesia 2014; 23: 357-64

This matched cohort study looking at anesthetic and obstetric outcomes in morbidly obese parturients was modeled after a previous study performed over 20 years ago. The authors compared 230 morbidly obese parturients (>300 lbs) to matched controls. Like previous studies, the authors confirmed that morbidly obese patients are at increased risk for antenatal disease (hypertensive disease of pregnancy, diabetes), failed labor analgesia (17% vs. 3%, p<0.01), longer first stage of labor, and cesarean delivery (50% vs. 32%, p<0.001). Other interesting findings were that the use of neuraxial block during labor was negatively correlated with the risk for cesarean delivery (p<0.0001) and that operative duration did not differ between groups. Finally, in comparing this recent data to their 1993 data, morbidly obese women in this study were significantly less likely to receive a general anesthetic (3% vs. 24%, p<0.01).

75. Butcher M, George RT, Ip J, Campbell JP, Yentis SM: **Identification of the midline by obese and non-obese women during late pregnancy**. Anaesthesia 2014; 69: 1351-4

This study concluded that obese women were less accurate at identifying the middle of their back than the non-obese women. Initially, 50 non-laboring women (25 with a BMI ≥30, 25 with a BMI <30) were asked to touch the "middle" of their back. Ultrasound was then used to identify the true midline. Only 52% of the obese group were accurate to within 5 mm in identifying their midline by pointing, compared with 84% of non-obese women (p = 0.03). Next, a horizontal line was drawn across the woman's back at L3-4 and 5-mm markings were made along the line in both directions starting at the midline. A sharp stimulus was applied at each marking with the subject being asked to describe it as being "left", "right" or in the middle of her back. Obese women displayed a wider discrimination range for sharp stimulus (median 33 (25-45) vs. 18 (13-25), p<0.0001) than non-obese patients, indicating that they were less likely to accurately describe the location of the pinprick stimulus. The authors D.O. comment that based on their results, obese women often will be able to help identify midline during central neuraxial blockade, just not as well as non-obese women.

76. Girsen AI, Osmundson SS, Naqvi M, Garabedian MJ, Lyell DJ: **Body mass index and operative times at cesarean delivery.** Obstetrics and gynecology 2014; 124: 684-9

This study was a secondary analysis of pre-existing data that had previously been used in a prospective cohort observational study looking at the risk of uterine rupture. Data from over 21,000 women undergoing primary (12,832; 60%) or repeat (8,540; 40%) cesarean delivery was evaluated to determine if there were differences in incision-to-delivery and total operative times among women73 stratified into four BMI categories at time of delivery (normal 18.5-24.9, overweight 25.0-29.9, obese 30.0-39.9, morbidly obese 40.0 and greater). Both incision-to-delivery interval and total

operative times were significantly longer among overweight (median (IQ) times 9.0 (6.0) and 45.0 (21.0) minutes), obese (10.0 (7.0) and 48.0 (22.0) minutes), and morbidly obese women (12.0 (8.0) and 55.0 (26.0) minutes) when compared to women with normal BMI at delivery (9.0 (5.0) and 43.0 (20.0) minutes, p <0.001). Additionally, the odds for *prolonged* incision to delivery (18 minutes or longer) were significantly associated with obese BMI (OR 1.62) and morbidly obese BMI (OR 2.81). The authors point out that although the absolute increase in incision-to-delivery interval may not be clinically relevant from most women, the increase in prolonged incision-to-delivery interval likely is.

77. Aune D, Saugstad OD, Henriksen T, Tonstad S: **Maternal body mass index and the risk of fetal death, stillbirth, and infant death: a systematic review and meta-analysis**. JAMA 2014; 311: 1536-46

This systematic review and meta-analysis was conducted to clarify the association between maternal BMI and risk of fetal death, stillbirth, and infant death. They included 38 different studies from across the world and stratified BMI in increments of 5 BMI units. The relative risk of fetal death per 5 BMI units was 1.21 (95% CI 1.09-1.35, p<0.001) with evidence for a nonlinear association with a steeper curve at the higher levels of BMI. The relative risk of stillbirth was 1.28 (95% CI, 1.15-1.43, p<0.001) per 5 BMI units, and this association appeared to be almost linear. The relative risk of infant death per 5 BMI units was 1.18 (95% CI, 1.09-1.28, p = 0.003). The greatest risk was observed in the category of severely obese women; women with a BMI of 40 had an approximate 2-to-3 fold increase in the RR of these outcomes vs. those with a BMI of 20. However, even modest increases in maternal BMI were associated with increased risk of fetal /infant death and stillbirth. The positive dose-response relationship between increasing maternal BMI and these risks suggests an underlying biological relationship between maternal adiposity and fetal and infant death.

Obstructive sleep apnea

78. Louis J, Mogos M, Salemi J, Redline S, Salihu H: **Obstructive sleep apnea and severe maternal-infant morbidity/mortality in the United States**, 1998-2009. Sleep 2014; 37: 843-9

This retrospective cross-sectional analysis of utilized the Nationwide Inpatient Sample database and ICD-9-CM codes to identify patients with obstructive sleep apnea (OSA) as well as determine length of hospital stay, in-hospital mortality and a number of other maternal and neonatal coexisting diseases. The authors found that in 1998 the rate of an OSA diagnosis was 0.7 per 10,000 maternal hospital discharges which climbed to 7.9 per 10,000 in 2009 (average annual increase of 24%). Women with OSA were more likely to be older, non-Hispanic black, low-income, have Medicare/Medicaid, have a previous cesarean delivery, and use tobacco, illicit drugs or alcohol during pregnancy. After attempting to control for these confounders and obesity, OSA was associated with preeclampsia (OR 2.5; 95% CI 2.2 – 2.9), eclampsia (OR 5.4; 95% CI 3.3 - 8.9), cardiomyopathy (OR 9.0; 95% CI 7.5 - 10.9), congestive heart failure (OR 8.9; 95% CI 7.5-10.7), pulmonary edema (OR 7.5; CI 95% 4.6 - 12.2), and pulmonary embolism (OR 4.5; CI 2.3-8.9). Women with OSA had a fivefold increased odds of in-hospital mortality (95% CI 2.4 - 11.5). Early onset delivery but not fetal growth restriction or stillbirth was also associated with OSA.

79. Pamidi S, Pinto LM, Marc I, Benedetti A, Schwartzman K, Kimoff RJ: **Maternal sleep-disordered breathing and adverse pregnancy outcomes: a systematic review and metaanalysis**. American journal of obstetrics and gynecology 2014; 210: 52 e1-52 e14

This metaanalysis systematically review initially including 4386 original studies published up until June 2012 that evaluated the association between gestation hypertension/preeclampsia, gestational diabetes, low birthweight infants and maternal sleep-disordered breathing. Thirty one studies met their criteria and showed the maternal sleep-disordered breathing was significantly associated with gestational hypertension/preeclampsia (5 studies, pooled OR 2.34, 95% CI 1.6-3.09) and gestational diabetes (5 studies, pooled OR 1.86, 95% CI 1.3-2.42). Although individual studies showed low birthweight infants were also associated with maternal sleep-disordered breathing, the way the data were reported in some of these studies and the heterogeneity of data in the remainder did not allow for pooling of data and meta-analysis.

80. Antony KM, Agrawal A, Arndt ME, Murphy AM, Alapat PM, Guntupalli KK, Aagaard KM: **Obstructive sleep apnea in pregnancy: reliability of prevalence and prediction estimates**. Journal of perinatology 2014; 34: 587-93

This prospective observation study sought to establish a prevalence of OSA in pregnancy as well as sought to determine the validity of two OSA screening scales in pregnancy (the Berlin Questionnaire and the Epworth Sleepiness Scale) in comparison to polysomnography. A total of 1509 women underwent OSA screening, 456 women (30.2%) screened positive by both questionnaires, and 58 women underwent polysomnography testing (398 women did not complete their referral to the sleep center after screening positive). Of the 58 women who completed their referral, 9 tested positive (15.5% of those tested) and 49 women tested negative. This resulted in an estimated point prevalence of OSA in this pregnant population of 4.9%. Therefore, the questionnaires were poorly predictive of OSA and were associated with a high false referral rate. The authors conclude, "…cautious use of these screening tools in clinical obstetrical practice is warranted."

81. Antony KM, Agrawal A, Arndt M, Murphy A, Alapat P, Guntupalli K, Aagaard K: **Association of adverse perinatal outcomes with screening measures of obstructive sleep apnea.** Journal of perinatology 2014; 34: 441-8

This prospective observational study explored the association between OSA and hypertensive disorders of pregnancy and small-for-gestational-age infants. The authors screened 1157 pregnant women of all gestational ages for OSA with the Berlin Questionnaire and the Epworth Sleepiness Scale and referred those that screened positive on for polysomnography. Screening positive on the Berlin Questionnaire was associated with hypertensive disorders of pregnancy (adjusted RR= 1.90, 95% CI 1.52-2.37) but not small for gestational age infants. This association between screening positive on the Berlin Questionnaire and hypertensive disorders held true for both obese and non-obese women. The Epworth Sleepiness Scale was not associated with any outcomes which the authors explained by hypothesizing that the frequency of sleepiness in pregnancy may make it a poor screening symptom for OSA in pregnancy.

82. Facco FL, Ouyang DW, Zee PC, Strohl AE, Gonzalez AB, Lim C, Grobman WA**: Implications of sleep-disordered breathing in pregnancy.** American journal of obstetrics and gynecology 2014; 210: 559 e1-6

This prospective observational study recruited women (n=182) at high risk for sleep disordered breathing and looked for its association with preeclampsia, gestational diabetes, preterm birth, and infant weight. All the patients had either a BMI > 30 kg/m^2 or greater, chronic hypertension, pregestational diabetes, prior preeclampsia, and/or a twin gestation. They had initial polysomnography testing between 6 and 20 weeks and repeat testing between 28 and 37 weeks. Those that tested positive were categorized according to their apnea hypopnea index as mild, moderate or severe. There were no relationships demonstrated between sleep disordered breathing and preeclampsia, preterm birth, or extremes of birthweight. There was a dose-dependent relationship between sleep disordered breathing and the subsequent development of gestational diabetes. In the absence of sleep disordered breathing, 25% of the cohort subsequently developed gestational diabetes, among those with mild sleep disordered breathing 43% developed diabetes, and among those with moderate/severe sleep disordered breathing 63% developed gestational diabetes (p=0.03), which calculates to an adjusted odds ratio for developing gestational diabetes for those with moderate to severe sleep disordered breathing of 3.6 (95% CI 0.6 – 21.8).

83. Practice guidelines for the perioperative management of patients with obstructive sleep apnea: an updated report by the American Society of Anesthesiologists Task Force on Perioperative Management of patients with obstructive sleep apnea. Anesthesiology 2014; 120: 268-86

This practice guideline for the perioperative management of patients with obstructive sleep apnea does not specifically address the management of obstetric patients. It does make statements that could be interpreted to include patients with OSA undergoing cesarean delivery. For example, it states “the benefits (improved analgesia, decreased need for systemic opioids) and risks (respiratory depression from rostral spread) of using an opioid or opioid-local anesthetic mixture rather than local anesthetic alone should be weighed.” It also states that “to reduce opioid requirements, nonsteroidal anti-inflammatory agents and other modalities… should be considered if appropriate,” and delineates that importance of appropriate postoperative monitoring stating patients with OSA “should not be discharged from the recovery area to an unmonitored setting (i.e., home or unmonitored hospital bed) until they are no longer at risk of postoperative respiratory depression.”

Cardiac disease

84. Grotegut CA, Kuklina EV, Anstrom KJ, Heine RP, Callaghan WM, Myers ER, James AH**. Factors associated with the change in prevalence of cardiomyopathy at delivery in the period 2000-2009: a population-based prevalence study**. British journal of obstetrics & gynaecology 2014; 121:1386-94

This population prevalence study from 2000 to 2009 utilized the Nationwide Inpatient Sample to identify pregnant women who were admitted for delivery and their prevalence of cardiomyopathy. The prevalence increased from 0.25 per 1000 deliveries in 2000 to 0.43 per 1000 deliveries in 2009 (p< 0.0001). Women with chronic hypertension were at increased odds of developing cardiomyopathy (OR 13.2; 95% CI 12.5-13.7). Notably, chronic hypertension amongst parturients increased linearly over the 10-year period and was the single identified pre-existing medical condition that explained the increasing prevalence of cardiomyopathy at delivery (p=0.005 for the differences in slopes for linear trends). Of note, the prevalence of cardiomyopathy at delivery did not change for women who did not have chronic hypertension.

85. Zhan Q, Wang X, Yu J, Fan Y. **Umbilical cord blood acid-base status in pregnancy with congenital heart disease.** Acta anaesthesiologica Scandinavica 2014; 58: 851-7.

These authors evaluated the umbilical cord blood from both women with (n=33) and without (n=44) congenital heart disease undergoing elective cesarean delivery. All women underwent CSE anesthesia. Lower umbilical arterial blood pH, lower base excess and lower bicarbonate levels were present in the cord blood of pregnant women with CHD than in healthy women.

Chronic Hypertension

86. Bramham K, Parnell B, Nelson-Piercy C, Seed PT, Poston L, Chappell LC. **Chronic hypertension and pregnancy outcomes: systematic review and meta-analysis.** BMJ 2014; 348: 2301

This systematic review includes retrospective cohorts, prospective cohorts, population studies and appropriate arms of randomized controlled trials to pool pregnancy outcomes of 795,221 pregnancies complicated by chronic hypertension. The authors then compare these outcomes to the outcomes of the US general population from the National Vital Statistics Report of 2006. In comparison, women with chronic hypertension had an increased risk of preeclampsia (RR 7.7; 95% CI 5.7 – 10.1), cesarean delivery (RR 1.3, 95% CI 1.1-1.5), preterm delivery < 37 weeks (RR 2.7, CI 1.9 – 3.6), birth weight <2500g (RR 3.2, CI 2.2 – 4.4), neonatal intensive care unit admission (RR 3.2, CI 2.2 – 4.2), and perinatal death (RR 4.2, CI 2.7 – 6.5). There was heterogeneity in the reported incidences of all outcomes (r^2 = 0.286 -0.766).

Preeclampsia

87. Mehrabadi A, Liu S, Bartholomew S, et al. **Hypertensive disorders of pregnancy and the recent increase in obstetric acute renal failure in Canada: population based retrospective cohort study**. BMJ 2014; 349: 4731

This retrospective cohort study evaluated all hospital deliveries in Canada (excluding Quebec) between 2003 and 2010 (n=2,193,425) for the incidence of obstetric acute renal failure. Rates of obstetric acute renal failure rose from 1.66 to 2.68 per 10,000 deliveries between 2003- 04 and 2009-10 (61% increase, 95% CI 24% to 110%). Adjustment for postpartum haemorrhage and other factors did not attenuate the increase. The temporal increase in acute renal failure was restricted to deliveries with hypertensive disorders. There was no significant increase among women without hypertensive disorders.

88. Zieleskiewicz L, Contargyris C, Brun C, Touret M, Vellin A, Antonini F, Muller L, Bretelle F, Martin C, Leone M: **Lung ultrasound predicts interstitial syndrome and hemodynamic profile in parturients with severe preeclampsia.** Anesthesiology 2014; 120: 906-14

This prospective cohort study enrolled 20 consecutively admitted patients with severe preeclampsia (previous ACOG definition) and 20 healthy parturients, and performed lung and cardiac ultrasound evaluations before and after delivery. Lung edema (as determined by "multiple B-Lines" or "comet tails" on lung ultrasound) was found in 5 (25%) of the patients with severe preeclampsia. Overall, in comparison to healthy parturients, parturients with severe preeclampsia had lung ultrasounds that showed an increased Echo Comet Score (31 versus 0%, P=0.02), an increased B-pattern (25 versus 0%, p=0.047), an increased lung ultrasound score (7 versus 1, p<0.001), and an increased rate of posterior basal lung consolidation (35 versus 0%, p=0.01). Likewise, parturients with severe preeclampsia had echocardiography that showed diastolic dysfunction with an increased E wave velocity (97 versus 79cm/s, p=0.03), an increased E/E' ratio (7.9 versus 6.6, p=0.04), and higher velocity-time index values (21 vs 17cm, p=0.002). Interestingly, the authors found a linear correlation between the E/E' ratio and the number of B-lines quantified by the Echo Comet Score (r=0.66, p<0.001), a linear relationship between the E wave velocity and the Echo Comet Score (r=0.36, p=0.018), and that increased LVEDP (E/E' > 9.5) was associated with an increased Echo Comet Score (95 vs 20, p <0.001). These findings imply a degree of validity to the lung ultrasound test when used in preeclampsia to determine the extent of pulmonary edema. The authors state that this simple test could help guide fluid management in parturients with severe preeclampsia and call for large investigations to determine its usefulness.

89. Pant M, Fong R, Scavone B: **Prevention of peri-induction hypertension in preeclamptic patients: a focused review.** Anesthesia and analgesia 2014; 119: 1350-6

This review summarizes the literature on drugs that have been used to attenuate the hypertensive response to laryngoscopy in preeclamptic patients. The evidence is summarized in a table which includes each drug's onset, duration, fetal to maternal ratio, its neonatal effects, maternal side effects, whether there is data available in preeclamptic patients and the doses studied. The authors emphasize the scant literature available on the use of propofol for this purpose. The authors discourage the use of a magnesium bolus, lidocaine, calcium channel antagonists other than nicardipine, and hydralazine to prevent peri-induction hypertension. The authors state that they utilize esmolol 1.5mg/kg or nitroglycerine 2mcg/kg combined with propofol 2mg/kg depending on the maternal hemodynamic variables at the time. They also state that labetalol, remifentanil and nicardipine are reasonable options, but data is lacking on nicardipine.

Medication Use in Pregnancy

90. Broussard CS, Frey MT, Hernandez-Diaz S, Greene MF, Chambers CD, Sahin L, Collins Sharp BA, Honein MA: **Developing a systematic approach to safer medication use during pregnancy: summary of a Centers for Disease Control and Prevention--convened meeting.** American journal of obstetrics and gynecology 2014; 211: 208-214 e1

The National Center on Birth Defects and Developmental Disabilities (NCBDDD) of the CDC brought together a multidisciplinary panel of experts to develop "a strategy to prioritize, synthesize, evaluate and disseminate the body of evidence on the comparative safety" of various drugs used in pregnancy. The product of the convention is a prototype of a formal review process that will occur to evaluate the quality and strength of the evidence regarding the pharmacologic treatment of various maternal conditions.

Opioid Use in Pregnancy

91. Desai RJ, Hernandez-Diaz S, Bateman BT, Huybrechts KF: **Increase in prescription opioid use during pregnancy among medicaid-enrolled women.** Obstetrics and gynecology 2014; 123: 997-1002

This retrospective cohort study utilized data from the Medicaid Analytical eXtract for 46 U.S. states and Washington, D.C. for the period from 2000-2007 which involved 1.1 million women with completed pregnancies. The authors identified women who filled prescriptions for opioid analgesics using pharmacy-dispensing claims and found that 21.6% (239,381 out of 1,106,757) of pregnant women filled at least one opioid prescription during their pregnancy. The main diagnoses for women receiving the opioid prescriptions were abdominal pain (48.4%), lower back pain (33.0%), headache syndromes (13.3%), joint pain (11.2%) and migraine (7.9%). Overall, 11.1% of pregnant women filled prescriptions for codeine, 10.0% for hydrocodone, 2.9% for propoxyphene and 2.2% for oxycodone. There were substantial regional differences ranging from 9.3% of pregnant women filling opioid prescriptions in the Northeast to 35.8% of pregnant women filling opioid prescriptions in the South. Utah had the highest rate of opioid prescriptions with 41.6% of women filling an opioid prescription during pregnancy. Interestingly, the proportion of pregnant women filling an opioid prescription increased between 2000 and 2007 from 18.5% to 22.8% (p value for the test of linear trend <0.001).

92. Maeda A, Bateman BT, Clancy CR, Creanga AA, Leffert LR: **Opioid Abuse and Dependence during Pregnancy: Temporal Trends and Obstetrical Outcomes**. Anesthesiology 2014; 121: 1158-65

    Accompanied by editorial:

    Flood P, Raja SN. **Balance in Opioid Prescription during Pregnancy**. Anesthesiology 2014; 120:1063-4

This retrospective review abstracted data from the Nationwide Inpatient Sample which included 56,900,512 delivery admissions between 1998 and 2011 in the United States. The authors found that the prevalence of opioid abuse or dependence increased by 127% during that time period—from 1.7 per 1,000 delivery admissions in 1998 to 3.9 per 1000 delivery admissions in 2011 (P for trend is <0.001). The authors analyzed the data between 2007 and 2011 for adverse outcomes while controlling for age group, race, primary payer, previous cesarean delivery, multiple gestation, and maternal preexisting conditions and found that opioid abuse and dependence increased the odds of maternal in-house mortality (adjusted OR 4.6, 95% CI 1.8-12.1), maternal cardiac arrest (adjusted OR 3.6, 95% CI 1.4-9.1) intrauterine growth restriction (adjusted OR 2.7, 95% CI 2.4-2.9), placental abruption (adjusted OR 2.4, 95% CI 2.1-2.6), preterm labor (adjusted OR 2.1, 95% CI 2.0-2.3), oligohydramnios (adjusted OR 1.7, 95% CI 1.6-1.9), blood transfusion (adjusted OR 1.7, 95% CI 1.5-1.9), stillbirth (adjusted OR 1.5, 95% CI 1.3-1.8), premature preterm rupture of membranes (adjusted OR 1.4, 95% CI 1.3-1.6), and cesarean delivery (adjusted OR 1.2, 95% CI 1.1-1.3). Although the risk of anesthesia complications was increased, it did not reach statistical significance (adjusted OR 2.1, 95% CI 0.8-5.3).

Addiction

93. Buckley DN, Ibrahim M: **Brief review: Obstetric care and perioperative analgesic management of the addicted patient.** Canadian journal of anaesthesia 2014; 61: 154-163

These authors searched seven databases for studies on perioperative management of patients addicted to alcohol and drugs. Although a limited number of publications exist in the obstetric population, these studies focus on addiction management during pregnancy and D.O. not address peripartum analgesic requirements. Although the authors provide recommendations for the perioperative and peripartum care of addicted patients, they admit that clinical trials are sparse and the physiologic and affective factors that impact perioperative/peripartum management remain poorly understood.

Major Mental Disorders

94. Babbitt KE, Bailey KJ, Coverdale JH, Chervenak FA, McCullough LB: **Professionally responsible intrapartum management of patients with major mental disorders**. American journal of obstetrics and gynecology 2014; 210: 27-31

This opinion was published by psychiatrists, ethicists, and obstetricians and proposes an algorithm for the management of parturients with major mental disorders during labor and delivery. The algorithm asks 5 questions: 1) Does the patient have the capacity to consent to treatment? 2) Is there time to attempt restoration of capacity? 3) Is there an opportunity for substituted judgment? 4) Is the patient accepting treatment? 5) Is there an opportunity for active assent? If the above 5 questions are “no,” then the algorithm recommends “coerced clinical management as the least worst” alternative.

Infectious Disease

95. Jamieson DJ, Uyeki TM, Callaghan WM, Meaney-Delman D, Rasmussen SA: **What obstetrician-gynecologists should know about ebola: a perspective from the centers for disease control and prevention.** Obstetrics and gynecology 2014; 124: 1005-10

This commentary published by Centers for Disease Control and Prevention gives obstetricians background and guidance regarding caring for pregnant patients who could potentially have Ebola. These experts state that "limited evidence suggests that pregnant women are at increased risk for severe illness and death when infected with Ebola Virus." They also state that pregnant women with Ebola are at an increased risk for spontaneous abortion and pregnancy-associated hemorrhage and neonates born to mothers with Ebola Virus have not survived. The authors suggest screening of all patients presenting to labor and delivery units regarding travel in West Africa in the past 21 days, and if a pregnant woman screens in positive and ultimately is diagnosed, then the clinical guidance would be the same as for nonpregnant adults, "with an emphasis on monitoring and early treatment of hemorrhagic complications." They also remind providers to observe all prevention precautions for the neonates born to these women.

96. Delamou A, Hammonds RM, Caluwaerts S, Utz B, Delvaux T: **Ebola in Africa: beyond epidemics, reproductive health in crisis.** Lancet 2014; 384: 2105

This letter to the editor presents the declining admissions to the Matam Maternity Hospital in Conakry, Guinea (904 admissions between January 2014 and March 2014 and only 123 admissions between July 2014 and September 2014). The authors believe this is a result of women fearing contraction of the Ebola virus at a health facility. As a result, the authors state, "we are concerned that women in need of reproductive health care because of pregnancy, childbirth, and post-partum related complications, including hemorrhage, eclampsia, obstructed labor, and abortion, will not have the necessary and even life-saving care and attention." They go on to state that the United Nations Population Fund "estimates that 15% of the 800,000 women who will give birth in the next 12 months in Guinea, Liberia, and Sierra Leone could die of complications because of inadequate emergency obstetric care…"

97. Cambic CR, Avram MJ, Gupta DK, Wong CA: **Effect of ritonavir-induced cytochrome P450 3A4 inhibition on plasma fentanyl concentrations during patient-controlled epidural labor analgesia: a pharmacokinetic simulation.** International journal of obstetric anesthesia 2014; 23: 45-51

Because ritonavir is known to decrease fentanyl clearance in human volunteers, this study simulated the effect the antiretroviral drug ritonavir had on plasma fentanyl concentrations during epidural labor analgesia. The authors modeled the "worst case scenario" that could compromise patient safety. They posited the administration of an 80mcg fentanyl bolus over the first 20 minutes of epidural analgesia followed by one of six PCEA regimens which included infusions ranging between 16 and 24 mcg/hour fentanyl with 16mcg bolus doses every 20 minutes, and in some scenarios, an additional 100mcg fentanyl bolus. They utilized the most detailed pharmacokinetic description of drug absorption from the epidural space. The results of the simulations showed that in spite of ritonavir-induced CYP2A4 inhibition of fentanyl metabolism, no scenario produced plasma fentanyl concentrations that are known to be associated with a 50% decrease in minute ventilation.

98. Collins S, Ramsay M, Slack MP, Campbell H, Flynn S, Litt D, Ladhani SN**: Risk of invasive Haemophilus influenzae infection during pregnancy and association with adverse fetal outcomes**. JAMA : 2014; 311: 1125-32

    Accompanied by editorial:

    Edwards M.S.. **Adverse fetal outcomes: expanding the role of infection**. JAMA; 311: 1115-6

This retrospective study determined the epidemiology of invasive *Haemophilus influenzae* between 2009 and 20012 in England and Wales. The National Health Service laboratory provided all isolated *H. influenzae* cases and Public Health England sent questionnaires to the general practitioners that cared for the patients. Among 45,215,800 woman-years, 2568 cases if invasive *H. influenzae* were identified, 171 women had invasive *H. influenzae*, and 75 of the women infected were pregnant at the time of infection. The authors calculate that the incidence of invasive unencapsulated *H. influenzae* was 17.2 (95% CI, 12.2-24.1, $p<0.001$) times greater in pregnant compared to nonpregnant women. They also found that unencapsulated *H. influenzae* infection during the first 24 weeks of pregnancy was associated with fetal loss or extremely premature birth, and in the second half of pregnancy was associated with premature birth and stillbirth. The authors conclude that in cases of intrapartum sepsis, intrauterine death, septic abortion, or premature rupture of membranes that vaginal and placental samples should be routinely tested using culture media that support the growth of *H. influenzae*.

Morbidity and Mortality

OB anesthesia quality and safety

99. D'Angelo R, Smiley RM, Riley ET, Segal S: **Serious complications related to obstetric anesthesia: the serious complication repository project of the Society for Obstetric Anesthesia and Perinatology**. Anesthesiology 2014; 120: 1505-12

    Accompanied by editorial:

    Bateman BT, Tsen LC: **Anesthesiologist as epidemiologist: insights from registry studies of obstetric anesthesia-related complications.** Anesthesiology 2014; 120: 1311-2

The Serious Complication Repository Project of the Society for Obstetric Anesthesia and Perinatology incorporated 30 institutions over a 5 year period during which time quality reports from each institution was sent into a central repository with the goal of establishing the incidences and the risk factors associated with serious complications in obstetric anesthesia. The researchers captured 257,000 anesthetics and reported 157 total serious complications [incidence 1:1,959 (95% CI 1,675 – 2,294)]; 85 of which were anesthesia related [incidence 1:3,021 (95% CI 2,443 - 3,782)]. Among all the complications, the incidence of maternal death was 1:10,250 (95% CI 7,180 – 15,192); cardiac arrest 1:7,151 (95% CI 5,319 – 9,615); myocardial infarction 1:153,748 (95% CI 42,562 – 1,269,541); serious neurologic injury 1:11,389 (95% CI 7,828-17,281); anaphylaxis 1:61,499 (95% CI 26,353– 189,403); and respiratory arrest in the labor suite 1:8,455 (95% CI 5,714 – 12,500). Specifically for anesthesia-related complications, there were no maternal deaths and the following incidences calculated: cardiac arrest 1:128,393 (95% CI 35,544 – 1,060,218); myocardial infarction 1:128,393 (95% CI 35,544 – 1,060,218); epidural abscess/meningitis 1:62,866 (95% CI 25,074 – 235,620); epidural hematoma 1:251,463 (95% CI 46,090 – 10,142,861); serious neurologic injury 1:35,923 (95% CI 17,805 – 91,244); failed intubation 1:533 (95% CI 290 – 971); high neuraxial block 1:4,336 (95% CI 3,356– 5,587); respiratory arrest in the labor suite 1:10,042 (95% CI 6,172 – 16,131); and unrecognized spinal catheter 1:15,435 (95% CI 9,176 – 25,634). Interestingly, there were no cases of aspiration reported. The authors were not able to comment on risk factors because of the low number of events. The editorial that accompanies the article authored by Dr. Brian Bateman emphasizes the reassuringly low rates of epidural hematoma, infection or serious neurologic injury, but highlights the maternal deaths that occurred in about 1 out of every 10,000 deliveries (consistent with U.S. estimates) with hemorrhage being the leading cause of both arrest and death. Dr. Bateman calls for anesthesiologists to play a role in reducing the rate of maternal mortality in the United States and actively transition to the role of "peri-delivery physicians" drawing on our operative and critical care experience to manage high risk and critically ill parturients.

100. El Haj Ibrahim S, Fridman M, Korst LM, Gregory KD: **Anesthesia complications as a childbirth patient safety indicator**. Anesthesia and analgesia 2014; 119: 911-7

These authors designed an experimental "Anesthesia Complication Quality Indicator" specific to childbirth using the methodology of the Agency for Healthcare Research and Quality (AHRQ), Patient Safety Indicators (PSI). They then used the California hospital discharge data to calculate hospital-specific rates, adjusting for age, race, and pregnancy complications. Among 508,842 deliveries in 254 California hospitals, the rate of anesthesia complications was 0.31%. Note that this was greater than the standard AHRQ population which included all surgery types whose rate was 0.13%. Stratified by mode of delivery, anesthesia childbirth complication rates were 0.49% for caesarean delivery and 0.22% for vaginal delivery ($p<0.0001$). The authors found that 13 hospitals were in the upper quartile of outliers with adjusted rates from 0.52% to 2.13%. They conclude that a childbirth-related AHRQ PSI could "identify hospitals with extreme complication rates that may provide insights into systematic ways to improve patient safety."

OB quality and safety

101. Pettker CM, Thung SF, Lipkind HS, Illuzzi JL, Buhimschi CS, Raab CA, Copel JA, Lockwood CJ, Funai EF: **A comprehensive obstetric patient safety program reduces liability claims and payments.** American journal of obstetrics and gynecology 2014; 211: 319-25

These authors describe their experience with a comprehensive patient safety program at Yale-New Haven Hospital that was successful in reducing their liability claims and payments over the 10-year period while the state of Connecticut claims and payments did not reduce. Their effort included an outside expert review, increased use of protocols and guidelines, the hiring of an obstetric safety nurse, the advent of anonymous event reporting, the introduction of obstetric hospitalists, the creation of an obstetric patient safety committee, the annual use of a Safety Attitude Questionnaire, required team training, and electronic fetal heart rate certification.

102. Howell EA, Zeitlin J, Hebert PL, Balbierz A, Egorova N: **Association between hospital-level obstetric quality indicators and maternal and neonatal morbidity.** JAMA 2014; 312: 1531-41

This observational study examined the New York City hospital discharge and birth certificate data sets from the year 2010 and examined whether maternal and neonatal morbidity had any association to the two current Joint Commission obstetric quality indicators: 1) non-medically indicated deliveries between 37 and 39 weeks gestation and 2) cesarean delivery performed in low-risk mothers. Maternal morbidity occurred in 2372 of 115,742 deliveries (2.4%) and neonatal morbidity occurred in 8,057 of 103,416 term newborns without anomalies (7.8%). Neither of the maternal quality indicators was associated with severe maternal or neonatal complications. The risk ratio for elective delivery before 39 weeks was 1.00 (95% CI 0.98-1.02) for maternal morbidity and 0.99 (95% CI 0.91-1.01) for neonatal morbidity. The risk ratio for cesarean delivery performed in low-risk mothers was 0.99 (0.95% CI 0.96-1.01) for maternal morbidity and 1.01 (95% CI 0.99-1.03) for neonatal morbidity. The authors conclude that there were no correlations between the Joint Commission quality indicators and maternal and neonatal complications.

103. Hinton L, Locock L, Knight M: **Experiences of the quality of care of women with near-miss maternal morbidities in the UK.** British journal of obstetrics & gynaecology 2014; 121 Suppl 4: 20-3

This qualitative interview study involved 35 women and 11 of their partners who had experienced a severe life-threatening complication in pregnancy such as uterine rupture, amniotic fluid embolism, massive hemorrhage or severe sepsis. The subjects were interviewed regarding their experiences and key factors were identified by women which they associated with good-quality care. These included small, personal touches and reassurances from doctors and nurses during the event itself (examples included hand-holding and telling patients they were going to be okay); constant communication with a health professional for both the woman and her family during the event itself (explaining what was going on); sensitivity to a postpartum woman's emotional, physical and breastfeeding needs after childbirth, even in the intensive care unit; the ability to communicate with healthcare professionals afterwards and to go through the notes regarding the event to help women make sense of the experience; the ability to recognize the long-lasting mental health impacts and offer counselling resources to patients.

104. Callaghan WM, Grobman WA, Kilpatrrick SJ, Main EK, D'Alton M: **Facility-based identification of women with severe maternal morbidity: it is time to start**. Obstetrics and Gynecology 2014; 123:978-81

This commentary discusses the importance of hospitals defining "severe maternal morbidity" and reviewing the care of patients that meet the definition in order to improve patient safety. The authors propose the transfusion of 4 or more units of blood products and/or admission to the intensive care unit as a starting point for helping hospitals identify women who may have experienced severe maternal morbidity to allow for subsequent case investigation which would thereby allow hospitals to identify failures within their systems.

105. Kilpatrick SJ, Berg C, Bernstein P, Bingham D, Delgado A, Callaghan WM, Harris K, Lanni S, Mahoney J, Main E, Nacht A, Schellpfeffer M, Westover T, Harper M. **Standardized severe maternal morbidity review: rationale and process**. Obstetrics and Gynecology 2014; 124: 361-6

This expert opinion presents guidance for a standardized severe maternal morbidity interdisciplinary review process to identify system, professional, and facility factors that can be ameliorated, with the overall goal of improving institutional obstetric safety and reducing severe morbidity and mortality among pregnant and recently pregnant women. The authors discuss the review committee's organization, the review process, the medical record abstraction and assessment, the review culture, the data management, the review timing, and the review confidentiality.

106. Callaghan WM: **State-based maternal death reviews: assessing opportunities to alter outcomes**. American journal of obstetrics and gynecology 2014; 211: 581-2

This author's editorial calls for state-based identification and investigation into maternal deaths in order to better understand the causes of and risk factors for maternal death. The author states that many states D.O. not currently review maternal deaths. Callaghan discusses identifying maternal deaths, deciphering which of these are potentially preventable, and then utilizing a state's department of health to improve systems of care to prevent such maternal deaths in the future.

Severe maternal morbidity and mortality in developed countries

107. Grobman WA, Bailit JL, Rice MM, Wapner RJ, Reddy UM, Varner MW, Thorp JM, Jr., Leveno KJ, Caritis SN, Iams JD, Tita AT, Saade G, Sorokin Y, Rouse DJ, Blackwell SC, Tolosa JE, Van Dorsten JP: **Frequency of and factors associated with severe maternal morbidity.** Obstetrics and gynecology 2014; 123: 804-10

This study is a secondary analysis of data from the "Assessment of Perinatal Excellence" cohort from the Eunice Kennedy Shriver National Institutes of Child Health and Human Development Maternal-Fetal Medicine Units Network. It involved 115,502 deliveries between 2008 and 2011 that occurred in 25 hospitals in the United States. The authors created a scoring system to classify severe morbidity which included unanticipated surgical intervention (1 point), intubation for more than 12 hours (2 points), red blood cell transfusion greater than 3 units (3 points), admission to the ICU (4 points), failure of at least one organ system (5 points). Overall, 332 women (2.9/1000 births, 95% CI, 2.6-3.2) had a total of 8 or more points which classified them as experiencing severe morbidity. The primary etiology was determined to be as follows: Postpartum hemorrhage (n=158, 47.6%), hypertension complications (n=68, 20.5%), acute cardiopulmonary complications such as cardiomyopathy, cardiac arrest, ARDS, or pulmonary edema (n = 63, 19.0%), infection (n=20, 6.0%), preexisting maternal medical conditions (n=8, 2.4%), trauma (n=4, 1.2%), acute neurologic complications (n=3, 0.9%), iatrogenic events (n=2, 0.6%), and pregnancy specific conditions such as acute fatty liver or amniotic fluid embolism (n = 2, 0.6%). Patient factors associated with severe morbidity included placenta accreta, antenatal anticoagulation, cigarette use, hypertension, diabetes, abruptio placentae, and prior cesarean delivery.

108. Frolich M.A., Banks C, Brooks A, Sellers A, Swain R, Cooper L: **Why D.O. pregnant women die? A review of maternal deaths from 1990 to 2010 at the University of Alabama at Birmingham**. Anesthesia and analgesia 2014; 119: 1135-9

This case-control study at the University of Alabama at Birmingham reviewed all maternal deaths between 1990 and 2010 in order to determine if pregnant women who were African American were more likely to die than Caucasian women. Each maternal death was matched 1:2 with women who did not die and delivered as close as possible to the same time. The data did not suggest racial disparity in maternal deaths with the proportion of African American women in the maternal death group at 57% (42 of 77) and in the control group 61% (94 of 154) (p=0.23). The authors also reported that secondary analysis showed no significant association of mortality with insurance status, income, BMI, marital status, or parity. There was a significant difference between case and control patients in the residence-to-hospital distance, gestational age, fetal survival, duration of hospital stay, lack of prenatal care and cesarean delivery rate. Of note, distance between a patient's residence and the hospital differed by race, with African American women living significantly closer than Caucasian women, and a longer distance from the hospital was associated with a more frequent mortality. The authors suggest that "the next step toward understanding racial differences in maternal deaths reported in the United States should be directed at the health care delivery outside the tertiary care hospital setting, particularly at eliminating access barriers to health care for all women."

109. Clark SL, Christmas JT, Frye DR, Meyers JA, Perlin JB: **Maternal mortality in the United States: predictability and the impact of protocols on fatal postcesarean pulmonary embolism and hypertension-related intracranial hemorrhage**. American journal of obstetrics and gynecology 2014; 211: 32 e1-9

This retrospective review evaluated maternal deaths between 2007 and 2012 among the 110 maternal/newborn facilities in 21 states that comprise the Hospital Corporation of America (HCA). This review is a follow-up to a similar maternal mortality review that occurred in the HCA system between 2000 and 2006 as a result of which three disease-specific protocols were introduced in all HCA hospitals: 1) the universal use of intra- and postoperative pneumatic compression devices in women who undergo cesarean delivery; 2) a specific checklist-based protocol to promptly recognize and treat hypertensive crisis and preeclampsia-related pulmonary edema; and 3) a checklist-based protocol directed at obtaining assistance and timely fluid and blood replacement in cases of postpartum hemorrhage. Between 2007 and 2012 there were 81 maternal deaths in 1,256,020 deliveries for a rate of 6.4 per 100,000 births. Between the 2000-2006 data and the 2007-2012 data, there was a significant decline in postcesarean pulmonary embolism (p = 0.038), and the rate of deaths from hypertensive diseases of pregnancy (p = 0.02). The rate of death as a result of hemorrhage did not decrease, and trended toward an increase (p = 0.07). The authors discuss the success of the protocols implemented regarding prevention of postcesarean pulmonary embolism and preeclampsia, but admit that more needs to be done beyond the implementation of hemorrhage protocols to prevent maternal death from hemorrhage.

110. Knight M, Kenyon S, Brocklehurst P, Neilson J, Shakespeare J, Kurinczuk JJ (Eds.) on behalf of MBRRACE-UK. **Saving Lives, Improving Mothers' Care - Lessons learned to inform future maternity care from the UK and Ireland Confidential Enquiries into Maternal Deaths and Morbidity 2009–12**. Oxford: National Perinatal Epidemiology Unit, University of Oxford 2014.

This most recent triennial report (2009-12) shows an overall decrease in the rate of maternal death across the UK (357 maternal mortalities), and for the first time includes Ireland's data (203 maternal mortalities). Maternal death from genital tract sepsis fell, but death from different infections increased, attributable to the influenza A H1N1 pandemic (1 in 11 of all deaths). Rates of obstetric causes of maternal deaths continued to fall, with death from hypertensive disorders the lowest it's been since 1952. However, maternal death from indirect causes continued to rise, with women with severe co-existing disease such as heart disease, epilepsy, cancer, diabetes and mental health disease vulnerable. The report emphasizes the importance of influenza immunization in pregnancy, multidisciplinary care for women with co-existing disease, watching for early obstetric warning signs with rapid escalation of care when indicated, the provision of obstetric critical care for deteriorating women, and the early suspicion of sepsis.

111. Creanga AA, Bateman BT, Kuklina EV, Callaghan WM: **Racial and ethnic disparities in severe maternal morbidity: a multistate analysis, 2008-2010**. American journal of obstetrics and gynecology 2014; 210: 435 e1-8

This study utilized delivery data from seven states through the State Inpatient Database to examine delivery hospitalizations from 2008-2010. The purpose of the study was to use population-level data to examine racial and ethnic disparities in severe maternal morbidity indicators during delivery hospitalization. Blood transfusion, as collected by ICD-9 codes, was the most common indicator of severe morbidity. Overall, severe maternal morbidity rates that were measured with and without blood transfusion were, respectively, 150.7 and 64.3 per 10,000 delivery hospitalizations. Race/ethnicity was found to be an important predictor of severe morbidity with non-Hispanic black women reported to have the highest rates of severe morbidity with blood transfusion compared to other racial groups.

112. Creanga A, Berg C, Callaghan W, et al. **Maternal Mortality and Morbidity in the United States: Where Are We Now?** Journal Of Women's Health 2014;23(1):3-9.

These authors report the work of the Division of Reproductive Health at the Centers for Disease Control and Prevention on severe maternal morbidity and mortality in the US. This division of the CDC collects death certificates from all states of women who die during or within one year of pregnancy. Notably, the pregnancy-related mortality ratio has increased steadily from 7.2 deaths per 100,000 live births in 1987 (when they first started collecting data) to 17.8 deaths per 100,000 live births in 2009. Race differentials are striking. There have been changes to the way the data are collected which the authors state could account for the increasing numbers. However, the increase trends of severe maternal morbidity mirror the increases in maternal mortality. And, the authors postulate from other studies that an increasing number of women with chronic disease are getting pregnant. Notably, there was a disproportionately high rate of maternal deaths in 2009 due to the H1N1 influenzae A pandemic.

The national partnership for maternal safety

113. D'Alton ME, Main EK, Menard MK, Levy BS: **The national partnership for maternal safety**. Obstetrics and gynecology 2014; 123: 973-7

This commentary discusses the 2012 formation of the National Partnership for Maternal Safety which is a multi-stakeholder organization comprised from leaders across the spectrum of women's health (including SOAP) with the goal of improving maternal health and safety in the United States. This organization has developed three core patient safety bundles-- obstetric hemorrhage, severe hypertension in pregnancy and venous thromboembolism prevention in pregnancy. They have also created supplemental patient safety bundles which include maternal early warning criteria, case review packages for use in cases of severe maternal morbidity and mortality, and family and staff support for patients families and staff who experience a severe maternal event. The steering committee of the National Partnership for Maternal Safety and the Council on Patient Safety in Women's Health Care believe the three core patient safety bundles should be implemented in every birthing facility in the United States within the next 3 years with the goal of reducing maternal death and morbidity by 50% in the next 5 years.

114. http://www.safehealthcareforeverywoman.org

This is the website for the Council on Patient Safety in Women's Health Care whose mission is to "continually improve patient safety in women's health care through multidisciplinary collaboration that drives culture change." The goal of the organization is to foster investigation to better understand the causation of harm, to foster programs to implement patient safety initiatives, to educate to promote patient safety and to foster a health care culture of respect, transparency and accountability. The website introduces their National Improvement Challenge which seeks to improve maternal care through the development of patient safety and quality improvement programs at the residency and educational program level. It also offers resources such as free safety teleconferences, patient safety bundles (e.g. the "hemorrhage bundle"), as well as forms that can help institutions through the process of reviewing maternal morbidity events.

115. Mhyre JM, D'Oria R, Hameed AB, Lappen JR, Holley SL, Hunter SK, Jones RL, King JC, D'Alton ME: **The maternal early warning criteria: a proposal from the national partnership for maternal safety**. Obstetrics and gynecology 2014; 124: 782-6

Reviewed under "Maternal early warning systems"

Severity of illness scores in pregnancy

116. Rojas-Suarez J, Paternina-Caicedo AJ, Miranda J, Mendoza R, Duenas-Castel C, Bourjeily G: **Comparison of Severity-of-Illness Scores in Critically Ill Obstetric Patients: A 6-Year Retrospective Cohort**. Critical care medicine 2014; 42: 1047-54

    Accompanied by editorial:

    Lapinsky SE: **Severity of illness in pregnancy**. Critical care medicine 2014; 42: 1284-5

This retrospective study evaluated multiple mortality prediction scores on all obstetric patients admitted to the intensive care unit between 2006 and 2011 in a Columbian teaching hospital. Overall, 726 obstetric critical care patients were included. The Simplified Acute Physiology Score 2 and the Simplified Acute Physiology Score 3 overestimated mortality. The Mortality Probability Model III was inaccurately calibrated. The Mortality Probability Model II (MPM II) predicted mortality best with a mortality ratio of 0.88 (95% CI 0.60-1.25). This article is accompanied by an editorial which discusses the value of ICU scoring systems and the very good discrimination and calibration that the MPM II providing, suggesting that "this is a score against which new (critical care obstetric patients) should be compared."

117. Bandeira AR, Rezende CA, Reis ZS, Barbosa AR, Peret FJ, Cabral AC: **Epidemiologic profile, survival, and maternal prognosis factors among women at an obstetric intensive care unit**. Internation journal of gynecology & obstetrics 2014; 124: 63-6

This prospective cohort study of women admitted to a Brazilian obstetric intensive care unit between 2007 and 2009, found that among 298 women admitted to the ICU, mortality was 4.7% (n=14). Hypertensive disorders (46%) hemorrhage (16%), sepsis (14%) and heart disease (5.7%) were the main causes of admission. Most of the survivors were admitted for direct obstetric causes (75.5%; p=0.044). Survival rates of patients admitted for indirect causes were lower than those admitted for direct obstetric causes (27.8 versus 19.6 days, respectively, p=0.019). The authors conclude that the patients that were admitted to their ICU with direct obstetric causes had a better prognosis.

Maternal early warning systems

118. Mhyre JM, D'Oria R, Hameed AB, Lappen JR, Holley SL, Hunter SK, Jones RL, King JC, D'Alton ME: **The maternal early warning criteria: a proposal from the national partnership for maternal safety**. Obstetrics and gynecology 2014; 124: 782-6

This commentary reviews the evidence and considerations for implementation regarding the Obstetric Early Warning Criteria, a list of abnormal patient parameters that trigger urgent bedside evaluation by a clinician who can then potentially pursue diagnostic and therapeutic interventions. The authors discuss the various types of early warning systems (single parameter systems versus multi-parameter aggregate-weighted tools) and the sensitivity and specificity of the Modified Early Obstetric Warning system which was recommended in the 2003-2005 Saving Mother's Lives report. In the United States, the National Partnership for Maternal Safety brought together a workgroup that defined this list of abnormal parameters which compromise the "Maternal Early Warning Criteria" which include HR <50 or >120, SBP <90 or >160; DBP >100; RR <10 or >30; Oxygen saturation on room air < 95%; UOP <35mL/hr for $\geq$2 hour; and various maternal symptoms such as agitation, confusion, unresponsiveness, shortness of breath or non-remitting headache. The authors of this commentary recommend randomized controlled trials to evaluate whether the Maternal Early Warning Criteria facilitates more timely diagnosis and treatment and thus limit the severity of obstetric morbidity.

119. Isaacs RA, Wee MY, Bick DE, Beake S, Sheppard ZA, Thomas S, Hundley V, Smith GB, van Teijlingen E, Thomas PW: **A national survey of obstetric early warning systems in the United Kingdom: five years on**. Anaesthesia 2014; 69: 687-92

These authors sent surveys through the Obstetric Anaesthetists' Association in 2012 to all 205 lead obstetric anaesthetists in the United Kingdom regarding their use of an obstetric early warning system. An obstetric early warning system was recommended for use in the UK in the 2003-2005 Saving Mother's Lives report and is considered an auditable maternal safety standard for the National Health System in the UK. These authors obtained a response rate of 63% (n= 130) and all (100%) respondents reported the use of an obstetric early warning system. This is in comparison to a similar survey performed in 2007 which indicated a 19% use. The respondents believed the most important parameters to record were respiratory rate, heart rate, temperature, systolic and diastolic blood pressure and oxygen saturation. Ninety one percent agreed that the use of the early warning system helped to prevent obstetric morbidity. Staffing pressures were felt to be the greatest barrier to the tool's use.

Cardiac arrest

120. Lipman S, Cohen S, Einav S, Jeejeebhoy F, Mhyre JM, Morrison LJ, Katz V, Tsen LC, Daniels K, Halamek LP, Suresh M.S., Arafeh J, Gauthier D, Carvalho JC, Druzin M, Carvalho B: **The society for obstetric anesthesia and perinatology consensus statement on the management of cardiac arrest in pregnancy**. Anesthesia and analgesia 2014; 118: 1003-16

These guidelines were commissioned by the Board of Directors of SOAP with the goal of addressing the challenges of maternal cardiac arrest. It delves far deeper into the topic of maternal cardiac arrest than the 2010 American Heart Association guidelines. From recommendations regarding point-of-care checklists to operational strategies such as educational, communication, and periodic systems testing, this excellent consensus statement is a must-read for all directors of obstetric anesthesia practices. Of note, the authors recommend manual uterine displacement instead of a left lateral tilt.

121. Butcher M, Ip J, Bushby D, Yentis SM: **Efficacy of cardiopulmonary resuscitation in the supine position with manual displacement of the uterus vs lateral tilt using a firm wedge: a manikin study**. Anaesthesia 2014; 69: 868-71

This simulation study compared the effectiveness of chest compressions in a manikin in the supine position (simulating manual uterine displacement) versus left lateral tilt using a foam-rubber wedge both on the floor and in a hospital bed. The tilt of the manikin was confirmed with a digital angle meter smartphone applications, and the efficacy of the chest compressions were evaluated the Laerdal PC Skill Reporting software installed on the manikin. The effectiveness of the chest compressions were similar in the supine versus the lateral tilt positions on both the floor and the bed, but the participants rated the manikin as feeling more stable and rated the chest compressions easier to perform in the supine position.

122. Mhyre JM, Tsen LC, Einav S, Kuklina EV, Leffert LR, Bateman BT: **Cardiac Arrest during Hospitalization for Delivery in the United States, 1998-2011**. Anesthesiology 2014; 120: 810-8

    Accompanied by editorial:

    Morrison LJ, Jeejeebhoy FM: **Estimating maternal cardiac arrest incidence and outcomes: a rare and challenging complication of pregnancy that behooves preparedness**. Anesthesiology 2014; 120: 790-1

This retrospective review of the Nationwide Inpatient Sample evaluated 56,900,512 hospitalizations for deliveries between 1998 and 2011 and found that cardiac arrest occurred in 4,843 cases or 8.5 per 100,000 (99% CI, 7.7 to 9.3 per 100,000) hospitalizations. The most common causes of arrest were postpartum hemorrhage (n= 1349, 27.9%), antepartum hemorrhage (n= 813, 16.8%), heart failure (n = 645, 13.3%), amniotic fluid embolism (n = 645, 13.3%), sepsis (n=544, 11.2%), anesthesia complications (n = 379, 7.8%), aspiration pneumonitis (n = 346, 7.1%), venous thromboembolism (n = 346, 7.1%), and eclampsia (n = 296, 6.1%). Overall, 59.0% (99% CI, 54.9 – 63.1%) of women who experienced cardiac arrest survived to hospital discharge. Survival was lowest for aortic dissection/rupture (14 women, 0 survived) and trauma (125 women, 29 [23.3%] survived), and highest for anaphylaxis (15 women, 15 [100%] survived), magnesium toxicity (66 women, 57 [85.9%] survived), aspiration pneumonitis (346 women, 287 [82.9%] survived), and anesthesia complications (379 women, 310 [81.9%] survived). Women who experienced cardiac arrest were more likely to be 35 years or older, black, and more likely to be funded by Medicaid. The medical conditions associated with cardiac arrest included pulmonary hypertension (aOR 13.3; 99% CI 6.0-39.6), malignancy (aOR 12.5; 99% CI 4.7-33.0), ischemic heart disease (aOR 7.6; 99% CI 2.1-27.5), liver disease (aOR 5.5; 99% CI 2.3-13.1) congenital heart disease (aOR 4.2; 99% CI 1.6-11.0), systemic lupus (aOR 4.1; 99% CI 1.8-9.8), and cardiac valvular disease (aOR 3.8; 99% CI 2.2-6.3). Overall, the frequency of arrest remained unchanged throughout the time period (p=0.017), but survival improved slightly. The editorial that accompanies this article discusses that this study reports the largest sample of maternal cardiac arrest in the published literature, and the rate of 1 in 12,000 deliveries is much higher than previous estimates. Further, the editorial states that this rate underrepresents maternal cardiac arrest in total because arrests in the postpartum after hospital discharge were not included in this study.

Amniotic fluid embolism

123. Tamura N, Kimura S, Farhana M, Uchida T, Suzuki K, Sugihara K, Itoh H, Ikeda T, Kanayama N: **C1 Esterase Inhibitor Activity in Amniotic Fluid Embolism**. Critical care medicine 2014

Hamamatsu University School in Medicine maintains the Japan amniotic fluid embolism (AFE) registration center which began collecting a data base and specimen bank in 2003 of clinical data, maternal serum and uterine tissue of women with both fatal and nonfatal AFE as defined by The Japan Consensus Criteria for the Diagnosis of AFE. The school has collected such data and samples on nearly every fatal AFE that has occurred in Japan since 2003. They previously determined the amount of amniotic fluid complements in the serum of women with AFE, as well as that uterine atony in AFE cases seems to be associated with uterine angioedema. These authors suspected that C1 esterase inhibitor may contribute to the overall AFE syndrome because of its role in the coagulofibrinolytic system, complement system, kallikrein-kinin system and the fact that its deficiency causes both hereditary and acquired angioedema. Among 106 cases of AFE in the registry during the years 2010 and 2011, 85 were nonfatal and 21 fatal. The authors used serum samples obtained from 88 women who delivered without AFE as controls. C1 esterase inhibitor activity levels were lower in women with AFE (30.0% $\pm$ 1.8%) than in control women (62% $\pm$ 2.0%) ($p< 0.0001$). C1 esterase inhibitor activity levels in fatal amniotic fluid

embolism cases (22.5% ± 3.4%) were significantly lower than those in nonfatal amniotic fluid embolism cases (32.0% ± 2.1%) ($p<0.05$). The authors speculate on the potential clinical application of utilizing C1 esterase inhibitor levels to determine women at risk for AFE, as a prognostic indicator for those who have experienced AFE, as well as the use of C1 esterase inhibitor concentrates in the treatment of AFE.

124. Clark SL: **Amniotic fluid embolism**. Obstetrics and gynecology 2014; 123: 337-48

This review by one of the world's experts in amniotic fluid embolism (AFE) emphasizes the difficulty in diagnosing AFE; the likely involvement of trophoblastic tissue antigens producing thromboplastin-like effects resulting the observed coagulopathy; similar endogenous pro-inflammatory mediators and pro-coagulant activation as is observed in anaphylaxis, SIRS, and septic shock; variable clinical expression of the syndrome; the possibility that the stimulus may involve either fetal or infectious stimuli from the uterus; the fact that the diagnosis involves the triad of hypotension, hypoxia and coagulopathy with the exclusion of other conditions; and the fact that any biochemical indices for diagnosis are still investigational. He goes on to emphasize the importance of emergent delivery, lateral displacement of the uterus during CPR prior to delivery, preparation for transfusion prior to laboratory confirmation of coagulopathy, and crystalloid fluid management during the event recognizing that acute lung injury and pulmonary edema will likely follow in surviving patients.

Aortic dissection

125. Rajagopalan S, Nwazota N, Chandrasekhar S. Outcomes in pregnant women with acute aortic dissections: a review of the literature from 2003 to 2013. International journal of obstetric anesthesia 2014; 23: 348-56

These authors reviewed the PubMed database to identify publications related to pregnant women with acute aortic dissections during the period 2003-2013. Fifty nine articles and 75 patients were included in the analyses. Stanford type A accounted for 77% of all cases. The majority of cases (78%) occurred in the third trimester and immediate postpartum period. Inherited connective tissue disorders were causative in 49% of patients. Maternal mortality was not statistical different between type A and type B dissections (21% vs. 23%), but fetal outcomes were worse in type B dissections (35% vs. 10.3%; $P<0.05$). Fetal mortality in type A dissections was dependent on the timing of aortic repair, with antepartum aortic repair associated with a higher mortality (36%). Patients undergoing combined cesarean section with aortic repair had favorable fetal outcomes.

Pulmonary embolism

126. Kamel H, Navi BB, Sriram N, Hovsepian DA, Devereux RB, Elkind M.S.. **Risk of a Thrombotic Event after the 6-Week Postpartum Period**. The New England Journal of Medicine 2014, 370:1307-1315

This retrospective study used insurance claims data from emergency departments and acute care hospitals in California between 2005 and 2010 to determine the rate of ischemic stroke, acute myocardial infarction or venous thromboembolism in postpartum women in comparison to the following year when they are not postpartum. There were 1,687,930 women with first deliveries and 1015 had a thrombotic event (248 cases of stroke, 47 cases of myocardial infarction, and 720 cases of venous thromboembolism). The risk of primary thrombotic events was markedly higher within 6 weeks after delivery than in the same period 1 year later, with 411 events versus 38 events, for an absolute risk difference of 22.1 events (95% CI 19.6 - 24.6) per 100,000 deliveries and an odds ratio of 10.8 (95% CI, 7.8 to 15.1). The elevated risk of thrombosis was lesser from 6 to 12 weeks than 0 to 6 weeks, but was still greater than the following year's risk. The risk of thrombotic event was not increased after the first 12 weeks after delivery.

Sepsis

127. Bauer ME, Bauer ST, Rajala B, MacEachern MP, Polley LS, Childers D, Aronoff DM: **Maternal physiologic parameters in relationship to systemic inflammatory response syndrome criteria: a systematic review and meta-analysis**. Obstetrics and gynecology 2014; 124: 535-41

This systematic review worked to establish and compare the normal maternal range for each component of the systemic inflammatory response syndrome (SIRS) criteria and then compare normal maternal parameters to SIRS criteria. The authors narrowed their extensive literature search to 87 articles including 8,834 parturients and 15,237 observations of healthy parturients overall. The authors found that overlap with the SIRS criteria occurred in healthy pregnant women during the second trimester, third trimester, and labor for every criteria (RR, $PaCO_2$, HR, and WBC count) except temperature. The authors conclude that current SIRS criteria are inadequate for women in pregnancy and postpartum and "novel criteria will likely be required to facilitate early diagnosis and prevent pregnancy-associated sepsis-related death."

128. Albright CM, Ali TN, Lopes V, Rouse DJ, Anderson BL: **The Sepsis in Obstetrics Score: a model to identify risk of morbidity from sepsis in pregnancy**. American journal of obstetrics and gynecology 2014; 211: 39 e1-8

These authors designed a novel model to score potential sepsis severity and then retrospectively applied it to a cohort of pregnant and postpartum women who presented to an emergency department between 2009 and 2011 with a clinical suspicion of sepsis. Various vital signs and laboratory values were given a zero score when in the normal range and anywhere between 1 and 4 points depending on the degree of variance from normal. The primary outcome for the authors was admission to the intensive care unit. There were 850 women included with 9 (1.1%) ICU admissions, 32 (3.8%) telemetry admissions, and no maternal deaths. A score of ≥ 6 had a sensitivity of 88.9% and a specificity of 95.2%, a positive predictive value of 16.7% and a negative predictive value of 99.9% for ICU admission. A score of ≥ 6 was also independently associated with increased ICU or telemetry unit admissions, positive blood cultures, and fetal tachycardia. The authors recommend prospective validation.

129. Chau A, Tsen LC: **Fetal optimization during maternal sepsis: relevance and response of the obstetric anesthesiologist**. Current opinion in anaesthesiology 2014; 27: 259-66

This review article focuses on what the obstetric anesthesiologist can D.O. to optimize maternal and fetal outcomes in maternal sepsis. The authors discuss how both maternal and fetal management strategies are typically complementary, but occasionally added maternal physiologic optimization may be necessary for fetal benefit. The concepts that the authors discuss include maximizing uteroplacental blood flow, minimizing fetal oxygen demand, early and appropriate intrapartum antibiotic administration, avoiding preterm delivery when possible, identifying a compromised fetus, and maintaining communication among obstetric team members. The authors recommend fetal monitoring for gestations beyond 24 weeks, and discuss areas of controversy that require further clinical trials including specific vasopressor choice, fluid management, and appropriate hemodynamic monitoring in maternal sepsis.

130. O'Higgins AC, Egan AF, Murphy OC, Fitzpatrick C, Sheehan SR, Turner MJ: **A clinical review of maternal bacteremia**. International journal of gynaecology and obstetetrics 2014; 124: 226-9

This retrospective study identified 58 cases of maternal bacteremia among 37,584 obstetric patients who presented at the Coomb Women and Infants University Hospital, Dublin, Ireland. Of the 58 cases, bacteremia was diagnosed in 19 women prepartum, in 20 women intrapartum, and in 19 women postpartum. No women died, two women developed septic shock, 4 women experienced early pregnancy loss, and 2 women experienced stillbirth. *Escherichia coli* was the most common organism in prepartum and postpartum bacteremia (n = 14 prepartum, n = 0 intrapartum, n = 10 postpartum) , and beta-hemolytic, Lancefield Group B *Streptococcus agalactiae* was the most common intrapartum bacteremia (n = 0 prepartum, n = 10 intrapartum, n = 5 postpartum). Other organisms included *Enterococcus faecalis* (n = 4), *Staphylococcus aureus* (n = 2), *Streptococcus* pyogenes (n = 2), Klebsiella pneumonia (n = 2), and Haemophilus influenza (n = 2). There were no multi-drug resistant organisms.

131. Acosta CD, Kurinczuk JJ, Lucas DN, Tuffnell DJ, Sellers S, Knight M: **Severe maternal sepsis in the UK, 2011-2012: a national case-control study**. PLoS medicine 2014; 11: e1001672

This prospective case-control study utilized the United Kingdom Obstetric Surveillance System to estimate the incidence of, the causative organisms in, the sources of infection of, and the risk factors for maternal sepsis in the United Kingdom. Overall, 365 confirmed cases of severe maternal sepsis were collected between June 2011 and May 2012 out of 780,537 maternities for an incidence of severe sepsis of 4.7 (95% CI 4.2 - 5.2) per 10,000 maternities. Seventy-one (19.5%) women developed septic shock, and 5 (1.4%) women died. Causative organisms were identified in 233 (63.8%) cases with a source of the organism in 270 (74.0%) cases. The most common organism identified in the antepartum was *E.coli* (n=33, 24.6%) and Group B streptococcus (n=13, 9.7%), and in the postpartum were *E.coli* (n=44, 19.1%), Group A streptococcus (n=30, 13.0%), staphylococcus (n=21, 9.1%) and Group B streptococcus (n=17, 7.4%). Overall, the most common source of infection was the genitourinary tract (31.0%). Readmission was more common in women diagnosed in the postpartum (n = 108, 48%) versus antepartum (n = 6, 5.0%). Risk factors for severe sepsis included black or minority ethnicity (adjusted OR 1.82, 95% CI 1.32-2.51); nulliparity (adjusted OR 1.17, 95% CI 1.17-2.20), a preexisting medical problem (adjusted OR 1.4, 95% CI 1.01-1.94), and a febrile illness or the use of antibiotics in the 2 weeks prior to presentation (adjusted OR 12.07, 8.11-17.97). Infection with Group A streptococcus (adjusted OR 4.84, 2.17-10.78) and multiple gestations (adjusted OR 5.75, 95% CI 1.54 – 21.45) were risk factors for progressing to septic shock. It was noted that Group A streptococcus progressed extremely rapidly from the first sign of SIRS to septic shock—in 50% of women in less than two hours and for 75% of women in less than 9 hours.

Postpartum Hemorrhage

Epidemiology

132. Patterson JA, Roberts CL, Bowen JR, Irving DO, Isbister JP, Morris JM, Ford JB: **Blood transfusion during pregnancy, birth, and the postnatal period**. Obstetrics and gynecology 2014; 123: 126-33

This retrospective review of maternal blood transfusions in New South Wales, Australia identified 12,147 women that received transfusions across 891,914 deliveries to 578,207 women between 2001 and 2010 for a transfusion rate of 1.4%. The rate of obstetric blood transfusion steadily increased by 33% throughout the study period from 1.2% in 2001 to 1.6% in 2010 ($p<0.001$). Transfusion rate was high amongst women having a hysterectomy during their birth admission (n=439 [896 per 1000 deliveries]). Forceps delivery carried the greatest risk of transfusion (RR 2.8, 99% CI 2.51-3.04), followed by intrapartum cesarean delivery, vacuum delivery, and prelabor cesarean delivery. Women with placenta previa and bleeding (RR 4.6, 99%CI 3.44-6.26) or platelet disorders (vaginal delivery RR 7.8, 99% CI 6.93-8.73; cesarean delivery RR 8.7, 99% CI 7.69-9.76) also carried significantly greater risk of requiring blood transfusion.

133. Bateman BT, Tsen LC, Liu J, Butwick AJ, Huybrechts KF: **Patterns of second-line uterotonic use in a large sample of hospitalizations for childbirth in the United States: 2007-2011**. Anesthesia and analgesia 2014; 119: 1344-9

These authors used the Premier Research Database to identify patterns of second-line uterotonic use among 367 hospitals for the treatment of uterine atony between 2007 and 2011 with the goal of determining if different hospitals utilize second line uterotonic agents at different frequencies not explained by risk factors for uterine atony. The cohort included 2,180,916 patients with an overall frequency of second-line uterotonic use of 7.1 % with methergonovine 5.2%, carboprost 1.0% and misoprostol 1.2%. The authors observed wide interhospital variation which was not explained by patient-level or hospital-level characteristics. In their model adjusted for demographics, year of delivery, method/mode of delivery, medical/obstetrical conditions and hospital characteristics, 95% of hospitals had a predicted probability of utilizing second-line uterotonic agents between 1.69% ($\pm$0.12%) and 24.96% ($\pm$1.28%) suggesting that the frequency of use may largely be based upon nonmedical and institution-specific factors such as physician preferences, drug cost or availability, and local hospital culture.

134. Oberg AS, Hernandéz-Diaź S, Frisell T, Greene MF, Almqvist C, Bateman BT. **Genetic contribution to postpartum haemorrhage in Swedish population: cohort study of 466,686 births**. BMJ 2014; 349: 4984

This study evaluated the effect of familial clustering on postpartum hemorrhage (>1000mL blood loss) in the Swedish Medical Birth Register. Overall, 4.6% of vaginal deliveries were complicated by a postpartum hemorrrhage. Among vaginal deliveries, 18% (95% CI 9% - 26%) of the variation in postpartum haemorrhage liability was attributed to maternal genetic factors, 10% (95% CI 1% - 19%) to unique maternal environment, and 11% (95% CI 0% - 26%) to fetal genetic effects. The authors conclude that “adjustment for known risk factors only partially explained estimates of familial clustering, suggesting that the observed shared genetic and environmental effects operate in part through pathways independent of known risk factors.”

135. Oberg AS, Hernandez-Diaz S, Palmsten K, Almqvist C, Bateman BT. **Patterns of recurrence of postpartum hemorrhage in a large population-based cohort**. American Journal of Obstetetrics & Gynecology 2014; 210: 229. e1-8.

This study evaluated the effects of postpartum hemorrhage history on the severity and the type of postpartum hemorrhage in subsequent pregnancies among 538,332 women in the Swedish Medical Birth Registery between 1997 and 2009. Women with a history of PPH had a 3-fold increased risk of PPH in their second pregnancy compared with unaffected women (15.0% vs 5.0%). Adjustment for stable maternal risk factors did not attenuate this risk significantly (adjusted RR 3.0; 95% CI 2.9-3.1). In a third pregnancy, the risk of PPH was 26.6% after 2 previously affected pregnancies, compared with 4.4% in women with no previous PPH. A history of a specific type of PPH (atony, retained placenta, or laceration) predicted recurrence of PPH in the second pregnancy, not only of the same type but other causes too. The authors conclude that “the recurrence patterns across PPH subtypes may point to shared pathologic mechanisms underlying the varying PPH causes.”

136. Butwick AJ, Carvalho B, El-Sayed YY: **Risk factors for obstetric morbidity in patients with uterine atony undergoing Caesarean delivery**. British journal of anaesthesia 2014; 113: 661-8

This retrospective study sought to find risk factors for uterine atony through a secondary analysis of data collected between 1999 and 2002 as part of the Cesarean Registry, an observational study conducted by the Eunice Kennedy Shriver National Institute of Health and Development Maternal-Fetal Medicine Units Network. Uterine atony was determined by a clinical note in the chart and administration of a second-line uterotonic agent. Hemorrhage related morbidity was defined by the presence of red cell transfusion, cesarean hysterectomy, uterine artery ligation, hypogastric artery ligation or ICU admission for pulmonary edema, coagulopathy, ARDS, postoperative ventilation, or the need for invasive monitoring. Overall, 57,182 women underwent cesarean delivery and 2,294 (4%) experienced uterine atony with 5 maternal deaths. In two different multivariate models, African-American race, Hispanic ethnicity, multiple gestation, placenta previa, ASA class III or IV, general anesthesia, and two or more prior cesarean deliveries were associated with the risk of hemorrhage-related morbidity.

137. Briley A, Seed PT, Tydeman G, Ballard H, Waterstone M, Sandall J, Poston L, Tribe RM, Bewley S: **Reporting errors, incidence and risk factors for postpartum haemorrhage and progression to severe PPH: a prospective observational study**. British journal of obstetrics & gynaecology 2014; 121: 876-88

This prospective observational study sought to determine the incidence and risk factors for postpartum hemorrhage (PPH) and the progression to severe postpartum hemorrhage in two United Kingdom maternity units. Two researchers reviewed all clinical data including lab reports, transfusion records and clinical notes to determine estimated blood loss and the accuracy of the estimated blood loss documented at the time. Overall 10,213 women delivered between 2008 and 2009 and 9937 were included in the study. Overall 33.7% of patients had a PPH $\geq$ 500, 3.9% $\geq$ 1500, and 0.82% $\geq$ 2500. Risk factors for PPH included Black African ethnicity (aOR 1.77, 95% CI 1.31-2.39), assisted conception (aOR, 2.93, 95% CI 1.30-6.59), elective cesarean delivery (aOR 24.4, 95% CI 5.53-108.00), emergency cesarean delivery (aOR 40.5, 95% CI 16.30-101.00), and retained placenta (aOR 21.3, 95% CI 8.31-54.7).

138. Dutton RP, Lee LA, Stephens LS, Posner KL, Davies JM, Domino KB: **Massive hemorrhage: a report from the anesthesia closed claims project**. Anesthesiology 2014; 121: 450-8

This Anesthesia Closed Claims Project involved 3,211 closed surgical or obstetric anesthesia malpractice claims from 1995-2011. Overall, 14%41 (4%) claims involved hemorrhage. Obstetric anesthesia overrepresented hemorrhage claims accounting for 30% of hemorrhage claims compared to 13% of non-hemorrhage claims ($p<0.001$). Mortality was higher in hemorrhage claims versus non hemorrhage claims (77 vs 27%, $P<0.001$), anesthesia care was more often to be judged less than appropriate (55 versus 38%, $p < 0.001$), and median payments were higher ($607,750 versus $276,000, $p<0.001$). Among the 43 OB hemorrhage cases, 13 (30%) had placenta accreta, 10 (23%) had retained placenta, 7 (16%) had uterine atony, 5 (12%) had amniotic fluid embolism, 4 (9%) had uterine rupture, 3 (7%) had placenta abruption, 3 (7%) had placenta previa, and 3 (7%) had intrauterine fetal demise. Common among many of the cases was a lack of timely diagnosis of hemorrhage.

Prevention and treatment of postpartum hemorrhage

139. Heesen M, Bohmer J, Klohr S, Rossaint R, van de Velde M, Dudenhausen JW, Straube S: **Prophylactic tranexamic acid in parturients at low risk for post-partum haemorrhage: systematic review and meta-analysis**. Acta anaesthesiologica Scandinavica 2014; 58: 1075-85

This systematic review and meta-analysis involved 7 trials (n=1760) comparing prophylactic tranexamic acid and placebo for the prevention of postpartum hemorrhage in low risk women undergoing vaginal delivery (1 trial) or cesarean delivery under spinal anesthesia (6 trials). Doses in the studies were either 1 gram, 10 mg/kg, or 15 mg/kg. The risk ratio for blood transfusions was reduced after tranexamic acid administration (RR 0.34, 95% CI 0.20-0.60) when all 7 trials were included, but when the 2 trials with unusually high rates of transfusion in both control and treatment groups were eliminated, the risk ratio was no longer significant (RR 0.35, 95% CI 0.12 – 1.04, $p=0.06$). There was a reduction in blood loss in the tranexamic group versus the placebo group as well, (WM.D. -140.29mL, 95% CI -189.64-90.93mL; $p < 0.00001$) but heterogeneity was significant. Only four cases of thrombosis occurred, 2 in the tranexamic group, and 2 in the control group.

140. Prick BW, Jansen AJ, Steegers EA, et.al: **Transfusion policy after severe postpartum haemorrhage: a randomised non-inferiority trial**. British journal of obstetrics & gynaecology 2014; 121: 1005-14

This non-blinded study randomized women (n = 521)between 2004 and 2011 who had experienced a postpartum hemorrhage, were now 12 to 24 hours after birth and were clinically stable with a hemoglobin of 4.8-7.9g/dL, to either an intervention arm (RBC transfusion to a goal Hgb of 8.9) or nonintervention arm (RBC transfusion only if severe symptoms of anemia developed). The study was designed and powered in a non-inferiority design with the primary outcome of physical fatigue at 3 days postpartum measured with the Multidimensional Fatigue Inventory (scale 4-20, higher score indicating more fatigue). Starting hemoglobin between the groups was similar, women randomized to the intervention arm received a mean of 2 units (interquartile range 2-2) and were discharged with a mean hemoglobin of 9.0g/dL (interquartile range 8.5-9.5), and in the non-intervention arm was 0 units (Interquartile range 0-0) and were discharged with a mean hemoglobin of 7.4g/dl (interquartile range 6.8-7.7). Mean physical fatigue score at day 3 was 0.8 (95% CI 0.1-1.8, $p = 0.02$) lower in the intervention arm. Because the study was designed with a non-inferiority boundary of a 1.3 maximal difference in fatigue score, and the confidence interval of the difference between fatigue scores crossed 1.3, non-inferiority could not be demonstrated. However, because the physical fatigue difference was so small and there was no difference in secondary outcomes (breastfeeding, infectious complications, thromboembolic events etc.), the authors conclude that "implementation of restrictive management seems clinically justified" in stable patients with hemoglobins between 4.8 and 7.9 at 12 to 24 hours after delivery.

141. Ducloy-Bouthors AS, Susen S, Wong CA, Butwick A, Vallet B, Lockhart E: **Medical advances in the treatment of postpartum hemorrhage**. Anesthesia and analgesia 2014; 119: 1140-7

This review article discusses the most recent evidence on the postpartum hemorrhage assessment and subsequent pharmacologic and transfusion therapy. The authors present the evidence of low fibrinogen as a predictor of severe postpartum hemorrhage and the application of early fibrinogen testing or, more rapidly, thromboelastometry in postpartum hemorrhage. They discuss the avoidance of hydroxyethyl starch in obstetric hemorrhage as well as the trauma literature regarding RBC to FFP transfusion ratios and how this may, or may not translate to hemorrhaging obstetric patients. The authors discuss the unanimous agreement from professional societies regarding multidisciplinary obstetric hemorrhage protocols. The authors call for randomized controlled trials to validate the efficacy and safety of antifibrinolytic therapy as well as fibrinogen concentrates. They discuss the ongoing, randomized, placebo-controlled trial enrolling 20,000 patients to investigate the endpoint of tranexamic acid on maternal death or hysterectomy.

142. Girard T, Mortl M, Schlembach D: **New approaches to obstetric hemorrhage: the postpartum hemorrhage consensus algorithm**. Current opinion in anaesthesiology 2014; 27: 267-74

This article presents a postpartum hemorrhage algorithm that was developed by obstetricians, anesthesiologists and hematologists from Austria, Germany and Switzerland. The algorithm is divided into 4 steps progressing from moderate vaginal bleeding to persistent bleeding with hemodynamic instability and outlines the escalation of personnel, uterotonic drugs, transfusion, and pharmacologic therapies as well as criteria for transfer from one institution to another with greater resources.

143. Albright CM, Rouse DJ, Werner EF: **Cost savings of red cell salvage during cesarean delivery**. Obstetrics and gynecology 2014; 124: 690-6

These authors assess cell salvage from an economic perspective. They developed a decision model and compared two cesarean delivery strategies—the setup of intraoperative cell salvage for routine cesarean delivery versus standard care without cell salvage for cesarean delivery. The authors estimated that if 3.2% of women undergoing cesarean delivery required a blood transfusion then cell salvage would only be cost saving if each of these women required at least 60 units. If two units are needed per cesarean delivery then at least 58% of patients would need to require transfusion to make routine use of cell salvage cost-saving. Because in cases of severe anemia or in abnormal placentation, the likelihood of transfusion for these patients could be this high, the authors argue that in those scenarios, cell salvage could be cost-saving. Otherwise, according to their calculations, the routine setup of intraoperative cell salvage would increase the cost per cesarean delivery by $223.80.

144. Kacmar RM, Mhyre JM, Scavone BM, Fuller AJ, Toledo P: **The use of postpartum hemorrhage protocols in United States academic obstetric anesthesia units**. Anesthesia and analgesia 2014; 119: 906-10

These authors surveyed directors of United States academic obstetric anesthesia units regarding whether their units had a postpartum hemorrhage protocol as recommended by the National Partnership for Maternal Safety. They had a 58% response rate and 67% of the responding units had a postpartum hemorrhage protocol. Larger units were more likely to have a protocol in comparison to smaller units-- the median annual delivery volume for responding units with a PPH protocol was 3900 while that for units without a PPH protocol was 2300. Therefore, the authors recommend that national efforts to ensure universal presence of PPH protocols should focus on small-volume facilities to achieve the greatest impact.

145. Balki M, Erik-Soussi M, Kingdom J, Carvalho JC: **Comparative efficacy of uterotonic agents: in vitro contractions in isolated myometrial strips of labouring and non-labouring women**. Canadian journal of anaesthesia 2014; 61: 808-18

This study describes the comparison of contractile responses of myometrium excised from the uteri of 46 laboring and non-laboring women undergoing cesarean delivery under spinal anesthesia. The myometrial strips were exposed *in vitro* to one of four uterotonic agents—oxytocin, ergonovine, prostaglandin F_2 alpha and misoprostol. The motility index (MI = amplitude x frequency of tissue contraction) was greatest overall for oxytocin (mean 5.1, 95% CI 4.7-5.5) than for ergonovine (mean 3.46, 95% CI 3.13-3.80, $p<0.001$), PGF_2alpha (2.64, 95% CI 2.40-2.87, $p<0.001$), and misoprostol (2.52, 95% CI 2.22-2.82, $p<0.001$). The MI for oxytocin was significantly lower in augmented labor than in non-augmented labor, or no labor. Even in augmented labor, though, oxytocin still produced superior contractions compared to the second-line uterotonic drugs. The second-line uterotonic drugs were unaffected by labor or prior exposure to oxytocin.

146. de Lange NM, van Rheenen-Flach LE, Lance M.D., Mooyman L, Woiski M, van Pampus EC, Porath M, Bolte AC, Smits L, Henskens YM, Scheepers HC: **Peri-partum reference ranges for ROTEM(R) thromboelastometry**. British journal of anaesthesia 2014; 112: 852-9

This multicenter trial sought to obtain reference ranges for rotational thromboelastometry during the peripartum period by taking blood samples from 161 women in labor and within one hour of delivery. The results were comparable between centers and between the two times the samples were taken from women allowing for the establishment of reference values.

Recognition and management of postpartum hemorrhage

147. Le Bas A, Chandraharan E, Addei A, Arulkumaran S: **Use of the "obstetric shock index" as an adjunct in identifying significant blood loss in patients with massive postpartum hemorrhage**. Internation journal of gynecology & obstetrics 2014; 124: 253-5

This retrospective case-control study compared 50 women who experienced massive postpartum hemorrhage (>30% loss of blood volume) with 50 controls in order to determine an "obstetric shock index" at 10 and 30 minutes from the onset of the hemorrhage. A "shock index" is defined as a patient's heart rate divided by the systolic blood pressure and has previously been described to assess hypovolemic shock in trauma and non-trauma blood loss. A normal shock index range for a healthy nonpregnant person not losing blood is 0.5-0.7. Both cesarean and vaginal deliveries were included. The mean Obstetric Shock Index in the case group at 10 minutes was 0.91 ± 0.42 (range 0.4-1.5) and at 30 minutes was 0.90 ± 0.33 (range 0.5-1.4). The mean Obstetric Shock Index in the control group was 0.74 ± 0.30 (range 0.4-1.1) at 10 minutes and 0.76 ± 0.27 (range 0.5-1.1) at 30 minutes. The authors recommend that a normal Obstetric Shock Index after birth be 0.7-0.9, and an OSI greater than 1 could be useful in estimating the need for blood products.

148. Yamada T, Akaishi R, Oda Y, Nishida R, Ishikawa S, Morikawa M, Kojima T, Minakami H: **Antenatal fibrinogen concentrations and postpartum haemorrhage**. International journal of obstetric anesthesia 2014; 23: 365-70

This retrospective study evaluated women who had a fibrinogen level tested in the 21 days prior to delivery and looked for a correlation between this and the estimated blood loss at delivery. Postpartum hemorrhage was defined as an estimated blood loss ≥700mL for vaginal delivery, and ≥ 1000mL for cesarean delivery. The authors found that for vaginal delivery (n=337), antenatal blood loss tended to increase with decreasing antenatal fibrinogen concentrations (R=-0.107, p= 0.05); median fibrinogen concentration was lower in the 69 women with postpartum hemorrhage than in the 268 women without postpartum hemorrhage (3.93 vs, 4.18 g/L, p = 0.025); and postpartum hemorrhage occurred significantly more often in women with fibrinogen concentrations <3.3g/L compared to those with concentrations ≥ 3.3g/L (38%[11/29] vs 19% [58/306]. P = 0.018). The correlations, however, did not hold true for women under undergoing cesarean delivery (n = 534).

149. Farber MK, Sadana N, Kaugman RM, Liu X, Kodali BS. **Transfusion ratios for postpartum hemodilutional coagulopathy: an in vitro thromboelastographic model.** American journal of obstetrics and gynecology 2014; 210: 323 e1-7

These authors created an obstetric in vitro hemodilution model to investigate the 1:1:1 ratio as recommended in trauma hemorrhage. Blood from 20 parturients at term was diluted 50% with 0.9% normal saline and was reconstituted with 1:1 PRBC:FFP or 3:1 PRBC:FFP. In 10 samples, platelets were also added. Maximum amplitude was lower compared to baseline values in both groups after 50% dilution with normal saline (P < .001) and remained lower than baseline despite reconstitution with 3:1:0 or 1:1:0 PRBC:FFP:PLT (P < .0001) or 3:1:1 PRBC:FFP:PLT (P < .01). Maximum amplitude approached baseline in the samples with 1:1:1 PRBC:FFP:PLT.

150. Karlsson O, Jeppsson A, Hellgren M. **Major obstetric haemorrhage: monitoring with thromboelastography, laboratory analyses or both?** International journal of obstetric anesthesia 2014; 23: 10-7

These authors compared thrombelastography and laboratory analysis in the management of 45 obstetric patients experiencing major hemorrhage and 49 women with a blood loss greater than 600mL. They found the strongest correlations between fibrinogen and TEG-MA; and between estimated blood loss and TEG-MA, fibrinogen and antithrombin, respectively. Overall, thromboelastography provided faster results than standard laboratory testing. However, laboratory analyses found greater differences in coagulation variables, which correlated better with estimated blood loss.

Placenta Accreta

151. Cali G, Forlani F, Giambanco L, Amico ML, Vallone M, Puccio G, Alio L: **Prophylactic use of intravascular balloon catheters in women with placenta accreta, increta and percreta**. European journal of obstetrics, gynecology, and reproductive biology 2014; 179: 36-41

This prospective observational study reports an Italian hospital's experience managing 53 cases of placenta accreta/increta/percreta. From 2004 through 2009, 23 cases were managed with cesarean hysterectomy alone and from 2009 through 2013, 30 cases were managed with cesarean hysterectomy and intravascular balloon catheters in the internal iliac arteries. Placenta accreta/increta/percreta was confirmed via pathology of the removed uterus. There were no complications with the endovascular balloons. All women in the study were managed with an epidural anesthetic which was converted to a general anesthetic in the event of severe bleeding. Overall, a difference was found between the estimated blood loss and the amount of transfused blood products between the hysterectomy only group (EBL 1156 ± 576.69mL; 1.96 units ± 2.46 units) versus the balloon catheter group (EBL 846.67mL ± 280.06mL; 0.47 units ± 0.86 units) (p=0.036 for EBL and p=0.011 for blood products transfused). Interestingly, though, when those with placenta accreta/increta and those with placenta percreta cases were analyzed separately, no differences in EBL or transfusions were found in those with placenta accreta/increta, but significant differences were found in both EBL and blood products transfused in those with placenta percreta. The authors conclude that the use of balloon catheters is safe, and that they should be used when prenatal diagnosis

does not allow for differentiation between placenta accreta and percreta, and in cases where the woman wishes to attempt to keep her uterus to preserve her fertility. The authors also conclude that balloon catheters may not provide benefit in placenta accreta without percreta which is proceeding directly to hysterectomy.

Maternal mortality in developing countries

152. Say L, Chou D, Gemmill A, et. al. **Global causes of maternal death: a WHO systematic analysis** The Lancet Global Health 2014; 2 e323-33.

These authors utilized the WHO mortality database as well as searched for articles published between 2003 and 2012 to gather data on maternal mortality. They identified 23 eligible studies and included 417 datasets from 115 countries comprising 60,799 deaths. About 73% (1 771 000 of 2 443 000) of all maternal deaths between 2003 and 2009 were due to direct obstetric causes and 27.5% (672 000, 95% UI 19.7-37.5) were from indirect causes. Haemorrhage accounted for 27.1% (661 000, 19.9-36.2), hypertensive disorders 14.0% (343 000, 11.1-17.4), and sepsis 10.7% (261 000, 5.9-18.6) of maternal deaths. The rest of the deaths were due to abortion (7.9% [193 000], 4.7-13.2), embolism (3.2% [78 000], 1.8-5.5), and all other direct causes of death (9.6% [235 000], 6.5-14.3). Regional estimates varied substantially.

153. Lawn JE, Blencowe H, Oza S, et. al. **Every Newborn: progress, priorities, and potential beyond survival.** Lancet 2014; 384: 189-205

and

Mason E, McDougall L, Lawn JE, et. al. **From evidence to action to deliver a healthy start for the next generation.** Lancet 2014: 384: 455-67

These article published in the Lancet focus on how newborn deaths and stillbirths have been overlooked in the past in global health efforts. They discuss the worldwide trends since the 2005 Lancet Series on Neonatal Survival and proposes targets for 2035 of no more than 10 stillbirths per 1000 total births, and no more than 10 neonatal deaths per 1000 livebirths. The excellent review reminds us that the 2.9 million annual neonatal deaths worldwide are attributable to three main causes: infections (0.6 million), intrapartum conditions (0.7 million), and preterm birth complications (1.0 million). They also state that "failure to improve birth outcomes by 2035 will result in an estimated 116 million deaths, 99 million survivors with disability or lost development potential, and millions of adults at increased risk of non-communicable diseases after low birthweight."

154. Kassebaum NJ, Bertozzi-Villa A, Coggeshall M.S., et. al. **Global, regional, and national levels and causes of maternal mortality during 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013.** Lancet 2014; 384:980-1004.

This article funded by the Bill and Melinda Gates Foundation is an update on the Millennium Development Goal which established the goal of a 75% reduction in the worldwide maternal mortality ratio between 1990 and 2015. The authors aimed to measure mortalities and track trends using a database of data that encompassed 7065 site-years among 188 countries between 1990 and 2013. Overall, 292,982 maternal deaths occurred in 2013, compared with 376,034 in 1990. The global annual rate of change in the maternal mortality ratio was -0.3% (-1.1 to 0.6) from 1990 to 2003, and -2.7% (-3.9 to -1.5) from 2003 to 2013 suggesting an acceleration of progress. Causes of death varied by region and year. In 2013, most maternal deaths occurred intrapartum or postpartum. The authors found substantial variation in the maternal mortality ratio by country in 2013, from 956.8 (685.1-1262.8) in South Sudan to 2.4 (1.6-3.6) in Iceland. The authors state that their data suggests that only 16 countries will achieve the Millennium Development Goal target by 2015.

155. British Journal of Obstetrics and Gynecology 2014; 121 Supplements #1 and #4.

With the end of 2014 marking the end of the WHO Millennium Development Goal of reducing maternal mortality ratio by three quarters, the BJOG journal published special issues focusing on international maternal and neonatal mortality. Commentaries include maternal mortality reduction through evidence-based clinical guideline adherence,[1] conducting near-miss audits,[2] and the cultural environment necessary to conduct successful maternal morbidity audits and reviews.[3] Neonatal morbidity and mortality is also addressed.[4,5] Multiple authors describe experiences with maternal death reviews and collecting obstetric quality data from the United Kingdom,[6] India, Indonesia, Myanmar, Nepal and Sri Lanka,[7] as well as the countries of Cameroon, Nigeria, Malawi, Ghana , and Moldova. These articles drive home that nearly all deaths in developing regions would be preventable in the developed world. For example, a study following four districts of Bangladesh showed that 78.8% (450 out of 571 maternal deaths in a 2 year period) occurred in the first 6 hours after giving birth with the most likely cause hemorrhage.[8] Audits showed improvements of quality of care in Niger and Mali (who were focusing on the postpartum period and hemorrhage reduction/treatment) which, in turn, markedly improved maternal mortality rates.[9] Further commentaries include lessons learned while reducing maternal mortality in Central Asia, Europe[10] and Malaysia.[11] This issue also contains descriptions of the confidential enquiry into maternal deaths in South Africa[12] and Kerala,[13] as well as a series of excellent articles on stillbirth and neonatal death reduction.[14-17] The opening editorial on supplement 4 reminds us that in 2014, there is still an estimated 289,000 maternal mortalities per year worldwide, with 2.6 million babies stillborn, and 3 million babies dying within one month of birth.[18] This issues serve as primers for those interested in one of the world's most pressing needs—reduction of worldwide maternal and neonatal mortality.

[1] Heiby JR, Armbruster D, Jacobs TA. Better care for every patient, every time: improving quality in low health systems. British journal of obstetrics & gynaecology 2014; 121 Suppl 4: 4-7

[2]Tuncalp O, Souza JP. Maternal near-miss audits to improve quality of care. Br J Obstet Gynecol 2014; 121 Suppl 4: 102-4

[3] Lewis G: The cultural environment behind successful maternal death and morbidity reviews. British journal of obstetrics & gynaecology 2014; 121 Suppl 4: 24-31

[4]Pileggi-Castro C., Camelo JS, Perdona GC, et.al. Development of criteria for identifying neonatal near-miss cases: analysis of two WHO multicountry cross-sectional studies. British journal of obstetrics & gynaecology 2014; 121 Suppl 1: 110-8

[5]Vogel JP, Souza JP, Mori R, et. al. Maternal complications and perinatal mortality: findings of the World Health Organization Multicountry Survey on Maternal and Newborn Health. British journal of obstetrics & gynaecology 2014; 121 Suppl 1: 76-88

[6] Kurinczuk JJ, Draper ES, Field DJ et al. Experiences with maternal and perinatal death reviews in the UK--the MBRRACE-UK programme. British journal of obstetrics & gynaecology 2014; 121 Suppl 4: 41-6

[7] Mathur A, Awin N, Adisasmita A, et al. Maternal death review in selected countries of South East Asia Region. British journal of obstetrics & gynaecology 2014; 121 Suppl 4: 67-70

[8] Halim A, Utz B, Biswas A, Rahman F, van den Broek N Cause of and contributing factors to maternal deaths; a cross-sectional study using verbal autopsy in four districts in Bangladesh. British journal of obstetrics & gynaecology 2014; 121 Suppl 4: 86-94

[9] Boucar M, Hill K, Coly A, et al. Improving postpartum care for mothers and newborns in Niger and Mali: a case study of an integrated maternal and newborn improvement programme. British journal of obstetrics & gynaecology 2014; 121 Suppl 4: 127-33

[10] Bacci A: Quality of maternal and neonatal care in Central Asia and Europe--lessons learnt. British journal of obstetrics & gynaecology 2014; 121 Suppl 4: 11-4

[11] Racichandram J, Ravindran J. Lessons from the confidential enquiry into maternal deaths, Malaysia. British journal of obstetrics & gynaecology 2014; 121 Suppl 4: 47-53

[12] Moodley J et al. The confidential enquiry into maternal deaths in South Africa: a case study. British journal of obstetrics & gynaecology 2014; 121 suppl 4: 53-61

[13]Paily BP, et al. Confidential review of maternal deaths in Kerala: a country case study. British journal of obstetrics & gynaecology 2014; 121 suppl 4:61-67

[14] Buchmann EJ. Towards greater effectiveness of perinatal death audit in low- and middle-income countries. British journal of obstetrics & gynaecology 2014; 121 Suppl 4: 134-6

[15] Aminu M, Unkels R, M.D.egela M et al. Causes of and factors associated with stillbirth in low- and middle-income countries: a systematic literature review. British journal of obstetrics & gynaecology 2014; 121 Suppl 4: 141-53

[16] Rhoda NR, Greenfield D, Muller M, et al. Experiences with perinatal death reviews in South Africa--the Perinatal Problem Identification Programme: scaling up from programme to province to country. British journal of obstetrics & gynaecology 2014; 121 Suppl 4: 160-6

[17] Stratulat P, Curteanu A, Caraus T, et al. The experience of the implementation of perinatal audit in Moldova. British journal of obstetrics & gynaecology 2014; 121 Suppl 4: 167-71

[18] van den Broek N, Lewis G, Mathai M: Guest editors' choice. British journal of obstetrics & gynaecology 2014; 121 Suppl 4: 2-3

156. International Journal of Gynecology and Obstetrics 2014; 126 Supplement #1

The July 2014 supplement to the International Journal of Gynecology and Obstetrics reports on the International Federation of Gynecology and Obstetrics (FIGO) effort to reduce maternal morbidity and mortality associated with unsafe abortion. Various authors cite the prior 2008 WHO report of 21.6 million unsafe abortions occurring worldwide per year with some areas attributing 13% of their maternal mortalities to death from sepsis or hemorrhage because of the practice. FIGO's international efforts described in this issue "range from preventing an unintended/unwanted pregnancy to preventing an inevitable abortion from being unsafe; preventing further complications resulting from an unsafe abortion that has already been performed; and preventing repeat abortion through postabortion counseling and by immediately providing a contraceptive method of the woman's choice."[1] In this supplement, articles are split into regions describing FIGO's efforts in South America,[2] Central America and the Caribbean, East, Central and Southern Africa,[3] West and Central Africa,[4] and South-Southeast Asia.[5] The manual vacuum aspiration and its use in incomplete abortion in Honduras,[6] Cameroon,[7] Bangladesh,[8] and Pakistan[9] is described. FIGO's initiative in postabortion contraception in general [10] and specifically in Gabon,[11] Zambia,[12] Bangledesh,[13] and Pakistan[14] are discussed.

[1]Faundes A. A professional duty to contribute toward preventing unsafe abortion and its consequences. Internation journal of gynecology & obstetrics 2014; 126 Suppl 1: S1-2

[2]Tavara L: Contribution of obstetrics and gynecology societies in South America to the prevention of unsafe abortion in the region. Internation journal of gynecology & obstetrics 2014; 126 Suppl 1: S7-9

[3] Jaldesa GW: Contribution of obstetrics and gynecology societies in East, Central, and Southern Africa to the prevention of unsafe abortion in the region. Internation journal of gynecology & obstetrics 2014; 126 Suppl 1: S13-6

[4] Leke RJ, Njotang NP, Shearon AB, Wankah CA. The impact of signing a memorandum of understanding on reproductive health with the Ministry of Public Health in Cameroon. Internation journal of gynecology & obstetrics 2014; 127 Suppl 1: S13-4

[5] Zaidi S, Begum F, Tank J, et al. Achievements of the FIGO Initiative for the Prevention of Unsafe Abortion and its Consequences in South-Southeast Asia. Internation journal of

gynecology & obstetrics 2014; 126 Suppl 1: S20-3

[6] Chinchilla AL, Flores IF, Morales AF, de Gil MP: Changes in the use of manual vacuum aspiration for postabortion care within the public healthcare service network in Honduras. Internation journal of gynecology & obstetrics 2014; 126 Suppl 1: S24-7

[7] Tumasang F, Leke RJ, Aguh V: Expanding the use of manual vacuum aspiration for incomplete abortion in selected health institutions in Yaounde, Cameroon. Internation journal of gynecology & obstetrics 2014; 126 Suppl 1: S28-30

[8] Begum F, Zaidi S, Fatima P, et al. Improving manual vacuum aspiration service delivery, introducing misoprostol for cases of incomplete abortion, and strengthening postabortion contraception in Bangladesh. Internation journal of gynecology & obstetrics 2014; 126 Suppl 1: S31-5

[9] Zaidi S, Yasmin H, Hassan L, et al. Replacement of dilation and curettage/evacuation by manual vacuum aspiration and medical abortion, and the introduction of postabortion contraception in Pakistan. Internation journal of gynecology & obstetrics 2014; 126 Suppl 1: S40-4

[10] Gemzell-Danielsson K, Kopp Kallner H, Faundes A: Contraception following abortion and the treatment of incomplete abortion. Internation journal of gynecology & obstetrics 2014; 126 Suppl 1: S52-5

[11] Mayi-Tsonga S, Obiang PA, Minkobame U, et al. Introduction of postabortion contraception, prioritizing long-acting reversible contraceptives, in the principal maternity hospital of Gabon. Internation journal of gynecology & obstetrics 2014; 126 Suppl 1: S45-8

[12] Macha S, Muyuni M, Nkonde S, Faundes A. Increasing access to legal termination of pregnancy and postabortion contraception at the University Teaching Hospital, Lusaka, Zambia. Internation journal of gynecology & obstetrics 2014; 126 Suppl 1: S49-51

[13] Begum F, Zaidi S, Fatima P, et al. Improving manual vacuum aspiration service delivery, introducing misoprostol for cases of incomplete abortion, and strengthening postabortion contraception in Bangladesh. Internation journal of gynecology & obstetrics 2014; 126 Suppl 1: S31-5

[14] Zaidi S, Yasmin H, Hassan L, Khakwani M, Sami S, Abbas T: Replacement of dilation and curettage/evacuation by manual vacuum aspiration and medical abortion, and the introduction of postabortion contraception in Pakistan. Internation journal of gynecology & obstetrics 2014; 126 Suppl 1: S40-4

157. International Journal of Gynecology and Obstetrics 2014; 127 Supplement #1

The October 2014 supplement to the International Journal of Gynecology and Obstetrics reports on the International Federation of Gynecology and Obstetrics (FIGO) effort to reduce worldwide maternal mortality. FIGO's initiative is discussed. [1,2] Guidelines, tools, lessons, and training in conducting maternal death reviews are described.[3,4] Efforts in maternal death reviews in Ethiopia[5] and India[6] are presented. There is also a unique focus on professional organizations taking a lead in reducing maternal mortality through communication within their own organizations, advocacy for the cause, as well as working with governments and institutions in low-resource countries and regions.[7-11]

[1] Rushwan H. The FIGO Leadership in Obstetrics and Gynecology for Impact and Change (LOGIC) Initiative in Maternal and Newborn Health. Internation journal of gynecology & obstetrics 2014; 127 Suppl 1: S1-2

[2] Taylor DJ, Vander Plaetse B. The FIGO Leadership in Obstetrics and Gynecology for Impact and Change (LOGIC) Initiative in Maternal and Newborn Health. Internation journal of gynecology & obstetrics 2014; 127 Suppl 1: S3-5

[3] De Brouwere V, Zinnen V, Delvaux T, Leke R. Guidelines and tools for organizing and conducting maternal death reviews. Internation journal of gynecology & obstetrics 2014; 127 Suppl 1: S21-3

[4] De Brouwere V, Zinnen V, Delvaux T, Nana PN, Leke R: Training health professionals in conducting maternal death reviews. Internation journal of gynecology & obstetrics 2014; 127 Suppl 1: S24-8

[5] Gebrehiwot Y, Tewolde BT: Improving maternity care in Ethiopia through facility based review of maternal deaths and near misses. Internation journal of gynecology & obstetrics 2014; 127 Suppl 1: S29-34

[6] Purandare C, Bhardwaj A, Malhotra M, et al. Every death counts: electronic tracking systems for maternal death review in India. Internation journal of gynecology & obstetrics 2014; 127 Suppl 1: S35-9

[7] Perron L, Vander Plaetse B, Taylor D. United Nations Millennium Development Goals 4 and 5: augmenting the role of health professional associations. Internation journal of gynecology & obstetrics 2014; 127 Suppl 1: S6-9

[8] Osman NB, Almeida ML, Usta MB, et al. Development of a strategic plan by the Mozambican Association of Obstetricians and Gynaecologists: direct and indirect effects. Internation journal of gynecology & obstetrics 2014; 127 Suppl 1: S10-2

[9] Leke RJ, Njotang NP, Shearon AB, Wankah CA: The impact of signing a memorandum of understanding on reproductive health with the Ministry of Public Health in Cameroon. Internation journal of gynecology & obstetrics 2014; 127 Suppl 1: S13-4

[10] Chaudhary P, Tuladhar H: Novel ways of improving communication with members of health professional associations. Internation journal of gynecology & obstetrics 2014; 127 Suppl 1: S15-6.

[11] Beyeza-Kashesya J, Kaharuza F, Murokora D: The advantage of professional organizations as advocates for improved funding of maternal and child health services in Uganda.

Internation journal of gynecology & obstetrics 2014; 127 Suppl 1: S52-5

Postdural puncture headache and epidural blood patch

158. Pratt SD, Kaczka DW, Hess PE: **Observational study of changes in epidural pressure and elastance during epidural blood patch in obstetric patients**. International journal of obstetric anesthesia 2014; 23: 144-50

This prospective observational study found a curvilinear relationship between the volume of blood injected during an epidural blood patch and the pressure generated in the epidural space. Eighteen EBPs were performed in 17 patients in the left lateral decubitus position. After LOR, a three-way stopcock was placed at the end of the 17-gauge Tuohy needle. One port of the stopcock was connected to a strain-gauge pressure transducer using sterile non-compressible tubing. Initial pressure in the epidural space for each patient was defined as the zero point prior to injection of blood. Static epidural pressure was measured after each 5 mL injection of blood with until the patient experienced mild back pressure or discomfort. After EBP completion, the patient was asked to sit and the initial efficacy of the injection was categorized as "complete", "partial", or "no improvement." Mean (SD) blood volume injected was 18.9 (+/- 7.8) mL with a range of 6-38mL. Mean (SD) final pressure was 13.1 (+/- 13.4) mmHg with a range of 2-56 mmHg. Fifteen out of eighteen (83.3%) patients had "complete" or "partial" initial success. There was a strong correlation between the volume injected and the pressure generated. This could be expressed by both a quadratic (=0.0254 x (mL injected)^2 +0.0297 mL) or power (=0.0679 x mL injected$^{1.742}$) relationship, each with fair correlation (r^2=0.57). There was no correlation between the final pressure generated and the success of the epidural blood patch, however the sample size was small. The authors point out that much of the procedure was not standardized, such as the rate of injection of blood and the time at which steady state epidural pressure was determined.

159. Stein MH, Cohen S, Mohiuddin M.A., Dombrovskiy V, Lowenwirt I: **Prophylactic vs therapeutic blood patch for obstetric patients with accidental dural puncture--a randomised controlled trial**. Anaesthesia 2014; 69: 320-6

    Accompanied by editorial:

    Hewson D, Graham G. **Accidental dural puncture: patch or wait?** Anaesthesia 2014; 96: 785-6

This study randomized patients experiencing an accidental dural puncture (ADP) to prophylactic epidural blood patch (EBP) versus therapeutic (traditional management) EBP. Patients experiencing an ADP had an epidural catheter re-sited. They were then randomized to prophylactic vs. therapeutic EBP groups. In the prophylactic group, 15-20 mL of autologous was given through the indwelling epidural catheter at least 5 hours after the last dose of epidural local anesthetic. Subjects in the therapeutic EBP group were initially treated with conservative management and then offered EBP if postdural puncture headache (PDPH) developed. Sham EBPs were not used. An independent blinded observer evaluated all patients at 12-hour intervals while in hospital and daily for one week after discharge. In contrast to other studies (most notably Scavone and Wong in 2004), the authors found a significant decrease in the frequency of headaches in patients receiving a prophylactic EBP (18.3% vs. 79.6%, $p < 0.0001$). Only 10% of patients in the prophylactic EBP group received a second EBP. There was no significant difference in onset time to PDPH between groups. In patients who did develop a headache, there did not appear to be differences in headache severity. No adverse effects or events were reported.

160. Verstraete S, Walters M.A., Devroe S, Roofthooft E, Van de Velde M: **Lower incidence of post-dural puncture headache with spinal catheterization after accidental dural puncture in obstetric patients**. Acta anaesthesiologica Scandinavica 2014; 58: 1233-9

This retrospective study compared the effects of placing an intrathecal catheter versus re-siting an epidural catheter after accidental dural puncture (ADP) on the development of postdural puncture headache (PDPH). For the first six years of the study period, re-siting an epidural was performed following an accidental dural puncture (n=39) while in the most recent 10 years, an intrathecal catheter was placed (n=89). After delivery, the intrathecal catheter was kept in situ for a minimum of 24 hours with 0.9% NaCl running at 2 ml/hr. Prolonged intrathecal catheter placement reduced the risk of PDPH after ADP to 42% compared with 62% in patients who had the epidural re-sited (OR 2.3, 95% CI 1.04-4.86). The need for EBP was not statistically different between groups (36% vs. 54%, p=0.06), but fewer patients in the intrathecal catheter group needed a 2nd EBP. Although the 16 year study period was lengthy, and small unconscious practice differences between the two epochs could have occurred that influenced results, 18 gauge epidural needles were used for the entire study period and departmental policies remained consistent over the study period.

161. Miu M, Paech MJ, Nathan E: **The relationship between body mass index and post-dural puncture headache in obstetric patients**. International journal of obstetric anesthesia 2014; 23: 371-5

This retrospective study evaluated 125 accidental dural punctures/post-dural puncture headaches over a six-year period (the 125 include witnessed wet taps, intrathecal catheters, or PDPH criteria being met after difficult epidural insertion). Women were classified into "non-obese" (<30 BMI) and "obese" (>30 BMI) groups. Contrary to previous studies, this study found *no difference* in the incidence of PDPH following accidental dural puncture between obese and non-obese women (82% vs. 80%, p=0.827). Additionally there was no statistical difference between BMI groups with regards to PDPH intensity, EBP performance (57% vs. 54%, p=0.806), or EBP success (full relief 57% vs. 65%, p=0.783).

162. Loures V, Savoldelli G, Kern K, Haller G. **Atypical headache following dural puncture in obstetrics.** International journal of obstetric anesthesia 2014. 23; 246-52.

These authors analyzed a series of 27,064 patients who had neuraxial procedures between 2001 and 2010 and found 142 post-dural puncture headaches. Eight (5.6%, 95% CI 1.7-9.4%) presented with an atypical non-postural headache. Associated symptoms were stiffness and pain in the cervical, thoracic or lumbar vertebral area, visual disturbances and vertigo. Risk factors for developing a nonpostural postdural puncture headache included previous migraine, odds ratio 6.1 (95% CI 1.2-28.7), a more cephalad level of needle insertion, (OR 17.2, 95% CI 1.4-210.1) and identification of dural puncture by aspiration of cerebrospinal fluid from the epidural catheter, (OR 5.5, 95% CI 1.2-24.4). In multivariate analysis, recognition of dural puncture by flow of cerebrospinal fluid from the epidural catheter was the most significant predictor of non-orthostatic postdural puncture headache.

Non-obstetric surgery during pregnancy

163. Abbasi N, Patenaude V, Abenhaim HA: **Management and outcomes of acute appendicitis in pregnancy-population-based study of over 7000 cases**. British journal of obstetrics & gynaecology 2014; 121: 1509-14

This population-based matched cohort study utilized data from the Healthcare Cost and Utilization Project, Nationwide Inpatient Sample between 2003 and 2010 and found that among 7,037,386 births, 7114 women developed appendicitis for an incidence of 101.1 cases per 100,000 births. They found that peritonitis (aOR 1.3), sepsis (aOR 1.9), transfusion (aOR1.7), pneumonia (aOR 2.5), bowel obstruction (aOR 1.9) postoperative infection (aOR2.0), and length of stay >3 days (aOR2.3) were all more likely in pregnant women compared to nonpregnant women. Women who were pregnant were more likely to be managed conservatively compared to those who were not pregnant. Pregnant women who were managed conservatively were at increased risk of sepsis (aOR 2.6), septic shock (aOR 6.3), peritonitis (aOR 1.6), and venous thromboembolism (aOR 2.5) compared to pregnant women with appendicitis who underwent surgical management.

Prenatal care and assessment

164. Bianchi DW, Parker RL, Wentworth J, Madankumar R, Saffer C, Das AF, Craig JA, Chudova DI, Devers PL, Jones KW, Oliver K, Rava RP, Sehnert AJ: **DNA sequencing versus standard prenatal aneuploidy screening**. The New England journal of medicine 2014; 370: 799-808

    Accompanied by editorial:

    Yurkiewicz IR, Korf BR, Lehmann LS. **Prenatal whole-genome sequencing--is the quest to know a fetus's future ethical?** The New England journal of medicine 2014; 370: 195-7

This series collected blood from 1914 general obstetric patients (i.e. not high risk) who were undergoing standard aneuploidy screening (which included biochemical assays with and without nuchal translucency measurements) in order to determine the accuracy of maternal plasma cell-free DNA testing for diagnosis of aneuploidy. The cell free DNA testing detected all cases of aneuploidy. For trisomy 21 and 18, the false positive rates were significantly lower than those for standard screening (0.3% vs 3.6% for trisomy 21, p<0.001; and 0.2% versus 0.6% for trisomy 18, p = 0.03). The positive predictive values for cell free DNA versus standard screening was also superior (45.5% versus 4.2% for trisomy 21 and 40.0% versus 8.3% for trisomy 18).

165. Huybrechts KF, Palmsten K, Avorn J, Cohen LS, Holmes LB, Franklin JM, Mogun H, Levin R, Kowal M, Setoguchi S, Hernández-Díaz S: **Antidepressant use in pregnancy and the risk of cardiac defects**. The New England journal of medicine 2014. 19; 370: 2397-407

This cohort study of the nationwide Medicaid Analytic eXtract included 949,504 women who were pregnant between 2000 and 2007 of which 64,389 (6.8%) used antidepressants during the first trimester. Although the unadjusted analysis showed a relative risk of 1.25 (95% CI 1.13 – 1.38) for structural cardiac defects, the fully adjusted analysis restricted to women with depression showed no increased risk (RR1.06, 95% CI 0.93 -1.22). The authors conclude that this cohort study "suggested no substantial increase in the risk of cardiac malformations attributable to antidepressant use during the first trimester."

166. Khatib N, Weiner Z, Beloosesky R, Vitner D, Thaler, I: **The effect of maternal supine position on umbilical and cerebral blood flow indices.** European journal of obstetrics, gynecology, and reproductive biology 2014; 175: 112-4

These authors assessed 23 low-risk women between 36 and 40 weeks' gestation and performed Doppler flow velocity waveforms on the fetal middle cerebral and umbilical artery in the supine and left lateral position. The pulsatility index in the fetal middle cerebral artery decreased from 1.78 (+/-0.27) in the left lateral decubitus position to 1.29 (+/-0.16) in supine position (p<0.0001). Peak systolic velocity decreased from 46.05 (+/-7.85cm/s) to 39.43 (+/-7.95cm/s), respectively (p=0.001). The pulsatility index in the umbilical artery decreased from 0.89 (+/-0.13) in the left lateral position to

0.74 (+/-0.11) in the supine position (p<0.0001). The authors state that "this study demonstrates that the supine position in late pregnancy, causing aortic and venacaval compression, leads to brain auto-regulation that activates the brain sparing effect in the fetus." They comment that assessment of this brain sparing effect could be used in other studies to assess fetal compromise.

Neonatal Care

167. **Executive summary: neonatal encephalopathy and neurologic outcome, second edition**. Obstetrics and gynecology 2014; 123: 896-901

This report from the ACOG Task Force on Neonatal Encephalopathy outlines the assessment process for distinguishing hypoxic ischemic encephalopathy from other forms of neonatal encephalopathy when clinicians are attempting to establish a link between an acute intrapartum event and a poor neonatal neurologic outcome. This report differs from previous editions of the report in that it recommends a more comprehensive multidimensional assessment that includes all potential contributing factors including maternal history, obstetric antecedents, intrapartum factors, and placental pathology. The authors outline the neonatal signs consistent with an acute peripartum event including low Apgar scores at 5 and 10 minutes, fetal umbilical artery pH less than 7.0 or a base deficit $\geq$ 12, distinct patterns of MRI imaging obtained between 24 and 96 hours of life, and the presence of multisystem organ failure.

168. Chollat C, Enser M, Houivet E, Provost D, Benichou J, Marpeau L, Marret S: **School-age outcomes following a randomized controlled trial of magnesium sulfate for neuroprotection of preterm infants**. The journal of pediatrics 2014; 165: 398-400 e3

This study followed up with school-age assessment on children who were in the French PREMAG trial which randomized mothers of preterm (33 wks or earlier) fetuses threatening delivery to either magnesium or placebo. This prior study demonstrated a neuroprotective effect of magnesium. This study did not have the power to support the benefit of the magnesium exposure. However there were trends toward reductions in qualitative behavior disorders, cognitive difficulties, school grade repetition, and education services among the children who were exposed to magnesium prior to birth.

169. Russo A, McCready M, Torres L, et. al. **Reducing hypothermia in preterm infants following delivery**. Pediatrics 2014; 133: 1055-62

These authors assessed a multidisciplinary practice plan designed to keep premature infants <35 weeks old warm after delivery (admitting axillary temperature <36 degrees C without increasing exposure to a temperature >37.5 degrees C). They implemented the use of an occlusive wrap, a transwarmer mattress, and a cap for all infants as well as maintained an operating room temperature between 21 degrees C and 23 degrees C. The practice plan was associated with a significant increase in the newborns' admitting axillary temperatures, a decrease in the number of infants with moderate hypothermia, and a reduction in neonatal intubation at 24 hours.

170. Pinheiro JM, Furdon SA, Boynton, S, Dugan R, Reu-Donlon C, Jensen S. **Decreasing hypothermia during delivery room stabilization of preterm neonates.** Pediatrics 2014; 133: 218-26

These authors report a 5-year qualitity improvement project involving a thermoregulation bundle. Introduction and optimization of the bundle decreased the incidence of hypothermia, with rates remaining in the target range for the last 13 study months. The incidence of temperatures >38 degrees C was about 2% both before and after bundle implementation.

171. Wiest DB, Chang E, Fanning D, Garner S, Cox T, Jenkins DD: **Antenatal pharmacokinetics and placental transfer of N-acetylcysteine in chorioamnionitis for fetal neuroprotection**. The journal of pediatrics 2014; 165: 672-7

This double-blind study administered pregnant women with a clinical diagnosis of chorioamnionitis either 100mg/kg N-Acetylcysteine every 6 hours or placebo. The authors found rapid placental transfer of the drug with a cord to maternal ratio of 1.4 $\pm$ 0.8 suggesting a slower rate of fetal clearance, with babies closer to term clearing the drug more quickly than those more preterm. Because animal models have demonstrated that N-Acetylcysteine provides neuroprotection in hypoxic ischemic brain injury and in maternal inflammation, this study shows that antenatal neuroprotection may be possible through N-acetylcysteine administration to mothers with chorioamnionitis. This study was not powered to assess neonatal outcomes.

172. Shankaran S, Laptook AR, Pappas A, et. al: **Effect of depth and duration of cooling on deaths in the NICU among neonates with hypoxic ischemic encephalopathy: a randomized clinical trial.** JAMA 2014; 312: 2629-39

    Accompanied by editorial:

    Robertson NJ, Marlow N. Depth and duration of cooling for perinatal asphyxial encephalopathy. JAMA 312: 2623-4.

This multicenter randomized controlled trial assigned neonates to one of four hypothermia groups; 33.5 degrees C for 72 hours, 32.0 degrees C for 72 hours, 33.5 degrees C for 120 hours, or 32.0 degrees C for 120 hours. The primary outcome of death or disability at 18 to 22 months is ongoing. The trial was closed at 364 neonates enrolled (of 726 planned) because a futility analysis determined that the probability of detecting a statistically significant benefit for longer cooling, deeper cooling, or both for NICU death was less than 2%. The authors concluded that "among neonates who were full-term with moderate or severe hypoxic ischemic encephalopathy, longer cooling, deeper cooling, or both compared with hypothermia at 33.5 degrees C for 72 hours did not reduce NICU death."

173. Grunebaum A, McCullough LB, Sapra K J. **Early and total neonatal mortality in relation to birth setting in the United States, 2006-2009**. American journal of obstetrics and gynecology 2014; 211: 390 e1-7.

These authors used data from the Centers for Disease Control and Prevention-linked birth and infant death dataset from 2006 through 2009 to assess neonatal mortality in babies delivered in the hospital or in babies delivered by midwives outside of the hospital. The data showed a significantly increased total and early neonatal mortality for home births.

Fetal surgery

174. Cohen AR, Couto J, Cummings JJ, Johnson A, Joseph G, Kaufman BA, Litman RS, Menard MK, Moldenhauer JS, Pringle KC, Schwartz MZ, Walker WO, Jr., Warf BC, Wax JR: **Position statement on fetal myelomeningocele repair**. American journal of obstetrics and gynecology 2014; 210: 107-11

The Fetal Myelomeningocele Maternal-Fetal Management Task Force published these optimal practice criteria for institutions who wish to perform in utero myelomeningocele repairs. They define minimal criteria for "a fetal therapy center" which includes an experienced fetal care team, a multidisciplinary spina bifida program, a Level IIIC Neonatal Intensive Care Unit, a labor and delivery unit with around the clock availability of specialists, an IRB, an ethics committee, a maternal/fetal advocate, and an institutional commitment to track long-term pediatric neurodevelopmental outcomes. For the procedures, they recommend strict adherence to the protocol outlined in the Management of Myelomeningocele Study (MOMS trial), which would involve adopting the inclusion and exclusion criteria of the study. The children should be provided long term care in the multidisciplinary spina bifida clinic. The parents must go through nondirective counseling which involves a full disclosure of risks and potential management outcomes as well as reflective period for them to thoroughly contemplate their choice. Finally, each center should agree to join and support a central registry to track outcomes data. Optimally, the centers should be geographically distributed throughout the country to allow access.

Anesthesia effects on the developing brain

175. Creeley CE, Dikranian KT, Dissen GA, Back SA, Olney JW, Brambrink AM: **Isoflurane-induced apoptosis of neurons and oligodendrocytes in the fetal rhesus macaque brain**. Anesthesiology 2014; 120: 626-38

This study exposed fetal rhesus macaques at 120 days gestational age to isoflurane anesthesia for 5 hours in utero. Apoptosis of neurons and oligodendrocytes was increased 4.1 fold in comparison to controls. The authors discuss how the oligodendrocytes become vulnerable when they are just achieving myelination competence which results in the neurotoxic potential of isoflurane increasing between the third trimester and the neonatal period in the nonhuman primate brain studied here.

176. Peng J, Drobish JK, Liang G. et al. **Anesthetic preconditioning inhibits isoflurane-mediated apoptosis in the developing rat brain.** Anesthesia and analgesia 2014; 119:939-46.

These authors evaluated whether preconditioning with a short exposure to isoflurane would reduce neuroapoptitic changes in neonatal rats. The preconditioned rates were exposed to 1.5% isoflurane for 30-minutes on one day, and then exposted to 1.5% isoflurane for 6 hours the following day. There was lesser neuroapoptic changes in the cerebral cortex of the rats who underwent preconditioning.

177. Takaenoki Y, Satoh Y, Araki Y, Kodama M, Yonamine R, Yufune S, Kazama T: **Neonatal exposure to sevoflurane in mice causes deficits in maternal behavior later in adulthood**. Anesthesiology 2014; 120: 403-15

Animal models have previously shown that general anesthetic exposure induces neuronal apoptotic changes in the developing brain with learning and social abnormalities subsequently evident in these animals as adults. This study exposed 6-day-old female mice to six hours of 3% sevoflurane with and without 1.3% hydrogen. At 7-9 weeks, these mice were mated and their maternal behaviors were studied. The mice exposed to sevoflurane without hydrogen lost >50% of their pups (compared to 80% survival amongst controls, $p < 0.0001$) as a result of lack of maternal nurturing (incomplete nest building, shorter durations of crouching for nursing, fewer pups with milk in their digestive tracts, greater percentage of poorly cleaned pups, greater ratio of scattered pups out of the nest, lower scores on the pup retrieval test,). Co-administration of hydrogen gas with the sevoflurane as an anti-oxidant agent prevented these behavioral alterations. This study adds further animal evidence to the neurobehavioral alterations that can occur as a result of the apoptotic cell death from sevoflurane exposure in newborn animals.

178. Cheng Y, Levy RJ: **Subclinical carbon monoxide limits apoptosis in the developing brain after isoflurane exposure**. Anesthesia and analgesia 2014; 118: 1284-92

Accompanied by editorial:

Jevtovic-Todorovic V: **Good gas, bad gas: isoflurane, carbon monoxide, and which is which?** Anesthesia and analgesia 2014; 118: 1160-2

This study exposed 7-day-old mice to one hour of 0, 5, or 100ppm of carbon monoxide in air with or without 2% isoflurane. The authors found that the mice exposed to isoflurane had neuronal apoptosis which was measurable by increased cytochrome c peroxidase activity and cytochrome c release from forebrain mitochondria as well as activated casoase-3 cells and TUNEL positive nuclei. Simultaneous exposure of carbon monoxide with the isoflurane decreased these measurable signs of neuronal apoptotic changes. The authors discuss that "low-flow anesthesia designed to re-breath specific concentrations of carbon monoxide may be a strategy that could potentially prevent anesthesia-induced neurotoxicity in infants and children."

179. Duan X, Li Y, Zhou C, Huang L, Dong Z: **Dexmedetomidine provides neuroprotection: impact on ketamine-induced neuroapoptosis in the developing rat brain**. Acta anaesthesiologica Scandinavica 2014; 58: 1121-6

Neonatal rats were either administered saline, saline and ketamine, saline and dexmedotomidine, or dexmedotomidine and ketamine once per day for three days. Neuronal apoptosis in the CA1 region and the dentate gyrus of rats was examined by transferase dUTP nick end labeling (TUNEL) assays. Learning and memory abilities of 2-month old rats were examined by the Morris water maze test. The authors found that dexmedetomidine alone was not neurotoxic to the developing brain and that when administered with ketamine, dexmedetomidine attenuated the neuronal apoptotic effects of ketamine.

180. Tan S, Xu C, Zhu W, et.al. **Endocrine and neurobehavioral abnormalities induced by propofol administered to neonatal rats.** Anesthesiology 2014; 121: 1010-7

These authors anesthetized rats using intraperitoneal propofol for 5 h on postnatal days 4, 5, or 6 and gave controls saline or intralipid. Propofol acutely increased corticosterone levels. The authors conclude that "propofol caused acute increases in corticosterone levels and gamma-aminobutyric acid type A receptor-mediated excitation at the time of anesthesia (and this) may play mechanistic roles in development of exacerbated endocrine responses to stress and neurobehavioral abnormalities."

181. Nemergut ME, Aganda D, Flick RP. **Anesthetic neurotoxicity: what to tell the parents?** Pediatric Anesthesia 2014; 24: 120-6

This article reviews the history of the research regarding anesthesia risk for adverse neurodevelopmental outcomes in infants and children. The authors "impart a framework from which anesthesiologists may address the apprehensions of parents who actively bring up this issue…(and) discuss whether such a conversation should be undertaken as a part of the consent process."

External Cephalic Version

182. Munoz H, Guerra S, Perez-Vaquero P, Valero Martinez C, Aizpuru F, Lopez-Picado A: **Remifentanil versus placebo for analgesia during external cephalic version: a randomised clinical trial**. International journal of obstetric anesthesia 2014; 23: 52-7

This randomized, double-blinded, placebo- controlled trial examined 60 term parturients receiving either remifentanil infusion with patient controlled boluses or saline placebo during external cephalic version (ECV) attempts. Mean pain scores immediately after attempted ECV were lower and overall maternal satisfaction scores were statistically significantly improved amongst women receiving remifentanil compared to saline placebo. However, the overall success rate of ECV (48.3%) was not significantly different between remifentanil and control groups. Cesarean delivery rates were also similar. Nausea and vomiting, dizziness, drowsiness, fetal bradycardia occurrences and baseline oxygen saturation levels were not significantly different in the two study groups. It appears, compared to no additional analgesic treatment, remifentanil achieved a reduction in maternal pain ratings immediately following ECV and increased maternal satisfaction with no additional adverse effects, but did not improve the success of the procedure.

183. Burgos J, Quintana E, Cobos P, Osuna C, Centeno M.D.el M, Melchor JC: **Effect of maternal intravenous fluid therapy on external cephalic version at term: a prospective cohort study**. American journal of obstetrics and gynecology 2014; 211: 665 e1-7

This prospective cohort observational study compared external cephalic version (ECV) in 100 term parturients administered 2 liters of *hypotonic* saline to a historical control cohort of women who underwent ECV without additional hydration. Although prior studies suggest that an amnionic fluid index(AFI) >13 cm results in greater success with ECV, this study was not able to achieve a significant increase in ECV success between cohorts, even considering a marked increase in AFI (posthydration AFI 16.13 =/-3.96 cm vs 12.47 =/-3.85cm in controls). In fact, ECV success was actually non-statistically lower in the hydration (43%) than the control group (47%). No clinically significant fluid or electrolyte imbalances occurred in the hypotonic saline group.

Anesthesia and Lactation

184. Dalal PG, Bosak J, Berlin C: **Safety of the breast-feeding infant after maternal anesthesia**. Pediatric anesthesia 2014; 24: 359-71

    Followed by letters to the editor:

    Camporesi A, Silvani P: Comment on 'Safety of the breast-feeding infant after maternal anesthesia' Dalal PG, Bosak J, Berlin C. Pediatric anesthesia 2014; 24: 453

    Dalal PG, Berlin C: Response to Silvani and Camporesi, regarding their comment on our paper Safety of the breast-feeding infant after maternal anesthesia. Pediatric anesthesia 2014; 24: 453-4

This article reviews the literature on anesthetic drugs administered to nursing mothers and the passage of these drugs to the neonate. They state that very small amounts of propofol, thiopental, and etomidate can be found in the milk or colostrum of mothers after a general anesthetic. There is no data on ketamine, nondepolarizing muscle relaxants or volatile anesthetic agents. Opioids and benzodiazepines transfer to the breast milk but the shorter acting drugs such as fentanyl and midazolam administered in single doses to nursing mothers are "considered safe in lactating women." Local anesthetics and anticholinesterases are also considered safe. The authors recommend a general anesthetic for nursing mothers that can include midazolam, propofol, nitrous oxide, any of the volatile agents, neuromuscular blockade and reversal, and antiemetics such as ondansetron and dexamethasone. The authors state that "because the exposure of the infant over 24 hours to most drugs transferred to breast milk is rarely >1-2% of the original maternal dose some anesthesiologists make the recommendation to resume breast-feeding when sufficiently recovered from anesthesia." They go on to say that "there are no scientific data to support postoperative 'pump and dumping' unless the mother is not awake enough to breast feed…" This article resulted in letters to the editor because some did not agree with the authors' conclusions and because the authors did not address potential neuronal apoptotic changes from anesthetic agents to the developing brain of the nursing babies.

185. Bolat E, Bestas A, Bayar MK, Ozcan S, Erhan OL, Ustundag B: **Evaluation of levobupivacaine passage to breast milk following epidural anesthesia for cesarean delivery**. International journal of obstetric anesthesia 2014; 23: 217-21

These authors administered 20 women undergoing elective cesarean delivery 0.5% levobupivacaine or 0.5% bupivacaine via epidural catheter and measured maternal plasma and breast milk levels at 30min, 1 h, 2 h, 6 h, 12 h, and 24 hours. The authors' found that both drugs were measured in the breast milk at 30 minutes. The milk/plasma ratios were 0.34 $\pm$0.13 for levobupivacaine and 0.37 $\pm$0.14 for bupivacaine, in other words, the concentration of both drugs was about three times lower in breast milk than in maternal plasma. Both drugs showed similar decreases in levels with time and were nearly undetectable at 24 hours.

Racial and Ethnic Disparities of Care

186. Caballero JA, Butwick AJ, Carvalho B, Riley ET: **Preferred spoken language mediates differences in neuraxial labor analgesia utilization among racial and ethnic groups**. International journal of obstetric anesthesia 2014; 23: 161-7

This retrospective cohort study of 3129 parturients examined ethnic and racial diversity concerns surrounding utilization of neuraxial labor analgesia. Uniquely, this study investigated preferred spoken language as a variable. It appears language barriers (limited English proficiency) may be contributing to neuraxial local anesthesia use among various ethnic groups. Spanish language and multiparity were found to be independently associated with reduced likelihood of receiving labor analgesia. Additionally, this study highlights the importance of collecting preferred spoken language as a variable in future studies on this topic.

187. Wilson SH, Elliott MP, Wolf BJ, Hebbar L: **A prospective observational study of ethnic and racial differences in neuraxial labor analgesia request and pain relief**. Anesthesia and analgesia 2014; 119: 105-9

This prospective cohort study of 397 term parturients investigated ethnic and racial diversity concerns surrounding the timing of neuraxial analgesia. Ethnicity categories were collected based on parturient self-identification. The primary outcome was cervical dilation at the time of analgesia request. Study design controlled for education, rationale for placement, labor augmentation, and mode of delivery. The study showed that Hispanic women have 0.5cm greater cervical dilation at time of neuraxial request compared to non-Hispanic whites. This difference was neither statistically significant, nor perhaps a clinically significant. The authors' conclude that ethnicity/race identification likely played a minor role in accepting and requesting labor analgesia in their cohort.

188. Creanga AA, Bateman BT, Mhyre JM, Kuklina E, Shilkrut A, Callaghan WM: **Performance of racial and ethnic minority-serving hospitals on delivery-related indicators**. Am J Obstet Gynecol 2014; 211: 647 e1-647 e16

This study utilized the State Inpatient Database (delivery data from seven states 2008-2011) to specifically explore how racial/ethnic minority-serving hospitals perform on 15 delivery-related indicators and examine whether indicators vary by race/ethnicity within the same category of hospital. Hospitals were categorized as non-Hispanic white, non-Hispanic black and Hispanic-serving if >50% of deliveries corresponded to the specific racial group. Black-serving hospitals performed worse than other hospitals on 12/15 indicators, suggesting that an overall lower performance of these hospitals compared to white- and Hispanic-serving hospitals. Although indicator rates were similar in Hispanic- and white-serving hospitals, the most prevalent indicators examined (complicated vaginal delivery, complicated cesarean delivery, OB trauma) were lowest in Hispanic-serving hospitals. This is an area in need of future systematic review.

189. Creanga AA, Bateman BT, Kuklina EV, Callaghan WM: **Racial and ethnic disparities in severe maternal morbidity: a multistate analysis, 2008-2010**. American journal of obstetrics and gynecology 2014; 210: 435 e1-8

Reviewed under "Severe maternal morbidity and mortality in developed countries"

Teamwork

190. Dharmadasa A, Bailes I, Gough K, Ebrahimi N, Robinson PN, Lucas DN: **An audit of the efficacy of a structured handover tool in obstetric anaesthesia**. International journal of obstetric anesthesia 2014; 23: 151-6

This study evaluated a handover tool which delineates which patients should be specifically discussed with the next call team at sign-out time. The pneumonic is SAFE which stands for **S**ick patients, **A**t-risk patients (for emergency cesarean delivery, hemorrhage or anesthetic problems), **F**ollow-ups (such as postdural puncture headaches, post-hemorrhage patients, or those with neurologic deficit after delivery) and **E**pidurals (patients who have epidurals running). The authors found that after they introduced the tool to a team, the team increased specifically handing over patients that fit into the SAFE criteria from 49% to 79% of the time ($p<0.0001$, OR 4.1, 95% CI 2.19-7.6).

Simulation

191. Marshall SD, Mehra R: **The effects of a displayed cognitive aid on non-technical skills in a simulated 'can't intubate, can't oxygenate' crisis.** Anaesthesia 2014; 69: 669-77

Reviewed under "The obstetric airway"

192. Siddiqui NT, Arzola C, Ahmed I, Davies S, Carvalho JC: **Low-fidelity simulation improves mastery of the aseptic technique for labour epidurals: an observational study.** Canadian journal of anaesthesia 2014; 61: 710-

Reviewed under "Asepsis"

193. Butcher M, Ip J, Bushby D, Yentis SM: **Efficacy of cardiopulmonary resuscitation in the supine position with manual displacement of the uterus vs lateral tilt using a firm wedge: a manikin study**. Anaesthesia 2014; 69: 868-71

    Reviewed under "Cardiac arrest"

194. Balki M, Chakravarty S, Salman A, Wax RS: **Effectiveness of using high-fidelity simulation to teach the management of general anesthesia for Cesarean delivery**. Canadian journal of anaesthesia 2014; 61: 922-34

This simulation study taught PGY2 and PGY3 residents with a didactic session on general anesthesia for cesarean delivery, then followed it with a high fidelity simulation of general anesthesia for cesarean delivery. Then, two months later, repeated the simulation again. The authors found that there was an improvement in the validated checklist scores and nontechnical skills scores from the first to the second simulation.

Title: What's New in Fetal Surgery

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Objectives: The objectives of this presentation are to review

- Expansion of indications for open fetal surgery, minimally invasive fetal surgery and EXIT procedures
- Controversy over the use of TIVA in open fetal surgeries and EXIT procedures
- Controversy, general versus regional ones or the use of local anesthesia for minimally invasive surgery

Summary: The modern era of fetal surgery began in1981 with Michael Harrisonis pioneering procedure to create bilateral uretero stomies in a fetus with bladder outlet obstruction due to posterior urethral valves.Since then we have seen a progressive expansion of indications for open fetal surgery to include congenital pulmonary airway malformation (CPAM), sacrococcygeal teratoma (SCT), pericardial and mediastinal teratoma and myelomeningocele. In addition, minimally invasive surgery are now the most common procedures performed including fetoscopic laser photocoagulation for twin-twin transfusion syndrome (TTTS), lysis of amniotic bonds devascularization of chorioangioma, tracheal balloon occlusion in congenital diaphragmatic hernia (CDH). Ultrasound guided radio frequency ablation for twin reverse darterial perfusion (TRAP) sequence is among the most successful minimally invasive procedures performed.EXIT procedures continue to be more broadly applied to ar ange of diagnoses including EXIT-to-Airway for cervical teratoma, lymphangioma and micrognathia, EXIT-to-Resection for CPAM, SCT's and EXIT-to-ECMO/CPB for severe CDH and hypoplastic left heart with intact ventricular system.

The use of high doses of inhalational agents for open fetal surgeries and EXITprocedures is thought to adversely affect fetal myocardial function. Total intravenous anesthesia (TIVA) has been reported as a means of limiting duration of fetal exposure to high dose of in inhalational agents with better intraoperative fetal myocardial function,but this remains controversial and not uniformly applied.

The anesthetic technique employed for minimally invasive fetal surgery may vary widely from institution to institution. Few persist in using general anesthesia and most use either regional (spinal/epidural) or local with IV sedation. Dexmedetomedine can be a useful adjunct in fetoscopic treatment of TTTS in the preserve of an anterior placenta for example, to reduce respiratory excursion.

Abstract #:O2-01

Association between the administration of intrapartum magnesium and the incidence of intrapartum fever

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Introduction: Maternal fever, defined as a temperature ≥ 38° C (100.4° F), is associated with several adverse neonatal outcomes including hypotonia, seizures, and need for resuscitation. An association between the use of intrapartum neuraxial analgesia and maternal fever exists, possibly mediated by interleukin-6.1 In a rat model, magnesium sulfate suppressed interleukin-6-induced increases in maternal temperature. We hypothesized that patients exposed to intrapartum magnesium would have a lower incidence of fever than patients not exposed to magnesium.

Methods: In this retrospective, cross-sectional study, electronic medical record data from all live-born deliveries at Northwestern Memorial Hospital between 2007 and 2014 were evaluated. Cases without temperature data were excluded. Extracted data included parity, gestational age, labor type, membrane status at admission, mode of delivery, the use of neuraxial analgesia/anesthesia, diagnosis of preeclampsia, and whether magnesium sulfate was administered. The primary outcome was the diagnosis of fever. After initial univariable analyses, variables with a P <0.1 were entered into a multivariable model.

Results: There were 62,646 deliveries that met inclusion criteria; 6,163 of these developed a fever (9.8%). Women who developed fever were more likely to be nulliparous, term, not preeclamptic, have used neuraxial analgesia/anesthesia, and have delivered via cesarean. The incidence of fever was lower in women who were exposed to magnesium than those who were not (4.3% vs. 9.9%, P<0.001). In a multivariable logistic regression model (Table), women exposed to magnesium were less likely to develop a fever than those who were not (adjusted odds ratio 0.58, 95% CI 0.42 to 0.81).

Table: Factors associated with intrapartum fever

Variable	Adjusted Odds Ratio (95% CI)
Magnesium	0.58 (0.42-0.81)
Nulliparity	3.34 (3.13-3.57)
Preeclampsia	0.57 (0.49-0.67)
Preterm Labor	0.68 (0.61-0.75)
Spontaneous Rupture of Membranes	1.17 (1.06-1.29)
Artificial Rupture of Membranes	1.21 (1.10-1.33)
Neuraxial Analgesia	3.76 (3.22-4.38)
Cesarean Delivery	2.24 (2.11-2.38)

Adjusted odds ratios were determined using a logistic regression model with intrapartum fever as the outcome of interest.

Conclusions: Our data suggest that magnesium may play a protective role against the development of maternal fever. Future work should evaluate the association between the duration of magnesium administration and the development of fever, as well as evaluate neonatal outcomes. These findings should be validated in prospective study, in order to inform the use of magnesium as a potential intervention.

Reference:

1. Goetzl L et al. Am J Obstet Gynecol 2002;187:834-8.

Abstract #:O2-02

Continuous Hemodynamic Monitoring during Cesarean Delivery: Phenylephrine Infusion versus Lower Extremity Compression. A Randomized, Double-blinded, Placebo-controlled Study

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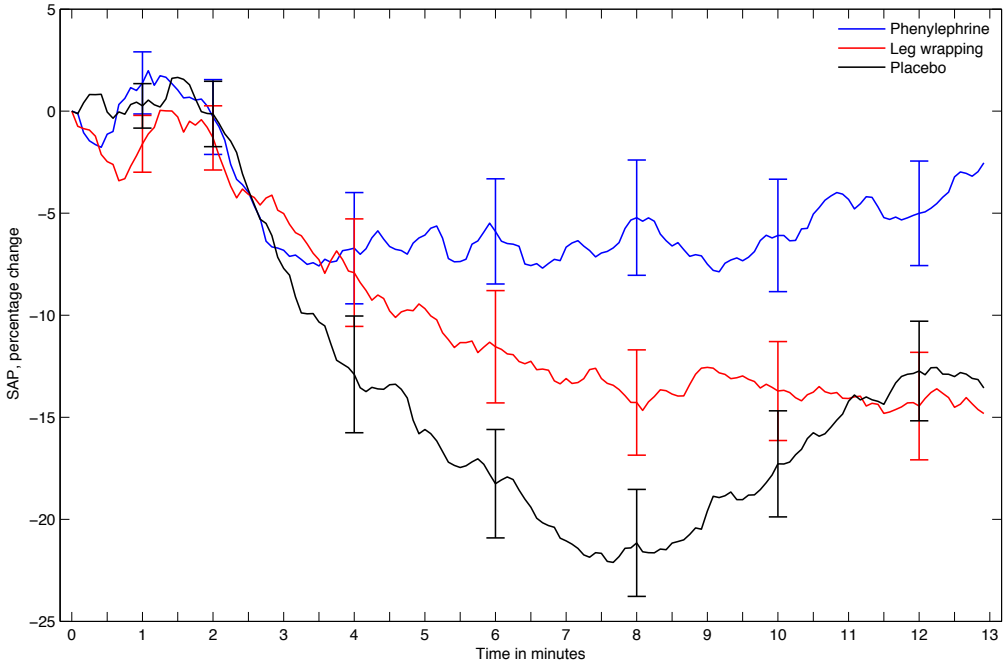
Background: Phenylephrine infusion is the current first-line choice for prevention of spinal hypotension during cesarean delivery. The optimal dosage regimen is still undetermined. A mechanical alternative, lower limb wrapping, has been examined in few small studies showing moderate success. The primary aim of this trial was to compare the prophylactic effect of low-dose phenylephrine infusion and lower limb wrapping on maternal hemodynamic condition. Secondly, we intended to examine the hemodynamic effects of including a start-bolus into low-dose phenylephrine infusion. Thirdly, this is the first study using continuous invasive monitoring to investigate the hemodynamic effects of lower limb wrapping, and to compare prophylactic interventions based on different physiologic strategies.

Methods: In this randomized double-blinded placebo-controlled study, 120 healthy women either received phenylephrine (starting bolus of 0.25 µg▪kg-1and infusion of 0.25 µg▪kg-1▪min-1), leg wrapping, or placebo during spinal anesthesia for elective cesarean delivery. LiDCOplus was used for continuous minimally invasive hemodynamic monitoring.

Results: In the phenylephrine group, systolic blood pressure and systemic vascular resistance were statistically significantly higher, duration of hypotension shorter, stroke volume was similar, and heart rate and cardiac output were statistically significantly lower compared to the leg-wrapping group. Compared to placebo, the leg-wrapping group had statistically significantly higher blood pressure, stroke volume, and cardiac output.

Conclusions: Low-dose phenylephrine infusion is superior to lower limb compression and placebo for hemodynamic stability during spinal anesthesia for cesarean delivery. Phenylephrine stabilizes blood pressure more efficiently and more physiologically, by counteracting arterial vasodilation, the main hemodynamic effect of spinal anesthesia. Our findings suggest that phenylephrine also improves preload, by increasing venous return, likely via splanchnic recruitment.

Lower limb wrapping reduces hypotension compared to placebo by impeding venous pooling to the lower extremities, thus increasing venous return. Concerning the recent debate on the role of venous and arterial circulation in obstetric spinal hypotension, this finding supports that there actually is some early venodilatation after induction of spinal anesthesia which contributes to hypotension.



Abstract #:O2-03

Phenylephrine versus Ephedrine for the Management of Spinal Anesthesia-Induced Hypotension in Preeclamptic Patients During Cesarean Delivery

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Introduction: Hypotension is the most common complication of spinal anesthesia for cesarean delivery and is associated with considerable morbidity. Preemptive use of vasopressors appears to reduce the severity of hypotension. (1) Phenylephine has surpassed ephedrine as the preferred vasopressor for healthy parturients, as it has been shown to have similar efficacy in managing spinal anesthesia-induced hypotension, with less associated fetal acidosis. (2-5) Yet, the optimal vasopressor for preeclamptic women remains unknown. We hypothesized that phenylephrine compared to ephedrine for the management of hypotension during spinal anesthesia in preeclamptic patients would result in higher umbilical artery (UA) pH.

Methods: 110 preeclamptic parturients >18yo presenting for cesarean delivery under spinal anesthesia were recruited. Women were randomized to receive: phenylephrine infusion (100µcg/min) or ephedrine infusion (8mg/min) at completion of spinal anesthesia and titrated to keep systolic blood pressure > 80% of baseline but not > 160mmHg until delivery of infant. Preparation and initiation of spinal anesthesia was standardized. The primary outcome was UA pH. Nominal data was compared by using the Fishers-exact test, continuous and interval data were compared between groups using the Mann-Whitney U-test. $P < 0.05$ was significant.

Results: There were no differences in subject characteristics (Table). The median UA pH was not different between the groups: phenylephrine UA pH=7.23 (IQR 7.19 to 7.25) vs ephedrine UA pH=7.23 (IQR 7.16 to 7.28), P=0.91. The overall incidence of fetal acidosis, defined as UA <7.20, was 29%; 24% in the phenylephrine group and 33% in the ephedrine group, P=0.49 (mean 7.20 + 0.09; Range 6.91-7.38). There was no difference in neonatal ICU admission between the phenylephrine and ephedrine groups, 46% vs 39%(P=0.55), respectively.

Discussion: UA pH was not different between vasopressor groups, although the overall incidence of absolute fetal acidosis was higher than in studies of healthy parturients; most likely due to the uteroplacental insufficiency associated with preeclampsia. Phenylephrine and ephedrine appear to be safe although neither one offered a clear advantage over the other in regards to improved neonatal acid-base status.

References:

1. Ayorinde et al. Br J Anaesth 2001: 86:372-6
2. Lee et al. Anesth Analg 2002;94:920-6
3. Cooper et al. Anesthesiology 2002;97:1582-90
4. Ngan Kee et al. Anesth Analg 2004;98:815-2

	Phenylephrine (n=54)	Ephedrine (n=54)	P
Age (years)	33 (29 to 38)	36 (30 to 40)	0.16
EGA (weeks)	36 (33 to 37)	36 (34 to 37)	0.47
BMI (kg/m2)	31 (28 to 37)	33 (29 to 36)	0.59
Average SBP (mmHg)	150 (139 to 162)	146 (136 to 157)	0.21
Total infusion volume (mL)	3.7 (2.0 to 6.4)	2.8 (2.0 to 6.0)	0.32
Total intravenous fluids (mL)	2200 (1600 to 2500)	1900 (1600 to 2200)	0.09
EBL (mL)	900 (700 to 1000)	900 (700 to 1100)	0.58
Apgar 1 min	8 (7 to 8)	8 (7 to 8)	0.55
Apgar 5 min	9 (9 to 9)	9 (8 to 9)	0.59

EGA = Estimated gestational age
BMI = Body Mass Index
SBP = Systolic Blood Pressure
EBL = Estimated Blood Loss

Abstract #:MA-01 & S-14

Pregnancy Related Spontaneous Coronary Artery Dissection (SCAD): A Comprehensive Review of the Literature

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Introduction: Although rare, SCAD usually occurs in young healthy women.(1) Over a quarter of the cases are pregnancy-related (PSCAD).(2) Still unknown is the ideal treatment as well as the exact mechanism of pathogenesis, although several theories have been proposed.(2)

Methods: A comprehensive PubMed search was executed, finding all published case reports of PSCAD. This was conducted using the terms "spontaneous coronary artery dissection" and "pregnancy". The following elements were collected for cases published after the last review from 2010-2015: age, gravity & parity, presenting symptoms, EKG findings, comorbidities, timing of event, coronary arteries involved & management strategies.

Results and Discussion: Our review of the literature yielded 33 cases of PSCAD from mid 2010 to early 2015. With this data, we can preliminarily report a total of 151 published cases of PSCAD since 1952. This diagnosis is becoming more frequent, likely due to improved and more readily available diagnostic techniques. The average age was 34 with a range between 25-45. Where gravity and parity were reported, 100% of the patients were multiparous. This and advanced maternal age have previously been identified as risk factors for PSCAD.(1) The most frequent presentation was chest pain (96%). However, since these patients are most often healthy young females without cardiac risk factors, more than once were they discharged from the ED, after a normal workup, with diagnosis and management delayed due to decreased awareness. It is essential to have a low threshold for considering PSCAD in this patient population.(2) Timing can range throughout pregnancy to the distant PP period. Our earliest reported case was at 23 weeks gestation and the latest was 7 months PP. In 79% of the cases the dissection was diagnosed in the PP period. Concerning the coronary arteries involved, 64% involved a single artery, with the LAD being the most commonly involved in 73% of the cases and only 2 cases presenting with involvement of the 3 main coronary arteries (LAD, LCx & RCA). Mortality is improving with only one reported death since 1999. The previous mortality rate was as high as 38% prior to 2001.(3) Improved awareness and diagnostic tools along with advances in treatment options have significantly diminished morbidity and mortality rates for this disease.

References:

1. Exp Clin Cardiol. 2009; 14: e8-e16.
2. Heart Views. 2012; 13: 53-65.
3. Catheter Cardiovasc Interv. 2001; 52: 88-94.

Abstract #:MA-01 & S-14

Case number	Author	Year	Age	Parity	Comorbidities	Presentation	Time	EKG	Coronary	Treatment
1	Petrou	2014	39	G2P2	Hashimoto's	CP, dyspnea	postpartum	STEMI	LM,LAD, LCx	Thrombolytics, IABP,CABG, ECMO
2	Pullivarthi	2014	32	multip	Dyslipidemia, Gest DM	CP	2 weeks PP	STEMI	LAD	Medical
3	Nizamuddin	2014	35	G2P1	Nail Patella Syndrome, Gest DM, Vitiligo, Hashimoto's, GERD	CP, SOB	30 weeks gest	STEMI	LAD, diagonal	Stents
4	Vijayaragharan	2014	34	G2P2	not reported	not reported	10 days PP	STEMI	LAD	Stents, CABG
5	Vijayaragharan	2014	40	G2P2	not reported	not reported	10 days PP	NSTEMI	LAD, diagonal	CABG
6	Vijayaragharan	2014	37	G2P2	not reported	not reported	9 days PP	NSTEMI	LAD	Medical
7	Jofre	2014	38	G5P5	Hypothyroid	CP	7 days PP	NSTEMI	LM, LCx, Marginal	IABP,CABG
8	Khan	2014	27	G4P2	none reported	CP, SOB	24 weeks gest	STEMI	LM	CABG
9	Buppajarntham	2014	32	not reported	Preeclampsia, dvt	CP	3 weeks PP	STEMI	LM, LCx, LAD	CABG
10	Jain	2013	45	G2	Hyperlipidemia	CP	2 weeks PP	NSTEMI	LCx	Medical
11	Dalmia	2013	26	G3P2	migraine	CP	23 weeks gest	STEMI	LCx	Medical
12	Weinberg	2013	33	G3P2	none reported	CP, Tachypnea	37 weeks gest	STEMI	LM	CABG
13	Shahzad	2013	29	G?P5	none reported	CP	3 weeks PP	NSTEMI	OM of the LCx	Medical
14	Aprigliano	2013	38	not reported	none	CP	8 weeks PP	NSTEMI	LM	Stents
15	Vecchio	2013	41	not reported	Gest HTN	CP	6 days PP	STEMI	LAD, LCx, RCA	Stents/IABP
16	Higgins	2013	25	not reported	PCOS	CP	5 days PP	STEMI	LM, LAD, Diag	CABG, LVAD, Heart Tx
17	Cenkowski	2012	35	G2P2	none reported	CP, diaphoresis	7 months PP	STEMI	OM	Medical
18	Brantley	2012	32	2 previous preg	Thyroid cancer	CP	1 week PP	NSTEMI	LAD	CABG
19	Sharma	2012	33	G3P2	no cardiac risk factors	CP, SOB	36 weeks gest	STEMI	LAD. LCx and interm	IABP,CABG
20	Newell	2011	37	G2P1	Migraines, IBS	Hypotension	37 weeks gest	STEMI	LAD	Medical
21	Ito	2011	30	not reported	none reported	not reported	4 weeks PP	STEMI	LAD	Medical
22	Ito	2011	30	not reported	not reported	not reported	14 days PP	NSTEMI	LAD, LCx	Medical
23	Ito	2011	35	not reported	not reported	not reported	19 days PP	UAP	LAD, LCx, RCA	CABG
24	Ito	2011	36	not reported	not reported	not reported	7 days PP	STEMI	LAD	Failed rheolytic thrombectomy
25	Ito	2011	37	not reported	not reported	not reported	5 months PP	NSTEMI	LAD	CABG
26	Ito	2011	39	not reported	not reported	not reported	12 days PP	STEMI	LM, LAD, LCx	CABG
27	Ito	2011	39	not reported	not reported	not reported	10 days PP	NSTEMI	LAD	Stent
28	Dhakam	2011	30	multigravida	not reported	CP	11 days PP	STEMI	LM	Stent
29	Martins	2010	28	G2P?	not reported	CP	36 weeks gest	STEMI	LAD	CABG, ECMO
30	Marcoff	2010	32	G2P2	not reported	CP	5 days PP	NSTEMI	LAD	CABG

31	Singh Pabla	2010	35	not reported	not reported	CP	8 weeks PP	STEMI	LAD, LCx	Dead
32	Our case	2013	29	G3P2	Anemia	CP	13 days PP	NSTEMI	LAD, LM, LCx	IABP, CABG
33	Our case	2014	29	G3P3	Cholelithiasis, Hgb C trait	CP	23 days PP	NSTEMI	LM, LAD, LCx	Stents, IABP

Table 1. Cases of spontaneous coronary artery dissection during pregnancy and the postpartum (PP) period from 2010-2015

Abstract #:MA-02 & S-22

Syringomyelia in pregnancy: A retrospective study and systematic review of the literature

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Introduction: Syringomyelia is a rare, slowly progressive neurological condition characterized by the presence of a syrinx within the spinal cord. Consensus regarding the safest mode of delivery and anesthetic management remains controversial and thus presents management dilemmas. The aim of this study was to review cases of syringomyelia at our institution and undertake a systematic review to guide management decisions.

Methods: The study was conducted as a retrospective review of cases at our hospital from 2002 to 2014 and a systematic review of the literature from 1946 to 2014. For chart review, electronic database and patient's charts were identified using ICD10 codes for syringomyelia. A systematic review of electronic databases including PubMed, Cochrane and Embase in addition to a hand search of references using keywords "syringomyelia", "syringobulbia" and "pregnancy" was performed. There was no restriction to language or publication year. For both chart and systematic review, data were collected on patient demographics, neurological symptoms, labor and mode of delivery, type of anesthesia, and maternal/neonatal outcomes.

Results: Chart review: 13 deliveries were identified in 9 women with syringomyelia (Table 1). 10 deliveries occurred by cesarean section [CS] (general anesthesia [GA] n=8, epidural n=1, spinal n=1) and 3 by vaginal deliveries (epidural n=2, IVPCA n=1). There were no maternal or neonatal complications.

Systematic review: 524 articles were identified, of which 25 articles with 28 cases were included (Table 1). 21 deliveries by CS (GA n=10, epidural n=6, spinal n=2, unknown n=3) and 7 had vaginal deliveries (epidural n=4, unknown n=3). All epidurals were administered using small volume, titrated boluses of drug to achieve desired sensory level. Complications were reported after GA in 2 cases: one had worsening of neurological symptoms postpartum and one had prolonged muscle paralysis after atracurium. No neurological complications were noted with neuraxial blockade.

Discussion: In our case series and systematic review, we found that 76% of women had CS (GA 61%, neuraxial 32%), and 26% had vaginal deliveries. Inspite of concerns regarding aggravation of the syrinx with vaginal delivery, this mode of delivery has never caused any documented worsening of neurology. All techniques of anesthesia have been carried out successfully without major complications; however, titrated regional anesthesia appears to be a safer alternative.

Abstract #:MA-02 & S-22

Table 1: Syringomyelia Case series and systematic review

Author (publication year)	*Syrinx level*	*Arnold-Chiari*	*Signs/ Symptoms*	*Gravida Para*	*Gest age (wk/d)*	*Delivery*	*Anesthesia*	*Rational for delivery and anesthesia*	*Anaesthesia complications/neuro status*	*Discharge day postdelivery*	*Apgars 1, 5 mins*
Case Series	**Garvey et al.**	***-2015***									
Patient 1	T4-T8, T11-L1	No	Pain in middle of back, shoulder, hands and neck	G1 P0	38 +0	CS	General	Multidisciplinary meeting, neurosurgeons advice	Nil	2	8,9
Patient 2	C3-thoracic	No	Pain and tingling in hands	G2 P0	39 +4	CS	Spinal	Avoidance of valsalva	Nil	4	9,9
Patient 3	C4 -T1	No	Pain in upper back, loss of temperature sensation and weakness left arm	G3 P1	39+3	CS	Epidural	Patient's choice, was cleared by neurosurgeons for either operative or vaginal delivery	Nil	3	8,9
Patient 4	C2-T11	No	sensory loss right arm (pinprick and temperature)	G4 P0	38+5	CS	General	Antepartum hemorrhage at term; neurosurgeons advised not to labor	Nil	3	6,9
Patient 4	As above	No	As above	G5 P1	34+4	CS	General	Presented in preterm labor with previous CS	Nil	5	8,9
Patient 4	As above	No	As above	G6 P2	36+4	CS	General	Presented in labor - 2 previous CS and syringomyelia	Nil	3	7,9
Patient 5	C7-T2	No	Left knee numbness	G1 P0	39+1	CS	General	Syringomyelia	Nil	3	8,9
Patient 5	C7-T2	No	As above	G5 P1	39+1	CS	General	Avoid increases in ICP associated with labor	Nil	3	8,9
Patient 6	C5-conus	Yes	Complete paraplegia, reduced pain, temperature and proprioception from nipples down	G1 P0	36+3	CS	General	No valsalva or regional as per neurosurgeon	Nil	4	5,9
Patient 7	C4-T11	No	Weakness and numbness in left hand	G1 P0	38+2	CS	General	Literature search and departmental discussion, felt general anesthetic safer	Nil	2	9,9
Patient 8	Cervicothoracic	Yes	Slight loss of temperature and pain left forearm, hand and left foot	G1 P0	35 +4	SVD	Epidural	As per neurosurgeons	Nil	2	9,9
Patient 8	Cervicothoracic	Yes	As above	G2 P1	38+4	SVD	Epidural	As per above	Nil	3	8,9
Patient 9	C1-T11	Yes	Early Brown-Sequard syndrome, advised for syrinx drainage but patient refused.	G1 P0	27 +4	Vg-vacuum	IVPCA remifentanil	Was advised CS by neurosurgeon, but patient refused	Nil	1	4,5
Systematic Review											
Parker (2002)	NA	NA	Headaches, sensory changes	G1 P0	38	CS	Epidural	Presented in labor with worsening neurological symptom. CS chosen as fastest way to deliver given new symptoms	Symptoms resoved within 24 h postpartum	NA	NA
Daskalakis (2001)	Cervical	NA	Sensory and motor changes, depressed reflexes, ataxia	G1 P0	37	CS	General	Combination of CS and general anesthetic "least likely to aggravate the syrinx"	Nil	5	8,9
Nel (1998)	C2 - T8	Yes	Neck pain, sensory changes.	G2 P1	38	CS	Epidural	Least likely to aggrevate the syrinx "interdisciplinary" neurologist and neurosurgical opinion	No change in neuro symptoms 7days postpartum	4	NA
Margarido (2001)	C4 - T1	NA	Decreased sensation below C2. Motor changes arms	G3 P1	39+3	CS	Epidural	Potentially difficult airway therefore neuraxial thought to be safer	Nil	3	8,9
Agusti (2004)	NA	Yes	Sensory changes C4 - L1, areflexia, bilateral trophic changes	G1 P0	NA	CS	General	Breech presentation, concerns about complications of epidural and spinal, particularly in presence of coexisting ACM	Prolonged action of atracurium, no neurological deterioration	7	"healthy"
Nawaz (2010)	C6 - T9	Yes	Sensory changes face, chest and limbs	G1 P0	37	CS	General	NA	Nil	NA	6,1
Murayama (2001)	T3	NA	Headache	G1P0	38	CS	General	NA	Nil	NA	NA
Honemann (2014)	T6 - T8	NA	Chronic persistent back pain	G1 P0	36	CS	Spinal	Patient did not want general anesthesia	Nil	NA	NA
Honemann (2014)	T6 - T8	NA	Chronic persistent back pain	G2 P1	36	CS	Spinal	Patient did not want general anesthesia	Nil	NA	NA
Gredilla (2004)	C4 - Counus	NA	Kyphoscoliosis, spasiticity, sensory loss, loss of patellar reflexes and urinary incontinence	NA	NA	CS	General	Due to severity of neurological symptoms	Nil	7	6,8
Jayaraman (2011)	T12 - L5	No	Motor, sensory and trophic changes left leg, limping gait	G1 P0	NA	CS	General	Cephalopelvic disproportion and breech presentation	Nil	5	NA
Yturralde (2005)	T4 - T6	No	Pain in leg, difficulty walking, lumbar pain, dizziness	G3 P2	39	CS	NA	Concernes about aggravting neurological syptmoms with expulsive efforts	Nil	NA	9,9
Yturralde (2005)	C2 - T2	No	Sensory changes in hands, neck and shoulder	G2 P0	39	CS	NA	Concernes about aggravting neurological symptoms with expulsive efforts	Nil	4	9,9
Ghaly (2012)	Cervical to lumbar	NA	Paraesthesia, headaches, neck pain, poor balance	G2 P1	38	CS	General	Advised by neurosurgeon given residual ACM 1	Nil	4	9,9
Roelofse (2012)	NA	NA	Anesthetic areas on body	NA	NA	CS	General	For medicolegal reasons, concerns about spinal or epidural	New areas of anesthesia on body - resolved within 24 hours	NA	NA
Hayashi (2011)	C3	NA	Dizziness	NA	38	CS	Epidural	NA	Nil	8	"healthy"
Neilsen (2011)	C6-7, T4/5-T9	No	Back pain, motor weakness and sensory changes lower limbs	G2P1	35	CS	General	CS expedited to ensure quick neurosurgery	Planned decompressive laminectomy and syringosubarachnoid shunt postdischarge	NA	6,9
Hinojosa (1996)	Cervical	NA	Sensory changes C5 and C6 dermatome, trophic changes, decreased reflexes, orthostatic hypotension	G4	38	CS	Epidural	CS To avoid valsalva in labor. Epidural to avoid GA - concerns with neck extension, muscle relaxation, hyperkalaemia	Nil	NA	NA
Cantú Esquivel (1994)	Cervical	NA	Numbness left hand	G4P1A1	38	CS	Epidural	Concern that valsalva could increase intercranial pressure	NA	NA	8,9
Diez (2009)	Thoracolumbar	NA	Headache, back pain, parathesia of lower limbs	NA	37	CS	General	Literature consenus - possibility of neurological deterioration with labour and effort of second stage	Nil	3	9,9
Castello (1996)	Cerebellar tonsils to C7	Yes	Previous motor and trophic changes. Resolved	NA	35	CS	General	Based on literature search	Nil	NA	9,9
Parker (2002)	NA	Yes	Asymptomatic	G1 P0	39	Vg-forceps	Epidural	NA	NA	NA	NA
Meuller (2005)	Cervicothoracic	Yes	Headache, dizziness, vision changes, dyspnoea, sensory changes upper limbs	G2 P1	32	SVD	Epidural	NA	Nil	NA	NA
Meuller (2005)	Cervical	Yes	Headache, tinnitus, neck pain, fatigue, numbness mid thoracic	G1 P0	NA	SVD	NA	NA	NA	NA	healthy'
Baker (1947)	Cervical	No	Thoracic kyphosis, sensory, trophic and motor changes upper limbs, motor changes lower limbs, sensory changes right side of body, nystagmus	G3P2	39	SVD	General	NA	Nil	NA	"healthy"
Lopez (2007)	C3 - T4	Yes	NA	NA	38	SVD	Epidural	NA	Episode of fainting postepidural, weakness all extremities, N/V	NA	9,9
Lopez Torres(2011)	C3 - T4	Yes	Asymptomatic	G1 P0	41	Vg-vacuum	Epidural	NA	Nausea and vomiting	NA	8, 9
Natarajan (2012)	cervical - T11	Yes	Sensory changes T12 - L2, ocassional paraesthesia upper limbs	G1P0	NA	Vg-vacuum	Epidural	Maternal request and detailed discussion with neurologist and obstetrician	MRI unchanged 2 wks postpartum	NA	NA
Yaskin (1932)	Cervical, upper dorsal	NA	Motor and sensory left side, limping gait, abnormal reflexes, Horner's syndrome, affected cranial nerves, scoliosis	G2P1	38	SVD	NA	NA	8 months post delivery, improved power left hand, loss of vibratory sense left legs to iliac crest	NA	NA

CS=cesarean section; SVD= spontaneous vaginal delivery; Vg=vaginal; NA=not available

Abstract #:MA-03 & T-52

A Systematic Review of Cases of Cerebral Venous Thrombosis

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Introduction: Cerebral venous thrombosis (CVT) is estimated to occur in 10 to 20 per 100,000 deliveries in developed countries. Its early symptoms are often difficult to distinguish from postdural puncture headaches, as both can have a postural component, and CVT may also be preceded by a dural puncture. It is unknown whether there is an association between dural puncture and development of CVT. Therefore we conducted a systematic review of all cases of CVT in the obstetric population that had a neuraxial anesthetic attempted or performed.

Methods: A systematic review of cases was performed using PubMed to identify all cases of CVT in obstetric patients following attempted or performed neuraxial anesthesia. Cases were identified using the key words: anesthesia, obstetric, epidural, cesarean section, parturition, peripartum, postpartum, childbirth, or pregnancy and intracranial, venous, sinus, brain or cerebral thrombosis. Reference lists were searched for additional articles. Only studies published in English were included. A standardized data abstract form was used to abstract case details.

Results: The search resulted in 348 articles of which only 32 articles were included. Of the articles excluded, the main reasons were: they involved thrombosis of the wrong organ (191 articles), they discussed fetal CVT (32 articles), or they did not involve thrombosis (32 articles). The 32 articles contained 33 cases of CVT. Age for the patients ranged from 18 to 37 years old. Twenty-six patients had an epidural attempted or performed; 2 patients had a combined spinal-epidural attempted or performed; 6 patients had a spinal attempted or performed. Some patients had more than one technique attempted. Of the epidurals attempted, 7 patients had a dural puncture noted. Including spinals and combined spinal epidurals, 11 of 33 patients had known dural punctures. For 8 patients the authors noted multiple attempts at neuraxial anesthesia despite no frank dural puncture. All 33 cases had headache as their presenting symptoms with 22 cases reporting the headache as being positional at least during a portion of their symptoms. Epidural blood patches were performed for 18 cases with 14 cases reporting at least partial temporary relief of headache. Seventeen cases reported the patient experienced seizures. Diagnosis was confirmed with radiographic imaging, typically magnetic resonance venography. Anticoagulation was given in 28 cases and 21 cases returned to their baseline status.

Conclusions: Symptoms for CVT share similarities with post-dural puncture headaches making early diagnosis challenging. It is difficult to ascertain whether dural puncture predispose patients to formation of CVT, but many authors suggest an association. Further work in this subject is needed before a definitive association can be established.

Abstract #:MA-04 & S-64

Local anesthetic wound infiltration for post-cesarean analgesia: a systematic review and meta-analysis

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Introduction: Inadequate postoperative analgesia is one of the most common causes of poor patient satisfaction following cesarean delivery (CD). Wound infiltration with local anesthesia has been investigated as a potentially useful method for providing analgesia after CD. We performed this systemic review and meta-analysis to assess the efficacy of local anesthetic wound infiltration for postoperative analgesia following CD.

Methods: We searched MEDLINE, EMBASE, CENTRAL and CINAHL for studies that assessed the efficacy of continuous or single injection wound infiltration with a local anesthetic for post cesarean analgesia. Only randomized controlled trials that compared local anesthetic wound infiltration versus control and reported post-cesarean pain scores and/or opioid consumption were included in the review. Studies were combined according to their use or non-use of intrathecal morphine (ITM). Studies that involved continuous wound infusion were analyzed separately from single injection. We assessed pain scores and opioid consumption at 6, 24 and 48 hrs after surgery, as well as opioid related side effects. We analyzed data using random effects model.

Results: A total of 17 studies were included in this review (8 studies with continuous infusion and 9 studies with single injection). In 13 studies the CD was performed under spinal anesthesia, 1 study used epidural anesthesia, and 3 studies used general anesthesia. Results are summarized in the table. In patients who did not receive ITM, continuous wound infusion with a local anesthetic significantly reduced pain scores at rest at 6 hours, during movement at 24 and 48 hours, as well as opioid consumption at 6, 24, and 48 hours. There was a decrease in nausea in patients with continuous local anesthetic infusion who did not receive ITM. Single injection infiltration with a local anesthetic significantly reduced opioid consumption at 24 hours in patients who did not receive ITM and decreased pain scores at rest at 24 hours in patients who received ITM.

Conclusion: Local anesthetic wound infiltration might be an effective modality for improving post CD analgesia. However, there is a lack of data on the efficacy of this technique in patients who receive neuraxial morphine.

Outcome	Continuous Infusion		Single Injection	
	Without ITM	With ITM	Without ITM	With ITM
Pain scores at 6h (at rest)	-1.48 (-2.44, -0.52) {3}	NA	-0.84 (-1.93, 0.24) {6}	NA
Pain scores at 6h (with movement)	-1.77 (-3.58, 0.05) {3}	NA	-1.33 (-3.91, 1.25) {2}	NA
Pain scores at 24 h (at rest)	-0.52 (-1.03, -0.00) {6}	NA	0.01 (-0.21, 0.24) {6}	-0.09 (-0.15, -0.03) {2}
Pain scores at 24h (with movement)	-1.03 (-2.03, -0.02) {4}	NA	-0.38 (-1.13, 0.36) {2}	0.60 (-0.8, 2.03) {1}
Pain scores at 48 h (at rest)	-0.10 (-0.53, 0.33) {4}	NA	0.00 (-0.29, 0.29) {2}	0.20 (-0.63, 1.03) {2}
Pain scores at 48h (with movement)	-0.88 (-1.59, -0.18) {2}	NA	NA	NA
Morphine consumption at 6h	-8.12 (-10.38, -5.87) {2}	NA	NA	NA
Morphine consumption at 24 h	-14.68 (-25.72, -3.64) {5}	1.25 (-4.02, 6.52) {1}	-9.32 (-15.05, -3.60) {4}	NA
Morphine consumption at 48 h	-17.67(-26.84, -8.50) {5}	3.12 (-3.37, 9.62) {1}	NA	NA
Opioid related side effects				
Nausea	0.52 (0.33, 0.82) {4}	NA	0.70 (0.40, 1.21) {3}	0.43 (0.05, 3.54), {2}
Vomiting	0.58 (0.25, 1.32) {2}	NA	0.73 (0.44, 1.20) {4}	2.37 (0.10, 56.76) {1}
Pruritis	0.84 (0.52, 1.35) {2}	NA	0.49 (0.23 , 1.04) {2}	0.56 (0.23 , 1.37) {1}

Table 1- Data is expressed as mean difference or relative risk (95% CI) {number of studies included in the analysis}; NA, not applicable

Abstract #:MA-05 & F-67

A meta-analysis evaluating the effect of low and high dose morphine on maternal and neonatal outcomes

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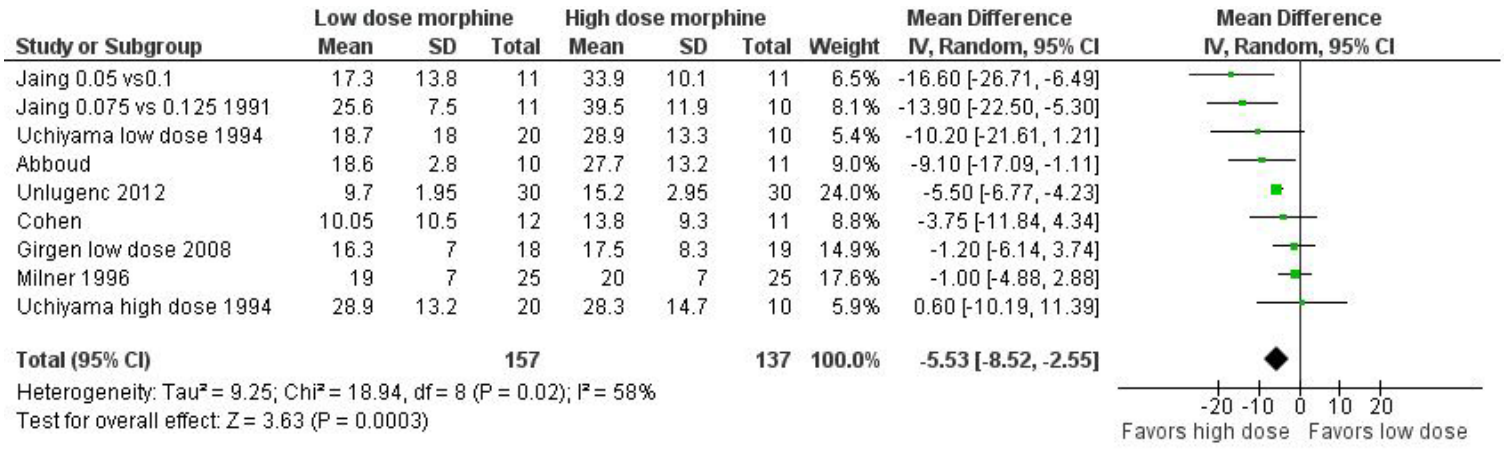
Introduction: The intrathecal morphine dose for elective cesarean delivery which provides optimal analgesia while minimizing side-effects has not yet been defined. The objective of this meta-analysis was to determine the optimal dose of intrathecal morphine for the provision of post-cesarean delivery analgesia.

Methods: A literature search (PubMed, EMBASE, MEDLINE, Scopus and CINAHL) was performed to identify randomized controlled trials involving patients undergoing elective cesarean delivery under spinal anesthesia comparing low dose (50 to 100 mcg) spinal morphine to higher dose (>100 to 250 mcg). Primary outcome was the duration of analgesia (defined as the time for first request for supplemental analgesia). Secondary outcomes included: pain scores, morphine usage and maternal side-effects (vomiting and pruritus), and neonatal outcome (Apgar scores). Mean differences / odds ratios / risk differences (M.D./OR/RD) were calculated with 95% confidence intervals. Data were analysed using Review Manager (version 5.1).

Results: Twelve articles met our inclusion criteria. A total of 604 patients were recruited in all study groups (320 in the low dose group and 284 patients in the high dose group). There was significantly greater time to first analgesic request in the high dose group (mean difference -5.53 [-8.52, -2.55]; p=0.0003). Pain scores (0-100) at 12 hours (M.D. 2.54 [-2.55, 7.63]; p=0.33), 24 hours (M.D. 1.00 [-2.26, 4.26]; p=0.55) and morphine consumption at 24 hours (M.D. 2.21 [-2.85, 7.27] p=0.39) were not different between groups. The incidence of vomiting (RD -0.13 [-0.21, -0.06]; p=0.0003) and pruritus (OR 0.41 [0.26, 0.66]; p=0.0002) were greater in the high dose group. Apgar scores <7 at 1 minute were similar between groups (OR 0.61 [0.07, 4.96]; p=0.64).

Conclusion: This meta-analysis shows that higher doses of intrathecal morphine prolong analgesia following cesarean delivery. However the additional 5.5 hours of pain relief must be balanced against the increased risk of maternal pruritus and vomiting. The trade-off between improved analgesia and increased side-effects should be appreciated by both care providers and women undergoing cesarean delivery. Results from this study can be used to fully inform patients of the benefits and side-effects of using higher doses of intrathecal morphine for cesarean delivery.



Study or Subgroup	Low dose morphine Mean	SD	Total	High dose morphine Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI
Jaing 0.05 vs0.1	17.3	13.8	11	33.9	10.1	11	6.5%	-16.60 [-26.71, -6.49]
Jaing 0.075 vs 0.125 1991	25.6	7.5	11	39.5	11.9	10	8.1%	-13.90 [-22.50, -5.30]
Uchiyama low dose 1994	18.7	18	20	28.9	13.3	10	5.4%	-10.20 [-21.61, 1.21]
Abboud	18.6	2.8	10	27.7	13.2	11	9.0%	-9.10 [-17.09, -1.11]
Unlugenc 2012	9.7	1.95	30	15.2	2.95	30	24.0%	-5.50 [-6.77, -4.23]
Cohen	10.05	10.5	12	13.8	9.3	11	8.8%	-3.75 [-11.84, 4.34]
Girgen low dose 2008	16.3	7	18	17.5	8.3	19	14.9%	-1.20 [-6.14, 3.74]
Milner 1996	19	7	25	20	7	25	17.6%	-1.00 [-4.88, 2.88]
Uchiyama high dose 1994	28.9	13.2	20	28.3	14.7	10	5.9%	0.60 [-10.19, 11.39]
Total (95% CI)			**157**			**137**	**100.0%**	**-5.53 [-8.52, -2.55]**

Heterogeneity: Tau² = 9.25; Chi² = 18.94, df = 8 (P = 0.02); I² = 58%
Test for overall effect: Z = 3.63 (P = 0.0003)

Abstract #:MA-06 & S-66

A meta-analysis assessing the effect of active warming on maternal and neonatal outcomes

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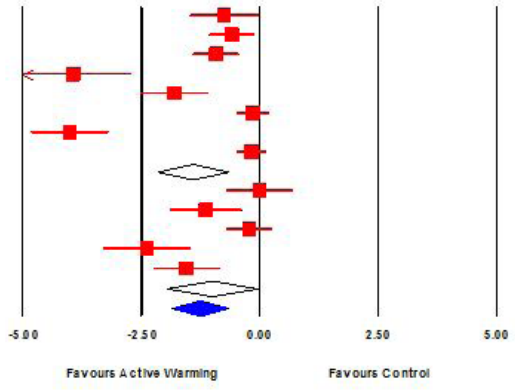
Introduction: Active warming is recommended to maintain normothermia for surgical procedures under anesthesia. The role of perioperative warming for cesarean delivery is uncertain and currently not considered standard of care. This meta-analysis aimed to determine the efficacy of active warming on maternal and neonatal outcomes following elective cesarean delivery.

Methods: We searched databases (PUBMED, EMBASE, SCOPUS, MEDLINE, CINAHL) and the Cochrane Central Register of Controlled Trials using MeSH terms and text words "temperature OR warming" AND "caesarean." We included randomized controlled trials utilizing forced air warming or warmed fluid that commenced warming within 30 minutes of neuraxial anesthesia placement. Study quality was graded using the Jadad 5 point scale. The primary outcome was maximum change in core temperature. Secondary outcomes included maternal (temperature at the end of surgery, shivering, thermal comfort, hypothermia, vomiting, vasopressor use) and neonatal (temperature, umbilical cord pH and Apgar scores at 1 and 5 minutes) outcomes. Standardized mean difference / mean difference / risk ratio (SM.D./M.D./RR) and 95% confidence interval (CI) were calculated using random effects modeling (CMA, version 2, 2005).

Results: 13 studies (median Jadad score 3; range 0-5) met our criteria. 789 patients (416 warmed and 373 controls) were analysed for the primary outcome. Warming significantly reduced core temperature change (SM.D. -1.27 [- 1.86, -0.69]; p=0.00002), and resulted in higher temperatures at the end of surgery (M.D. 0.43 [0.27, 0.59]; p<0.00001). Warming was associated with significantly less shivering (RR 0.58 [0.43, 0.79]; p=0.0004), improved thermal comfort (SM.D. 0.98 [0.24, 1.72]; p=0.01), and a lower incidence of hypothermia (RR 0.66 [0.50, 0.87]; p=0.003). The incidence of vomiting and vasopressor use did not vary significantly between groups. Neonatal outcomes did not vary between groups except for umbilical artery pH, which was higher in the warmed group (M.D. 0.02 [0, 0.05]; p=0.04).

Conclusion: Active warming for elective cesarean delivery decreases core temperature reduction, and decreases the incidence of hypothermia and shivering. Findings from this meta-analysis suggest that forced air warming or warmed fluid should be utilised for elective cesarean delivery.

Group by Subgroup within study	Study name	Std diff in means	Warming Method	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value	Sample size Warming	Sample size Control
Fluid	Chung	-0.750	Fluid	0.378	0.143	-1.490	-0.010	-1.985	0.04711	15	15
Fluid	Goyal	-0.587	Fluid	0.255	0.065	-1.087	-0.086	-2.297	0.02159	32	32
Fluid	Woolnough	-0.919	Fluid	0.256	0.066	-1.421	-0.417	-3.587	0.00033	50	25
Fluid	Yokoyama	-3.922	Fluid	0.624	0.390	-5.146	-2.699	-6.283	0.00000	15	15
Fluid	Chan	-1.806	Fluid	0.376	0.141	-2.542	-1.070	-4.809	0.00000	21	19
Fluid	Jorgensen	-0.142	Fluid	0.188	0.035	-0.511	0.228	-0.752	0.45227	57	56
Fluid	Smith	-4.000	Fluid	0.423	0.179	-4.830	-3.170	-9.448	0.00000	35	32
Fluid	Paris	-0.170	Fluid	0.164	0.027	-0.491	0.152	-1.033	0.30161	73	76
Fluid		-1.428		0.381	0.145	-2.175	-0.682	-3.751	0.00018		
Forced Air	Butwik	0.000	Forced Air	0.365	0.133	-0.716	0.716	0.000	1.00000	15	15
Forced Air	Chung	-1.131	Forced Air	0.393	0.155	-1.902	-0.361	-2.877	0.00402	15	15
Forced Air	Fallis	-0.222	Forced Air	0.255	0.065	-0.721	0.278	-0.870	0.38451	32	30
Forced Air	Horn 2002	-2.374	Forced Air	0.477	0.227	-3.309	-1.440	-4.980	0.00000	15	15
Forced Air	Horn 2014	-1.537	Forced Air	0.360	0.130	-2.243	-0.831	-4.267	0.00002	19	21
Forced Air		-1.023		0.485	0.236	-1.974	-0.071	-2.107	0.03514		
Overall		-1.274		0.300	0.090	-1.861	-0.687	-4.251	0.00002		



Abstract #:MA-07 & F-72

Obstetric Societies' Guidelines For Postpartum Hemorrhage; One Size Fits All?

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Introduction: Guidelines from national obstetric societies aim to inform practitioners of key strategies for the prevention and treatment of postpartum hemorrhage (PPH). However, it is unclear whether the content of national PPH guidelines is uniform and up-to-date.(1) We performed a detailed review to compare key aspects of PPH guidelines from five national obstetric societies.

Methods: We independently reviewed the most recent PPH guidelines from the United Kingdom (RCOG), United States (ACOG), Australia and New Zealand (RANZCOG), Canada (SOGC) and the combined guidelines from Germany, Austria, and Switzerland (DACH). We reviewed information sources used by each society for formulating guidelines. We compared the societies' recommendations for the prevention and treatment of PPH, including: pharmacological, medical and surgical interventions for PPH prevention and treatment.

Results: Key elements of the societies' recommendations are presented in the Table. Information sources are cited by all societies, but only the RCOG describe the methodological approaches used for constructing their guidelines. Based on our review, we observed notable differences between societies for the following: the definition of PPH, clinical signs accompanying PPH, and PPH preventive measures. All societies recommend multi-disciplinary management and clinical drills for optimizing acute care for women with severe PPH. However, only three societies (SOGC, RCOG, DACH) provide transfusion recommendations, with two societies (RCOG, DACH) providing information about a massive transfusion protocol.

Discussion: Based on our review, PPH guidelines of national obstetric societies are not uniform. In particular, recommendations for transfusion are poorly described and are not in keeping with contemporary hematologic and transfusion strategies for the management of major PPH.(2-3) PPH guidelines of national obstetric societies should be updated to reflect current expert recommendations for obstetric hemorrhage management.

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3. Transfusion 2011;51:2540-8.

Abstract #:MA-07 & F-72

Summary of National Obstetric Societies' Postpartum Hemorrhage Guidelines

	ACOG- 2006	SOGC - 2009	RCOG – UK 2009	RANZCOG –2011	DACH –2014
Definitions of PPH	EBL > 500ml (VD) EBL > 1000ml (CD)	EBL > 500ml (VD) EBL> 1000ml (CD) EBL associated with hemodynamic instability	Minor PPH: EBL 500-1000ml; Moderate PPH: EBL 1000-2000ml; Severe PPH: EBL>2000ml*	EBL > 500ml Severe PPH: EBL ≥1000ml*	EBL>500ml VD or EBL>1000ml CD Severe PPH: EBL>1500-2000ml or >150ml/min or EBL>50% circulating volume within 3 hours
Management of patients at risk of PPH	Not discussed	Not discussed	Not discussed	Ensure rapid access to blood products. Correct prepartum anemia	Prepartum care by a specialist
Uterotonics for treating PPH	Oxytocin Carboprost Misoprostol Methylergonovine Dinoprostone	Oxytocin Carboprost Misoprostol Ergonovine Carbetocin	Oxytocin Carboprost Misoprostol Ergometrine	Oxytocin Misoprostol Ergometrine Prostaglandin F2α	Oxytocin Carboprost Misoprostol Intramyometrial prostaglandins Sulprostone
Intrauterine balloon tamponade	Yes	Yes	Yes	Yes	Yes
Hemostatic brace suture	Yes	Yes	Yes	Yes	Yes
Vessel ligation	Yes	Yes	No	Yes	Yes
Hysterectomy	Yes	Yes	Yes	Yes	Yes
Interventional radiology	Yes	Yes	Yes	Yes	Yes
Transfusion indications	Ongoing blood loss ± unstable vital signs	Not discussed	Yes – according to clinical picture	Not discussed	Yes – according to clinical picture
Massive transfusion protocol	Not discussed	Not discussed	Yes	Not discussed	Yes
Pharmacologic adjuncts for PPH	Not discussed	RVIIa not recommended	Tranexamic acid - not recommended. RVIIa with haematology approval	Tranexamic acid recommended. RVIIa as salvage treatment	Tranexamic acid and fibrinogen concentrate recommended. RVIIa as salvage treatment

RCOG = Royal college of obstetricians and gynaecologists, ACOG = American College of Obstetricians and Gynecologists, RANZCOG = Royal Australian and New Zealand College of Obstetricians and Gynaecologists, SOGC = Society of Obstetricians and Gynaecologists of Canada, DACH = Deutschland, Austria & Switzerland EBL = Estimated blood loss, VD = Vaginal delivery, CD = Cesarean delivery, RVIIa = Recombinant factor VIIa, PPH = postpartum hemorrhage

Research Hour: Research Applications/Opportunities with Non-Invasive Cardiovascluar Monitors

Speakers: Richard M. Smiley, M.D., Ph.D; John T. Sullivan, M.D., M.B.A.

NOTES

Sunday, May 17, 2015

Chronic Pain Panel: Prediction, Prevention, Genetics of Obstetric Pain

Moderator: *Pamela Flood, M.D.*
Speakers: *Inna Belfer, M.D.; Ruth Landau, M.D.*

Pro-Con Debate: Nitrous Oxide

Moderator: *Manuel C. Vallejo, Jr., M.D., D.M.D.*

- **Pro:** Manuel C. Vallejo, Jr., M.D., D.M.D.
- **Con:** Robert S. McKay, M.D.

SOAP Chronic Pain Panel: Prediction, Prevention and Genetics of Obstetrical Pain

Moderator: Pamela Flood, M.D.
Speakers: Inna Belfer, M.D.; Ruth Landau, M.D.

Objectives: Upon completion of this presentation participants will

- Know different estimates for the incidence of chronic pain after child birth
- Understand the relationship between acute pain and chronic pain
- Describe predictive factors including genetic differences that with the intention to move toward the personalization of pain management for the parturient.

Introduction and Prevention
Pamela Flood

There is strong evidence for linkage of severe acute pain after cesarean delivery and the incidence of chronic pain. For the median, pain after cesarean section is well managed and transient. However, there remain significant outliers who experience severe acute pain despite multimodal treatment including intrathecal opioid, acetaminophen and non-steroidal The first 6 weeks after surgery, before the patient returns for their post-operative visit is somewhat of a black box with little granular data regarding patient experience. The majority of women report mild to moderate pain at rest with moderate to severe pain with movement one day after cesarean section (1). Approximately 10 % reported pain at 8 weeks, mostly mild to moderate. Two to three% reported pain at 6 months and less than 1% at 1 year (2-4). More severe acute pain was a risk factor for persistent pain at 8 weeks. It is unknown whether acute pain causes sensitization, resulting in increased sensitivity to future pain or whether it is a harbinger of preexisting enhanced sensitivity to pain. Prediction, discussed below is critical to the identification of patients at risk for severe acute and persistent pain. True long lasting chronic pain is less common than in other types of abdominal surgery such as inguinal hernia (5). It may be that hormones of pregnancy are protective.

Prediction
Ruth Landau

There have been several studies in the last decade designed to evaluate the incidence of and to predict pre-operatively women's propensity to experience acute pain (2), chronic pain (3,4) and surgery-related neuropathic symptoms (4) after cesarean delivery.

- Experimental pain modalities such as quantitative sensory tests with heat and pressure (QST) have been applied to predict women's risk for severe post-cesarean pain (6-12). These tests may not necessarily predict post-partum pain very well, because sensitivity to heat and pressure may be unrelated to multi-faceted post-partum pain (uterine cramping and post-surgical pain). In addition, most of these tests are not convenient in a clinical setting and would not be useful to guide clinicians caring for women during cesarean delivery.
- Questions to assess women's capacity to catastrophize pain (9), their level of anxiety and anticipated pain, and analgesic need from surgery in addition to experience of loud sound (8) have been shown to predict severe acute post-cesarean pain and may be used to screen and dose multimodal analgesics (15).
- Testing women undergoing a repeat cesarean delivery to assess whether the degree hyperalgesia in their old scar, which reflects hypersensitization, is present prior to surgery has been shown to predict acute post-cesarean pain and analgesic consumption in the first 48 hours following the repeated procedure (13). This confirms the concept that central sensitization preceding surgery may impair pain modulation and result enhanced pain during second surgical procedure.
- In sum, identifying women with predisposing factors such as preexisting chronic pain, neuropathic symptoms or other contributors such as psychological or genetic factors with simple bedside tests can be proposed; this should allow tailored approaches so these women (only) may be offered targeted anti-hyperalgesic/neuropathic adjuvants and other modalities.

Genetics
Inna Belfer

Under strict embargo from the FDA. Please attend to find out more!

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Title: Pro-Con Debate: Nitrous Oxide - Pro

Manuel C. Vallejo, M.D., D.M.D.
Professor and Chair, Department of Anesthesiology, West Virginia University School of Medicine

Objectives:

1. Discuss the advantages and disadvantages of nitrous-oxide for labor analgesia.
2. Discuss reasons why nitrous-oxide is not a popular technique for the provision of labor analgesia in the United States.
3. Discuss the safety profile of nitrous-oxide in pregnancy.

Nitrous-oxide for labor analgesia is widely used by women in almost all other developed countries including Europe, Canada, Australia, and New Zealand by Obstetricians, Family Practitioners, and Midwives for the provision of labor analgesia. So, why is nitrous-oxide labor analgesia typically not an option for women in the United States?

Nitrous-oxide analgesia is relatively safe, inexpensive, and a fairly simple option for labor pain. Nitrous-oxide analgesia has been shown to be just as efficacious as Transcutaneous Electrical Nerve Stimulation (TENS) and a Paracervical block. It also provides better analgesia than opioids, but happens to be less effective than epidural analgesia, which in and of itself can have up to a 15% failure rate. Nitrous-oxide offers a significant cost advantage compared to epidural analgesia, is much simpler and less expensive to maintain, and does not result in complications that may require longer hospital stays (i.e. post dural puncture headache). Nitrous-oxide produces both analgesia and anxiolysis and hence may be an appropriate choice for the extremely anxious parturient. In the anxious patient, it is common to see a decrease in both heart rate and blood pressure with nitrous. Failure with nitrous-oxide is typically associated with poor patient selection. Nitrous-oxide indications include analgesia (pain threshold elevation), alleviation of mild to moderate fear and anxiety, and stress reduction. The physical characteristics of nitrous-oxide is it is a colorless, sweet smelling non pungent gas, easy to administer, lacks flammability, has minimal toxicity, has minimal effect on cardiovascular and respiratory depression, is not an airway irritant, does not increase mucus production or cause bronchospasm, and does not trigger malignant hyperthermia as other inhalational agents.

Its use in pregnancy is safe for the parturient, newborns, and healthcare workers in attendance. It has no effect on uterine contractility, it does cross the placental barrier but has minimal effect. It is not teratogenic in therapeutic concentrations for short periods and is a good analgesic choice because of its rapid elimination and insignificant body metabolism.

The primary site of action of nitrous-oxide is in the central nervous system in the cerebral cortex. It modulates pain stimuli by way of the descending spinal cord nerve pathways. Its effect is due in part to the release of encephalin and endorphins. It works at the opioid receptor and naloxone administration diminishes its effects. Nitrous-oxide has very distinct pharmacokinetic properties such as a fast onset, quick recovery, and an ability to rapidly titrate levels of sedation. Its effect begins quickly (< 1 min) and peaks within 5 minutes. Recovery is achieved within a few breaths of discontinuation.

Because the pain of labor elevates the pain threshold, the therapeutic window is widened and its side effect profile minimized. Patient use is intermittent where the parturient typically self-administers via a face mask. There is usually a time lag of approximately one minute before full analgesic effect, and therefore it is best for the patient to breathe the gas 30-50 seconds before a contraction to ensure maximal effect. It is important to instruct the patient to take slow deep breaths, remove the face mask between contractions, and breathe normally. For the second stage of labor, the parturient can take two to three deep breaths before each push. Soon after delivery, the patient can be discharged within minutes after discontinuation with no special precautions. Usually, the patient will report feeling exactly the same as she did before the procedure.

Key safety features of the nitrous-oxide equipment include that the machine is constructed to deliver at least 30%-50% oxygen at all times, which cannot be bypassed and insures that hypoxic mixtures are not delivered. When in use, if the woman becomes drowsy, her hand will fall away from her face, rendering the device non-functional just like an intravenous narcotic patient controlled analgesia (PCA).

Additionally, another fail-safe mechanism is that a minimum of 3 liters of oxygen flow is delivered at all times.

Current National Institute of Occupational Safety and Health (NIOSH) standards in the United States for management of waste anesthetic gases call for limiting occupational exposure to nitrous-oxide to not more than an 8-hour time-weighted average concentration to less than 25 parts per million of nitrous in the ambient air. Several steps can be taken to reduce the escape of nitrous into the atmosphere such as ventilating scavenged gases appropriately and having routine equipment maintenance of hoses and tanks.

The CDT code D9230 for analgesia, anxiolysis, and inhalation of nitrous-oxide can be used for billing the procedure or its use can be rolled into the entire hospital stay for delivery.

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Title: Pro-Con Debate: Nitrous Oxide - Con

Robert McKay, M.D.
KUSM-Wichita

Objective: To open debate on reasons nitrous oxide should not be used in labor and delivery.

Summary: The decision whether or not to use nitrous oxide should be based on sound scientific principles rather than passion and rhetoric. Nevertheless, one can argue that a modern society is based on a number of ethical principles that should be considered when making medical judgments. One may further argue that such principles might override science, especially in the absence of sound scientific facts. These principles include respect (autonomy), justice, non-maleficence and beneficence.

Respect for persons / autonomy is the acknowledgement that each person has the right to make their own choices, hold their own views and take actions based on personal values and beliefs. In the debate about nitrous oxide, my opponent may argue that this ethical principle would make it wrong to withhold nitrous oxide from a hospital's formulary because that would limit the autonomy of those wanting to use the gas. However, this argument fails because innumerable substances and devices that a person may choose in the belief that they might help them in their distress, e.g., water baths, marijuana, cocaine, peyote, ecstasy, heroin, alcohol, various herbals, etc., are not available. A medical practitioner is not obliged to respond to every passing (or even persistent) fad. Thus, not all pharmacologic and non-pharmacologic techniques for coping with labor are widely available. In part, this is because respect for persons (autonomy) is not the only ethical principle in making sound medical decisions.

Justice suggests we need to treat all fellow humans equitably and thereby distribute benefits equally and fairly. As society cannot afford to make all treatments available at all times to everyone, it is most ethical to choose which therapies to make available using a cost-benefit analysis. Thus, low cost and efficacious interventions such as vaccines should be made widely available whereas the higher cost therapies should be limited to addressing clearly demonstrated need with unquestionably efficacious methods. If not highly efficacious, the cost to society as a whole of a higher cost therapy will deprive others of effective therapies that are less expensive. Nitrous oxide, while not particularly expensive, nonetheless has a high cost to benefit ratio because, in fact, it is so marginally effective. Moreover, through the consumption of limited medical resources, the provision of nitrous oxide for labor has the effect of depriving others of more effective therapies, be it a woman needing a more advanced treatment for hepatitis C or a child needing a lower radiation CT scanner. D.O. we as anesthesiologists really want to promote a marginally effective analgesic regimen at the cost of children receiving higher radiation doses from the old CT scanner? While that line of argument could be extended by some to epidural analgesia—"Is it really necessary?"—it can be argued strongly that epidural analgesia is highly effective and has additional benefits beyond pain management. Epidural anesthesia clearly meets any cost-benefit analysis in the choice of appropriate medical interventions.

Nonmaleficence is of course the first ethical principle taught to physicians: "*Primum non nocere*." It is probable that nitrous oxide is a safe drug and we D.O. no direct harm with the doses used in a laboring woman. That being said, nitrous oxide remains a very poorly studied drug for long-term effects, particularly among those chronically exposed. Recent studies looking at chronic exposure have not become more reassuring but rather more concerning. Moreover, nitrous oxide is known to have some potential toxicities that other more effective drugs, in particular, narcotics, D.O. not have. The "history of safe use" is a meaningless statement if the potential adverse effects were uncertain and therefore not studied. Our new ambulatory surgery center chose to omit nitrous oxide from routine use as little advantage to its use could be demonstrated. Thus with irony, nitrous is creeping back into labor and delivery just as we eliminate it from use elsewhere in anesthesiology. Another sound reason to eliminate nitrous oxide from the ORs is to eliminate the risk of the abuse of nitrous oxide that occurs in unattended ORs. Nitrous oxide abuse is, in fact, becoming a major problem in many developed countries because of its ready availability and the false sense of security that it is a safe drug. Does adding nitrous oxide to a labor and delivery regimen promote the idea that it is a safe drug? Of course, we are using it in pregnant women! Would it be any surprise then if a particular woman, having enjoyed the euphoria associated with nitrous oxide, decided to self-treat her postpartum depression with more? How about her significant others deciding that nitrous oxide would be appropriate for their ailments

or enjoyment? Might it be better to bring an already widely used street drug like marijuana into the labor suite instead? One can argue that marijuana would be more efficacious, would certainly produce less nausea and vomiting and might even give higher HCAHPS scores to the hospital food service! I am joking about marijuana, of course, though I'm quite serious about the growing problem with nitrous oxide abuse.

Finally, we need to look at beneficence. If nitrous oxide really provided a significant benefit to the laboring woman, we would not even be having this debate. The fact is nitrous oxide is a very weak analgesic, only marginally better than placebo at a 50% concentration. Its use therefore will not greatly impact anesthesia services other than perhaps making anesthesiologists appear less patronizing. But are we not the experts trained in making sound ethical medical decisions? That decision should be to utilize our medical resources better elsewhere.

Thursday, May 14, 2015

Abstract #:T-01

Reduction of Maternal Mortality in Ghana: Is an Obstetric Early Warning System the answer?

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Background: The early detection of severe illness in obstetric patients is challenging. Physiologic deterioration is often evident six to eight hours before cardiopulmonary arrest, but the warning signs of deterioration can go undetected [1]. The United Kingdom's Centre for Maternal and Child Enquiries has recommended that all hospitals utilize a modified early warning scoring system to improve care [2]. Ridge Regional Hospital in Accra, Ghana has approximately 9000 deliveries per year and had 45 maternal deaths in 2014. Currently there is not an early warning scoring system in use at Ridge Hospital, but the implementation of such a system has the potential to decrease adverse maternal outcomes.

Methods: We performed a retrospective review of the maternal deaths in 2014 to determine if an early warning scoring system could be applicable in a low resource environment. Severe vital sign parameters were locally defined by the departments of obstetrics and anesthesia: SBP>200 or <80, HR>140, SpO2<90%, RR>40 and any change in consciousness. Of the 43 charts that were available for review, 37 patients or 86% had vital signs in the severe range that were present on average 40 hours prior to death. None of the charts had documentation of the bedside nurse's response to the severe vital sign recorded and 100% of charts had poor dating and timing of physician notes. This precluded analysis of the time span between abnormal parameters and physician review and intervention. Ridge Hospital's local audit committee identified 49% of the charts as lacking adequate documentation.

Conclusion: The majority of deaths in this low resource setting demonstrated early evidence of severe vital signs that required early intervention. Delay or absence of intervention often led to poor outcome. A standardized protocol that initiates an expedited communication to senior help is nonexistent. Furthermore, no standardized method of documentation exists. A Modified Early Obstetric Warning Score is an example of a system that can be beneficial by 1) ensuring proper documentation of vital signs and interventions 2) linking abnormal vital sign parameters to specified intervention and 3) eliminating delay in seeking more experienced help of senior physicians.

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Abstract #:T-02

A Conundrum: General or neuraxial anesthesia and the use of ROTEM®

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Introduction: Thrombocytopenia occurs in approximately 10% of all pregnancies.(1) However, there are no published studies demonstrating a specific platelet count that predicts the risk for neuraxial hematoma in obstetric patients. In the absence of clinical hemostatic anomalies, a minimum platelet count of 80 x 10^9/L has been suggested as sufficient for the safe initiation of neuraxial techniques.(2) We report the use of rotational thromboelastometry (ROTEM®) to guide the management of a patient with thrombocytopenia and multiple comorbidities that complicated the management of her pregnancy and delivery.

Case: A 29 year old primigravida at 36 weeks gestation with non-cirrhotic portal hypertension, esophageal varices, splenomegaly, steroid refractory thrombocytopenia and pseudocholinesterase deficiency presented with new onset severe hypertension, significant edema, a Mallampati III airway and a platelet count of 63 x 10^9/L. A multidisciplinary team identified concerns of increased bleeding risk from esophageal varices with Valsalva maneuvers, risk of spinal hematoma from neuraxial anesthesia with thrombocytopenia, airway management in a parturient with a potentially difficult airway, pseudocholinesterase deficiency and use of succinylcholine, and the patient's strong reluctance to undergo intubation due to prior awareness under anesthesia. Although forceps delivery with pudendal block was contemplated, preoperative platelet transfusion and cesarean delivery under spinal anesthesia was performed. Baseline ROTEM parameters demonstrated decreased maximum clot firmness and increased clot formation time suggesting a defect in platelets. Following transfusion of two units of platelets, the ROTEM parameters improved and the platelet count increased to 88 x 10^9/L. Spinal anesthesia was performed using a 25 gauge Whitacre needle under ultrasound guidance. A cesarean section was undertaken with an estimated blood loss of 800 ml. The patient was monitored for signs of spinal hematoma. An 8 week postpartum follow up showed no complications related to the anesthetic or operative procedure.

Discussion: Although the platelet count and ROTEM® parameters that predict the ability to safely use neuraxial techniques in parturients has not been defined, the marked improvement of the maximum clot firmness and clot formation time combined with the improvement in the platelet count after a platelet transfusion optimized the risk benefit ratio of performing a spinal anesthetic. Future studies are needed to evaluate the use of ROTEM® in assessing the safety of neuraxial techniques in parturients with abnormal coagulation profiles.

References:

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2. van Veen JJ, Nokes TJ, Makris M: The risk of spinal haematoma following neuraxial anaesthesia or lumbar puncture in thrombocytopenic individuals. Br J Haematol 2010; 148:15-2

Abstract #:T-03

The Effect of a Single Dose of Intravenous Dexamethasone on Nausea and Vomiting when Administered Prior to Intrathecal Morphine for Cesarean Section: a Randomized, Placebo-controlled, Double-blinded Trial

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Background: The incidence of intraoperative and postoperative nausea and vomiting (IONV & PONV) during Cesarean section under spinal anesthesia is estimated to be 30-60%. Prophylaxis of PONV, therefore, is an area of great interest to the obstetric anesthesiologist. Administration of dexamethasone as a prophylactic agent has been investigated secondary to its effective use in the context of general anesthesia. Multiple studies have confirmed a significant reduction in PONV in patients that received dexamethasone prior to epidural Duramorph. Three randomized control trials (RCTs) have investigated the use of dexamethasone for PONV prophylaxis during spinal anesthesia. Two showed no effect when given after Duramorph, one showed a significant reduction when given prior. This study is the largest RCT of its type and an attempt to replicate the positive finding.

Methods: A double-blinded, randomized, placebo-controlled trial was conducted between November, 2012 and September, 2014. 108 pregnant women scheduled for cesarean section were randomized into two groups: group A received 8 mg of dexamethasone, group B received placebo. Both groups then received spinal anesthesia with 200mcg of Duramorph. Patients were seen upon arrival to the post-operative care unit (PACU) and at 1, 3, 6, 24 and 48 hours following PACU arrival. At these time points, the patients' report of nausea and vomiting, pain and overall satisfaction were recorded. Vital signs, rescue anti-emetics and analgesics were extracted from the electronic medical record. Chi-square tests, two sample t-tests and non-parametric Mann-Whitney U tests were performed, as appropriate. All P values were two-sided with significance evaluated at the 0.05 alpha level. All analyses were executed in Stata IC, Version 13 (College Station, TX, USA).

Results: The treatment group receiving dexamethasone prior to Cesarean section (N=55) did not significantly differ from the control group (N=53) in whether or not they experienced an emesis episode at any time up to 48 hours after surgery, p=0.34, Chi square=0.93. Likewise, there was no significant difference in the total dose of rescue antiemetics administered throughout the 48 hour period (treatment mean=2.26, 95% CI=1.47-3.06; control mean=3.27, 95% CI=2.32-4.23).

Conclusions: Administration of 8 mg of intravenous dexamethasone prior to spinal anesthesia with Duramorph was not associated with a decrease in PONV. Likewise, dexamethasone was not superior to placebo in overall use of antiemetics or analgesics. There is some evidence to suggest that a single dose of antenatal glucocorticoids has an effect on neonatal hypothalamic-pituitary axis function, although no evidence demonstrating harm to the mother or fetus. However, given that this rigorously designed and analyzed study did not identify any benefit associated with the use of dexamethasone, it may be prudent to avoid administering the medication prior to delivery.

Abstract #:T-04

Retrospective Review of the Anesthetic Management of Parturients with Sickle Cell Disease with Case-matched Controls

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Background: Sickle cell disease (SCD) is the most common inherited disease worldwide. The disease manifests as chronic anemia, multi-organ damage, and painful vaso-occlusive crises. As care and management of SCD has improved, life expectancy for patients with SCD has increased and patients are no longer being counseled to avoid pregnancy. There is limited literature regarding the anesthetic management of parturients with SCD. Our goal is to provide a framework for other anesthesia providers to address the concerns regarding analgesic and anesthetic management of parturients with SCD.

Methods: Hospital billing database search was used to identify parturients with SCD who delivered between November 2008 and 2014. For each found, two matches were identified using anesthesia billing records with preference for approximate date of service, mode of delivery, and similar BMI. For each record, the following was extracted: patient demographics, medical history, gestational history, analgesic history, peripartum course, anesthetic techniques during peripartum period, peripartum analgesic requirements, and complications of peripartum anesthetic interventions. Odds ratios with 95% confidence intervals adjusted for mode of delivery were calculated.

Results: 39 pregnancies involving parturients with SCD were identified, 26 vaginal and 13 cesarean deliveries. 76% of SCD patients received narcotics during labor prior to epidural placement versus 22% of controls. SCD patients received epidural catheter placement when less dilated, median of 2cm vs. 4cm at time of placement, and had longer duration of use, 76% vs. 40% for >8hrs. Increases in rate of epidural infusion or manual rebolus of the epidural catheter were required by 41% of SCD parturients vs. 17% of controls. Odds ratios with 95% confidence intervals are shown in Table 1.

Conclusion: This unique dataset assessing the anesthetic needs of parturients with SCD is small and therefore may be underpowered to detect statistical significance. Trends toward early epidural catheter usage, need for an increase in epidural infusion rate/manual rebolus, and narcotic usage prior to epidural catheter placement suggest parturients with SCD are less tolerant of labor pain and have higher requirements for analgesia during the peripartum period. Our results confirm increased need for transfusion and increased rate of preeclampsia in SCD patients, factors of concern for anesthesiologists.

Table 1:

Odds Ratio Estimates and Profile-Likelihood Confidence Intervals for Parturients with SCD vs. Controls		
	Odds ratio	95% confidence interval
Narcotics during labor prior to epidural catheter placement	0.6	0.2-1.9
Dilation < 4cm at time of epidural catheter placement	3.0	0.7-20.5
Duration of epidural catheter usage > 8hrs	1.5	0.4-5.9
Need for increase in rate or rebolus of epidural infusion	1.3	0.3-6.8
VAS score > 3 at 12hr post delivery	1.3	0.3-5.0
Transfusion	34.0	7.3-604.1
Preeclampsia	2.9	1.3-7.3

Abstract #:T-05

Cross-Discipline Perceptions of Interdisciplinary Rounding as a Method of Improving Teamwork and Patient Safety in an Academic, Tertiary Care Labor and Delivery Unit

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Introduction: The Institute of Medicine has recommended that organizations establish strategies to develop interdisciplinary team management, acknowledging that teamwork is critical to the delivery of safe and effective healthcare. Recently, certain knowledge, skills, and attitudes (KSAs) have been observed to be essential for highly functioning teams. [1] In 2005, physician and nursing leaders on our labor and delivery suite (L&D) initiated structured, twice daily interdisciplinary rounds (IDRs). We hypothesized that these IDRs promote important KSAs necessary for teamwork and patient safety.

Methods: We developed a 25-item questionnaire to evaluate whether specific KSAs were present in our IDRs using a 5-point Likert scale (1=strongly agree 2=agree 3=neutral 4=disagree 5=strongly disagree), thus generating a total response score that ranged from 25-125 for each respondent. Four of the 25 items queried KSAs directly associated with patient safety. Participants included all L&D midwives (MW), nurses (RN), anesthesiologists (ANES), obstetricians (OB), and trainees involved in the IDRs. The primary outcome was the mean total response scores (MTRS) based on professional roles, total years of practice and L&D years of practice. ANOVA test with Bonferroni correction was used to assess the intergroup differences in MTRS. All analyses were performed with questions assigned equal weight and response direction.

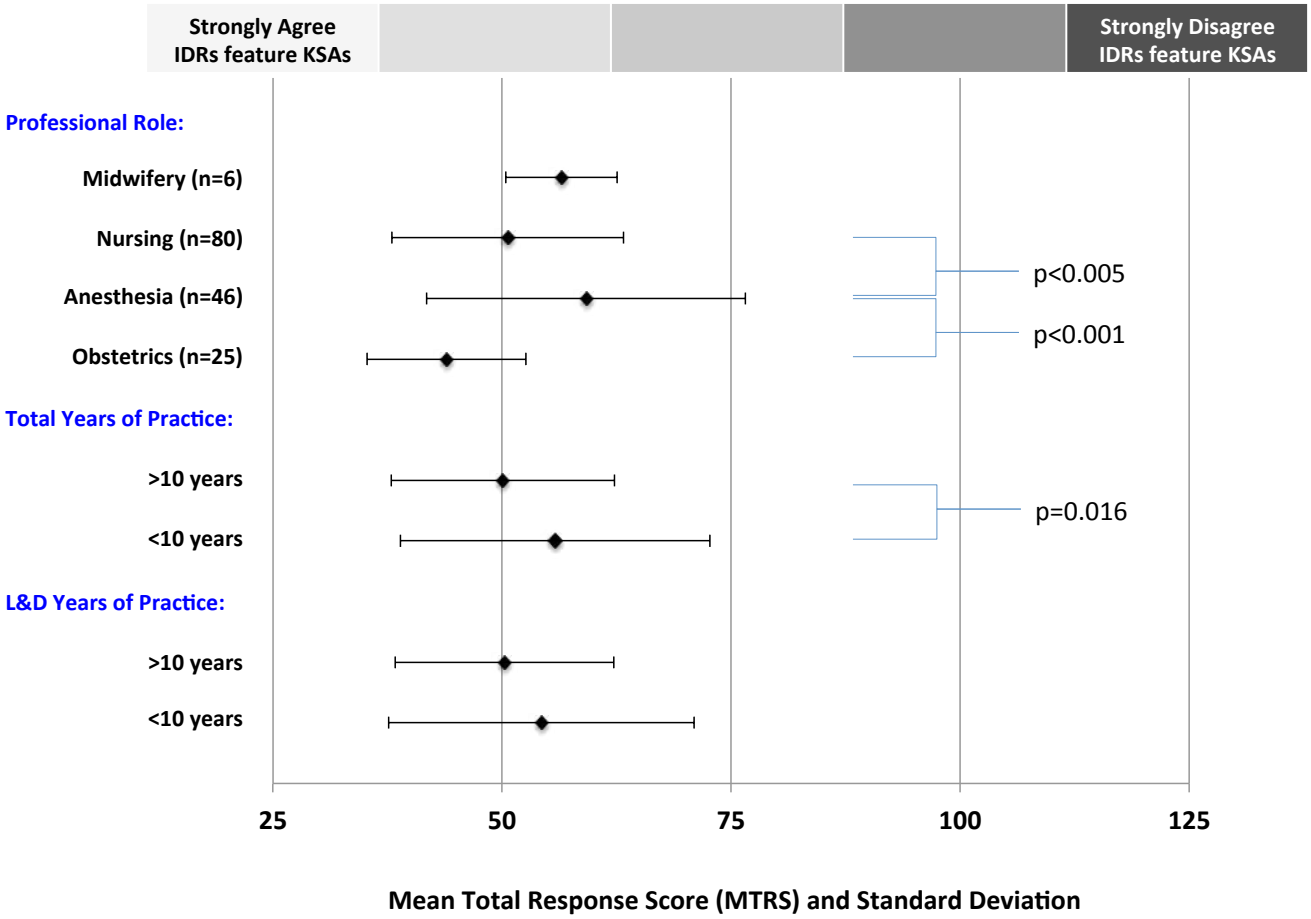
Results: To date, 157 of 190 providers have responded. The MTRS(SD) per item for all questions and the patient safety subset were 2.0(0.6) and 2.0(0.7) respectively. Compared to OB and RN providers, MTRS were significantly higher for ANES providers ($p<0.001$ and $p<0.005$, respectively). There were no differences in MTRS amongst OB, RN and MW providers. Providers with total years of practice <10, vs. >10, had higher MTRS ($p=0.016$). Providers with L&D years of practice <10, vs. >10, had similar MTRS. (see Figure)

Discussion: Among all L&D providers, our results indicate that IDRs promote specific KSAs essential for teamwork and patient safety. Although all providers agree that IDRs effectively promote KSAs, ANES providers and staff with fewer than 10 years of practice indicated this significantly less strongly. Further investigation into why these differences exist, and which KSAs have the most relevance to improving IDRs, may ultimately benefit both the providers and patients.

Reference:

1. Baker DP et al. Jt Comm J Qual Patient Saf. 2005;31(4):185-202

Abstract #:T-05



Abstract #:T-06

Can we predict who will develop postoperative nausea and vomiting following cesarean delivery under spinal anesthesia?

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Introduction: Postoperative nausea and vomiting (PONV) occur commonly in women undergoing cesarean delivery. Numerous studies have investigated risk factors for PONV in the general surgical population, and a number of risk scores have been developed. No such studies have been conducted in obstetric patients and it is not known if those risk scores are applicable to parturients. We therefore performed this study to assess risk factors for PONV in women undergoing cesarean delivery under spinal anesthesia.

Methods: This is a post-hoc analysis of data from two multicenter randomized controlled trials that investigated PONV. Anesthetic management was similar in both studies and included spinal anesthesia with 12 mg hyperbaric bupivacaine, 15 mcg fentanyl and 150 mcg morphine. Intraoperatively systolic blood pressure (SBP) was maintained within 20 % of baseline using a prophylactic phenylephrine (PE) infusion or boluses of PE for the treatment of hypotension according to a predefined algorithm. Potential risk factors for PONV based on available literature with some added pregnancy specific factors were collected: history of PONV, motion sickness, morning sickness, or hyperemesis gravidarum, smoking during or prior to pregnancy, preoperative nausea, intraoperative nausea and vomiting (IONV), intraoperative SBP drop >20%, use of intraoperative rescue antiemetics, and exteriorization of the uterus. Additional covariables included receipt of prophylactic antiemetics and method of phenylephrine administration. We used random effects meta-analysis regression methods that include a random effect for study and fixed effects for PE infusion and prophylactic antiemetic treatment. Covariates with a significant association at $p<0.1$ were subsequently included in a final multivariate random effects model to estimate their independent association with PONV.

Results: 460 patients were included in the analysis. A chi-square test of heterogeneity for the rates of PONV found no significant difference (p=0.3) between the two studies. 381 patients received prophylactic PE infusions, 260 received no prophylactic antiemetics, 99 received metoclopramide and 101 received a combination of metoclopramide and ondansetron. PONV occurred in 250 (54%) patients. Results are summarized in the table.

Variable	No PONV (N=210)	PONV (N=250)	P-value (Univariate)	P-value (Multivariate)
History of PONV	104 (54 %)	123 (54 %)	0.72	
History of motion sickness	67 (32 %)	76 (31 %)	0.77	
History of morning sickness	151 (72 %)	198 (79 %)	0.07	0.07
History of hyperemesis gravidarum	9 (4 %)	7 (3 %)	0.49	
Non smoker (never smoked)	120 (60 %)	175 (71 %)	0.02	0.02
Preoperative nausea	32 (15 %)	47 (19 %)	0.36	
IONV	83 (40 %)	116 (46 %)	0.18	
Intraoperative rescue antiemetic	42 (20 %)	61 (24 %)	0.37	
Intraoperative hypotension	58 (28 %)	77 (31 %)	0.32	
Exteriorization of the uterus	124 (59 %)	149 (60 %)	0.89	
PE infusion	173 (82 %)	208 (83 %)	0.82	
Prophylactic antiemetics - No prophylaxis - Metoclopramide - Metoclopramide + Ondansetron	 114 (54%) 43 (21 %) 53 (25 %)	 146 (58%) 56 (22 %) 48 (19 %)	0.09	0.08

Conclusions: Non-smoking was the only risk factor for PONV in our analysis. History of morning sickness was associated with increased risk for PONV, but was not statistically significant.

Abstract #:T-07

Developing and Testing an Objective Pain Measurement Device in Laboring Women

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Introduction: There are currently no reliable, commercially available, objective pain measurement devices.[1] This study aimed to perform algorithm calibration and testing for a novel pain measurement device for labor pain and neuraxial analgesia evaluation.

Methods: 15 healthy pregnant women requesting epidural labor analgesia were enrolled in this IRB-approved, prospective cohort study. A non-invasive, adhesive sensor (Covidien NellcorTM) was placed on the subject's forehead and connected to the pain measurement device in development (ROPAMedics, LLC). An independent investigator recorded timing and numerical rating pain scores (NRS) of contractions and other painful events. The study started at setup for epidural analgesia and ended with achievement of analgesia (NRS ≤2 with contractions). Patients received an epidural (5+5+5 ml 0.125% bupivacaine + sufentanil 10 mcg) or combined-spinal epidural (bupivacaine 2.5 mg + sufentanil 5 mcg). De-identified data was then used by ROPAMedics to calibrate an algorithm that calculates Real-Time Cerebral Hemodynamic Response (RTCHR). RTCHR is a measure of frontal lobe cortical activity, driven by regional changes in oxygenated and deoxygenated hemoglobin concentration, which has been shown to correlate with pain or nociception.[2] Correlation analysis was performed using Spearman's rank or Kendall-Tau, as appropriate, to assess the relationship between RTCHR recordings and patient-reported pain NRS.

Results: The study protocol was successfully applied to 15 laboring women. A representative patient dataset showing overlay of events during the study period, fetal heart rate, uterine contractions, and RTCHR measurements is shown in Fig 1A. The Kendall-Tau correlation coefficient between measured RTCHR and patient-reported pain NRS was strong and statistically significant (0.81, $p<0.001$;Fig 1B).

Discussion: An objective pain measurement device would be invaluable for patients who cannot verbalize pain scores, such as infants or sedated patients, or could complement subjective pain scores to prevent under or over treatment of pain. Laboring women receiving neuraxial analgesia provided an excellent study population for device algorithm development and calibration. Double-blinded studies to validate and further develop this novel pain measurement tool in obstetric and non-obstetric subjects are ongoing.

References:

1. J Pain. 2009;10(10):1001-11
2. J Neurosci. 2006;26(14):3662-6

Abstract #:T-07

Figure 1A:

Representative patient dataset showing events with patient-reported numerical rating score (NRS) pain ratings, fetal heart rate (FHR) tracing, contraction tracing (TOCO), and Real-Time Cerebral Hemodynamic Response (RTCHR) data.

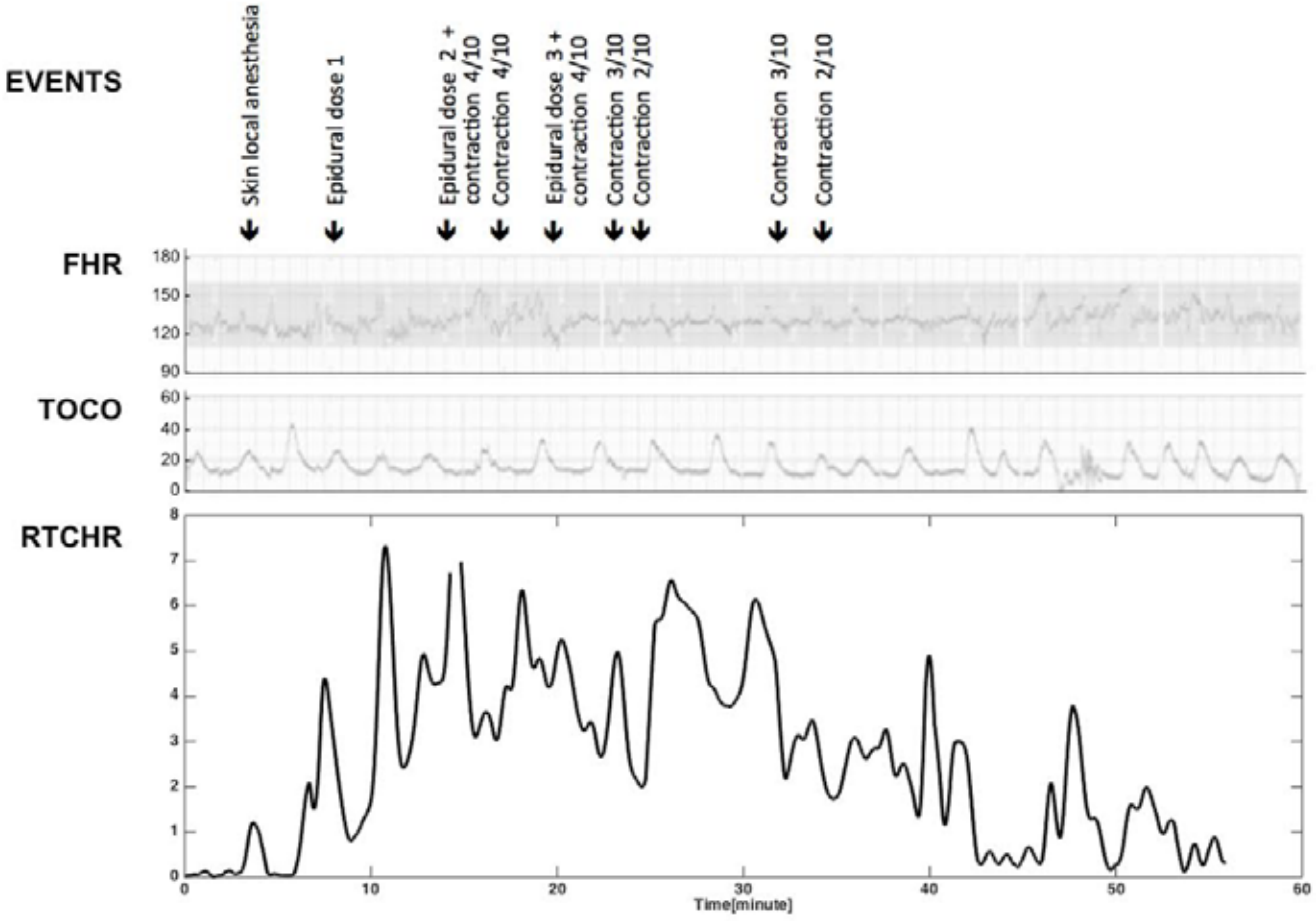
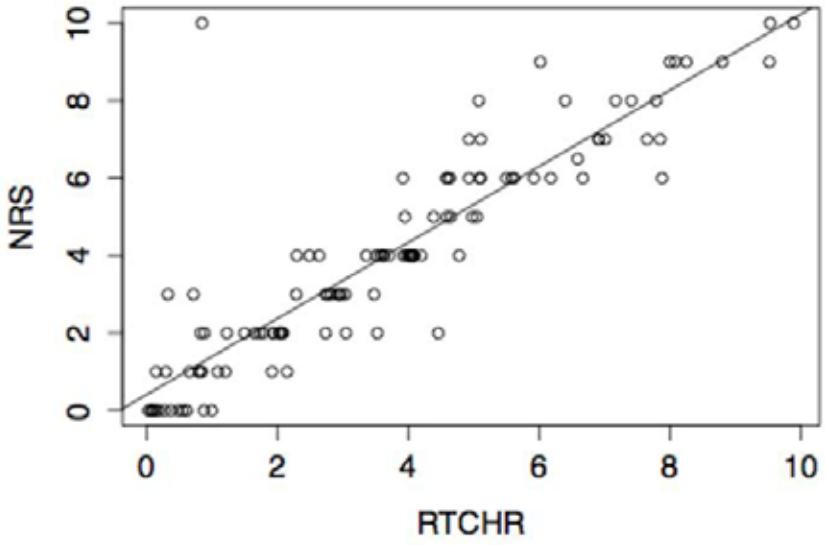


Figure 1B:

Correlation between NRS pain ratings and RTCHR scores. (Kendall-Tau 0.81, p<0.001).



Abstract #:T-08

A Case Of Intracranial Epidural Hematoma In A Patient Receiving Neuraxial Labor Anesthesia

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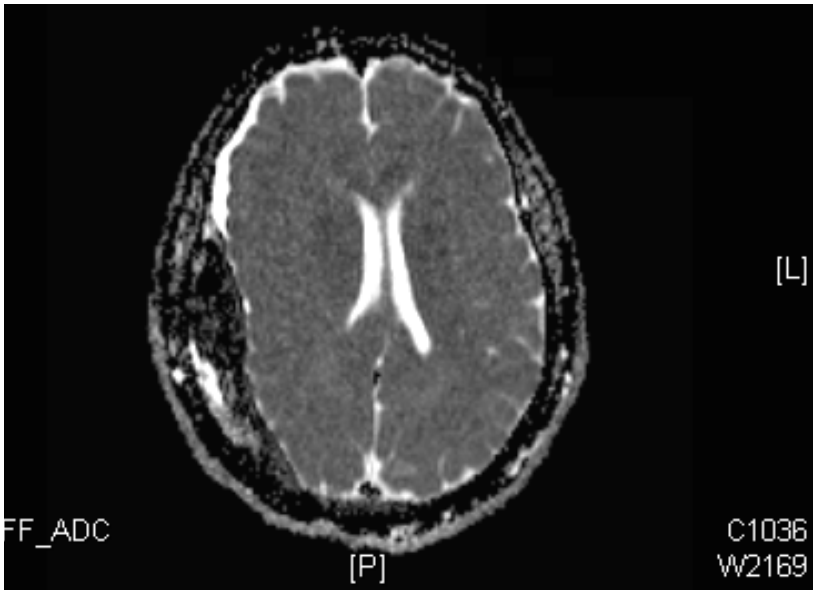
Introduction: Neurologic complications due to inadvertent dural puncture, including intracranial hemorrhage, are well described. Disruption of the bridging veins due to intracranial hypotension may result in a subdural hematoma. Intracranial epidural hematomas (EDH) however have not been a reported complication of inadvertent dural puncture. We report a case of a healthy parturient who following an uncomplicated labor with combined spinal-epidural (CSE) suffered an intracranial EDH, requiring decompressive craniotomy.

Case Presentation: A 34 year old G3P0020 at 41 weeks gestation presented to labor and delivery for a post-dates induction. Her medical history was significant for obesity and recurrent syphilis. An uncomplicated CSE was placed prior to delivery. On postpartum day (PPD) 0, she developed a postural right-sided headache, without cranial nerve symptoms. This was managed conservatively with intravenous hydration and caffeine. On PPD 1 an epidural blood patch was performed, resulting in moderate relief of her headache. On PPD 2, the headache returned; however, it was now left sided, with associated photophobia. An MRI revealed a right temporal-parietal EDH and a smaller right holo-hemispheric subdural hematoma with a resultant midline shift. CT angiography did not reveal definitive intracranial vascular malformation and initial coagulation studies were within normal limits. Following emergent neurosurgical consultation, a decompressive craniotomy was performed.

Discussion: Intracranial epidural hematomas are most commonly arterial in origin, and occur after trauma. Rarely traumatic EDH may be secondary to dural AV fistula; however, the most likely culprit is damage to the middle meningeal artery. There is one case report of intracranial EDH after spinal anesthesia for retained placenta, however it was discovered after epileptic seizure and was most likely traumatic. Non-traumatic etiologies of acute EDH include infection, coagulopathy, dural vascular malformations, and hemorrhagic tumors. Our patient was initially treated for postdural puncture headache; careful history taking disclosed subtle changes in her headache characteristics including laterality and cranial nerve involvement prompting imaging. This case emphasizes the importance of meticulous history and utilization of imaging when postpartum headache is not consistent with classical presentation of PDPH as there may be catastrophic etiologies that if undetected may be fatal.



Abstract #:T-09

Neuraxial anesthesia for a cesarean section in the setting of pityriasis rosea with skin lesions covering the lumbar spine

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Introduction: Pityriasis rosea (PR) is an acute exanthematous skin disease that begins with the appearance of a singular oval-shaped pink lesion followed by the eruption of numerous thin papules on the trunk and proximal extremities. A PubMed search for PR and neuraxial anesthesia yielded no results. We describe our clinical reasoning and management of a parturient with PR skin lesions covering her lumbar spine.

Case Description: A 35 year-old (P 3-0-0-2) parturient at 39 and 2/7 weeks gestational age with a history of two prior cesarean sections presented with painful contractions and a two-week diagnosis of PR. Physical exam revealed numerous scattered, scaly, lightly erythematous thin papules distributed along skin relaxation lines over the abdomen, thorax, and proximal extremities. The patient was asymptomatic other than pruritus. Significantly, the entire lumbar spine was covered with lesions necessitating that any attempt at neuraxial anesthesia would require that needle puncture go through a papule. Despite determining that the patient was not in active labor, the obstetric team offered her an elective repeat cesarean section.

After consulting with the infectious disease team, it was determined that epidural placement should be safe, even if the needle had to transverse infected skin. Out of theoretical concern for seeding the cerebral spinal fluid, an epidural was chosen over a spinal anesthetic. A healthy baby was delivered in the operating room, the patient's postoperative course was uneventful, and six weeks later her rash resolved.

Discussion: There is now strong evidence that PR likely represents reactivation of human herpes virus 7 (HHV7), and to a lesser extent human herpes virus 6 (HHV6). Broccolo et al. [1] isolated HHV6/7 DNA from the plasma of patients with PR (DNA not found in healthy patients or patients with inflammatory skin disease) and found HHV7 DNA from skin specimens in 10/12 PR subjects versus 0/12 control subjects. Additionally, valacyclovir has been shown effective in decreasing the duration of PR.

HHV6/7 are beta-herpes viruses (unlike alpha-herpes viruses such as herpes simplex or herpes zoster which infect keratinocytes) which target CD4+ T-cells in the blood and are consequently found in very low concentrations in the skin[2]. For this reason, while it may not be prudent to insert a needle through infected herpes simplex or herpes zoster, placing an epidural through infected PR skin likely poses no great risk.

References:

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2. Katsafanas GC, Schirmer EC, Wyatt LS et al. In vitro activation of human herpesviruses 6 and 7 from latency. Proc Natl Acad Sci USA. 1996; 93: 9788-92.

Abstract #:T-10

Ondansetron Does Not Prevent Spinal Hypotension But Reduces Total Vasopressor Requirements in Women Undergoing Cesarean Delivery

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Introduction: Ondansetron is used to prevent and treat nausea, vomiting and pruritus in obstetrics (1). Another potential indication, recently described, is prevention of spinal hypotension during cesarean delivery (CD) under spinal anesthesia (2). The aim of this study was to determine the efficacy of ondansetron in spinal hypotension prevention, and to evaluate if the effect was dose-dependent and correlated with blood levels of ondansetron.

Methods: 40 healthy women undergoing CD were randomly assigned to receive 4 or 8 mg IV ondansetron for a prospective, open-label pharmacokinetic study. Maternal blood was sampled at 7, 15 and 40 min after ondansetron administration. This data was then combined with a dataset collected retrospectively from medical records of 125 women undergoing CD who did not receive ondansetron. All women were healthy parturients with term singleton pregnancies having elective CD with spinal anesthesia (1.6 ml 0.75% bupivacaine, fentanyl 10 mcg, morphine 100-200 mcg). Outcome measures included phenylephrine use (first 20 minutes and total use during CD), blood pressure, heart rate, fluid requirements, and estimated blood loss (EBL).

Results: There was no difference between groups for phenylephrine use in the first 20 min (419 ± 279 in ondansetron group vs. 370 ± 275 mcg in no ondansetron group, $p=0.336$). However, total phenylephrine requirements were less (1008 ± 759 vs. 1518 ± 1000 mcg) in women receiving ondansetron ($p<0.001$). We found no difference in blood pressure measurements ($p=0.56$), heart rates ($p=0.07$), fluid requirements ($p=0.922$) or EBL ($p=0.622$). There was no dose effect when comparing 4 and 8 mg ondansetron doses, and no significant correlations between ondansetron blood concentration AUC and phenylephrine requirements were found (Figure).

Conclusions: Our results found that ondansetron does not prevent hypotension or early vasopressor use after spinal anesthesia for CD, suggesting a limited role of ondansetron for spinal hypotension prevention (3). A significant decrease in the total, but not early (first 20 minutes), phenylephrine requirements suggests ondansetron may have a potential role in blood pressure maintenance later on during CD, perhaps due to counteracting the hypotension side-effect of oxytocin.

References:

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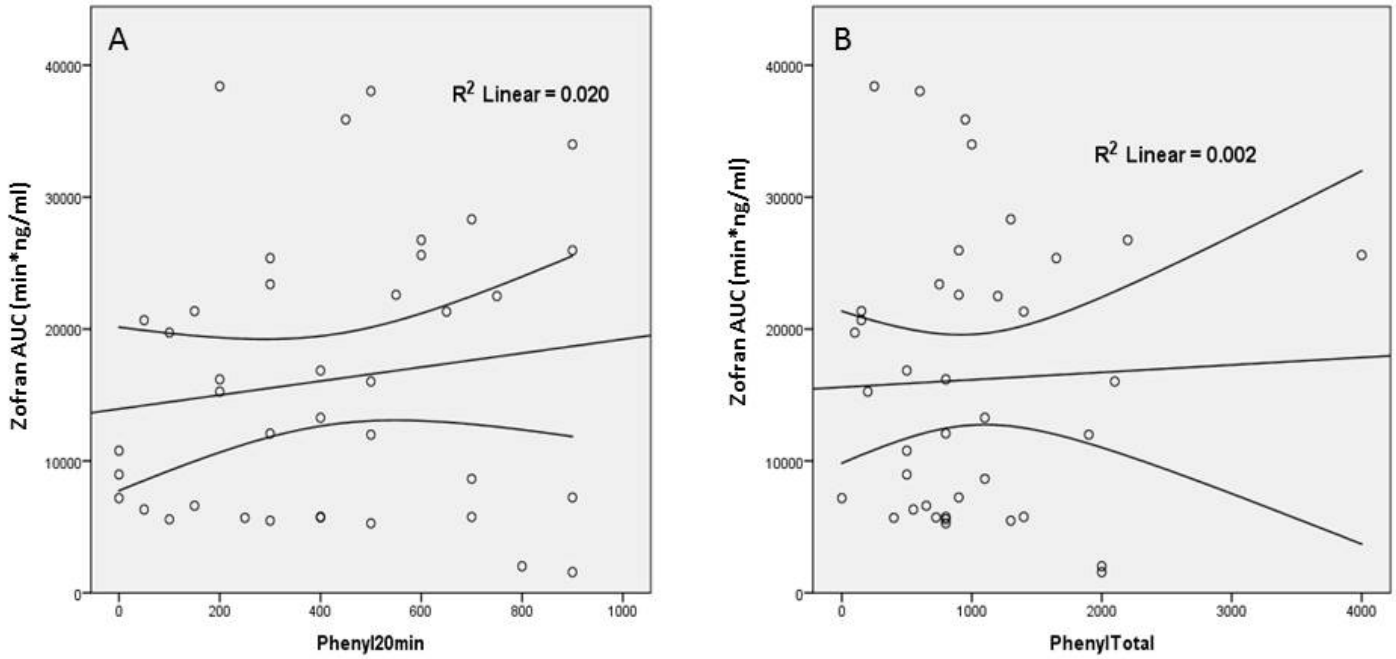
Abstract #:T-10

Figure 1a and B: Scatter plots of ondansetron blood concentration area-under the curve (AUC) concentrations and phenylephrine requirements first 20 minutes after spinal anesthesia (A) and total use during cesarean delivery (B)



Abstract #:T-11

Dual neuroaxial catheter placement for a super morbidly obese parturient undergoing cesarean section

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Introduction: Super Morbid Obesity is classified as a BMI > 50 Kg/m2. These patients present special challenges for the anesthesia provider.

Case Report: A 35 y/o G4 P1 presented at 39 weeks for an elective repeat C/S and BTL. Her BMI was 80.3 Kg/m2 classifying her as super morbidly obese. Her prior C/S was performed under GETA and complicated by a wound infection. The remainder of her history was benign except for well-controlled GERD.

A dual neuraxial anesthetic technique to include a thoracic epidural catheter for post-op pain control and lumbar dural puncture and placement of a spinal catheter for intraoperative anesthesia was planned. Our pre-anesthetic assessment was notable for an unfavorable airway, large pannus and potentially difficult peripheral IV access, therefore in the pre-op area we placed 2 large bore PIV's and an arterial line under ultrasound guidance (USG).

The patient was then taken to the OR and assisted to a sitting position using an epidural positioning device. Tape was applied to both sides of her back retracting tissue to allow landmarks to be identified with USG. A thoracic epidural was placed at the T10/11 level using a 9cm touhy needle, LOR was obtained at 9cm after several attempts.

The back was re-prepped and a lumbar intrathecal catheter was introduced at L3/4 after obtaining CSF at 11cm with a Gertie Marx 5" CSE needle. The spinal catheter was dosed with approximately half of our standard dose (6mg 0.75% Bupivacaine with Dextrose, 7.5 mcg Fentanyl and 75 mcg of preservative free Morphine). [1]

The patient was assisted to the lateral position and the catheters were secured with tegaderm. [2] A bilateral T4 level was obtained. A MAP of 80 mm Hg was maintained with phenylephrine boluses. The C/S was uneventful but due to a large hernia repair, the surgery lasted 7 hours. The lumbar catheter was re-dosed as needed and the patient tolerated the surgery well.

Postoperative pain control was obtained with an infusion of 0.2% Ropivacaine via the thoracic epidural. The patient spent 24 hours recovering on the L&D unit for close monitoring and was discharged home on PPD 4 with no complications.

Discussion: A dual catheter technique worked well for our 218Kg patient. The spinal catheter provided a reliable and predictable black especially important when surgery was unexpectedly prolonged.

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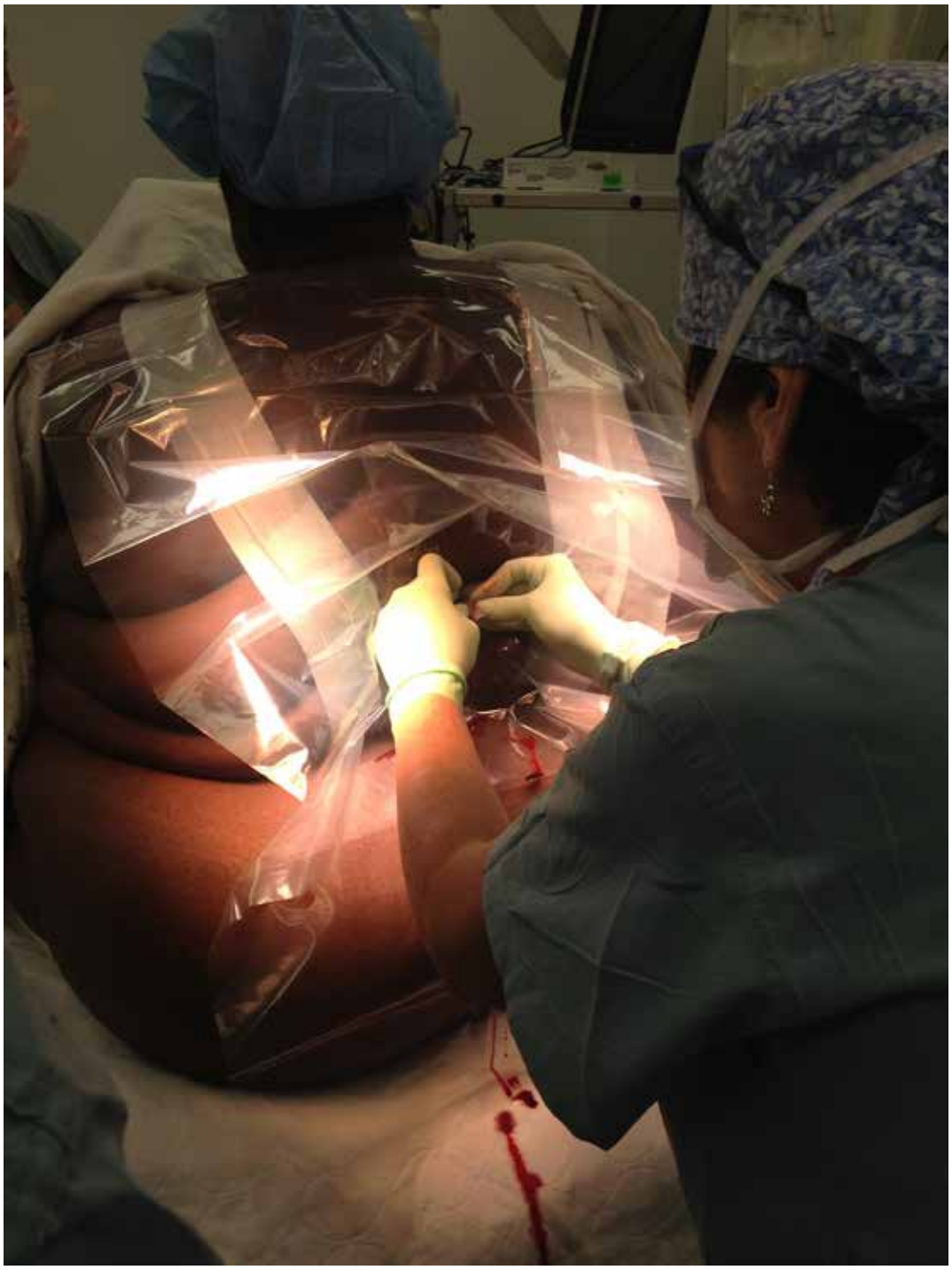
Abstract #:T-11



Abstract #:T-12

Late Pregnancy Exposure to Beta Blockers and the Risks of Neonatal Hypoglycemia and Bradycardia

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Introduction: Beta blockers are widely used in the treatment of hypertensive disorders during pregnancy. These medications cross the placenta and may cause physiologic changes in neonates exposed in utero. Some prior studies suggest an association between late pregnancy beta blocker exposure and the risks of neonatal hypoglycemia and bradycardia, but the magnitude of these risks and the question of whether they extend to the alpha-beta blocker labetalol are poorly defined.

Methods: We used a cohort of 2,292,116 completed pregnancies linked to liveborn infants of women enrolled in Medicaid from 2003 to 2007. We examined the risk of neonatal hypoglycemia and neonatal bradycardia associated with maternal exposure to beta blockers at the time of delivery, defined by a dispensed outpatient prescription whose days supply overlaps with the date of delivery. The reference group consisted of pregnancies not exposed to beta blockers at the time of delivery. Propensity score matching (1:3 fixed ratio) was used to control for potential confounders including maternal demographics, obstetric and medical conditions, and exposure to other medications.

Results: There were 10,585 (0.5%) pregnancies exposed to beta blockers at the time of delivery. The risk of neonatal hypoglycemia was 4.3% in the beta blocker exposed vs 1.2% in the unexposed; the risk of neonatal bradycardia was 1.6% in the exposed vs 0.5% in the unexposed. After controlling for confounders, risk remained elevated for both neonatal hypoglycemia and bradycardia among exposed pregnancies vs unexposed (adjusted odd ratio (aOR) 1.7, 95% CI 1.5 to 1.9 and aOR 1.3, 95% CI 1.1 to 1.6, respectively). Risks were similarly elevated for those exposed to labetalol vs unexposed (aOR 1.8, 95% CI 1.6 to 2.0 for hypoglycemia and 1.3, 95% CI 1.1 to 1.7 for bradycardia). Results were similar across multiple sensitivity analyses.

Conclusion: Our findings suggest that neonates born to mothers exposed to beta blockers in late pregnancy, including labetalol, are at elevated risk for neonatal hypoglycemia and bradycardia. Exposed neonates may benefit from monitoring for these conditions.

Abstract #:T-13

Neuraxial Ultrasound to Assess Midline Epidural Placement and Related Clinical Efficacy

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Co-Authors: Rachel R. Wang M.D. - Stanford School of Medicine - Stanford, CA
Benjamin Cobb M.D. - Stanford School of Medicine - Stanford, CA
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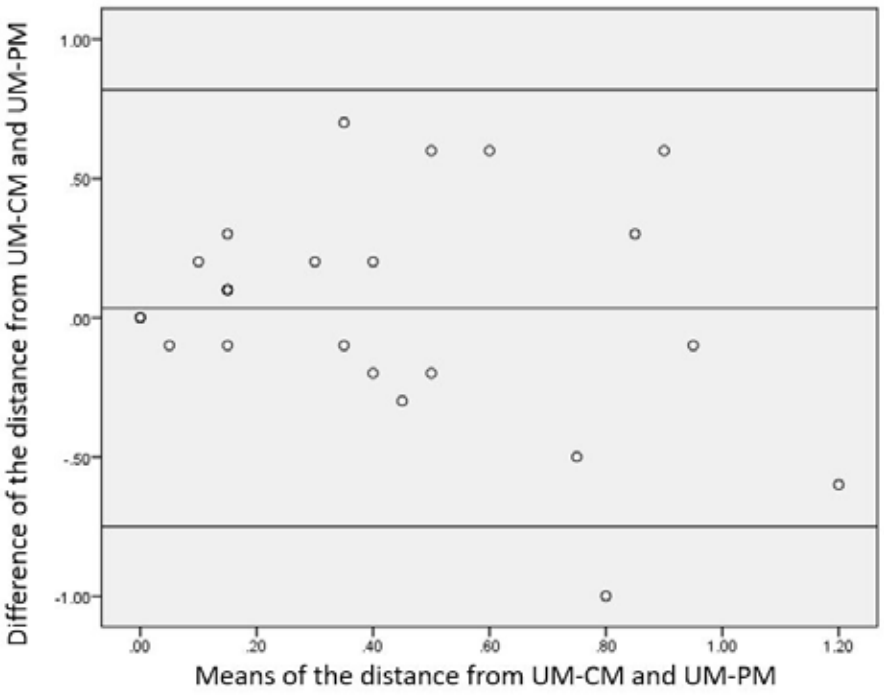
Introduction: Labor epidural analgesia (LEA) has a reported failure rate of 1.7-19.8%,(1) and identification of the midline for neuraxial anesthesia is important.(2) Ultrasound (US) has been shown to accurately assess the depth of the epidural space.(3) We hypothesized that US may be a useful tool to identify midline and that midline insertion improves LEA efficacy.

Methods: Fifty healthy women who received LEA inserted with landmark technique were approached immediately after delivery for this prospective cohort, IRB approved study. Prior to removing the epidural, we evaluated midline using US (UM), and measured the distance from UM to clinician midline (CM); the catheter inserted point. We also asked patients to self-identify their midline (PM) (assessed with pinprick in 1 mm increments) and measured the distance from UM to PM. LEA efficacy measures were average visual analogue score (VAS) for pain during stage 1 of labor, patient-controlled epidural analgesia (PCEA) pump demands and physician requested boluses. Data are described as mean±SD, median(IQR) and n(%). Bland-Altman analysis assessed US, clinician and patient self-identified midline distances, and correlations between UM-CM distance and block efficacy were performed.

Results: Our interim analysis cohort of 24 women aged 29±6, weighed 78±20 kg had parity 0(0-1). Bland-Altman analysis revealed that UM-CM distance was similar to the UM-PM distance, Figure. There were no significant correlations between UM-CM distance and PCEA demands (R=0.31, p=0.14), pain VAS (R=0.03, p=0.88) and physician bolus requirements (R=0.16, p=0.46).

Conclusions: In our low risk, non-obese laboring population, clinicians and patients reliably identified the midline, as confirmed by US assessment. Our interim results confirm the utility of patient's self-identified assessment of midline.(4) This ongoing study will further assess relationship of LEA block insertion midline deviation and analgesic failures in obese and non-obese parturients.

Figure. Bland-Altman plot to compare measurement of two distances. The two distances compared are 1) **distance from ultrasound-assessed midline to clinician midline** and 2) **distance from ultrasound-assessed midline to patient self-determined midline**. UM = ultrasound-assessed midline; CM = clinician midline (catheter insertion point); PM = patient self-determined midline



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Abstract #:T-14

Pulse oximetry is the least effective monitoring modality to detect respiratory depression among laboring women receiving remifentanil

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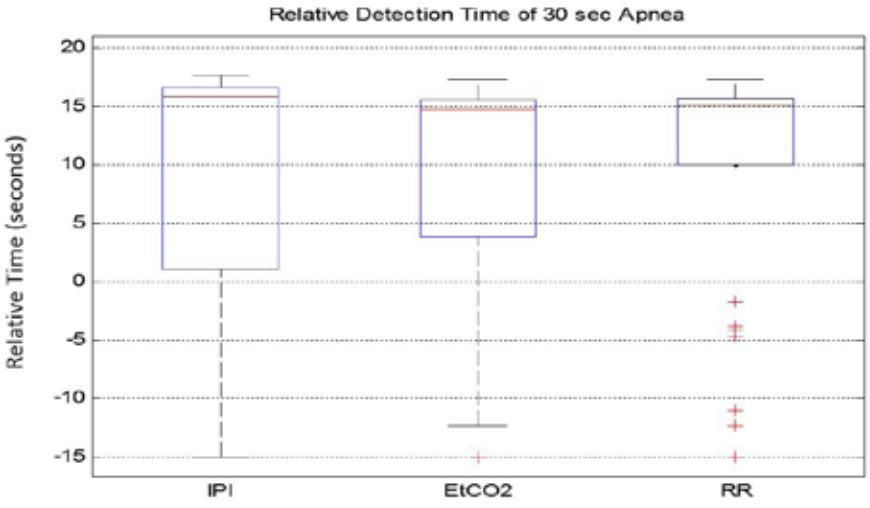
Introduction: Intravenous opioids may cause respiratory depression (RD); apnea leading to respiratory arrest has been reported with remifentanil used for labor analgesia (1). While frequent unnecessary alerts may lead to alarm fatigue, insufficient sensitivity increases the risk of undetected events. We aimed to identify a reliable monitor to detect RD in women receiving remifentanil during labor.

Methods: Secondary analysis of a prospective IRB-approved study of healthy women receiving intravenous patient-controlled boluses of remifentanil 20-60 mcg q1-2 mins for labor analgesia. Women were monitored continuously with respiratory rate (RR), end-tidal CO2 (EtCO2), pulse oximetry (SpO2), heart rate (HR), and the Integrated Pulmonary Index (IPI) (Capnostream©; Covidien, Boulder CO). The IPI value (1-10; 10 =healthy patient, =<4 =immediate attention required, 1 =dire condition), is generated from a logic algorithm using the RR, EtCO2, SpO2 and HR parameters. Alarm triggers included: RR <8 breaths per minute (bpm), EtCO2 <15 mmHg, and SpO2 <92% for at least 15 sec. Apnea was defined as EtCO2 <5 mmHg for at least 30 consecutive seconds.

Results: Nineteen laboring women, aged 31±5 yrs and BMI 26±3 were randomized to receive remifentanil (total dose 1725±1392 mcg, administered over 160±132 min). There were 331 cumulative individual parameter alerts; RR <8 bpm, EtCO2 <15 mmHg, SpO2 <92%, with 82% of these alerts lasting => 10 secs. There were 190 IPI alerts =<4, with 84% of these IPI alerts lasting =>10 secs. In total, 62 apneas were counted; 100% were detected by the IPI =<4 alert, 100% by RR <8 bpm, 76% by EtCO2 <15 mmHg, and 15% by SpO2 <92%. In 47/62 (76%) apnea events, IPI, RR and ETCO2 alerts were all triggered, Figure.

Conclusion: SpO2 - often viewed as the superior monitor for RD, exhibited the worst performance in detecting apnea. RR and IPI alarms were more sensitive than EtCO2 and SpO2 for detection of RD during intravenous remifentanil boluses for labor analgesia. Most of the alerts not captured by the IPI were of short duration,and of no clinical consequence.

Figure. Alarm detection boxplot. The IPI and RR alerts triggered for 100% of the 30 sec apnea events. To compare relative detection time, we only considered 30 sec apnea events that caused alerts from three parameters: IPI, RR and EtCO2, 47/62 (76%) of the apnea events. Time zero is the time of apnea onset. The EtCO2 alert triggered first in 33/47(70%), the IPI triggered first in 12/47(27%), and the RR triggered first in 2/47(4%) apnea events. In cases where the EtCO2 alert triggered first, the median time difference between EtCO2 and IPI alert was one sec.
IPI = integrated pulmonary index; ETCO2=end-tidal carbon dioxide; RR=respiratory rate



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Abstract #:T-15

Respiratory Decompensation in a Parturient with Hamman-Rich Syndrome

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Introduction: Anesthetic management of a parturient with restrictive lung disease can be challenging when faced with the cardiopulmonary changes of pregnancy. We present a rare case of respiratory decompensation in a parturient with Hamman-Rich Syndrome, involving worsening pulmonary edema and hypoxia in the setting of baseline pulmonary fibrosis.

Case Presentation: A 42 year old G2P0 female with history of gestational hypertension and Hamman-Rich Syndrome was initially seen in a consultation visit. She was requiring 3L/min oxygen during pregnancy, increased from her nocturnal 2 L/min baseline and using a scheduled ipratropium inhaler. With advancing gestation she required a wheelchair secondary to increasing dyspnea. Recent PFTs showed moderate to severe restrictive ventilatory defect with FEV=48(% predicted); FEV1=48%; FEV1/FVC=101%; FEF25-75=42%; DLCO47%. Initial anesthetic plan was for early placement of an epidural with slow dosing upon onset of labor. The patient presented a week later at 35 weeks with acute worsening of hypoxia, non-productive cough, lower extremity edema and concern for preeclampsia. On admission oxygen requirements were increased to 6L/min and ABG showed a PaO2 of 61. Notably, she was unable to lay flat without having severe coughing spells with oxygen desaturations to the 80's. Chest X-ray confirmed worsening pulmonary edema and small pleural effusions. She required urgent cesarean delivery due to her worsening respiratory status as well as non-reassuring fetal heart tones. Due to her inability to lay supine, she was preoxygenated in an upright position and only after rapid sequence induction was the patient flattened and intubated. After transfer to the intensive care unit her oxygenation showed marked improvement with positive pressure ventilation, PEEP, and small incremental doses of furosemide. Echocardiogram exhibited moderate pulmonary hypertension with calculated RVSP of 55mmHg. Following extubation on postoperative day one her respiratory status continued to improve and she was discharged home four days later without further complications.

Discussion: Hamman-Rich syndrome is a rare form of diffuse lung injury resembling acute respiratory distress syndrome. Diagnosis is based on pathologic evidence of diffuse alveolar damage along with associated clinical findings. Treatment is supportive and prognosis is very poor despite aggressive treatment efforts (1). Management of patients requires close monitoring, planning and supplemental oxygen, diuretics and corticosteroids when appropriate. Physiologic changes in pregnancy including an increase in oxygen consumption, minute ventilation, intravascular volume, cardiac output and a decrease in lung volumes acutely worsened the already compromised lung function of this patient.

Reference:

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Abstract #:T-16

Rapid resolution of peripartum cardiomyopathy with a minimally invasive ventricular assist device after Cesarean delivery

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Background: Peripartum cardiomyopathy (PPCM) is a rare form of heart failure with broad anesthetic and post-surgical implications. The incidence of PPCM is 1 in 3000-4000 births (1). The presentation of PPMC varies in onset, as it can occur between the last month of pregnancy or up to 5 months after delivery. Its etiology is nonspecific, as causes include viral, autoimmune and idiopathic mediated cardiomyopathy (2). We present a case of PPMC occurring immediately after cesarean delivery requiring emergent placement of an ImpellaTM (Abiomed, Danvers, MA) percutaneous ventricular assist device with successful recovery of cardiac function and removal of the assist device.

Case Description: A 34 year-old gravida 5, parity 3 female at gestational age of 39 weeks + 3 days was admitted for an elective cesarean section due to a failed external cephalic version. Toward the conclusion of the case the patient complained of chest tightness and was noted to be hypotensive (SBP 70-80's). The patient was noted to have pink frothy secretions with a decrease in oxygenation saturation levels. She was emergently intubated and an emergent transesophageal echocardiogram was performed which showed an ejection fraction of 10% with global hypokinesis. The decision was made to provide circulatory support with an ImpellaTM assist device via a percutaneous approach through her femoral artery. The patient's cardiac function improved gradually, and the ImpellaTM was removed 4 days after implantation.

Discussion: The diagnosis of PPCM entails the following clinical and objective data: development of heart failure with the absence of a determined etiology in the last month of pregnancy or within the first 5 postpartum months and an ejection fraction less than 45%. With mechanical assist device's becoming more common, their role in patients with PPCM is paramount. The Interagency Registry for Mechanically Assisted Circulatory Support (Intermacs) analyzed a total of 99 women with PPCM between 2006-2012. Overall, it was found that patients with PPCM receiving mechanical assist device's had an improved survival rate compared to women with non-PPCM cardiomyopathy receiving assist devices (P=0.01) (3). The ImpellaTM may represent an ideal assist device in patients with PPCM since patients with non-ischemic cardiomyopathy have a faster rate of recovery and this device was approved for shorter periods of use. Our case highlights the need for further research in this area and potentially foreshadows the critical role of minimally invasive LVAD's in patients with PPCM.

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Abstract #:T-17

Anesthetic Management of Maternal Cerebral Palsy and Intracranial Hemorrhage

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Introduction: A paucity of data exists in the literature regarding pregnancy, labor & delivery in patients with cerebral palsy (CP). The incidence of intracranial hemorrhage (ICH) in pregnancy ranges from 0.01-0.05%(1) and of all neurologic complications during pregnancy, ICH represents 2-7%.(2) We present a case of a mother with CP, chronic hydrocephalus, and an acute ICH who underwent cesarean delivery (CD) at 32 6/7 WGA, delivered a viable infant & subsequently recovered.

Case Description: A 22 y/o G1P0 at 31 2/7 WGA with a h/o CP and chronic hydrocephalus, for which she had bilateral VP shunts, was intubated after diagnosis of an ICH. Her initial CT demonstrated a large intraventricular hemorrhage (IVH), obstructive hydrocephalus & increased intracranial pressure (ICP). After extubation, she was at her baseline of mild cognitive dysfunction and lower extremity paraparesis. A repeat CT revealed global cerebral edema and possible impending infratentorial herniation. It was decided to perform a CD at 32 6/7 WGA due to concerns regarding the possibility of increasing cerebral edema or a subsequent IVH associated with the increased intravascular volume with further prolongation of the pregnancy. A multidisciplinary conference was held with obstetricians, MFM, anesthesiologists, and neurology. Although a general anesthetic (GA) would not allow for continuous monitoring of neurologic status, it was ultimately decided that a neuraxial technique was too risky given the potential for herniation.(3) The patient was taken to the OR where an A-line was placed prior to a RSI with propofol and rocuronium. She was given fentanyl, esmolol, labetalol, nitroglycerin & lidocaine to attenuate the response to laryngoscopy. She was maintained on propofol & remifentanil infusions during surgery. She underwent an uneventful CD and went to the ICU where she was extubated three hours later and found to be at her neurologic baseline. The source of her hemorrhage was never discovered.

Discussion: ICH during pregnancy is uncommon.(2) Since the nature of our patient's hemorrhage was never clear, it was assumed to be from vascular changes related to pregnancy in association with her preexisting VP shunts from the chronic hydrocephalus related to her CP. Prolongation of the pregnancy was thought to be too hazardous to maternal health & delivery was performed early. There was much debate at our multidisciplinary conference as to whether a neuraxial should be performed to be able to continuously monitor the patient's neurologic status as well as to diminish the risk of aspiration. (3) Because of the global cerebral edema, obstructive hydrocephalus, increased ICP & impending herniation it was decided to proceed with a GA.(3) Given the rarity of these occurrences it is crucial to take a multidisciplinary approach to individual patients.

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Abstract #:T-18

Nitrous Oxide In Labor and Delivery: Protocol Development and Implementation

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Introduction: Nitrous oxide has enjoyed resurgence in popularity in recent years as an alternative for labor pain management. Many studies have demonstrated the maternal and neonatal safety of nitrous oxide in labor when compared to parturients having an unmedicated birth. At our institution, The Colorado Institute for Maternal and Fetal Health, we recently implemented nitrous oxide in labor. We are presenting our experience with protocol development and implementation.

Results: We first sent out a questionnaire to the anesthesiology, nursing, obstetric, pediatric, family medicine, neonatology, maternal fetal medicine and midwifery departments to evaluate support and concerns. We found there was 98% support across the groups. We created a multidisciplinary working group that comprised members from most disciplines listed above and met on a weekly basis. For educational and informational purposes, Grand Round presentations were made to the involved departments. Guidelines, patient consent forms, patient education sheets and electronic medical record data collection sets for nursing documentation were created. Capital budget approval was received to purchase two Nitronox™ machines. We provided training in-services to the anesthesiology and nursing departments where we required competency sign-off for all staff. We also obtained approval from our biomedical and facilities department regarding fire codes. Our billing department provided the information required to obtain reimbursement for labor analgesia.

We learned that in order to offer anesthesia gas outside of the operating room, there were fire codes that needed compliance per the National Fire Protection Association Standards for Health Care Facilities (1999). This included, but was not limited to, a sufficient ventilation system for each labor room, adequate emergency electrical outlets and emergency battery powered lighting.

After six weeks of availability of this new program, approximately 20% of our parturients have requested nitrous oxide in labor. Of those, approximately 50% of our parturients convert to an epidural. This is higher than other published studies and may be due to the effect of altitude on partial gas pressures. Nitrous oxide has also been requested for postpartum laceration repairs, retained products of conception and external cephalic versions. We have had 100% reimbursement for our nitrous cases and no patient complaints.

Conclusion: We have successfully implemented a program for use of nitrous oxide in labor at our institution using a multidisciplinary approach. No complications or adverse outcomes have occurred and our maternal satisfaction rate is high.

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Abstract #:T-19

Incidence of Post Dural Puncture Headaches and Epidural Blood Patches following Neuraxial Anesthesia in a Private Practice Setting: Analysis of 8,562 Anesthetics in 2014

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Introduction: According to the United States Department of Health and Human Services, 3.9 million births were registered in the United States in 2013. While percentages vary based on multiple factors, it is estimated that around 60% of vaginal deliveries and almost 95% of cesarean sections receive neuraxial anesthesia in the form of an epidural, spinal, or combined spinal epidural (CSE). Post dural puncture headache (PDPH) is a known complication of neuraxial anesthesia, and parturients are know to develop PDPH at a higher rate than their older counterparts. Most studies on the incidence of PDPH and epidural blood patches (EBP) have been completed at academic centers where the incidence of inadvertent dural puncture might be higher than in the private practice setting. We questioned if the incidence of inadvertent dural punctures, PDPH and EBP would be lower in an experienced private practice setting.

Methods: A review was performed on prospectively collected data from obstetric anesthesiologists at Sharp Mary Birch Hospital for Woman and Newborns for all neuraxial procedures on obstetrical patients in the year 2014. This included the type of neuraxial technique, type and size of needle used, inadvertent dural puncture, presence of PDPH and need for EBP.

Results: A total of 8,562 neuraxial anesthetics were performed during 2014 out of a total of 9400 deliveries. Of these, 4,893 were combined spinal epidural and 937 were continuous lumbar epidurals during labor. The remainder, 2732, were spinal anesthetics for cesarean delivery. The obstetric anesthesiology service was consulted to evaluate 24 post anesthetic headaches, of which 22 were deemed to likely be PDPH (0.28%). The incidence of inadvertent dural puncture with large bore needles (17 or 18G) during epidural insertion was 11/5,830 (0.19%). Three of those 11 required an EBP (27%). A total of 2,732 single shot spinal anesthetics were performed.for cesarean delivery. Of these, 2 patients required an EBP (0.07%). There were five more EBP done. Four on patients after CSE where it was uncertain if there was a dural puncture from the larger needle, and one from a 24 g pencil point needle for a cerclage. All patients had full relief from headache after EBP and were able to be discharged from hospital. To our knowledge, after follow up telephone calls 1 week, 3 months and 6 months following EBP no patient required a second blood patch.

Discussion: These numbers represent a lower incidence of inadvertent dural puncture, PDPH, need for EBP, and EBP success rates than those previously reported in the literature. The overall rate of EBP for all patients who received neuraxial analgesia/anesthesia in our hospital was 0.11%. It is likely these low numbers reflect the experience of the obstetrical anesthesiologists and the type of needles used.

Reference:

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Abstract #:T-20

Anesthetic management of a patient with symptomatic anterior mediastinal mass presenting for cesarean delivery

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A 25-year-old 33 weeks pregnant Hispanic female was admitted to the ICU with worsening shortness of breath, cough, wheezing and 3 pillow orthopnea. The patient had history of recently diagnosed anterior mediastinal mass with significant compression of distal trachea. CT scan showed anterior mediastinal mass (13 cm x 17 cm x 19 cm) with extension into the chest wall, SVC compression, tracheal deviation, tracheal compression to a diameter of 5mm at carina, and severe narrowing of RUL bronchus. The patient was started on heliox 70/30, and BIPAP. An interdisciplinary team discussion between OB-GYN, Anesthesia, pulmonary medicine, and cardiothoracic surgery took place, and the decision was made to immediately proceed with elective cesarean delivery to allow for continued care and treatment of the mother. The procedure was performed in the cardiac surgery operating room. Lumbar epidural catheter was placed in the sitting position and tested for functionality using a low dose bolus. Arterial and venous femoral lines were placed by the cardiac surgeon after placement of the epidural catheter. Perfusion team, ECMO circuit and the cardiac surgeon were on standby for immediate intervention in the event of cardiovascular or respiratory collapse. Epidural anesthesia was slowly administered via lumbar catheter with incremental doses of local anesthetic while maintaining spontaneous ventilation with BIPAP and heliox. After achieving adequate anesthetic level, the procedure commenced as planned. As the patient could not lie flat, she was maintained in 30 degrees head up position throughout the procedure. Femoral lines were removed in the operating room after the procedure. The patient had an uneventful cesarean delivery and started the work up and treatment of the mediastinal mass shortly after delivery.

Abstract #:T-21

Risk Factors for Failed Conversion of a Labor Epidural to a Surgical Block for Postpartum Tubal Ligation

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Background: Postpartum tubal ligation (PPTL) is a popular method of birth control, and neuraxial anesthesia is routinely performed for these procedures. Since the majority of PPTL occur within 24 hours of delivery, a common practice is to attempt labor epidural reactivation for surgical anesthesia. However, the failure rate of labor epidural reactivation is 8-26%, and failure to successfully reactivate the epidural can lead to maternal morbidity and increased health care costs [1-4]. Therefore, a decision must be made to either attempt labor epidural reactivation or pull the catheter and perform the procedure under general or spinal anesthesia. The aim of this study is to identify risk factors for failed conversion of a labor epidural to a surgical block for PPTL.

Methods: This is an observational study. 73 women requesting PPTL with a labor epidural secured within 2 cm of initial placement were recruited for the study. Informed consent was obtained. Patient data including body mass index (BMI), depth at loss of resistance (LOR), number of epidural top-ups requested during labor, and patient satisfaction were recorded. All epidural catheters were tested with 3cc 1.5% lidocaine with epinephrine and then dosed with 3% 2-chloroprocaine at 5cc increments to achieve a T6 sensory level. A failed reactivation was defined as a catheter unable to achieve a T6 level, perceived pain requiring IV opioids or local infiltration by surgeon, or conversion to general anesthesia.

Results: There were 17 patients in the failed epidural group (23%) and 56 patients in the successful reactivation group (77%). Groups differed significantly by weight (p=0.032); failure: 93±21 kg / reactivation: 83±14 kg. There was a trend toward significance with LOR (p=0.067); failure: 6.5 cm (3,10) / reactivation: 6.0 cm (3,9). Groups did not differ significantly with respect to BMI (p=0.150), patient satisfaction (p=0.125), or the number of top-ups requested during labor (p=0.104). The time from delivery to PPTL did not differ between groups (p=0.627); failure: 22.3± 11.3 hr / reactivation: 18.7± 10.3 hr.

Conclusions: In this study, we were able to show a significant relationship between weight and failure to reactivate a labor epidural for PPTL. There was a trend towards significance with increasing depth to LOR and epidural failure. Our epidural failure rate was similar to previous studies at 23% for PPTL, but interestingly, we were unable to show any significant difference in regards to the interval between delivery and PPTL as previous studies indicate [1-3]. This data may be used to support either pulling an epidural in preference for a spinal in a larger parturient or reactivating an epidural despite a prolonged time since delivery.

References:

1. Goodman EJ, Dumas SD. Reg Anesth Pain Med 1998; 23:258-61.
2. Vincent RD, Reid RW. J Clin Anesth 1993; 5:289-91.
3. Viscomi CM, Rathmell JP. J Clin Anesth 1995; 7:380-83.
4. Bucklin BA, Smith CV. Anesth Analg 1999; 89:1269-74.

Abstract #:T-22

Catechol-O-methyltransferase (COMT) Genotype is Highly Predictive of Prolonged Induction and Augmentation of Labor

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Background: Failed induction of labor is a common cause of cesarean section. Circulating epinephrine at physiological concentrations can inhibit uterine contractility via a beta-2 adrenoceptor mechanism. The enzyme COMT metabolizes systemic epinephrine. We hypothesized that polymorphisms (SNPS) in the COMT gene known to affect enzyme activity would modify the uterine contractile response to exogenous oxytocin used for induction and augmentation via alterations in uterine contractility related to systemic epinephrine.

Methods: We performed a secondary analysis of a cohort of 704 nulliparous women who underwent vaginal delivery at a major New York hospital. Oxytocin was administered according to institutional protocol with escalating doses to achieve adequate uterine contraction. We evaluated the effect of 3 common SNPs in the COMT gene that are known to alter protein function on the duration of oxytocin administration with Wilcoxon's Rank Sum Test using R-programing language.

Results: We found a correlation between expression of COMT rs6269 G allele and the amount of time a patient spent on an escalating infusion of oxytocin for induction and or augmentation (Figure 1 rs6269, P= 0.035). Genotype at COMT rs4646312 and rs4633 were not associated with oxytocin requirement.

Discussion: There are many SNPs that are in strong linkage disequilibrium within the COMT gene1. Further analysis of haplotypes important for COMT gene activity are warranted to determine whether any associated with reduced enzyme activity are present. Reduced COMT enzyme activity would be expected to cause increased concentrations of circulating catecholamines that would induce tonic relaxation, perhaps resulting in the need for increased oxytocin, or increased risk of induction failure. These findings should be confirmed in independent candidate gene or exome- or genome-wide studies.

Reference:

1. Belfer I, et al.Pain modality- and sex specific effects of COMT genetic functional variants. Pain 2013;154:1368–76.

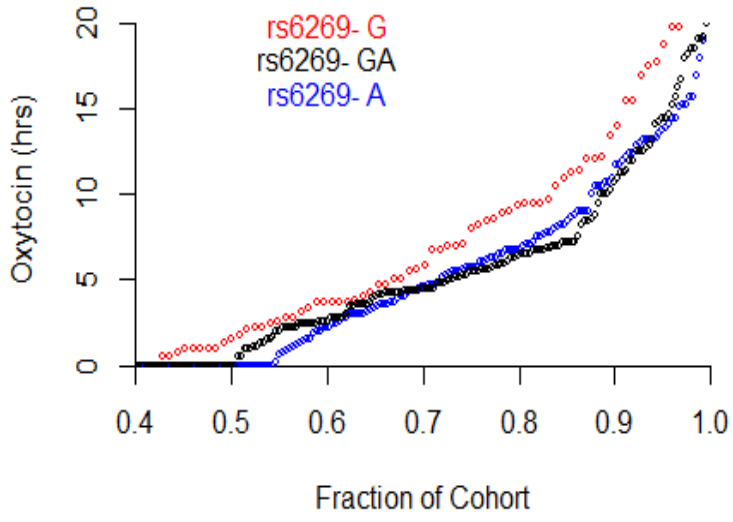

Figure 1_ Hours of Oxytocin Infusion Required for Vaginal Delivery According to COMT Genotype
Hours of oxytocin required vs. ranked fraction of cohort who express COMT rs6269 G, A or GA. Subjects who express COMT rs6269 G require more hours of oxytocin than those who express other alleles (P=.036)

Abstract #:T-23

Readability and Actionability of Patient Education Materials on Preeclampsia

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Background: Preeclampsia is a leading cause of maternal morbidity and mortality worldwide. The most vulnerable populations affected by preeclampsia often have low understanding of the disease. Patients are increasingly using the internet as a source of health information. the increased reliance on web-based materials, multiple studies have found that online patient education materials (PEMs) are written above the 6th grade reading level recommended by the U.S. Department of Health and Human Services. The objective of this study was to evaluate the readability, content, and quality of PEMs addressing preeclampsia.

Methods: The websites of the 240 U.S. academic medical centers with obstetric and gynecology (OB/Gyn) residency programs were searched for PEMs. Readability was assessed using three validated indices: Flesch-Kincaid Grade Level (FKGL), Simple Measure of Gobbledygook (SMOG), and Gunning Frequency of Gobbledygook (FOG). A scoring matrix was developed by an expert panel to evaluate 31 content domains of the PEMs focusing on the risk factors, signs/symptoms, and adverse outcomes of preeclampsia. Website quality was assessed using the Patient Education Materials Assessment Tool for Print (PEMAT-P). The PEMAT evaluates two components, the understandability of the content, and the actionability; defined as what actions should be taken based on the information presented. Websites with fewer than 30 sentences were excluded from analysis. Website content and quality were scored by two reviewers. Discrepancies were resolved by a third reviewer.

Results: One hundred fourteen websites with PEMs were identified. Five PEMs were excluded due to inadequate sentence length. The mean readability levels of all PEMs were higher than the recommended 6th grade reading level using all indices ($P<0.001$ for all). There was significant variability in the content of PEMs (Table 1). PEMAT-P scores were consistent with good website understandability (median 92%, interquartile range [IQR]: 92-94%); however actionability was poor (median 40%, IQR 0-40%).

Conclusions: The mean readability of Web-based PEMs addressing preeclampsia was above the recommended 6th grade reading level. Furthermore, while most PEMs explained the many of the risk factors, signs and symptoms and adverse outcomes of preeclampsia, the actionability of the PEMs was quite low. Thus, the content, readability, and actionability of PEMs on preeclampsia should be improved.

Abstract #:T-23

TABLE 1

Content Domains	Percentage Addressing Each Domain (95% CI)	Content Domains	Percentage Addressing Each Domain (95% CI)
Definition of Preeclampsia	95% (90-98%)	**Signs and Symptoms**	
		Swelling	100% (97-100%)
Risk Factors		Proteinuria	100% (97-100%)
Family History of Preeclampsia	24% (26-44%)	Headache	98% (93-100%)
History of Preeclampsia	35% (16-33%)	Hypertension	99% (95-100%)
Nulliparity	91% (84-95%)	Nausea and Vomiting	92% (85-96%)
New Paternity	4% (1-9%)	Abdominal Pain	99% (95-100%)
Obesity	38% (29-48%)	Sudden Weight Gain	92% (85-96%)
Advanced Maternal Age	88% (80-93%)	Vision Changes	100% (97-100%)
Hispanic	0% (0-3%)	Shortness of Breath	27% (19-37%)
African American	60% (51-70%)	HELLP Syndrome	87% (79-93%)
Multiple Gestation	89% (81-94%)	**Outcomes and Complications**	
Hypertension	99% (95-100%)	Postpartum Occurrence	44% (34-54%)
Diabetes Mellitus	81% (75-90%)	Maternal Death	81% (72-88%)
Chronic Kidney Disease	83% (72-88%)	Prematurity	90% (83-95%)
Antiphospholipid Antibody Syndrome	4% (1-9%)	Maternal Stroke	45% (35-55%)
Lupus	12% (6-19%)	Maternal Renal Failure	73% (63-80%)
		Fetal Mortality	69% (59-70%)

Abstract #:T-24

Recovery of physical activity after cesarean delivery and its relationship with pain

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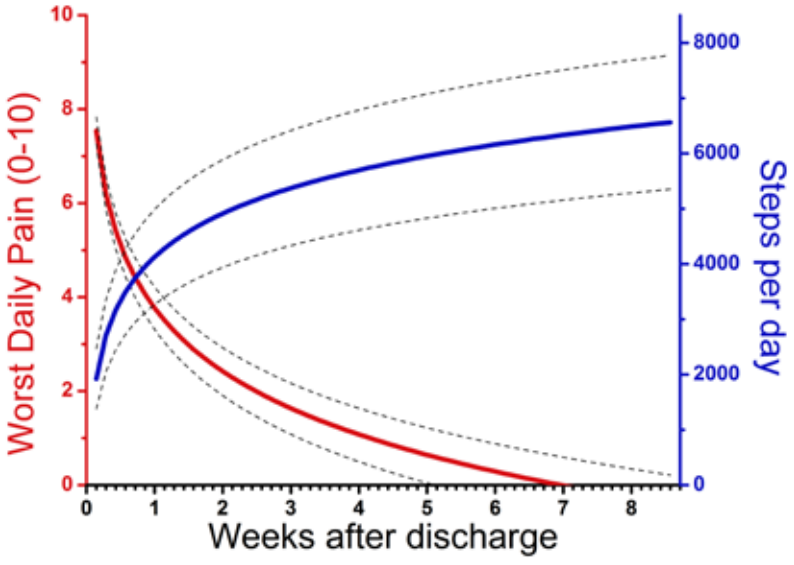
Introduction: Relatively little is known about recovery of physical activity after cesarean delivery (CD), yet early return to normal physical activity may improve sense of well-being, and reduce the risk of postpartum depression, anxiety, deep venous thrombosis.(1) Wearable fitness trackers have been used to objectively assess functional recovery in the elderly while in hospital after cardiac surgery(2) but recovery from physical inactivity after hospital discharge from major surgery including CD has not been reported.

Materials and Methods: Following IRB approval and informed consent, 55 parturients scheduled for elective CD have been enrolled. (All patients are enrolled and the study will be completed on April 14 and we anticipate presenting data on 50 patients at the meeting). Demographic information and preoperative questionnaires were completed. Anesthetic management was routine. Patients were instructed to wear a Fitbit™ wireless accelerometer on the first postoperative day and daily activity was tracked via Web interface for 60 days. Resting and evoked pain were assessed 24 hr after surgery using a visual analog scale 0-100 and average and worst daily pain were recorded until 60 days postoperatively. At that time, patients completed the Edinburgh Postnatal Depression Screening. Activity and pain were modeled to several functions.

Results: To date, 20 of 27 parturients who could have completed the study did so. Steps/day and pain were both best fit to ln(time) functions (Figure 1). Dotted lines in the figure represent 95% confidence intervals. A subject's current day level of activity accounted for 7% of the variance in their current pain ($p<.001$). A subject's yesterday activity accounted for an additional 6% of the variance in current day pain ($p<.001$). At the time of presentation, we will also determine predictors of physical activity using time-series regression analysis.

Conclusions: These data suggest that daily tracking of pain and activity following CD is feasible. Preliminarily, they suggest that recovery in these domains after surgery occurs within populations with a predictable form. Traditionally, persistent pain and disability are defined as dichotomous measures at single points in time, and these data suggest growth curve modeling may provide a more appropriate method to assess interventions to speed recovery.



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2. Ann Thorac Surg 2013; 96:1057-61

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Abstract #:T-25

Mastocytosis And Implications For The Obstetric Anaesthetist

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Mastocytosis is a rare disorder of mast cell proliferation & accumulation with a spectrum of clinical manifestations ranging from cutaneous symptoms through to severe bronchospasm and cardiovascular collapse[1]. Stimuli include trauma, emotional & physical stress, pain, temperature extremes & pharmacological agents.

Case: A 35 year old primagravida with cutaneous mastocytosis & needle phobia presented to anaesthetic pre-assessment services at 26 weeks gestation. She experienced predominantly skin manifestations but reported intermittent systemic symptoms. These included abdominal pain, fatigue, syncope, & palpitations. Her triggers were innocuous and included changes in environmental temperature & stress. Multiple specialities (obstetrics, cardiology, dermatology & anaesthetics) were consulted when formulating a delivery plan. Recommendations varied from elective caesarean section in a specialist centre through to permitting spontaneous delivery in her local unit. After carefully considering the predominantly cutaneous nature of her presentation & patient preference, antenatal care was conducted locally. Her delivery plan included an early epidural & drugs considered unsafe in mastocytosis were clearly documented.

Once spontaneous labour commenced at 40 weeks, the birthing pool was utilised & an intravenous cannula inserted with the aid of topical local anaesthetic. No epidural was requested. Temperature changes in the pool caused a cutaneous reaction, managed by exiting the pool & re-establishing normal body temperature. She had a spontaneous vaginal delivery with the aid of an episiotomy, which was sutured using lignocaine.

Discussion: Mastocytosis is subdivided into cutaneous and systemic forms, but those with cutaneous varieties may develop systemic symptoms[2]. Knowledge of appropriate drugs & anaesthetic techniques is vital as the risk of anaphylaxis-like reactions is high & women are exposed to multiple triggers during labour[3]. Regional analgesia is safe & low dose epidural mixtures can be used[1]. It is advisable to avoid drugs with high risk of precipitating allergy (suxamethonium) or histamine release (ester local anaesthetics, atracurium, morphine, pethidine)[3]. Rocuronium & cis-atracurium are safe choices & fentanyl & remifentanil can be used[3]. The role of prophylactic steroids is not established[1]. It must be appreciated that whilst creating a calming environment has clear benefits, even these simple interventions (e.g. birthing pool) may trigger a reaction.

In conclusion, careful pre-assessment & evaluation of individual disease severity permits the formulation of tailored management plans in mastocytosis parturients. Combined with vigilance & preparation for reactions, this allowed our case to be managed successfully at local level.

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1. Mastocytosis & anaesthesia 2014. http://www.rcoa.ac.uk/document-store/mastocytosis-and-anaesthesia
2. Obstet & Gynecol 1995;85:813-5
3. Int J Obstet Anesth 2013;22:243-6

Abstract #:T-26

"Lung Ultrasound in The Third Trimester of Pregnancy: A Feasibility and Descriptive Study"

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Introduction: Lung ultrasound (LUS) a diagnostic, point-of-care modality providing rapid, accurate, repeatable and non-invasive determination of pathology leading to lifesaving interventions. The use of LUS in the intensive care and emergency medicine is increasing in popularity. Furthermore, evidence demonstrates its superiority in the diagnosis of pneumothorax and interstitial syndrome when compared to chest radiographs.1 The use of non-ionizing radiation for the rapid diagnosis of various pulmonary complaints in the pregnant population is extremely appealing. Nevertheless, there is scarcity in the literature pertaining to the feasibility of performing ultrasound in the pregnant women and the ability to adequately identify sonographic features. The purpose of this study was to assess the feasibility of performing this technique in pregnant women, judge inter-rater variability and review ultrasonographic findings in this population.

Methods: We conducted a prospective, descriptive study in non-laboring women during the third trimester of pregnancy. Three anesthesiologists undertook a training program and competency assessments by an expert in LUS. Operators followed a standardized and systematic protocol (2-5 MHz curvilinear array transducer, semi-recumbent or supine position,) using eight pre-defined anterolateral chest areas.2. At least two anesthesiologists scanned each patient independently. Primary outcome: feasibility of performing the LUS examination and description of the sonographic features. Secondary outcomes: inter-rater reliability of sonographic findings among anesthesiologists and presence of abnormal sonographic features (e.g. > 3 B lines and pleural effusions). The sample size will include 40 women. The analysis will include Kappa statistics and proportions of specific agreement.

Results: The training and competency assessments were completed successfully. We have recruited 23 out of the 40 planned subjects totalling 46 scans. Data collection is ongoing. Age, height, weight, BMI, gestational age and examination time: mean (SD) of 34 (5.9) years, 79 (17.1) kg, and 29 (5.7) kg/m2, 32+4 (2.9) weeks, and 11 (3.6) min. No patient had clinical signs or symptoms suggestive of pneumothorax, effusion or interstitial syndrome. Semi-recumbent position was the most comfortable position during examination. When B-lines were observed (n=23/46), they presented preferentially in the upper lateral zones bilaterally (n=14) and left upper anterior zone (n=6). However, only two patients had an abnormal B lines pattern in one single zone with no clinical significance. Inter-rater reliability will be judged when the sample size is completed.

Discussion: Training clinical anesthesiologists in LUS appear to be feasible. This diagnostic modality may be a promising tool in the management of various complications observed in pregnancy.

References:

1. Intensive Care Med. 2012:38:577-91
2. Am J Emerg Med 2006;24:689-96

Abstract #:T-27

Parturients with Chiari Malformation Type 1 - A Case for Management Based on Symptoms

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Despite decades of experience, anesthetic management for patients with Chiari Malformation (CM) remains a topic of debate. With an incidence of 0.5%, a female: male ratio of 3:1 and typical presentation in the 2nd-4th decades of life, most obstetric anesthesia providers will manage this condition during their career. Of the four distinct types of CM, type 1 is the most common, and is characterized by protrusion of the cerebellar tonsils through the foramen magnum. Clinical symptoms include headaches, neck pain, and rarely, upper limb numbness or weakness. Although imaging is diagnostic, the degree of tonsillar descent does not correlate directly with symptoms.

Acquired CM as a result of lumbar CSF drainage is well documented. (1) Despite concern that neuraxial anesthesia could worsen herniation due to CSF loss, safe provision of neuraxial anesthesia in CM patients is also well documented. (2,3) The question remains, however, whether clinical markers can be useful in making the decision to provide neuraxial anesthesia. After review of the literature and the recent obstetric management of eight patients, we propose that the presence of clinical symptoms may be helpful in counseling patients concerning the potential risks associated with neuraxial techniques for patients with CM.

We present eight obstetric patients with underlying CM type 1 diagnosed by MRI. Delivery course was dictated by obstetric indications. The degree of tonsillar herniation ranged from 3 – 12 mm; all had headaches, and three had neurologic symptoms of upper limb deficits, and vision and hearing changes. Of all patients, one received spinal anesthesia for cesarean section and four had labor epidural analgesia. Three of these four patients failed induction and underwent cesarean section with epidural anesthesia. There were no anesthetic complications or post-partum progression of neurologic symptoms. The three patients with neurologic symptoms received non-neuraxial anesthetic techniques. Two underwent general anesthesia for cesarean section and one received IV opioids for labor analgesia. None of these patients had post-partum symptom progression.

Given the potential risk of worsening hind brain herniation associated with CSF loss, and the inherent risk of dural puncture with a neuraxial technique, it appears prudent to counsel patients with CM about the risks and choose the anesthetic technique that appears safest based on their clinical symptoms. In our series, three women were provided alternative analgesia for labor and delivery due to concern that underlying upper limb numbness and weakness, or visual and hearing loss, potentially could be worsened with dural puncture.

References:

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3. Case Rep Anes. 2013. http://dx.doi.org/10.1155/2013/512915

Abstract #:T-28

Tracheal Dilation During the Third Trimester: Anesthetic Considerations

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Introduction: Non-obstetric surgery occurs in 2% of pregnancies, which presents unique challenges to providers, who must consider effects of anesthesia on both mother and fetus.

Case: A 22yo G1 at 34 weeks gestation with a history of tracheal stenosis presented with worsening dyspnea and stridor. Her clinical picture was complicated by fetal congenital heart disease. Heliox was initiated in the ED, and she was taken to the OR for bronchoscopy and balloon dilation. With continuous FHR monitoring, general anesthesia was delivered using sevoflurane via LMA and remifentanil boluses. Her symptoms returned on postop days six and ten requiring repeat tracheal dilations. The first two cases were complicated by negative FHR changes thought to be caused by remifentanil. During the third case the patient was paralyzed, avoiding remifentanil. The procedure was uneventful, and paralysis was reversed using neostigmine and glycopyrrolate. Following extubation the patient developed progressive hypercapnia accompanied by rapid shallow breathing and subjective air hunger, which necessitated re-insertion of the LMA and positive pressure ventilation. Secondary to limitations ventilating across the stenosis, hypercarbia persisted with ETCO2 >60. During this period, a prolonged deceleration was noted on FHR monitoring, prompting resuscitation with fluid bolus, pressors, and increased left uterine displacement. Ultimately a STAT cesarean delivery of a baby girl with Apgars 2 and 4 was performed.

Discussion: Non-obstetric surgery in pregnancy presents many unique challenges in regards to pharmacology, airway management, ventilation, and uteroplacental perfusion. Pharmacologic effects on both mother and fetus must be considered. Most anesthetic medications cross the placenta and can affect FHR. Volatiles can indirectly affect the fetus by causing maternal hypotension and decreased uteroplacental perfusion or can directly depress fetal cardiovascular and CNS function. Their use, however, is generally well tolerated up to 1.0 MAC. Opioids also cross the placenta and can lead to decreased FHR variability, but in the absence of other physiologic derangements this is usually attributed to an anesthetized fetus and requires no intervention. Airway management in the routine obstetric patient can be difficult, with tracheal stenosis adding additional challenges. Difficulty in ventilating past a fixed intrathoracic obstruction can lead to hypercarbia, which increases uterine vascular resistance and decrease uterine blood flow (1). In the absence of CHD, early delivery of the fetus may have been preferred to avoid complications associated with tracheal stenosis; however, in the setting of cardiac anomalies, delivery after 39 weeks significantly decreases fetal morbidity and mortality (2).

References:

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2. Costello et al. Pediatrics. 2010 Aug;126(2):277-84

Abstract #:T-29

Quality Improvement: A time-motion survey of labor epidural requests

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Patient satisfaction scores are becoming increasingly more important to hospital administrators due to financial implications. According to private consultants working with our institution, women of child bearing age are the harshest critics on these surveys. In an effort to improve these scores at our institution, multidisciplinary committees have been formed to address a number of the elements of these surveys, particularly in pain management. Given that the majority of survey responders at our institution are obstetric patients, there has been significant pressure to improve pain management scores on the Labor and Delivery as well as postpartum units. We conducted a time motion survey to assess delays in epidural placement and reasons for such delays at the urging of the pain management improvement committee. Over the course of two weeks, 115 patients requested epidural placement for labor analgesia. We had a 37% completion rate of the time-motion survey which included the time each patient was admitted to triage, the time and location of epidural request by the patient, and the times such a request was approved by the obstetrician, the anesthesia team was consulted, and the arrival of the anesthesia team for placement. The survey was attached to each patient's chart and filled out in real time by the patient's nurse. Of the completed surveys, 54.8% had an acceptable time to arrival of anesthesiologist from time of request by patient (set at less than 30 minutes). 45.2% of patients experienced a delay (a time greater than 30 minutes from the time of patient request to arrival of anesthesiologist). In the cases of delay, 38% were due to lack of available labor rooms with an average delay of 2 hours, 26% were due to unavailable anesthesiologist with an average delay of 40 minutes, and 26% were delayed due to miscellaneous patient and obstetric reasons. Based on our findings and subsequent report to hospital administration, we were able to justify both a need for increased physical space, increased nursing availability (particularly for patients laboring in our triage area who would like an epidural), as well as the creation of a late-call shift in which an extra senior anesthesiology resident is available between the hours of 5 pm and 11 pm.

Abstract #:T-29

Labor and Delivery Patient Timeline

Date:

Location/Event	Time/Comments
Front Desk Check- In	
Arrival in Triage Room	
Arrival in Labor Room	
Request for Epidural	
Epidural Approved by OB	
Anesthesiology Consulted	
Arrival of Anesthesiologist	

To be completed by Anesthesia Provider:

If not immediately available upon request, please check reason

[ ] Patient in Triage

[ ] Labs required for epidural placement, please specify: _____

[ ] Anesthesia Provider in C-Section

[ ] Anesthesia Provider placing epidural of another patient

[ ] if above checked, please specify # of patients currently waiting: _____

[ ] Other, please specify: _____

Abstract #:T-30

Atrioventricular nodal reentrant tachycardia during a cesarean delivery

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Co-Authors: Glen Atlas M.D. - Rutgers - New Jersey Medical School - Newark, NJ
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Atrioventricular nodal reentrant tachycardia (AVNRT) is a type of tachycardia caused by a reentry circuit within, or near, the atrioventricular node. Typically the heart rate increases rapidly to 120 – 250 bpm. It is the most common type of paroxysmal supraventricular tachycardia (PSVT). It is also the most common arrhythmia in pregnancy.

A 30-year-old G2P1 woman with a history of palpitations presented to our institution at 39 weeks gestation for repeat cesarean delivery. Vital signs were BP 106/55, HR 64, temp 36.6°C, RR 20. Spinal anesthesia was planned for the surgery. Past medical and surgical history included an arrhythmia diagnosed intraoperatively during her previous cesarean delivery 5 years prior. The patient denied any recent palpitations or syncope during this pregnancy or needing to take any anti-arrhythmic medications. Her previous medical record revealed that after 10 ml of lidocaine 2% with epinephrine her EKG showed a narrow complex tachycardia. The fetal heart rate decreased to 100 bpm and an emergent cesarean delivery under general anesthesia was performed due to a patchy epidural. Cardiology was consulted intraoperatively and the patient was diagnosed with AVNRT, an esmolol drip was necessary to convert her arrhythmia to a sinus rhythm at 70 bpm. A postoperative EKG showed PACs with aberrant conduction. A TTE showed no abnormalities, and the patient was discharged on a β-blocker.

We considered the possibility of a positive test dose as the cause of her previous arrhythmia. Her current cesarean delivery was performed using a spinal anesthetic technique, consisting of bupivacaine 0.75% 1.5 ml, fentanyl 15 mcg, and morphine PF 150 mcg. Shortly after, the patient developed a heart rate in the 180s and EKG showed a narrow complex tachycardia. She was then given esmolol 10 mg IV, which broke the SVT and the heart rate returned to 80 bpm. During this episode the fetal heart rate was stable at 145 bpm. Cardiology was consulted, they recommended metoprolol XL 25 mg PO daily and follow up in cardiology clinic. The remainder of her hospitalization was uneventful. No cardiac abnormality was found.

PSVT occurs approximately at a rate of 2.6% in pregnant individuals; mostly AVNRT. (2) Our patient had an episode of AVNRT during each pregnancy after neuraxial anesthesia, but did not have any underlying cardiac pathology. The dilation of the cardiac chambers (which increases the length of a re-entrant circuit) and a decreased refractory period are some of the cardiovascular changes in pregnancy that can facilitate AVNRT. (3) Our patient might be particularly sensitive to those conduction changes of pregnancy. Fortunately, the majority of the arrhythmias occurring during pregnancy are non-lethal and they would resolve as these conduction changes return to their normal non-pregnant physiological state.

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Abstract #:T-31

Pulmonary Hypertension and Pregnancy: a Nationwide Analysis of Prevalence and Adverse Maternal Outcomes, 2003-2012.

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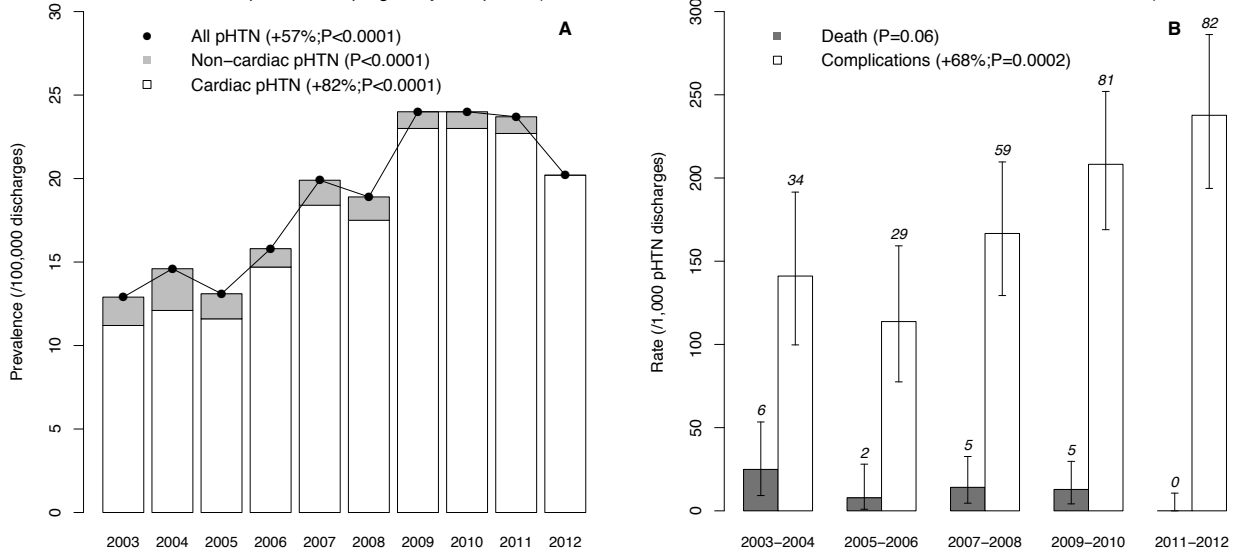
Background: Parturients with pulmonary hypertension (pHTN) present special challenges for obstetric anesthesiologists (Bonnin Anesthesiology 2005;102:1133). Case-series suggest that maternal mortality in women with pHTN has decreased (Duarte Chest 2013;143:1330). However, as more women with complex cardiac pathologies reach childbearing age, the prevalence of pHTN in parturients may increase. We examined temporal trends in the prevalence of pHTN in parturients and associated maternal morbidity and mortality in the United States between 2003 and 2012.

Methods: Data from the Nationwide Inpatient Sample 2003-2012 were analyzed. Non-cardiac and cardiac pHTN discharges, obstetrical outcomes, and maternal complications were identified through ICD-9-CM codes. Three obstetrical outcomes were defined: spontaneous loss (molar or ectopic pregnancy, abortion, or intra-uterine death), medical termination (aspiration, curettage or abortive intra-amniotic injection) and continuation of pregnancy until delivery. Cochran-Armitage test and adjusted logistic regression were used to test changes over time and adjusted logistic regression to assess risks of complication or death compared with non-pHTN pregnancies.

Results: During the 10-year study period, 8,525,624 pregnancies were identified, including 1,584 (1.9 per 10,000) with pHTN diagnosis (1,473 cardiac and 111 non-cardiac pHTN). Among pregnancies with pHTN, 69 were spontaneous losses (4.3%), 71 medical terminations (4.5%), and 1,444 continuations (91.2%). The prevalence of cardiac pHTN increased while non-cardiac pHTN decreased (Figure 1A). Of the parturients with pHTN, 18 (1.1%) died at discharge and 285 (18.0%) had at least 1 complication. The 3 most frequent complications were hemorrhage (7.3% of pHTN pregnancies), respiratory failure (4.9%), and kidney failure (3.3%). During the study period, the incidence of complications increased by 68% (p=0.0002) without a statistically significant change in mortality (p=0.06) (Figure 1B). Compared with similar obstetrical outcomes in pregnancies without pHTN, losses with pHTN were at higher risks of death or complications [adjusted odds ratio (aOR) 4.7, 95%CI:2.8-8.1] as were continuations [aOR=3.8:3.3-4.3] but not terminations [aOR=1.7:0.9-3.5]).

Conclusions: The prevalence of cardiac pHTN in parturients and incidence of complications have increased significantly in the United States. Programs for improving screening, counseling and management of women with pHTN are needed.

Figure 1: Pulmonary hypertension (pHTN) in pregnancy from the Nationwide Inpatient Sample 2003–2012.
1A: Prevalence of pHTN in all pregnancies according to etiology (cardiac versus non–cardiac pHTN)
1B: Trends for death and complications in pregnancy with pHTN (the number indicates the number of events and the vertical bar the 95%CI).



Abstract #:T-32

Anesthesiologist trainees' perceived barriers to providing empathetic care for women undergoing unscheduled cesarean deliveries

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Intro: Patient satisfaction, a key patient-centered outcome, is critical to improving health outcomes.1 In systematic reviews, the most important factor influencing maternal satisfaction and birth experience was, "the attitudes and behaviors of the caregivers." 2 Emergency cesarean delivery can lead to emotional distress, postpartum depression, and post-traumatic stress disorder, particularly in mothers who did not feel supported by their healthcare professionals.3,4 Empathy declines throughout medical training.5 In academic centers, the anesthesiologist trainee is the primary physician interacting with women during unscheduled cesarean delivery (UCD) potentially influencing maternal satisfaction and postpartum well-being. This is a qualitative exploratory study to elicit anesthesiologist trainees' perceived barriers to providing empathetic care during UCD.

Methods: This is part of an IRB-approved study. Resident and fellow anesthesiologists were recruited via email, consented and compensated to participate. They were individually interviewed regarding their approach to communicating with women during UCD. Semi-structured interviews consisting of nine questions lasted approximately 15 minutes. Interviews were conducted by a qualitative researcher who was not a physician or a resident supervisor. Interviews (N=10) continued until saturation of themes was achieved. Interviews were audiotaped and transcribed. Two researchers independently reviewed the interviews for themes. Individual codes were then complied into one document and the two coders met and discussed inconsistencies to identify the emergent themes.

Results: Trainees' typical approach to caring for mothers involves completing medical tasks and providing factual information. Communicating with the mother beyond factual information is viewed as "optional" to clinical care. Primary barriers that residents perceived in providing empathetic care in urgent cases include managing their own affect and completing medical tasks quickly, which they prioritize over communication. Trainees felt they should provide "reassurance without commitment" and wanted to learn "best practice phrases". They feel they learn communication skills through role models but no resident could verbalize or model empathetic phrases when asked. They believe nonverbal support (i.e. physical touch) should be based on resident comfort level.

Discussion: Anesthesiologist trainees perceive communication and empathetic care as separate and less important when providing medical care to women particularly in urgent situations. Resident empathy curriculums should address these issues to provide residents with strategies to maximize their interpersonal interactions with women undergoing UCD in an effort to improve women's postpartum emotional states.

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Abstract #:T-33

Coagulation Profile Surrounding Normal Cesarean Delivery

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Introduction: Hypercoagulability of normal pregnancy peaks at the time of delivery.1 The source of the procoagulants may be in the form of microparticles (MPs).2 Tissue-factor containing MPs are known to stimulate coagulation although sometimes pathologically. It has been proposed that TF-containing MPs may be released from the placental bed during normal delivery, and that release may be exaggerated in the setting of post-partum hemorrhage (PPH).3 We hypothesized that an increase in TF-bearing MPs would occur around the time of normal cesarean delivery (CD) and subside over several hours.

Methods: In this IRB-approved study we consented from 9 healthy parturients with a singleton pregnancy, gestational age >/= 36 weeks, who presented for scheduled CD. Exclusion criteria were hypertensive diseases of pregnancy, diabetes, known placental abnormalities, and coagulation disorders. Demographic data were collected. A 16g IV was placed for 5 blood draws: baseline antepartum, immediately after delivery of the placenta, then 1, 4, and 24-36 hours postpartum. Blood was collected in an ACD "yellow top" tube and centrifuged at 2000g for 20 min to separate plasma, which was aliquoted and stored at -800C. Samples underwent flow cytometry, confirmatory image stream microscopy, and staining to determine if MPs were endothelial, placental or leukocyte derived. TF levels were measured using ELISA. Comparisons were made for each assay result using ANOVA for repeated measures.

Results: Median (range) age of the parturient was 32 (24-39) years, BMI was 32 (26-41) kg/m2 and all patients had a gestational age between 39 0/7 to 39 6/7 weeks. There was a significant peak in TF-negative placental-derived microparticles immediately after delivery of the placenta (P = 0.001) (Figure). The other MPs were not different across time points.

Discussion: A peak in TF-negative placental-derived MPs occurs immediately after delivery of the placenta. Further investigation is needed to identify if procoagulant substances other than TF are represented on these placental-derived MPs, if our results can be replicated in laboring patients, how co-morbidities and PPH affect these results, and if presence of certain placental-derived MPs may identify patients at risk for PPH.

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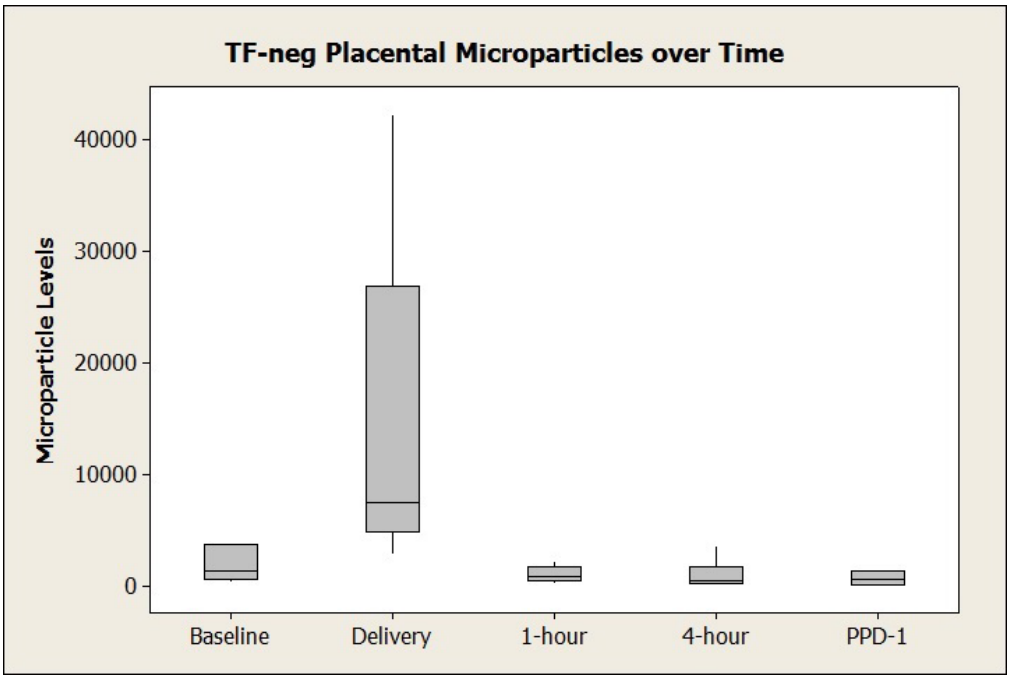

Abstract #:T-34

Non-fatal Acute Fatty Liver of Pregnancy: A case report of an uncommon disease

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We present a 35 year old G3P1011 female at 35 weeks with appropriate antenatal care that was admitted for contractions. She was seen at another facility for UTI symptoms (nausea, anorexia, and chills) and declined antibiotic therapy. Antepartum history was significant for gestational diabetes and a previous C-Section.

Physical exam showed a tachycardic (133bpm) and hypertensive (132/86) parturient with an average body weight. She was slightly lethargic with 4+ patellar reflexes bilaterally and 3 beat clonus and her glucose = 63. She was transferred to the operating room for an urgent C-Section due to persisting fetal late decelerations. She received a spinal anesthetic and the surgery lasted 91 minutes with uneventful intraoperative course. An acidotic female was delivered, requiring intubation and admission to NICU.

The patient continued to be lethargic in the recovery room, her glucose = 48 and VBG demonstrated metabolic acidosis with base deficit = 14.4. She was given Dextrose 25 gm and Sodium bicarbonate 50 mEq. The results for the labs drawn on admission returned demonstrating 14 fold elevation of LFTs, high PT/INR = 29.0/2.63, PTT = 49.5, lactic acid = 10.4, and low Fibrinogen = 75. She was transferred to ICU for management with close neuro-checks.

LFT derangement, hypoglycemia and elevated INR persisted. On POD 2, sudden onset confusion and tonic/clonic seizures occurred. She was intubated and CT scan showed a small subarachnoid hemorrhage. Neurosurgery was consulted and conservative treatment was recommended without surgical intervention.

On POD 3, she was diagnosed with Acute Fatty Liver of Pregnancy (AFLP) and was transferred to a liver transplant center for further evaluation if her liver failure symptoms continued to worsen. The patient had a lengthy post-operative course but eventually recovered and did not require liver transplant. The baby is alive and thriving after an 11 day course in NICU.

AFLP is a rare, and usually reversible, peripartum liver failure that is believed to affect <1 in 6700 gestations. Although routine assessment of liver function in every laboring patient is not practical, certain elements of a patient's history and physical exam can clue the anesthesiologist into further assessment. This case demonstrates the need for determination of liver functions during pregnancy for early recognition and termination of the pregnancy in such cases. Obstetrical emergencies can lead to death of both mother and child if not diagnosed in time to prevent coagulopathic complications.

While regional anesthesia in the setting of elevated INR may pose an unacceptable risk due to adverse neurologic outcomes, it must be weighed carefully with the inherent risks of general anesthesia in the parturient (e.g. difficult intubation and full stomach). Although our patient did not suffer any neurological deficits, if time permits every effort should be made to correct the coagulopathy prior to any neuraxial technique.

Abstract #:T-35

Familial arrhythmogenic cardiomyopathy masquerading as peripartum cardiomyopathy

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Introduction: New onset heart failure in the parturient can represent de novo disease in the form of peripartum cardiomyopathy (PPCM) or preexisting, subclinical disease unmasked by the physiologic stresses of pregnancy.(1) We present the anesthetic management of a woman who developed ventricular bigeminy and a decreased ejection fraction (EF) in labor, which was ultimately diagnosed as heritable arrhythmogenic cardiomyopathy (ACM).

Case presentation: A 28 year old G1P0 with hypothyroidism was admitted for induction of labor at 40+5 weeks. Several hours after initiation of oxytocin, she developed an irregular heart rate, palpitations, and mild dyspnea. She denied personal or family cardiac history. EKG revealed bigeminy. Hypomagnesemia (1.1 mg/dl) was the only lab abnormality. When bigeminy failed to resolve after repletion of magnesium, cardiology was consulted. Echocardiogram revealed frequent ectopy with a moderately reduced EF (35-45%) concerning for PPCM. An early labor epidural and arterial line were placed and low dose beta blockade initiated.

Hours later, the patient underwent Cesarean delivery for failure to progress with slow, sequential dosing of her labor epidural. She received 18ml epidural 2% buffered lidocaine with epinephrine 1:200,000, 1500ml crystalloid, and oxytocin 1 unit bolus followed by 7.5 unit/hr infusion. EBL was 700ml. She was hemodynamically stable through surgery. Postoperatively, she was monitored for 1 day in the cardiac care unit and ultimately discharged on POD 5 on low dose beta blockade, furosemide, and magnesium supplementation.

In outpatient cardiology follow up, the patient revealed that her father, paternal uncle, and cousin all died suddenly between age 30-40, attributed by the family to a curse rather than medical disease. 24 hour cardiac event monitor showed 20.4% PVCs. A cardiac MRI revealed right ventricular (RV) fatty deposits and persistently decreased EF of 40%, suggestive of ACM. Confirmatory genetic testing is pending. The patient was fitted for an external cardiac defibrillator vest with plans for an internal cardiac defibrillator (ICD).

Discussion: ACM is an autosomal dominant disorder characterized by fibro-fatty replacement of the RV myocardium. It is recognized as a leading cause of ventricular arrhythmias and sudden cardiac death in young adults, both of which are largely preventable with antiarrhythmics and ICDs.(1) ACM has variable penetrance and more commonly manifests in males; however, the physiologic stresses of pregnancy and labor may unmask symptoms in females.(2) Our case illustrates the importance of carefully elucidating family and cardiac history in patients with presumed PPCM. The identification of this life threatening genetic disease masquerading as PPCM allowed for treatment likely to increase this patient's life expectancy.

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Abstract #:T-36

The influence of prophylactic tranexamic acid on thromboelastography during cesarean delivery: A randomized, double-blind, placebo-controlled trial

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Michaela K. Farber M.D. M.S. - Brigham and Women's Hospital - Boston, MA

Introduction: Postpartum hemorrhage (PPH) remains a leading cause of maternal morbidity and mortality worldwide (1). Reduction in blood loss and progression to PPH has been demonstrated with the antifibrinolytic agent tranexamic acid (TXA) 1g IV (2), but the underlying hemostatic changes in pregnancy have not been clearly delineated. Point-of-care devices such as thromboelastography (TEG®) can reveal coagulopathy and guide transfusion during PPH. TEG® split point (SP) and maximum amplitude (MA) reflect fibrin formation and fibrin-based clot strength, respectively, and have been correlated with blood loss during cesarean delivery (CD) (3). We hypothesized that TXA treatment would be detectable by TEG® SP or M.A. during CD.

Methods: ASA I or II patients undergoing elective CD with neuraxial anesthesia were randomized to receive TXA 1 g IV or placebo immediately prior to surgery. Maternal hemoglobin, platelet count, prothrombin time, activated partial thromboplastin time, fibrinogen, and global hemostatic profile by TEG® were measured at three times: one hour prior to surgery and before study dose administration (baseline), one hour after drug infusion, and two hours postpartum.

Results: Twenty (TXA, n = 13; placebo, n = 7) of 200 patients have been recruited. Demographic and baseline laboratory values did not differ significantly between groups. TEG® parameters in both groups indicate hypercoagulable changes one hour post-infusion (Table), however, the magnitude of TEG® parameter changes between baseline and both subsequent times was not different between groups. There were no differences in hemoglobin change, secondary uterotonic requirement, or vasopressor requirement between groups.

Conclusions: Our preliminary findings show no global hemostatic TEG® changes in patients treated with a single IV dose of TXA 1g prior to CD. Evaluation with alternate TEG® assays, such as functional fibrinogen M.A. (4), or higher TXA doses may be necessary to indicate a difference in this patient population.

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Abstract #:T-36

Placebo	Baseline	1h post-infusion	Δ from baseline[a]	2h postpartum	Δ from baseline[b]
SP, min	6.2 (2.1)	5.4 (2.1)	-0.8 (1.6)	4.4 (1.1)*	-1.9 (1.4)
r, min	7.0 [5.2-8.9]	5.3 [4.2-7.7]	-1.1 (1.8)	5.1 [4.3-6.6]*	-1.7 (1.4)
k, min	1.5 [1.3-2.3]	1.2 [1.1-2.4]	-0.1 (0.3)	1.2 [1.2-2.2]	-0.2 (0.3)
a angle, deg	68.6 [55.3-71.9]	72.6 [57.3-75.4]*	3.0 (2.9)	73.2 [60.0-73.9]	2.1 (3.9)
MA, mm	68.7 (3.7)	69.4 (4.3)*	0.8 (0.8)	69.9 (3.3)	1.2 (1.8)
LY30, %	0.03 (0.05)	0.04 (0.11)	0.0 (0.1)	0.11 (0.30)	0.1 (0.3)
LY60, %	1.03 (1.07)	0.67 (0.92)	-0.4 (0.6)	0.97 (1.34)	-0.1 (0.9)
Platelets, x10^9/L	218 (67)	182 (53)*	-36 (23)	198 (55)	-20 (21)
Fibrinogen, mg/dL	524 [491-638]	484 [405-520]*	-82 (53)	475 [389-517]*	-78 (61)

TXA	Baseline	1h post-infusion	Δ from baseline[a]	2h postpartum	Δ from baseline[b]
SP, min	5.1 (1.5)	4.6 (1.4)	-0.5 (1.4)	3.8 (1.1)	-1.3 (2.1)
r, min	5.6 [4.3-7.2]	4.2 [4.2-6.0]	-0.6 (1.1)	4.0 [3.8-5.1]*	-1.0 (1.5)
k, min	1.2 [1.0-2.4]	1.0 [0.9-2.2]*	-0.2 (0.2)	1.1 [0.9-2.2]	-0.1 (0.3)
a angle, deg	71.8 [58.7-75.4]	75.6 [59.1-77.0]*	3.4 (5.1)	75.4 [55.5-77.1]	1.9 (6.9)
MA, mm	69.4 (4.6)	70.5 (4.4)*	1.2 (1.8)	71.1(4.5)*	1.8 (2.2)
LY30, %	0.08 (0.28)	0.04 (0.14)	0.0 (0.3)	0.10 (0.21)	0.0 (0.2)
LY60, %	0.89 (1.28)	0.75 (0.89)	-0.1 (1.1)	0.92 (1.25)	0.0 (1.1)
Platelets, x10^9/L	231 (54)	198 (41)*	-33 (17)	210 (45)*	-21 (16)
Fibrinogen, mg/dL	462 [441-503]	403 [384-426]*	-67 (36)	441 [413-457]*	-35 (40)

Data presented as mean (SD) and median [interquartile range]

*$p < 0.05$ compared to baseline values

[a]No significant differences when TXA compared to placebo

[b]No significant differences when TXA compared to placebo

TXA = tranexamic acid, SP = split point, MA = maximum amplitude, LY30 = clot lysis at 30 min, LY60 = clot lysis at 60 min

Abstract #:T-37

Low-fidelity haptic simulation versus "mental imagery" training for epidural anesthesia technical achievement in novice anesthesiology residents: a randomized comparative study

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Introduction: Epidural anesthesia (EA) is rated among the most difficult technical skills to acquire.[1] Many teaching methods for EA exist, ranging from low fidelity (LF) haptic to high fidelity (HF) haptic simulation. Previous work indicates that there is no difference in skill acquisition when novice learners engage in HF versus LF simulation for EA.[1] However, to our knowledge, no study has compared the effect of LF haptic simulation versus "mental imagery" training (or "non-haptic" simulation) for EA. We hypothesized that LF haptic simulation training for EA would be more effective in achieving technical skills among novice trainees, compared to "mental imagery" training in which no physical practice is attempted.

Methods: In this IRB approved single-center randomized comparative study, 20 PGY-2 anesthesiology residents were tested at the beginning of the training year. Baseline skills and demographic data were collected. Group 1 had 60 minutes of LF simulation training for EA using a banana.[2,3] Group 2 had 60 minutes of "mental imagery" training: they were oriented to the parts of the epidural kit, EA was described in detail, but no physical practice was undertaken. Each resident then individually performed EA on a partial-human task trainer on three consecutive occasions under the direct observation of skilled evaluators, who were blinded to group assignment and who assessed technical achievement using a modified validated skills checklist.[4] Scores (0 –21) and duration (minutes) to task completion were recorded. A mixed model analysis was performed to determine differences in scores and duration to task completion between groups and over time.

Results: Baseline characteristics between the groups were not significantly different. There was no statistically significant difference in scores between the two groups (16.5±1.8 vs. 15.5±2.0, 17.2±2.9 vs. 17.8±1.8, 19.0±1.6 vs. 18.5±2.6, P = 0.58) (Figure 1A). Both groups showed a similar increase in scores over time (Group 1: 16.2 to 17.7 to 18.9; Group 2: 15.9 to 17.4 to 18.6, P = 0.0015). Time to complete the procedure decreased similarly for both groups after the first attempt (Group 1: 15.8 to 13.4 to 13.1; Group 2: 16.0 to 13.7 to 13.3, P = 0.032) (Figure 1B).

Conclusion: Our results suggest that utilization of LF haptic simulation is not superior to "mental imagery" training for technical performance of EA. Education on EA with structured didactics and "mental imagery" training may be adequately preparative for novice learners prior to an attempt on human subjects.

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Abstract #:T-37

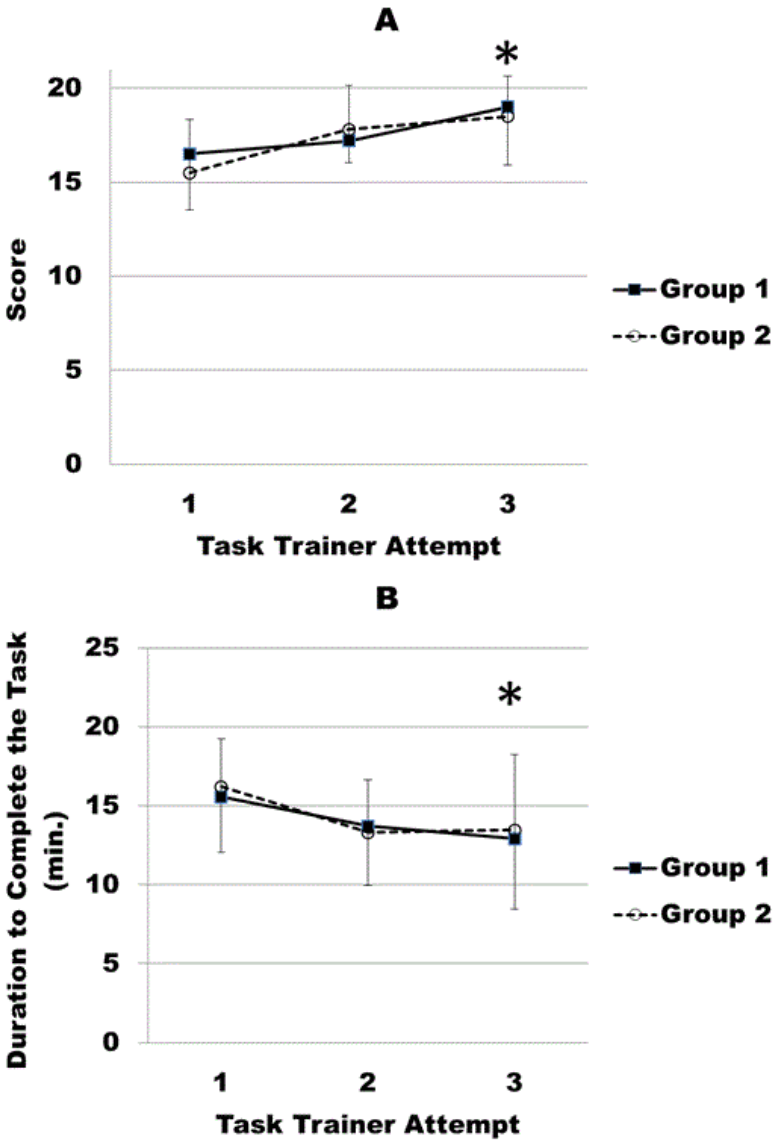

Figure 1. Score (A) and duration to complete the task (B) between groups and over three epidural placement attempts. The asterisk (*) denotes a $P<0.05$ for the third attempt compared to the first attempt among both groups.

Abstract #:T-38

Anesthetic Management of a Parturient with Type A Aortic Dissection During 2nd Trimester

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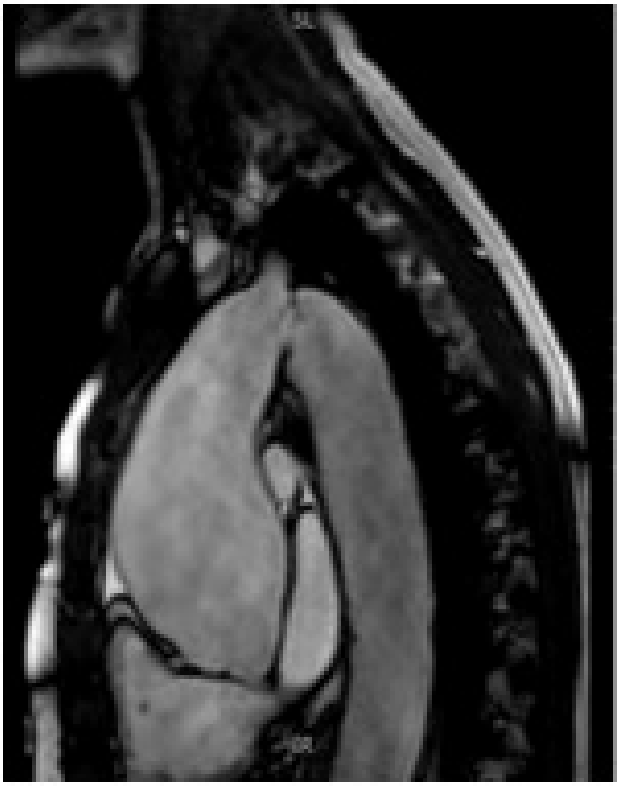
Introduction: Aortic dissection in pregnancy is life threatening for both mother and fetus. The hormonal and hemodynamic changes of pregnancy contribute to the increased risk of aortic dissection and rupture.

Case Description: A 29F G2P1 at 26w0d gestation presented to an outside institution with right shoulder, chest and abdominal pain. Abdominal CT demonstrated an abdominal aortic aneurysm with intimal dissection involving the mesenteric vessels extending to the iliac arteries bilaterally. She was then transferred to our hospital and received a transthoracic echo and cardiac MRI. These revealed a Type A aortic dissection beginning at the Sinuses of Valsalva, inclusive of the aortic arch involving all cranial vessels.

Members of a multidisciplinary care team involving Maternal Fetal Medicine, Pediatrics, OB Anesthesia, Cardiac Anesthesia and Cardiac Surgery developed a plan to address the safe delivery of the fetus while maintaining the health and safety of the mother. The decision was made to proceed to sequential cesarean section delivery immediately followed by repair of the Type A dissection at 27w0d gestation.

After the standard monitors were placed and left uterine displacement was accomplished, an awake radial arterial line was placed and a general endotracheal anesthetic was induced. Central venous access was obtained in the right internal jugular vein. C-section delivery was performed using a low vertical midline incision. A viable male infant was delivered with APGARS of 2 and 2 at 1 and 5 minutes. The patient then underwent replacement of the ascending aorta and lesser curve of arch, repair of coarctation of the aorta, reconstruction of dissected head vessels, and re-suspension of the native aortic valve. Total time on cardiopulmonary bypass was 153 minutes.

The patient was extubated 4 hours post-operatively and discharged home on POD 8. The infant was discharged home following a 3 month stay in the NICU. Genetic workup revealed a gene mutation of MYH11, which is associated with Familial Thoracic Aortic Aneurysms/Dissections and/or PDA.



Discussion: This case demonstrates aortic pathology due to an undiagnosed connective tissue disorder in a woman with an uncomplicated 1st pregnancy. Connective tissue disorders also raise the risk of uterine rupture and post-partum hemorrhage. A multidisciplinary approach is key to optimize maternal and fetal outcomes.

Abstract #:T-39

Umbilical Cord Magnesium Levels and Neonatal Resuscitation in Infants Antenatally Exposed to Magnesium Sulfate

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Introduction: Antenatal magnesium sulfate (MgSO4) administration has been associated with neonatal morbidity including poor tone and low Apgars, both surrogates for neonatal respiratory depression.(1-2) We previously determined MgSO4 pharmacokinetics (PK) and placental transfer, but the neonatal pharmacodynamics (PD) effects related to PK are unknown. (3) The aim of this study was to characterize the association between umbilical cord magnesium levels and the need for neonatal resuscitation in a cohort of neonates exposed to MgSO4 for either neuroprotection or preeclampsia.

Methods: Secondary neonatal pharmacodynamics analysis following a prospective, IRB-approved study of pregnant women prescribed MgSO4 for preeclampsia or prematurity (< 32 wks gestation) to determine maternal pharmacokinetics and pharmacodynamics after MgSO4 administration (3). Women received a 4g loading dose and a 2g/hr maintenance dose of MgSO4. Univariate and multivariate techniques were used to examine the impact of umbilical cord blood magnesium levels and the need for neonatal resuscitation (oxygen, bag/mask ventilation, intubation, or chest compressions), controlling for gestational age, mode of anesthesia, indication for magnesium sulfate, total dose of magnesium sulfate, and infant sex. A p-value of <0.05 was considered statistically significant.

Results: 55 umbilical cord magnesium samples were collected. Umbilical cord blood magnesium levels were highly correlated with total dose of MgSO4 exposure (r=724; p=0.01), however, these variables did not significantly predict neonatal respiratory outcomes. Delivery at a later gestational age was the only independent protective factor against need for neonatal resuscitation in the final regression model (OR = 0.6 (0.5, 0.9); p= 0.006). (Table)

Conclusion: Although magnesium exposure has been implicated as a predictor of the need for neonatal resuscitation after birth, this data suggests those outcomes are primarily driven by the gestational age of the infant and not the absolute amount of MgSO4 exposure or placental transfer antenatally.

Table: Predictors for the need for neonatal resuscitation

Predictors	OR (95% CI)
Gestational age (weeks)	0.64 (0.46, 0.88)
Antenatal magnesium dose (g)	1.00 (0.98, 1.02)
Cord blood magnesium (mg/dL)	0.78 (0.43, 1.49)
Gender	
Female	Ref
Male	2.97 (0.58, 15.18)
Indication of magnesium administration	
Preeclampsia	Ref
Neuroprotection	1.00 (0, 1.00)

References:

1. AJOG 2015; 212: 94.e1–94.e7
2. Am J Perinatol 2012; 29: 795–799
3. Society for Obstetric Anesthesia and Perinatology Annual Scientific Meeting 2014

Abstract #:T-40

The Effects of Crystalloid Coload Compared to Colloid Preload on Vasopresor Use and Hypotension for Cesarean Delivery under Spinal Anesthesia

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Introduction: Fluid loading is used to prevent spinal hypotension during cesarean delivery (CD), however the optimal fluid type and timing of fluid administration remain uncertain (1). The aim of this comparative effectiveness study was to compare vasopressor use and hemodynamics among women receiving a colloid preload versus a crystalloid coload for CD under spinal anesthesia.

Methods: We sequentially reviewed the medical records of women undergoing elective CD before and after an institutional practice change for fluid loading in August 2013 driven by an FDA warning for hydroxyethyl starches. Colloid preloading with 500 ml 6% hetastarch was used before and crystalloid coloading with 1000 ml crystalloid after the change. Inclusion criteria were: healthy women with singleton term pregnancies receiving spinal anesthesia (hyperbaric bupivacaine 12 mg, fentanyl 10 mcg, and morphine 100-200 mcg). Primary outcome was total phenylephrine (PE) dose administered from spinal block to delivery. Secondary outcomes were: maternal hemodynamics, estimated blood loss (EBL), and hemoglobin (Hb) values.

Results: 79 women received colloid preloading and 77 women received crystalloid coloading. The total PE dose was significantly lower in the colloid vs. the crystalloid group (489 ± 403 mcg vs. 647 ± 464 mcg respectively, P=0.02). 98% of women in the colloid preload group required phenylephrine compared to 92% in the crystalloid coload group (p=0.14). There were no differences in systolic BP or heart rate between groups; however, maximal decrease in systolic BP was greater in the colloid group (Table). Although EBL values were similar in both groups, there was a greater decrease in Hb values in the colloid group (Table).

Conclusion: Women in the colloid group received a significantly lower total dose of PE compared to women in the crystalloid group; however, this difference is likely to be clinically insignificant as it equates to approximately two 100 mcg PE doses. The smaller maximum drop in systolic BP may be a result of the high flow rate inherent with crystalloid coloading which reduced the delivery time of each PE bolus. The smaller decrease in Hb change among women in the colloid group was likely secondary to a lesser degree of hemodilution.

Table: Key Hemodynamic and Clinical Outcomes

	Colloid Preload (n = 79)	Crystalloid Coload (n = 77)	P Value
Phenylephrine use before delivery (mcg)	489 ± 403	647 ± 464	0.02*
Phenylephrine after delivery (mcg)	267 ± 316	355 ± 456	0.16
Patients that received ephedrine (%)	12.7%	9.1%	0.61
Mean delta heart rate (bpm)	7 ± 11	5 ± 14	0.37
Mean systolic blood pressure (mm Hg)	111 ± 9	114 ± 10	0.10
Max drop in systolic blood pressure (mm Hg)	36 ± 20	29 ± 16	0.02*
Quantified blood loss (ml)	657 ± 326	688 ± 238	0.51
Mean delta hemoglobin (g/dl)	1.9 ± 1.1	1.5 ± 0.8	0.02*
PACU admission temperature (°C)	36.5 ± 0.2	36.4 ± 0.3	0.06

*Data is presented as mean ± SD or percentages. * P < 0.05 considered statistically significant*

References:

1. Curr Opin Anaesthesiol 2012;25:286-291

Abstract #:T-41

The perioperative management of a parturient for cesarean delivery with a twin pregnancy complicated by abnormal placentation

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Introduction: Abnormal placentation is a leading cause of obstetric hemorrhage and subsequent maternal morbidity and mortality. Currently there is no consensus on the peripartum anesthetic management of these patients for cesarean delivery. We report the management of a cesarean delivery for a parturient with a twin pregnancy complicated by placenta previa and placenta increta.

Case: The patient was a 35 year old G2P1 with a previous uncomplicated cesarean section at term who presented with a sentinel vaginal bleed at 29 weeks gestation. This pregnancy was significant for dichorionic diamniotic twins and complete placenta previa. Her BMI was 24 kg/m2. On admission she was hemodynamically stable with a hemoglobin of 12.7 g/dL and a fibrinogen of 574 mg/dL. Magnetic resonance imaging revealed a placenta increta and possible percreta of the anterior portion of the placenta and complete placenta previa with increta of the posterior portion of the placenta for twin B. She remained stable until a planned cesarean delivery was performed at 33 weeks gestation by a multidisciplinary team in a hybrid operating suite. A delayed hysterectomy was planned 2 weeks later. Pre-operative arterial line and central venous catheter access were established. In anticipation of large vertical midline abdominal incision, a T9-10 epidural catheter was placed in addition to a CSE performed at L3-4. The spinal component of the CSE was dosed with 12 mg of hyperbaric bupivacaine, 15 mcg of fentanyl, and 150 mcg of PF morphine, which provided a block to T6. Tranexamic acid 1 g was administered intravenously before delivery. Both twins were delivered uneventfully and both placentas were left in situ. Following uterine closure, bilateral uterine artery embolization was performed. The estimated blood loss was 750 mL and no blood products were transfused. In PACU, postoperative analgesia was initiated with PCEA 0.1% bupivacaine with 10 mcg/mL hydromorphone administered via the thoracic epidural. Approximately 5h later she developed cramping lower abdominal pain associated with profuse vaginal bleeding with 650 mL blood loss. She was taken back to the OR for an emergency total abdominal hysterectomy and salpingectomy performed under general anesthesia. There was evidence of hemorrhage at surgery from the placenta previa. She received another dose of tranexamic acid plus 4 units of packed RBC and 2 units of FFP were transfused. The estimated intraoperative blood loss was 1000 mL. Postoperatively the thoracic epidural was used for analgesia for 48h. She was discharged on postop day 5 without any further complications.

Discussion: The management of patients with abnormal placentation for cesarean delivery requires significant resources. Postoperatively, patients with the placenta left in situ need to be closely monitored for postoperative bleeding. Additionally the use of the thoracic epidural provides excellent postoperative analgesia for patients with midline incisions.

Abstract #:T-42

Intrathecal hydromorphone for post-cesarean delivery pain—a dose finding study

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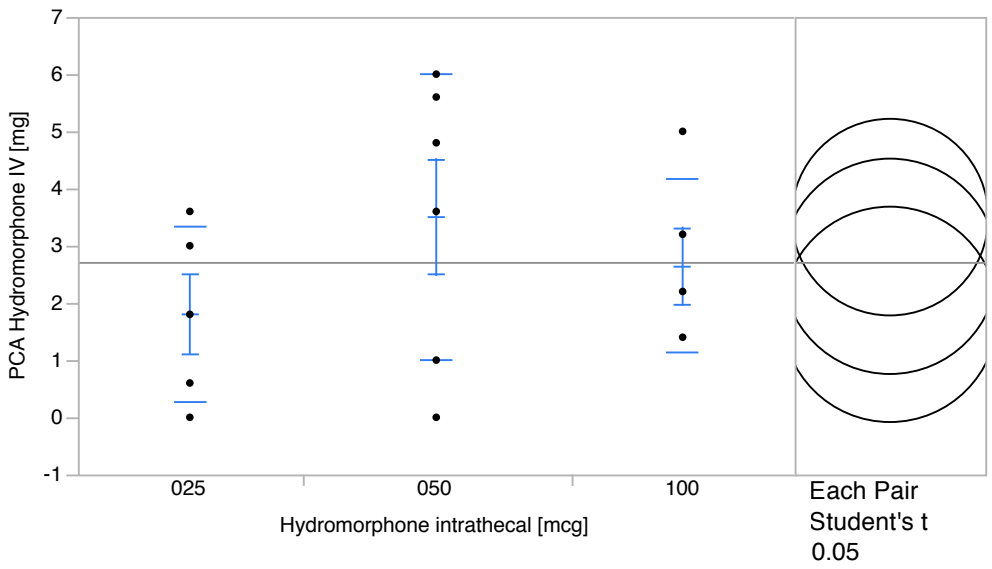
Introduction: Postoperative analgesia with intrathecal (IT) morphine 100 or 200 mcg is well established for cesarean delivery (CD). A national shortage of morphine prompted substitution of morphine with hydromorphone at our institution. A dose of 100mcg of hydromorphone has been advocated, but has yet to be validated. We have performed a randomized, blinded dose-finding study for IT hydromorphone for post-CD analgesia.

Methods: After informed consent, healthy ASA 1 or 2 women undergoing elective singleton CD were randomized to three groups: IT hydromorphone 25mcg (n=6), 50mcg (n=6), or 100mcg (n=5). Spinal anesthesia was achieved with hyperbaric bupivacaine 12mg, fentanyl 10mcg, and a blinded hydromorphone study dose. Postoperative pain was managed with intravenous (IV) hydromorphone administered via a patient-controlled analgesia (PCA) pump. Hydromorphone PCA use, Visual Analogue Scale (VAS) scores, incidence of nausea, vomiting, pruritus, hypothermia, respiratory depression, and all required interventions were recorded for 24 hours.

Results: Seventeen of 90 patients have been enrolled to date. There were no cases of postoperative hypothermia or respiratory depression. The postoperative pain assessed by the VAS was not different among the three groups 24 hours after surgery (25mcg: 2 [0-3], 50mcg: 1 [0-4], 100mcg: 0 [0-4]), nor was the cumulative VAS score (measured in the PACU, then every 4 hours until 24 hours) (25mcg: 8 [4-12], 50mcg: 9.5 [4-16], 100mcg: 10 [8-15]). Total IV hydromorphone PCA use was similar among groups (25mcg: 1.8 +/- 1.5mg, 50mcg: 3.5 +/- 2.5mg, 100mcg: 2.6 +/-1.5mg, p = ns). The incidence of nausea, vomiting, and pruritus was not different between the groups, but there was a trend for more interventions to treat nausea, vomiting, and/or pruritus in the 100mcg group (25mcg: reference group, 50mcg: .5 [-1.22 – 2.22], 100mcg: 1.8 [0 – 3.6], 95% CI, p=0.07).

Conclusion: Our goal was to determine the optimal dose of IT hydromorphone for post-CD analgesia and minimal side effects. Our preliminary data suggest no difference in postoperative analgesia requirement for elective CD after IT hydromorphone at 25, 50, or 100mcg doses. Further data collection will determine whether our observed trend for more nausea, vomiting, and pruritis intervention among the 100mcg hydromorphone group is a significant finding.



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Abstract #:T-43

Absence of Hypertension at Presentation in Pregnancy-Related Stroke: Findings from a Large US Stroke Registry

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Background: Stroke accounts for 14% of maternal deaths. Our knowledge of the risk factors and etiologies of pregnancy-related stroke (PRS) is limited, as most data are derived from small, single center series or large, administrative datasets lacking clinical detail. We sought to identify the risk factors and stroke characteristics of PRS by analyzing the Get with the Guidelines® (GWTG) Stroke Registry.

Methods: GWTG-Stroke is a national, voluntary quality improvement program sponsored by the American Heart Association with over 1,700 participating hospitals and over 3 million patients enrolled. For this study, all women aged 18-44 in GWTG from 2008-2013 with PRS (defined as stroke in a woman who was pregnant or <6 weeks postpartum) were identified using a combination of medical history of pregnancy and ICD-9 codes. There were 58% identified by a principal ICD-9 diagnosis code of stroke (430, 431, 433.xx, 434.xx, 436) plus a medical history of pregnancy vs. 42% with a principal ICD-9 code for PRS (671.5x, 673.04, 674.0x). Proportions for categorical and medians for continuous variables are reported.

Results: We identified 46043 patients with stroke from 1554 sites, of whom 668 (1.5%) had PRS. There were 338 (51%) ischemic strokes (IS), 178 (27%) intracerebral hemorrhages (ICH) and 152 (23%) subarachnoid hemorrhages (SAH). Many patient and stroke characteristics differed significantly by stroke subtype (Table). Hypertension, smoking and pre-stroke therapy with antithrombotic or antihypertensive medications were common; 7.4% of IS were recurrent. About 86% of all strokes did not occur in a healthcare setting and only 27% of patients arrived by EMS. Median initial blood pressure (BP) was higher in ICH and SAH than in IS patients, and half of all patients had first-recorded post-stroke BP below the threshold for pre-eclampsia (140/90 mmHg). HS patients were more often treated at larger, academic hospitals.

Conclusions: PRS constituted 1.5% of all strokes among women aged 18-44 in a large contemporary stroke registry with roughly equal proportions of IS and HS. Most PRS occurred out of hospital, when pregnant or postpartum patients are usually not under direct medical observation. Despite the known link between hypertensive disorders of pregnancy and stroke, half of all cases presented with normal BP levels. Further research is needed to better define PRS etiology and the role of hypertension.

Abstract #:T-43

Table. Pregnancy-Related Stroke: Patient and Hospital Characteristics					
Variable	***Overall (N=668)***	***IS (N=338)***	***SAH (N=152)***	***ICH (N=178)***	***P Value***
Age, median (IQR)	31 (27-35)	31 (26-35)	33 (27-37)	31 (27-35)	**0.07**
Race/Ethnicity					**0.01**
White, n (%)	324 (48.7)	185 (55.2)	55 (36.2)	84 (47.2)	
Black, n (%)	169 (25.4)	68 (20.3)	49 (32.2)	52 (29.2)	
Hispanic (any race), n (%)	96 (14.4)	50 (14.9)	25 (16.5)	21 (11.8)	
Asian, n (%)	19 (2.9)	7 (2.1)	7 (4.6)	5 (2.8)	
Health Insurance					0.92
Private/Champus/VA/Other, n (%)	348 (58.1)	179 (59.7)	78 (56.9)	91 (56.2)	
Medicaid, n (%)	200 (33.4)	95 (31.7)	48 (35.0)	57 (35.2)	
Symptom Onset Location					**<0.0001**
Not in healthcare setting, n (%)	570 (85.6)	295 (87.8)	124 (81.6)	151 (84.8)	
Another acute care facility, n (%)	54 (8.1)	16 (4.8)	25 (16.5)	13 (7.3)	
Arrival by EMS, n (%)	171 (27.4)	93 (30.2)	30 (20.3)	48 (28.6)	0.08
Medical History					
Previous stroke/TIA, n (%)	34 (5.1)	25 (7.4)	4 (2.6)	5 (2.8)	**0.03**
Diabetes Mellitus, n (%)	28 (4.2)	22 (6.5)	3 (2.0)	3 (1.7)	**0.01**
Hypertension, n (%)	111 (16.6)	59 (17.5)	25 (16.5)	27 (15.2)	0.79
Smoker, n (%)	133 (19.9)	77 (22.9)	25 (16.5)	31 (17.4)	0.16
Dyslipidemia, n (%)	14 (2.1)	11 (3.3)	0 (0.0)	3 (1.7)	0.06
Current Medications					
Antiplatelet/anticoagulants, n (%)	55 (8.5)	45 (13.9)	2 (1.3)	8 (4.6)	**<0.0001**
Antihypertensive, n (%)	72 (11.2)	48 (15.0)	10 (6.8)	14 (8.0)	**0.01**
Presenting Findings					
Systolic BP (mmHg), median (IQR)	134 (117-155)	127 (115-146)	144 (124-162)	141 (121-166)	**<0.0001**
Diastolic BP (mmHg), median (IQR)	81 (70-94)	78 (68-89)	83 (74-96)	87 (72-99)	**0.0005**
Heart rate (bpm), median (IQR)	80 (69-94)	82 (72-94)	75 (65-90)	78 (65-97)	**0.004**
NIHSS Score, median (IQR)	n/a	4 (1-9)	n/a	n/a	-
Hospital Characteristics					
Teaching hospital, n (%)	536 (80.6)	256 (76.2)	130 (86.1)	150 (84.3)	**0.01**
Number of beds, median (IQR)	475 (348-719)	451 (320-653)	548 (403-726)	524 (368-739)	**0.004**
Annual IS admissions, median (IQR)	282 (180-393)	266 (170-386)	282 (194-394)	327 (199-418)	**0.01**
Primary Stroke Center, n (%)	408 (61.1)	204 (60.4)	94 (61.8)	110 (61.8)	0.93

bpm = Beats Per Minute; BP = Blood Pressure; EMS = Emergency Medical Services; ICH = Intracerebral Hemorrhage; IQR = Interquartile Range; IS = Ischemic Stroke; NIHSS = National Institute of Health Stroke Scale; SAH = Subarachnoid Hemorrhage; VA = Veterans Administration

Abstract #:T-44

Anesthetic Management For a Parturient with Unrepaired Double Outlet Right Ventricle

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INTRODUCTION: Congenital heart disease, in the setting of physiological changes of pregnancy, is associated with increased cardiovascular events, including heart failure, arrhythmias, stroke, and death (1,2). We present the management of a parturient with an unrepaired double outlet right ventricle (DORV) who underwent cesarean delivery under general anesthesia.

CASE DESCRIPTION: 27 year old G3P0110 with a history of unrepaired DORV, large secundum ASD with unrestrictive left to right shunt, severe pulmonic stenosis (peak gradient 100mmg Hg), cyanosis (baseline SpO2 80%), and hypoplastic LV presented to her adult congenital cardiologist in early pregnancy. She was noncompliant with anticoagulation despite prior CVAs with resultant neurologic deficits. Her LV was filled with organized thrombus. Her delivery plan was discussed at a monthly multidisciplinary conference which includes MFM, adult congenital cardiology, OB anesthesiology, and CV anesthesiology. She had one prior cesarean delivery following IUFD at 30 weeks, and plan was for repeat cesarean delivery under general anesthesia. Neuraxial anesthesia was contraindicated given severe pulmonary stenosis.

Delivery was indicated at 33w5d for IUGR. She was admitted for preoperative optimization by cardiology. Neurology was consulted for evaluation of baseline deficits given concern for ongoing LV thrombus embolization. Arterial line and CVC were placed preoperatively and hemodynamics were optimized.

At 34w1d the patient was taken to the cardiac OR for cesarean delivery with cardiothoracic surgery on standby for possible ECMO. Coagulation studies, fibrinogen and ROTEM were found to be within normal limits for pregnancy. General anesthesia was induced with etomidate and succinylcholine and maintained with sevoflurane. Nitrous oxide was avoided due to its potential to increase pulmonary vascular resistance. RV function was monitored and fluid resuscitation guided by TEE intraoperatively. Prior to emergence, bilateral ilioinguinal/iliohypogastric blocks were performed for postoperative analgesia. Postoperative course was uneventful and she was discharged 6 days after surgery.

CONCLUSION: This case demonstrates the successful multidisciplinary management approach used for parturients with high risk cardiovascular disease at our institution. Careful planning and collaboration were crucial to successful management of this complicated patient.

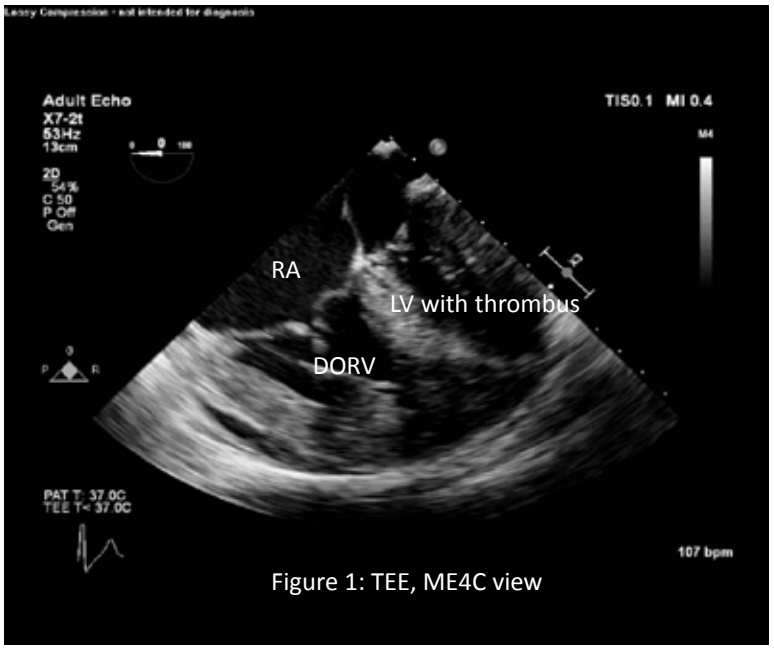

Figure 1: TEE, ME4C view

References:

1. Heart. 2011;98:145–151
2. Circulation. 2014; 130: 273-282

Abstract #:T-45

Extracorporeal Life Support for Anticipated Right Heart Failure at Cesarean Delivery in a Parturient with Severe Pulmonary Arterial Hypertension

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Introduction: Pulmonary hypertension can lead to significant morbidity and mortality in parturients and management during delivery is both difficult and controversial. We report a case of a parturient with severe pulmonary hypertension who had a complicated peripartum course requiring extracorporeal life support (ECLS).

Case Description: A 35-year-old Para 1001 at 37.1 weeks gestation was admitted after a new diagnosis of severe pulmonary hypertension detected by echocardiogram performed for a heart murmur on exam. As a non-English speaking refugee from East Africa, she had limited prenatal care. Right heart catheterization revealed a pulmonary artery pressure of 106/35 (62) mmHg. IV epoprostenol was started and uptitrated over 6 days, which she tolerated well. A multidisciplinary planning group agreed on a scheduled cesarean delivery.

The patient was brought to the operating room where an arterial line was placed followed by an epidural catheter. Epidural anesthesia was initiated via slow titration of local anesthetics with vasopressor use (maximum vasopressin 0.04 U/min, norepinepherine 0.05 mcg/kg/min) to maintain hemodynamic stability. Prior to incision, cardiac surgeons placed femoral arterial and central venous lines in case ECLS was required. The surgery proceeded uneventfully with delivery of a healthy infant. Immediately after delivery of the placenta, the patient had sudden hemodynamic collapse. General anesthesia was emergently induced and the patient was intubated while simultaneously being placed on veno-arterial ECMO. Intraoperative TEE showed biventricular failure with an EF of 10%. She stabilized on ECMO with vasopressor support. Over the next 3 days, she was able to be weaned from vasoactive agents, decannulated and extubated. Her hospitalization was complicated by a DVT, but she continued to progress and was discharged on postoperative day 30.

Two months postpartum, she remained on vasodilator therapy with treprostonil. Echocardiography revealed normal biventricular function and a right ventricular systolic pressure of 90 mmHg. After a thorough workup, the cause of her pulmonary hypertension remains unclear.

Discussion: Due to a high mortality rate, women with pulmonary hypertension are generally counseled against pregnancy. The optimal mode of delivery and anesthesia are debatable. In this case, ECMO was used to emergently stabilize a patient with severe pulmonary arterial hypertension who decompensated during cesarean section. The autotransfusion of blood that occurs after delivery likely led to right heart failure precipitating hemodynamic collapse. Despite this, the extensive preparation by a multidisciplinary team enabled a rapid response to her deterioration and a favorable outcome.

Reference:

Maxwell BG, El-Sayed YY, Carvalho B. Peripartum outcomes and anaesthetic management of parturients with moderate to complex congenital heart disease or pulmonary hypertension. Anaesthesia. 2013 Jan;68(1):52-9.

Abstract #:T-46

Management of Parturient with Prosthetic Aortic Valve: Prosthesis Patient Mismatch vs. Graft Stenosis

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Aortic Stenosis (AS) in pregnancy represents a life threatening medical condition as it may result in maternal death and/or poor fetal outcomes. Traditionally, patients of childbearing age were treated with metallic prosthetic valves because they offered better hemodynamics and a longer lifespan than bio-prosthetic valves. Unfortunately, anticoagulants required for metallic valves are teratogenic.

Newer bio-prosthetic valves have better hemodynamics, a longer lifespan, and D.O. not require anticoagulants. Overtime, the patient will require valve replacement but it does provide for a safer pregnancy. Importantly, the flow through prosthetic valves can appear stenotic during pregnancy though it is functioning well. This phenomenon is known as Prosthesis Patient Mismatch (PPM).

We present a 23 YO G2P1001 F with IUP at 39wks with prenatal dx of post valve replacement severe AS. Initial TEE at 33 wks showed AVA 0.8 with LVH. Porcine aortic valve replacement was done 7 years prior due to S. Bovi endocarditis. Obstetric plan was assisted vaginal delivery via induction of labor at 39 wks. TEE was repeated at 38 wks and showed EF 67% with AVA of 0.7 and systolic peak and mean gradients of 80 and 48 mmhg, respectively without LVH. At admission, physical exam revealed no symptoms related to severe AS. We determined the elevated gradients were likely due to PPM, given that the patient's body surface area (BSA) and cardiac output (CO) had increased due to pregnancy. The patient was well compensated. We gave a fluid bolus to ensure preload, placed an epidural, a 10cc bolus of 0.1% Ropivicaine with 2mcg/ml Fentanyl was administered, and the infusion was started at the rate of 10 ml/hr. Adequate labor analgesia was established. Labor progressed appropriately with stable blood pressures. Vaginal delivery with the assistance of forceps was achieved.

The risk of pregnancy is low in women with no or minimal AS and uncompromised ventricular function.[1] However, in patients with severe AS, medical treatment and indications for intervention are comparable with those for pregnancies with native valve AS. Patients, who are asymptomatic, even with severe AS, with normal LV size and function should be treated as low risk.[1] Additionally, when ECHO evaluations appear to show severe AS in asymptomatic patients, PPM should be considered. High velocity or gradient alone is not proof of intrinsic prosthetic obstruction and may be secondary to PPM or high flow state.[2] PPM occurs when the effective orifice area(EOA) of a normally functioning prosthesis is too small in relation to the patient's BSA or CO requirements. [2] Our patient's BSA increased and pregnancy is a high CO state. Both of these factors affected the initial ECHO values. Our diagnosis of intra-partum PPM was corroborated by repeat ECHO 2 month's post-partum. BSA and CO decreased, resulting in peak and mean gradients consistent with mild AS.

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2. Heart 2012;98:69-78

Abstract #:T-47

Pulmonary Hypertension in Pregnancy: a retrospective cohort study (1997-2013)

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Introduction: Pulmonary hypertension (pHTN) in pregnancy carries high risk of mortality.1 More women with complex cardiac disease are reaching childbearing age, hence the prevalence of pHTN is increasing. We hypothesize that outcomes of pHTN may differ in congenital heart disease patients with Eisenmenger syndrome (ES) compared to other causes. We analyzed the management and outcomes of pHTN patients at our institution (1997-2013).

Methods: EMRs were searched to identify all pregnancies with pHTN admitted to the ICU (during pregnancy or postpartum). Demographics, clinical characteristics, management and outcomes were identified. PHTN was classified by etiology: 'CHD' if due to congenital heart disease, 'RHD' if due to rheumatic heart disease, or 'OTH' due to another etiology (medication, thromboembolic disease, acquired non-rheumatic cardiomyopathy, systemic illness, or no cause identified-likely primary pHTN).

Results: There were 20 cases (Table). 8 patients had vaginal deliveries (VD), 9 patients had cesarean deliveries (CD) and 3 patients terminated pregnancy. There was a maternal/obstetrical or fetal indication for every CD performed. All women delivered with neuraxial anesthesia except one with general anesthesia for urgent CD for acute respiratory failure. ES was present in 5 of 6 CHD patients with 3 of the 5 dying within 90 days of delivery; all 3 women had CDs (1 planned, 2 urgent). There was one death after a termination.

Discussion: Advanced therapies for pHTN were used more often in the CHD group than in the RHD or OTH group; we believe that this is due to the severity of the disease with CHD as evidenced by ECMO use in 50% of this group. PAC use in the CHD group was similar to that reported by others.1 The 1-year mortality in the entire cohort was similar to what has previously been reported (20 vs 25%)1 and none of these deaths were in women who had a VD, supporting the recommendation that in patients with cardiac disease, VD is the preferred mode of delivery. Data from the Registry of Cardiac Disease in Pregnancy emphasizes that emergency CDs have comparable outcomes to planned CDs2; this may lead to a shift in management where providers no longer need to plan elective CDs in hopes of avoiding hypothetical risks of emergency CDs. We suggest that a trial of labor with neuraxial analgesia with early initiation of advanced therapies for pHTN is the best approach in this high-risk population.

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Abstract #:T-47

Table: Baseline characteristics, management and outcomes in pregnant patients with pHTN compared by etiology of pHTN

	Congenital cardiac disease	Rheumatic cardiac disease	Other*
Maternal Characteristics	(N=6)	(N=6)	(N=8)
Mean age in years (SD)	30 (6.6)	35 (5.6)	32 (6.7)
Nuliparous (N=)	5	0	2
Before Pregnancy	(N=6)	(N=6)	(N=8)
Baseline NYHA class I-II (N=)	5	6	7
Baseline NYHA class III-IV (N=)	1	0	1
During Pregnancy	(N=6)	(N=6)	(N=8)
Heart failure episode (N=)	6	5	8
Oxygen (N=)	4	1	6
Diuretics (N=)	5	4	2
Anticoagulation (N=)	6	3	4
Delivery	(N=6)	(N=6)	(N=8)
Early termination (D&E under neuraxial) (N=)	0	1	2
Mean gestational age at delivery (wks)(SD)	32.5 (2.6)	37.1 (2.2)	31.5 (4.2)
Vaginal delivery with neuraxial analgesia (N=)	2	4	2
Cesarean delivery with CSE/epidural (N=)	3	1	4
Cesarean delivery under GA (N=)	1	0	0
Management/advanced therapies for pHTN	(N=6)	(N=6)	(N=8)
Phosphodiesterase inhibitors (N=)	3	0	2
Prostacycline INH/IV (N=)	4	0	3
NO (N=)	3	0	2
Vasopressors (NE, vasopressin) (N=)	5	0	1
Inotropes (N=)	5	1	3
Transfusion (N=)	3	1	2
PA catheter (N=)	2	4	4
ECMO (N=)	3	0	1
Intubation in ICU (N=)	4	1	2
Death (total N=)	4	0	1
Within 48h of delivery (N=)	0	0	0
Within 7 days of delivery (N=)	1 (cesarean)	0	0
Within 30 days of delivery (N=)	1 (cesarean)	0	1 (termination)
Within 90 days of delivery (N=)	1 (cesarean)	0	0
>2 years of delivery (N=)	1 (vaginal delivery)	0	0
Neonatal Outcomes	(N=6)	(N=5)	(N=6)
Apgar <7	0	0	1
Neonatal death	0	0	0
Intrauterine growth restriction reported	4	1	0

*pHTN due to medication, thromboembolic disease, acquired non-rheumatic cardiomyopathy, systemic illness, or no cause identified

Abstract #:T-48

Phenylephrine infusion versus phenylephrine bolus alone in elective cesarean section after spinal (or CSE) anesthesia.

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Background: Phenylephrine has been shown to be as effective as ephedrine for treating maternal hypotension following spinal anesthesia for cesarean section, with improved fetal acid-base status. With a high incidence of hypotension in elective cesarean section patients under spinal anesthesia, prophylactic phenylephrine variable rate infusion regimens have been used as treatment. Multiple variable rate regimens have been described with mixed results.

Methods: We present a retrospective review comparing a phenylephrine variable rate infusion regimen adjusted to changes in arterial blood pressure and heart rate to traditional bolus injections alone observing the hemodynamic profiles of both groups, particularly the incidence and degree of hypotension and status of the newborn. We reviewed all elective cesarean sections performed at our institution from May, 2014 through January, 2015 under spinal or combined spinal epidural (CSE) anesthesia. Some anesthesia staff began implementing a phenylephrine infusion following neuraxial blockade in elective cesarean sections in an attempt to ameliorate the peaks and troughs often seen when treating hypotension with bolus dosing alone. For each group, we identified 1) initial baseline blood pressure in the operating room prior to the block, 2) the lowest blood pressure recorded after intrathecal injection, 3) episodes of hypotension defined as a 20% decrease from baseline, 4) the total number of hypotensive episodes prior to delivery of the fetus, 5) total phenylephrine dose administered and 6) APGARS at 1 and 5 minutes. The phenylephrine infusion was started at 50 mcg/min, with incremental increases or decreases of 25 mcg/min titrated to blood pressure measured every minute. Rescue bolus dosing of 50-100 mcg was noted in some cases. In the control group, bolus dosing of 50-200 mcg of phenylephrine was given incrementally as determined by the clinician.

Results: 186 patients met our inclusion criteria. 66 were in the infusion group and 117 were controls. 99 patients (53%) had combined spinal epidural (CSE) while 87(47%) had single-shot spinals with 12mg of 0.75% bupivacaine, 10-20 mcg of fentanyl and 150-200 mcg of DuramorphR. Our preliminary data was significant for 108 patients (58%) with pre-delivery hypotension. 69of these patients (64%) were in the control group and 39 (36%) in the infusion group. The infusion regimen required a higher total dose of phenylephrine compared to controls, but with a lower incidence of hypotension and fewer episodes prior to delivery (exact number currently being extracted from the data). Neonatal outcomes or APGAR scores were not different between the two groups.

Conclusion: Our preliminary data shows that prophylactic variable rate phenylephrine infusion with intermittent rescue bolusing is more effective than bolus dosing alone with respect to maintaining blood pressure and clinician workload.

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Abstract #:T-49

Ovarian Artery Aneurysm Rupture Presenting as Abdominal Pain in the Pregnant Patient

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Spontaneous rupture of an ovarian artery aneurysm is an exceedingly rare pathology that occurs most commonly during the peripartum and early postpartum periods. Less than 15 cases have been reported in the literature. The aneurysmal rupture is thought to result from hemodynamic and hormonal changes during pregnancy. Here we present a young G2P1 women at 25 weeks gestation who presented to triage in the labor and delivery suite with vague cramping abdominal pain. Vital signs were initially stable, and pain improved to the point that the patient was discharged home, however, prior to leaving she suddenly became hypotensive and tachycardic. A FAST exam was performed showing free fluid in the abdomen. Concurrently, fetal heart rate monitoring revealed severe decelerations necessitating emergency Cesarean delivery. In the operating room, emergent Cesarean was performed under GA, and upon opening of the abdomen the surgical team noticed several liters of blood in the abdomen. Massive transfusion protocol was initiated, and the young women was successfully resuscitated while bleeding was controlled with ligation of her ovarian artery. The newborn, however, had Apgar scores of 1 and 2 at one and five minutes respectively. Care of the newborn was transferred to the neonatal intensive care unit, but withdrawn on day of life #2. To my knowledge, this is the only case reported aneurysmal rupture in the antepartum period proceeding labor and leading ultimately to fetal demise. Although rupture of an ovarian artery aneurysm is an incredibly rare event, it is life-threatening to both mother and child, and is often associated with a non-specific clinical picture. Awareness of this pathology may lead to early diagnosis and treatment.

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Abstract #:T-50

OXYTOCIN- Friend AND Foe?

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Case: The OB Anesthesia team was contacted urgently for a cesarean section involving an otherwise healthy 36 year old G1P0 female who had SROM > 24 hours and had been admitted for induction of labor with oxytocin gtt. Baseline FHR was in the 130s with decreased variability for 4 hours and early and variable decelerations. Pt had not received any labor analgesia and had been practicing hypnobirthing. She was attended by a doula and her husband, and medically managed by a midwife from a nearby birthing center. Lethargy and vomiting was noted on anesthesia evaluation. Patients husband and midwife stated she was exhausted from being up laboring continuously for 2 days and actively pushing for 4 hours. She was complaining of a headache and projectile vomiting large amounts of clear fluid, but able to participate in the interview. Pt had been drinking coconut water with bottled water in unknown quantities.

Pt was transferred to the OR. Spinal anesthesia was attempted unsuccessfully x2 by resident and x2 by attending. Pt began projectile vomiting. GETA by RSI was induced uneventfully with propofol and succinylcholine. Delivery was 4 min after induction- apgars 1/8. Oxytocin 20 units/1L bag LR was started. Pt became hypertensive/tachycardic and was overbreathing the ventilator. PVCs were noted. Light anesthesia was assumed and anesthesia was deepened. Labetalol 10mg was given with normalization of vital signs. Pt was transferred to the PACU intubated due to lack of responsiveness at the end of case. Flumazenil and naloxone were given without response. iStat labs were drawn bedside and showed a Na of 114. On exam pupils were fixed and dilated. We were notified that the baby was seizing in the NICU with a Na of 116. A stat noncontrast CT showed "profound diffuse cerebral edema" with evidence of basilar artery infarction. The pt was transferred to the ICU and declared brain dead the next day after management c/w hospital policy. The cause of death was ruled to be diffuse cerebral edema with associated elevated intracranial pressure.

Discussion: This patient ultimately died of acute water intoxication due to copious PO intake of hypotonic solution while on an oxytocin infusion. Hyponatremia is a known complication of oxytocin administration in hypotonic solutions. [3] This is thought to be due to antidiuresis effects resulting from oxytocin mediated stimulation of vasopressin (V2) receptors in the kidney. [2] As many as 21% of laboring women develop hyponatremia, with increasing severity seen with prolonged labor (especially 2nd stage) and increased fluid administration (>2500cc). [1] As providers with often limited preoperative exposure to our patients- our index of suspicion for hyponatremia needs to remain high in any parturient on oxytocin with signs/symptoms of elevated ICP such as headache, nausea, or altered mental status.

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1. BJOG 2009;116:552-561
2. J Intensive Care Med 2012;27:207
3. Nephron 2000;86:342-43

Abstract #:T-51

Maternal Sepsis Deaths in the State of Michigan 1999 - 2006

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Introduction: Deaths due to maternal sepsis increased in the United States from 1998 to 2008.(1) According to the UK Saving Mothers' Lives report for the epoch 2009-2012, almost 25% of all maternal deaths were due to sepsis.(2) Diagnosis remains challenging due to the physiologic changes of pregnancy, resulting in delays of diagnosis and treatment.(3) The aim of this case series is to identify maternal sepsis deaths, review the events leading to diagnosis, and evaluate treatment to identify areas for improvement.

Methods: All maternal deaths in the state of Michigan 1999-2006 during pregnancy and up to 42 days postpartum were identified with Maternal Mortality Surveillance records from the Michigan Department of Community Health. Cause of death was determined from death certificates or by consensus of the Maternal Mortality Medical Surveillance Committee. Records were reviewed by both an obstetrician and an obstetric anesthesiologist.

Results: Maternal sepsis was the cause of direct death in 3.7% (22/593) of all maternal deaths during the time period. Of 22 maternal sepsis deaths, 12 women presented to the hospital with sepsis, three developed sepsis during hospitalization, and seven died at home. Of the women presenting to the hospital with sepsis, 75.0% (9/12) demonstrated one or more of the following vital sign derangements: HR>120, RR>30, SBP<90 mmHg, SpO2 <95% on room air (Maternal Early Warning Criteria).(4) Only 16.7% (2/12) of septic women were febrile on presentation, and many remained afebrile with resultant delays of diagnosis. One or more recognized risk factors for severe sepsis including: cesarean delivery, retained products of conception, stillbirth, and tobacco use were present in 77.3% (17/22) of all sepsis deaths. The most common organism was Group A Strep in 28.6% (4/14) of women with an identified organism. Delays of care occurred in the majority of deaths including 31.8% (7/22) of women who died at home.

Conclusions: In the majority of maternal sepsis deaths over eight years in the state of Michigan, there were delays in recognition of sepsis and escalation of care despite vital sign derangement. Escalation of care should include more frequent vital sign monitoring, adequate resuscitation, and prompt broad-spectrum antibiotic administration. Fever was rarely present in women who died of sepsis, and is not required for diagnosis. Educating patients about when to seek medical treatment may help decrease the rate of deaths occurring at home. Implementation of Maternal Early Warning Criteria may provide heightened awareness of changes in vital signs to aid in earlier diagnosis.

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Abstract #:T-52 & MA-03

A Systematic Review of Cases of Cerebral Venous Thrombosis

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Introduction: Cerebral venous thrombosis (CVT) is estimated to occur in 10 to 20 per 100,000 deliveries in developed countries. Its early symptoms are often difficult to distinguish from postdural puncture headaches, as both can have a postural component, and CVT may also be preceded by a dural puncture. It is unknown whether there is an association between dural puncture and development of CVT. Therefore we conducted a systematic review of all cases of CVT in the obstetric population that had a neuraxial anesthetic attempted or performed.

Methods: A systematic review of cases was performed using PubMed to identify all cases of CVT in obstetric patients following attempted or performed neuraxial anesthesia. Cases were identified using the key words: anesthesia, obstetric, epidural, cesarean section, parturition, peripartum, postpartum, childbirth, or pregnancy and intracranial, venous, sinus, brain or cerebral thrombosis. Reference lists were searched for additional articles. Only studies published in English were included. A standardized data abstract form was used to abstract case details.

Results: The search resulted in 348 articles of which only 32 articles were included. Of the articles excluded, the main reasons were: they involved thrombosis of the wrong organ (191 articles), they discussed fetal CVT (32 articles), or they did not involve thrombosis (32 articles). The 32 articles contained 33 cases of CVT. Age for the patients ranged from 18 to 37 years old. Twenty-six patients had an epidural attempted or performed; 2 patients had a combined spinal-epidural attempted or performed; 6 patients had a spinal attempted or performed. Some patients had more than one technique attempted. Of the epidurals attempted, 7 patients had a dural puncture noted. Including spinals and combined spinal epidurals, 11 of 33 patients had known dural punctures. For 8 patients the authors noted multiple attempts at neuraxial anesthesia despite no frank dural puncture. All 33 cases had headache as their presenting symptoms with 22 cases reporting the headache as being positional at least during a portion of their symptoms. Epidural blood patches were performed for 18 cases with 14 cases reporting at least partial temporary relief of headache. Seventeen cases reported the patient experienced seizures. Diagnosis was confirmed with radiographic imaging, typically magnetic resonance venography. Anticoagulation was given in 28 cases and 21 cases returned to their baseline status.

Conclusions: Symptoms for CVT share similarities with post-dural puncture headaches making early diagnosis challenging. It is difficult to ascertain whether dural puncture predispose patients to formation of CVT, but many authors suggest an association. Further work in this subject is needed before a definitive association can be established.

Abstract #:T-53

Effect of hetastarch on calculated blood loss during elective cesarean delivery

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Introduction: Hetastarch (HES) is the most commonly used synthetic colloid in the obstetrical population to prevent hypotension following subarachnoid anesthesia for cesarean birth. Synthetic colloids in general have been associated with coagulopathy, increased risk of bleeding and transfusion requirements, (1). Indeed, an accumulation of evidence has revealed an acquired coagulopathy associated with HES. The mechanism remains poorly defined but it is currently thought to be secondary to an acquired fibrinogen deficiency or fibrinogen dysfunction directly caused by the use of HES (2). The aim of this study was to determine whether preload/co-load of HES to prevent spinal hypotension during cesarean birth is associated with an increased risk in bleeding when compared to crystalloid.

Methods: We conducted a retrospective study of patients who underwent elective cesarean delivery under spinal anesthesia at the university of Virginia labor and delivery ward between 2011-2014. Data from 819 patients was used. Our primary outcome (blood loss) was calculated using the following; we calculated the blood loss based on the difference in preoperative (within one day) and postoperative (first postoperative day) hematocrit difference, using a previously validated method (3). A propensity match score was used to match patients who received hetastarch (HES group) to those who did not (Control group), based on age, Gravida, Para, number of fetuses, gestational age, BMI, number of previous cesarean delivery, infant weight, duration of surgery, and amount of oxytocin used during surgery.

Results: Using genetic matching, our matching resulted in 201 patients in HES group and 147 patients in the control group. Taking into account multiple comparisons were made, a Bonferroni-adjusted significance level of .005 was used. There where no difference in estimated blood loss ($p = .208$), calculated blood loss ($p = .789$), total intraoperative fluids intake ($p = .048$), urine output ($p = .721$), phenylephrine ($p = .141$), ondansetron ($p = .200$), ephedrine ($p = .030$), Apgar 1 min ($p = .796$), Apgar 5 min ($p = .643$), and length of hospital stay ($p = .288$).

Conclusions: Overall, our study revealed that there was no association between increased perioperative blood loss and hetastarch use in patients presenting for elective cesarean section. Therefore, hetastarch may be safe to use in this select patient population with respect to end-organ effect such as acute kidney injury without concern for increased blood loss. This study also did not find any associated benefits with hetastarch use such as less vasopressor use, less total intravenous fluid administration, higher Apgar scores, or decreases length of hospital stay to justify the increased cost associated with hetastarch use versus crystalloid use.

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Abstract #:T-54

High-fidelity simulation to evaluate an Interdisciplinary Teamwork Assessment Scale in obstetric crisis management

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Introduction: The Joint Commission has identified failures in human factors, communication, leadership and assessment as the most frequent root causes of sentinel events [1]. Since these elements are critical in obstetric crisis management, development of evaluated training programs and assessment tools is essential [2]. The objective of this study was to develop a valid and reliable interdisciplinary teamwork assessment scale (ITAS) to assess team dynamics during a simulated obstetric crisis.

Methods: This prospective, observational study developed a 5-point ITAS (34 items) using a modified Delphi technique to establish face and content validity. Two high fidelity simulations of preeclampsia (PE) and postpartum hemorrhage (PPH) were conducted a total of 50 times [8 (4 good, 4 poor) and 42 were performed by actors and multidisciplinary teams, respectively]. Five anesthesia and obstetric experts used the ITAS tool to assess the simulation video recordings. Two additional anesthesia experts rated each performance as good/intermediate and poor, without the use of ITAS, to establish a "gold" standard. A procedural checklist of expected actions was also completed. Cronbach's α and intraclass correlation coefficient, ICC (2,1) were calculated to examine consistency and level of agreement between raters, respectively. Construct validity was established by comparing the ratings of the 5 experts with the 2 gold standard experts. The primary outcome was the ITAS score.

Results: A total of 119 physicians/nurses participated in simulations. There was overall high consistency (Cronbach's α=0.98) and moderate agreement [ICC (95%CI)=0.49 (0.35, 0.63)] between raters. Significantly higher scores were seen in good/intermediate than poor performing teams (real scenarios $p<0.001$; acted scenarios $p<0.001$) suggesting a strong construct validity (Table 1). The overall ITAS scores were not different between PE [3.7 (0.8)] and PPH [3.7 (0.7)] ($p>0.05$). The scores of procedural skills were 74.3 % (8.3) for PE and 78.8 % (9.5) for PPH.

Discussion: We have established the reliability and validity of ITAS for use in simulated multidisciplinary obsteric settings. We found that our teams performed at a satisfactory/high level requiring some improvement in skills. This scale has a potential to be used in simulated and real clinical settings to provide feedback and improve teamwork skills.

References:

1. The Joint Commission 2004-14
2. Black et al. 2003;110:837-841

Abstract #:T-54

Table 1: Interdisciplinary Teamwork Assessment Scale scores

Measure	Cronbach's alpha	ICC (95% CI)	Scores Real Scenarios (n=42)				Scores Acted Scenarios (n=8)		
			Overall	Good / intermediate	Poor	p-value	Good	Poor	p-value
Overall Score	0.98	0.49 (0.35, 0.63)	3.7 (0.8)	3.8 (0.7)	2.9 (0.7)	<0.001	4.7 (0.5)	2.2 (0.7)	<0.001
Shared Mental Model	0.95	0.42 (0.28, 0.57)	3.8 (0.8)	3.9 (0.8)	3.1 (0.8)	0.001	4.8 (0.4)	2.1 (0.8)	<0.001
Communication	0.97	0.43 (0.28, 0.58)	3.5 (0.8)	3.6 (0.8)	2.6 (0.6)	<0.001	4.6 (0.6)	2.0 (0.7)	<0.001
Situational Awareness	0.96	0.42 (0.27, 0.57)	3.7 (0.8)	3.8 (0.8)	2.8 (0.8)	<0.001	4.6 (0.5)	2.3 (0.9)	<0.001
Leadership	0.95	0.43 (0.28, 0.58)	3.6 (0.8)	3.8 (0.8)	2.8 (0.6)	<0.001	4.6 (0.6)	2.3 (0.8)	<0.001
Followership	0.96	0.40 (0.26, 0.56)	3.7 (0.8)	3.8 (0.8)	3.0 (0.8)	0.004	4.6 (0.4)	2.6 (0.8)	<0.001
Workload Management	0.96	0.39 (0.25, 0.55)	3.6 (0.8)	3.7 (0.8)	2.8 (0.7)	<0.001	4.7 (0.5)	2.3 (0.8)	<0.001
Positive/Effective Behaviors and Attitudes	0.97	0.53 (0.39, 0.66)	3.8 (0.7)	3.9 (0.7)	3.3 (0.7)	0.013	4.8 (0.5)	2.2 (0.9)	<0.001

Five- point ITAS rating scale:
1=Unacceptable (team performance consistently unacceptable and requires serious remediation)
2= Poor (team performance consistently of a poor standard, with significant room for improvement)
3= Borderline (team performance consistently of a satisfactory level and just meets expectations, with more room for improvement)
4= Good (team performance consistently of a high standard, although there is some room for improvement)
5=Perfect (team performance consistently of an outstanding standard; could be used as a positive example to others)

Values are expressed as Mean (SD)

Abstract #:T-55

Characterization of Maternal Near Miss in Two Tertiary Referral Hospitals in Developed Nations

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Background: More than half a million women worldwide aged 15-49 die every year due to perinatal complications with many more having severe morbidity. The World Health Organization (WHO) has defined several criteria for identifying severe maternal morbidity, termed a "near miss." We aimed to characterize the maternal population admitted to the intensive care unit (ICU) in 2 developed countries as a representative sample of maternal near miss to study the relevance of WHO criteria in this population.

Methods: After IRB approval from both institutions, we retrospectively reviewed the charts of all peripartum ICU admissions over a 10 year period (2005-2014). Cases were identified through the hospital computerized databases. We used SPSS 20 for analysis of the partial data collected from the centers.

Results: We have collected data from 172 cases. Mean age was 31±7. Maternal medical history most commonly included hematologic (11%), cardiovascular (9%), respiratory (8%), and endocrine (7%) diseases. Almost 1/3 of the women were on medication at the time of admission including thyroid hormone replacement (7%), antihypertensives (6%), respiratory inhalers (6%) and anticoagulants (5%). The women had an obstetric history of 2.1±2.4 live births; 29% had a history of prior obstetric complication and 31% had a prior cesarean delivery. About 1/6 of the pregnancies resulted from fertility treatments.

The ICU admissions were most commonly during the 3rd pregnancy. Women presented to the hospital at 32±9 weeks, with complications occurring at 33±8 weeks. Only 9% of the cases had a prolonged or complicated delivery.

Near misses occurred most commonly postpartum (42%), followed by antepartum (39%) and intrapartum (19%). Almost 1/3 of the women presented in shock but overall 59% were in shock at some time during admission. Most events were directly related to the pregnancy (n=98, 57%). Hemorrhage (n=71) and preeclampsia (n=11) were the most common direct causes; 37.2% fulfilled criteria for massive transfusion (>5 packed cells per day). Indirect causes were mostly complications of cardiovascular disease and severe infections. Surgery to control hemorrhage (most commonly hysterectomy) was required in 48% and 22 women underwent repeat surgery. One-fifth of the women did not fulfill WHO criteria for critical illness during pregnancy. In most of these cases, admission was due to a medical complication unrelated to the pregnancy.

Conclusions: Hemorrhage and preeclampsia were the most common direct causes of maternal ICU admission, while cardiovascular disease was the most common indirect cause. The WHO criteria captured the majority of our critically ill population, but 22% did not fit the criteria. A modified classification scheme for near misses may be needed for developed countries.

Reference:

Say L, et al. WHO systematic review of maternal morbidity and mortality: the prevalence of severe acute maternal morbidity (near miss). Repro Health 2004; 1:3.

Abstract #:T-56

Disaster Training for Obstetric Units using an Obstetric-specific Disaster Toolkit and Training Drills

Presenting Author: Naola Austin M.D.
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Gillian Hilton M.B.Ch.B., FRCA - Stanford School of Medicine - Stanford, CA

Introduction: Despite a growing body of literature describing increased morbidity and mortality for pregnant women and infants affected by disaster events, there is a paucity of guidance related to obstetric disaster preparedness.[1,2] We developed a user-friendly, readily-accessible comprehensive Obstetric Disaster Toolkit, and designed disaster training drills for labor and delivery staff members.

Methods: In conjunction with our hospital Office of Emergency Management, we developed an Obstetric Disaster Toolkit which includes: Disaster Plan Binder and Checklist; Disaster Roles; Job Action Sheets with critical tasks for each disaster role; Disaster Boxes with flashlights and other supplies; Department Damage Map for assessing unit safety and census; a rapid obstetric specific triage system to prepare for possible evacuation (Figure); paper Patient Forms with relevant patient history; and Grab & Go Backpacks containing necessary equipment for off-unit delivery. Disaster training sessions explained the above tools and discussed disaster safety topics including: 'shelter in place'; 'surge capacity'; fire safety (extinguishers/ alarms/oxygen supply valves); emergency generator outlets; vertical evacuation using plastic MedSleds; and home preparedness.

Results: Fifteen multidisciplinary, two-hour disaster training sessions were performed. Sessions were well received by obstetricians, anesthesiologists, nurses, and other staff. Participant feedback led to improvement of the disaster tools. Of note, participants reported a lack of disaster preparedness at home that could directly affect their ability to provide patient care during a disaster, therefore we directed participants to read the national public service advertising campaign online.[3] We elected to share the toolkit via free online access so that other obstetric units can tailor it to their unique needs.[4]

Discussion: Disaster planning for obstetric units is challenging since disasters occur in many forms and obstetric units are far from ubiquitous. We developed an Obstetric Disaster Toolkit that will be useful to all obstetric providers. As a growing number of labor and delivery units improve their disaster preparedness, we should take further steps towards development of a National Disaster Plan for obstetric and neonatal safety.

References:

1. Obstet Gynecol 2014;124:154-158
2. Emerg Health Threats J 2009;2:e2:1-5
3. http://www.ready.gov/
4. http://obgyn.stanford.edu/community/disaster-planning.html

Figure: OB TRAIN for AP & L&D

Transport	Blue: CAR/ Discharge	Green: BLS	Yellow: ALS	Red: SPC	
Labor Status	None	Early	Active	At risk for En route delivery	If delivery imminent: Shelter in place and TRAIN after delivery
Mobility	Ambulatory*	Ambulatory or Non-ambulatory	Non-ambulatory	Non-ambulatory	
Epidural Status	None	Placement > 1 hour**	Placement < 1 hour**	N/A	
Maternal or Fetal Risk	Low	Low/ Moderate	Moderate/High	High	

TRAIN=Triage by Resource Allocation for Inpatients; AP=Antepartum; L&D=Labor and Delivery; BLS=Basic Life Support; ALS=Advanced Life Support; SPC=Specialized Patient Care

Abstract #:T-57

Multidisciplinary Team Performance During Simulated Local Anesthetic Systemic Toxicity and Maternal Cardiac Arrest: A Prospective Observational Study

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Introduction: Maternal cardiac arrest (MCA) from local anesthetic systemic toxicity (LAST) is a rare but potentially devastating event.[1] Individual performance during simulation of non-obstetric LAST has been studied, but data is limited on obstetric team performance.[2] This study aimed to measure time to critical resuscitation tasks during multidisciplinary team-based simulation of LAST and MCA.

Methods: Anesthesia residents and fellows, nurses, OR staff, and obstetric attendings, fellows and residents participated in this ongoing IRB-exempt, prospective observational study. An in situ, high-fidelity manikin simulated a 35 year old G1PO (65kg) who developed central nervous system and cardiovascular instability followed by asystole after receiving bupivacaine (12ml/hr of 0.0625% and 3x5ml of 0.25%) for labor analgesia and 20-25 ml of 2% lidocaine with epinephrine 1:200,000 for cesarean. We measured time to: announcement of obstetric code; initiation of advanced cardiac life support; manual uterine displacement; diagnosis of LAST; administration of lipid emulsion rescue and delivery of the fetus. Participants signed audiovisual consent and recordings were used to verify data. Sessions included an educational didactic presentation, debrief, and survey.

Results: To date, 7 multidisciplinary teams have participated. The Table shows times to critical resuscitation tasks. All teams called an obstetric code, performed chest compressions, and delivered the fetus, but no teams performed manual uterine displacement. Nurses, obstetric providers, and operating room staff in every session reported that the simulation, didactic, and debrief transformed their knowledge of LAST from limited to good or excellent.

Discussion: Multidisciplinary teams in this simulation study performed in accordance with the American Heart Association Guidelines and the Society for Obstetric Anesthesia and Perinatology Consensus Statement on Cardiac Arrest Management in Pregnancy.[3,4] Despite knowledge gaps among non-anesthesia providers, all teams diagnosed and treated LAST in accordance with the American Society of Regional Anesthesia practice advisory.[5] Teams did not perform manual uterine displacement, suggesting more education is required to optimize maternal and fetal resuscitation and improve outcomes.

References:

1. Int J Obstet Anesth 2011;20:60-3
2. Reg Anesth Pain Med 2012;37:8-15
3. Circulation 2010;122:S829–61
4. Anesth Analg 2014;118:1003–16
5. Reg Anesth Pain Med 2010;35:1

Table: Time taken to perform critical resuscitation tasks

Critical Task	Times		
	Median time	IQR	Range
Obstetric code announced	00:06	00:04-00:07; 00:03	00:01-00:08
Chest compressions started	00:15	00:11-00:15; 00:04	00:05-00:47
LAST considered	04:30	01:47-06:15; 04:28	01:12-08:20
Lipid emulsion requested	04:01	01:34-06:25; 04:51	01:15-08:37
Lipid emulsion started	05:46	03:39-08:18; 04:39	02:59-09:59
Fetus delivered	04:44	04:09-05:13; 01:05	03:08-06:45

Times all in minutes:seconds; IQR=interquartile range.

Abstract #:T-58

The Labor Pain Questionnaire: Reliability, Validity and Responsiveness in Women During Early Labor without Pain Relief

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Introduction: The Labor Pain Questionnaire(LPQ)is the first health-specific multidimensional psychometric instrument developed to measure women's pain experiences during childbirth. This study examined the revised LPQ's reliability, validity, sensitivity to change/responsiveness in women in early labor without pain relief.

Methods: After informed consent, ASA 1-2 laboring women with term fetuses were recruited. Women were fluent in English, >18 years of age, ≤6cm cervical dilatation and contracting ≥3 minutes apart. Women answered the LPQ in mixed or standard item format during 2 test sessions separated by a 20min window. Both sessions were administered by the same trained interviewer. None of the women received pharmacologic pain relief. Pain inducing interventions were minimized. Study duration was 45min-1hour. Concurrently administered pain tools(NRS, verbal pain rating scale (VPRS),Pain Mastery Scale (PMS)) were completed during each session to permit assessment of convergent validity. Changes in pain between tests were rated using the Patient Global Impression of Change Scale(PGICS). Raw scores were transformed to percentage scores to ensure even representation of subscales in LPQ composite/total scale scores. Internal consistency of LPQ/subscale scores was assessed using Cronbach's alpha. Test-retest reliability was assessed in women with no change in pain using ICC. Women with changes in pain were used to assess the sensitivity to change and responsiveness of the LPQ and subscales using the t-statistic(paired-t test),Effect size(ES), Standardized Response Mean(SRM),and Guyatt's Responsiveness Index(RI). LPQ scores for response levels on the PGICS, VPRS and PMS were determined. Sample size estimate for test-retest reliability was 90 women.

Results: 104 women completed the study. LPQ completion took 3-5mins. Cronbach's alphas for LPQ composite and subscale scores were good(0.94 and 0.72-0.94,respectively). 49 women reported no change in pain between tests and were used to assess test-retest reliability for the LPQ and subscales; ICC's were excellent(0.93-0.98, $p<0.001$).

55 women reported changes in pain (43=minimal,12=much worse/much better).Sensitivity to change analyses showed:t-values(df=54),t=-2.4 to 3.0, $p<0.017$ for LPQ composite, Uterine Contraction and Fear/Anxiety Subscales. Birthing, Backpain/LongHaul($p=0.05$)and Enormity of the Pain subscales were not statistically significant.

ES values were 0.29 to 0.46. SRMs were 0.8 to 1.4 and were interpreted as small to moderate based on study-derived ES thresholds. LPQ/subscale scores showed large levels of responsiveness based on RI's(0.84-1.5).Correlations between LPQ and NRS scores during tests were strong($r>0.77$,$p< 0.001$)and moderate between the LPQ and PMS($r>0.57$,$p<0.001$) LPQ and VPRS ($r>0.50$, $p<0.001$) supporting convergent validity of the tool.

Conclusions: The LPQ shows good test-retest reliability and acceptable sensitivity to change/responsiveness during early labor.

Abstract #:T-59

Combined Spinal-Epidural Anesthesia for Vaginal Delivery in a Patient with Takayasu's Arteritis

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Introduction: Takayasu's arteritis is a form of large vessel granulomatous arteritis that results in stenosis and aneurysms of the aorta, its branches, and the pulmonary arteries. It predominantly affects asian females, with onset between 15-30 years.

The course of the disease is generally unaffected by pregnancy, however these patients present unique anesthetic considerations that have thus far only been discussed in a few case reports. Evaluation of the extent of carotid involvement, cardiac function, and baseline blood pressure is necessary, but no consensus exists on the management of pain throughout the peripartum period.

Description: A 27 yo G4P0 Asian female presented to University Hospital at 35 weeks gestation for anesthesia evaluation prior to planned vaginal delivery. She had been followed in the high-risk pregnancy clinic secondary to her severe Takayasu's artertitis; all three of her prior pregnancies had resulted in spontaneous miscarriage.

Her rheumatologist at an outside facility had discontinued her prednisone, as she had not had an acute exacerbation in a few years. Her only current symptom was hip girdle claudication, which was stable. Nevertheless she was pulseless in three out of her four extremities; and non-invasive blood pressure monitoring was only possible on her left leg. The lumen of her infrarenal aorta was narrowed to 7 mm, with normal diameter being 12 +/- 1.6 mm. Additionally she had high grade stenosis of both common iliacs.

Given the risk of congestive heart failure in this disease, a cardiology consult was requested. Her transthoracic echo showed no evidence of heart failure or valvular abnormality, with a left ventricular ejection fraction of 62%.

At 37 weeks gestation, the patient presented in labor with an initial exam showing 3 cm dilation and effacement of 75 %, and a pain score of 6/10. A combined spinal-epidural was performed, with 25 mcg of fentanyl in the spinal and an infusion rate of 6 mL per hour of 0.1% bupivacaine with 3 mcg per mL of fentanyl. This brought her pain score from 10/10 immediately prior to the epidural to 0/10 immediately after. Her blood pressure changed from 145/90 to 125/60. Her baseline blood pressure was 120's/70's.

Her pain remained well controlled throughout her labor, and her systolic blood pressure ranged from the 110's to 150's. To avoid prolonged pushing, she had a vacuum assisted delivery that was devoid of complications.

Discussion: Maintaining hemodynamic stability is the primary goal in these patients. Both hypotension and hypertension are poorly tolerated by both mother and fetus; cerebral and placental bloodflow are often compromised.

By combining an opioid spinal with a low infusion rate of epidural local anesthetic, we met this goal while also providing adequate pain control. Given the lack of consensus on management of this disorder in the peripartum period, this method could be utilized in the future to safely provide analgesia to similar patients

Abstract #:T-60

Transient Loss of Consciousness after Spinal for Cesarean without Hemodynamic or Respiratory Compromise

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Case Report: A 33 year-old woman presented at 37 weeks for elective primary cesarean due to myomectomy four years prior. She had no other medical history. She had no allergies and took only prenatal vitamins. Physical exam showed only an anxious woman with hemodynamic s, complete blood count, electrolytes, within expected values. She was given metoclopramide, ondansetron , and cefazolin. Prior to spinal administration, vitals were recorded as blood pressure of130/80mmHg, heart rate of 90bpm, oxygen saturation of 99% on room air, and normal sinus rhythm. Spinal anesthesia was administered with 1.4mL of 0.75% bupivacaine. The patient was immediately laid supine and vitals measured as blood pressure of 145/58mmHg, heart rate of 110bpm, oxygen saturation of 100% on room air, and sinus tachycardia. After two minutes, we confirmed a T4 level block. The patient then expressed extreme anxiety– within seconds she closed her eyes her head tiled to the left. She was unresponsive to verbal command or taps to her glabella.

An evaluation of her vitals revealed a blood pressure of 157/57mmHg, heart rate of 112 bpm, oxygen saturation of 100% on room air, and a rhythm of sinus tachycardia. A circuit mask applied to her face demonstrated spontaneous tidal volumes of approximately 300mL at a rate of 10 to 12 per minute with a saturation of 100%. No medications were administered. Approximately two minutes after the initial unconsciousness, the patient began to rouse. After her episode of syncope was explained to her, she described hearing about possible intubation, which had been indeed discussed in the immediate moments of her unconsciousness. Other than anxiety and nausea, she did not describe any chest pain, shortness of breath, abdominal pain, or any other symptoms. The patient's entire loss of consciousness lasted approximately three minutes.

When deemed appropriate, the obstetrician continued with the cesarean and a viable male infant was delivered with APGARs of 9. The patient had no difficulties for the duration of the case and remained hemodynamically stable throughout. She was discharged to home four days later, a standard length of stay on the labor and delivery unit, without any further incident during her admission.

Discussion: We can eliminate vasomotor and autonomic aberrations or direct cardiac events in our patient because she remained hemodynamically stable during the entire course of her loss of consciousness. The diagnosis of exclusion is hysterical fainting, which is characterized by the near or complete loss of consciousness, loss of motor tone, tachypnea, and closed eyes, with normal hemodynamics and blood glucose, often in response to an emotionally demanding event.

It is important to quickly consider a diagnosis of hysterical fainting in order to prevent an instinctive action to reverse any hemodynamic instability perceived to be a causative factor in the loss of consciousness.

Abstract #:T-61

Sudden Cardiovascular Collapse in a Pregnant Patient and the Role of ECMO

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Introduction: There are many risk factors for thromboembolism, with pregnancy being one of them (1). This is a case of a patient with multiple thromboembolism risk factors who suffered a massive intraoperative pulmonary embolism (PE) and was successfully resuscitated with extracorporeal membrane oxygenation (ECMO).

Case Report: A 30 year-old G6P2032 at 17 weeks gestational age, with a past medical history significant for melanoma, obesity, and scoliosis, presented with a right femoral neck pathologic fracture. Despite appropriate anticoagulation recommendations, given the risk of immobility and other risk factors, some doses were not administered preoperatively. However, the patient proceeded to the operating room for an open biopsy along with a total hip arthroplasty. One hour after an unremarkable anesthetic induction and within 10 minutes of surgical incision, the patient became profoundly hypotensive and tachycardic, unresponsive to fluid and phenylephrine boluses. It was recognized that the patient was likely suffering from a PE; the operation was aborted and cardiopulmonary resuscitation (CPR) was commenced. Invasive monitoring was placed, including a transesophageal echocardiogram (TEE) probe, demonstrating a grossly dilated right ventricle, saddle pulmonary embolism, and hyperdynamic left ventricle. Meanwhile, given the acuity and direness, it was determined that ECMO would be most appropriate, and less than an hour after initiation of CPR, ECMO cannulation was inserted.

Upon arrival to the intensive care unit, Return of Spontaneous Circulation Protocol was initiated. The next day, the patient suffered termination of her pregnancy. However, on postoperative day (POD) #7, the patient's cardiopulmonary status improved to the point of ECMO decannulation. On POD #14, the patient was extubated, and on POD #37, the patient was discharged to a rehabilitation center, with near resolution of both cardiopulmonary and neurologic function. Three months after the operation, echocardiogram showed normal biventricular systolic function, with a right ventricular systolic pressure of 29 mmHg.

Discussion: This case aims to illustrate the risk factors for PE along with appropriate CPR status post PE with ECMO being a viable option. This patient possessed a number of thromboembolic risk factors, including pregnancy, obesity, immobility, and malignancy. Due to the drastic hemodynamic collapse, it was recognized that the patient was likely developing cardiogenic shock as a result of a PE. As such, CPR was quickly initiated, and the appropriate personnel were called for possible ECMO cannulation. Studies have demonstrated that CPR performed in the operating room by anesthesiologists yield some of the highest resuscitation success rates (2). ECMO is a viable rescue therapy in those suffering from acute cardiopulmonary failure.

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2. Pembeci K, et al. Resuscitation 2006; 68(2):221-29.

Abstract #:T-62

Acquiring Fiberoptic Skills in the Novice

Presenting Author: Raymond Glassenberg M.D.
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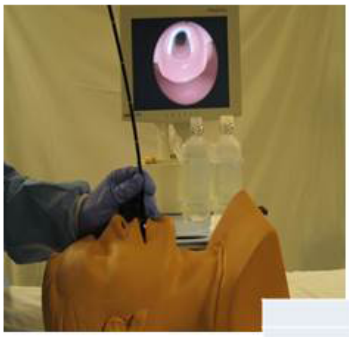
Introduction: Failed intubation occurs in the parturient at a rate of 1/250. The Accreditation Council for Graduate Medical Education (ACGME) reports that residents D.O. 469 rigid laryngoscopies and only 33 flexible fiberoptics over the course of their training, all in the supine position. Parturients in respiratory distress compensate for the physiologic changes of pregnancy by sitting upright. Following topicalization with nebulized lidocaine, they can be intubated by facing the patient. We tested a program to improve the fiberoptic intubation skills in both the supine and upright position.

Methods: 40 medical students were enrolled. They completed 10 virtual reality intubations using the smart phone app, iLarynx oriented in either the supine or upright position. They then performed 20 intubations on a mannequin randomly oriented to either position. Time to carina was recorded by a research nurse unaware of training assignment. Students were re-tested a week later to measure the effect of practice with the app on their retention skills.

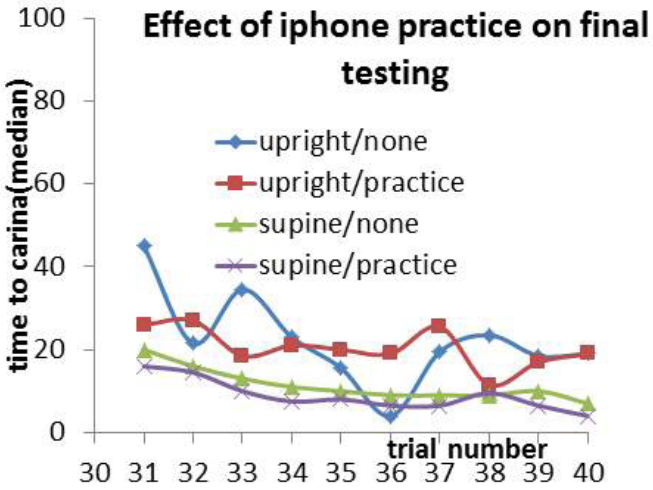
Results and Discussion: Learning curves showed that the upright position is definitely harder to master. Practice with a smart phone improved upright performance from 45 to 26 secs. It does not improve supine skills.

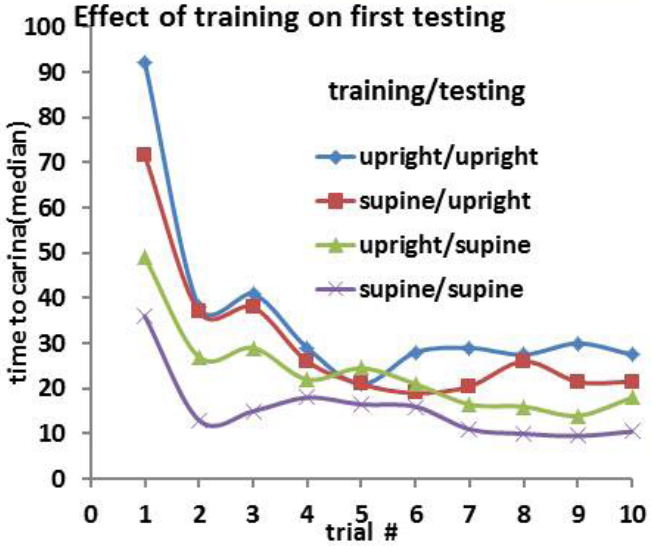
Reference:

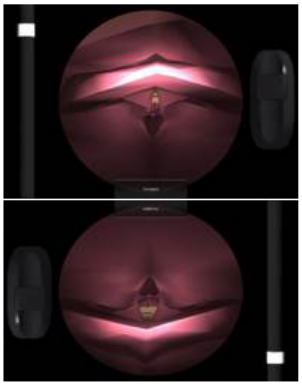
Anaesthesia. 2013 Oct;68(10):1053-8. doi: 10.1111/anae.12379. Epub 2013 Aug 19.

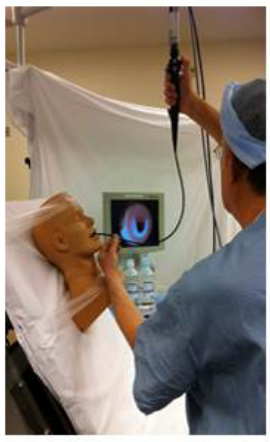


		training supine	training upright
testing	supine	36 secs	49 secs
testing	upright	72 secs	92 secs









Abstract #:T-63

More than meets the eye? Anesthetic management of a parturient with PHACE syndrome for cesarean delivery

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Introduction: An association between cervicofacial hemangioma and intracranial arterial abnormalities was first described by Pascual-Castroviejo in 1978. This association was thereafter coined 'PHACE syndrome' by Frieden in 1996. Features include posterior fossa malformations, hemangiomas, arterial anomalies, coarctation of the aorta and cardiac defects, and eye abnormalities. A paucity of data exists in the literature regarding the anesthetic management of these patients,especially in the parturient.

Case presentation: A 25-year-old nulliparous woman at 39 2/7 weeks of gestation presented to our labor and delivery unit for scheduled elective primary cesarean delivery. Her pregnancy had been uncomplicated. Past medical history was significant for moyamoya disease (MM.D.) which was diagnosed at age 19 following a 4 month episode of recurrent headaches, nausea, vomiting and blurred vision. Surgical history was significant for 27 facial reconstructive surgeries due to infantile hemangiomas, including laser ablation of subglottic and epiglottic hemangiomas as well as tracheostomy. Although assisted vaginal delivery was offered to the patient, she ultimately decided to proceed with elective cesarean delivery. Upon anesthesia consultation she was alert, cooperative, and neurologically intact. Further history elicited intermittent dysphagia attributed to her prior epiglottic procedures, although she denied history of aspiration or recurrent pneumonia. Airway exam revealed a Mallampati II which improved to I with phonation, small mouth opening, normal thyromental distance, normal tongue, ability to prognath, and full range of neck motion. Scarring was present over the lower lip, right mandible, chin, and neck; tracheostomy scar was also visible.

On the day of surgery, an epidural was placed, and following placement of a radial arterial line, her epidural was slowly dosed with a total of 15mL alkalinized 2% lidocaine . Hemodynamic stability was achieved with 1800 mL of Lactated ringers and a total of 350 mcg of phenylephrine. The patient remained cooperative and comfortable throughout the perioperative period and did not require intravenous sedation. Both mother and baby did well and were discharged home on postoperative day 3.

Discussion: PHACE syndrome is a diagnosis which is likely under-recognized in the general population. Clinical implications are important for the anesthesiologist, and include the determination of candidacy for neuraxial techniques, potential for difficult airway, understanding of hemodynamic goals in light of neurovascular disease, cardiovascular concerns, and recognition of endocrine abnormalities. Appropriate evaluation of syndrome features should be performed, and these findings should guide the management of these patients.

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Metry D et al. Pediatrics 2009 Nov;124(5):1447-56

Leffert LR et al. Anesthesiology 2013 Sept;119(3):703-18

Abstract #:T-64

A double blind randomized controlled trial of a prophylactic phenylephrine infusion versus bolus phenylephrine for the treatment of spinal induced hypotension in obese parturients

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Introduction: Hypotension is the most common complication of spinal anesthesia for cesarean delivery (CD).1 It is associated with maternal nausea, vomiting, and fetal acidosis.1 All previous research regarding the use of phenylephrine (PE) has excluded obese subjects. Our objective was to compare the incidence of intraoperative nausea and vomiting (IONV) in obese patients who receive a prophylactic PE infusion versus those who receive PE boluses for the treatment of spinal induced hypotension.

Methods: This study was a multi-centre, double blinded randomized controlled trial. With institutional REB approval and written informed consent, healthy, non-laboring obese (BMI>35) women, singleton gestation, ≥36 weeks undergoing elective CD were recruited. Participants were randomized to receive PE prophylactic infusion (50mcg/min) or a PE bolus (100mcg) to treat hypotension. A standard spinal technique (12mg hyperbaric 0.75% bupivacaine 15mcg, fentanyl, 150mcg morphine) was performed. Maternal systolic blood pressure (SBP) was maintained within 20% of baseline using a predetermined algorithm. The incidence of IONV and postoperative nausea and vomiting (PONV), need for rescue antiemetics and incidence of hypotension were compared between groups.

Results: Analysis included 160 parturients. The mean BMI of participants was 41 ± 4 kg/m2. There was no difference in group demographics (Table 1). The incidence of intraoperative nausea (ION) was significantly greater in the bolus group compared to the infusion group ($p < 0.001$) without any difference in intraoperative vomiting (IOV). This was associated with a significantly greater need for intraoperative rescue antiemetic in bolus participants ($p=0.04$). The incidence of postoperative vomiting (POV) was greater in the bolus group ($p=0.02$), however there were no differences in the incidence or severity of postoperative nausea (PON) or need for antiemetic. The infusion group had a significantly lower incidence of hypotension but greater incidence of hypertension (>20% SBP above baseline). There were no differences in umbilical cord pH between the groups.

Discussion: In obese women having a cesarean delivery with spinal anesthesia a prophylactic phenylephrine infusion leads to less ION requiring intervention. Infusions of phenylephrine in obese women may also lead to less POV.

References

1. BJA 2006;96:95-9.

Abstract #:T-64

	Infusion (n=81)	Bolus (n=79)	p-value
Age (year)	31 ± 5	32 ± 6	0.09
BMI (kg/m^2)	40.8 ± 4.2	41.1 ± 4.5	0.72
Gravidity / Parity	3 ± 1 / 1 ± 1	3 ± 2 / 1 ± 1	0.92 / 0.74
Baseline SBP (mmHg)	122 ± 11	124 ± 11	0.43
Block Height	T4 [T3-4]	T4 [T3-4]	0.791
Hypertension	36 (44)	17 (21)	0.002
Bradycardia (HR <50 bpm)	9 (11)	3 (4)	0.08
Pre/Post-delivery Hypotension	22 (27) / 6 (7)	59 (75) / 34 (43)	< 0.001
ION	37 (46)	59 (75)	< 0.001
IOV	8 (10)	15 (19)	0.11
Intraoperative Rescue Antiemetic	21 (26)	33 (42)	0.04
PON	26 (32)	29 (37)	0.55
POV	9 (11)	20 (25)	0.02
Postoperative Rescue Antiemetic	15 (19)	20 (25)	0.31

Data: mean ± SD, n(%), median [range]

Abstract #:T-65

Pain and analgesia during labor and delivery between 16 and 22 and 6/7 weeks gestational age: A retrospective chart review

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Background: Little is known about the severity of pain and its management during induction of labor at pre-viable estimated gestational ages (EGA), which can make counseling patients about analgesia options difficult. No data currently exist comparing neuraxial analgesia to systemic opioid analgesia in this clinical setting. Our objective in this study was to describe severity of pain during labor at pre-viable EGA and to determine the effectiveness of various methods of analgesia in this population.

Methods: In this IRB-approved study, we performed a retrospective chart review of all patients who underwent induction or augmentation of labor between 16w0d and 22w6d at the University of Chicago from 2011-2013. We noted demographic data, EGA, fetal weight, induction and delivery characteristics, and pain scores. Analgesia method (none, systemic or neuraxial) was recorded. We compared relevant patient characteristics to analgesia method and compared pain scores between methods using the Mann Whitney U test.

Results: Of eighty patients who met inclusion criteria, 4 requested no analgesia and 56 used systemic analgesia only (Group NONE-SYS, n=60); 11 patients used systemic analgesia initially and then requested neuraxial analgesia, and 9 used neuraxial only (Group NEUR, n=20). Median (IQR) age was 29 (23-35) and was not different between groups. Patients who chose neuraxial analgesia had higher EGA, fetal weight, and admission to delivery time intervals than those who chose no or systemic analgesia (Table and Figure). The median peak pain score for all patients was 7 (5–10) and not different between groups; nor did it vary by EGA or fetal weight. Immediate pre-analgesia peak pain scores were not different between groups, but patients who received neuraxial analgesia had lower immediate post-analgesia nadir scores than those who chose systemic pain relief.

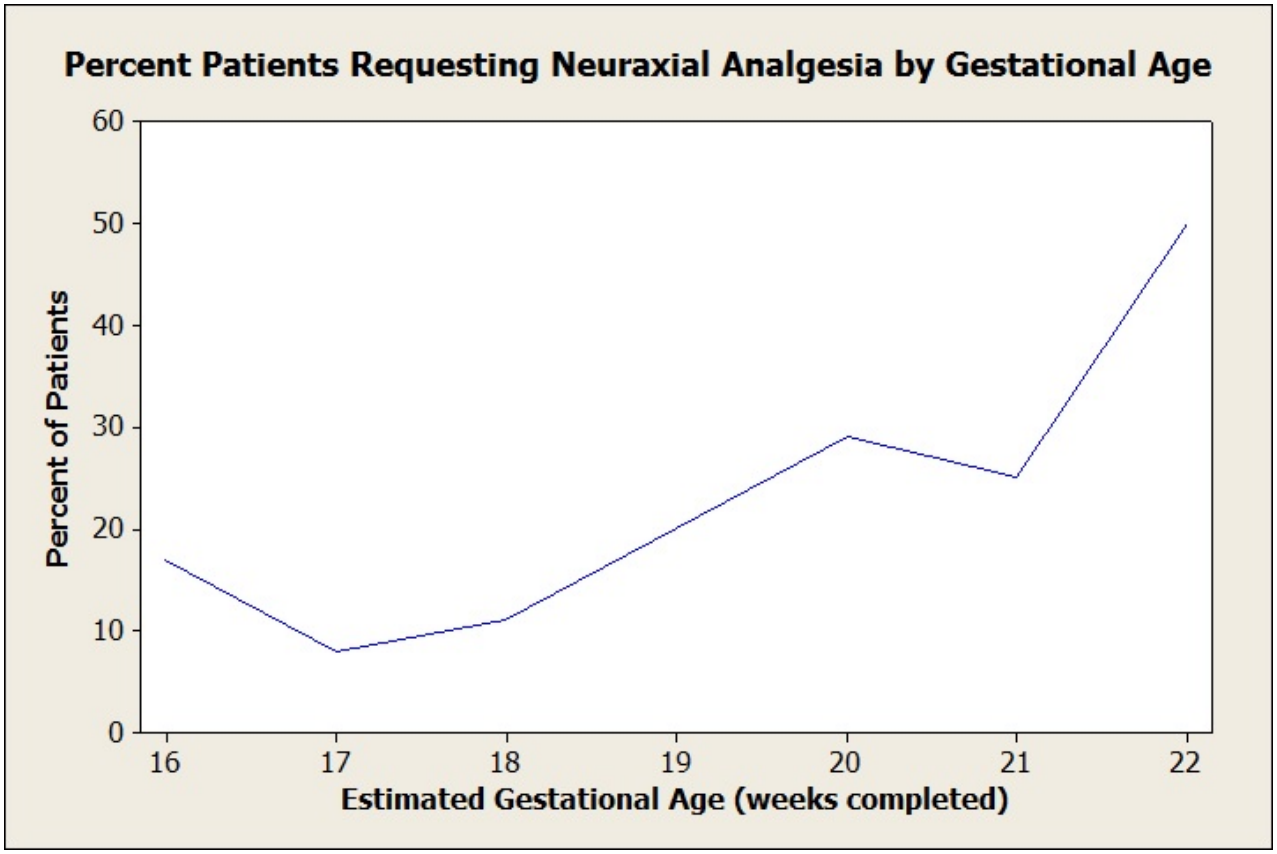
Conclusion: Induction of labor at pre-viable gestational age is associated with significant pain that often requires systemic opioids or neuraxial analgesia. Neuraxial analgesia may provide more optimal pain relief for patients with higher EGA and fetal weight, and longer labors, particularly after 22 weeks EGA.

Abstract #:T-65

Table 1

	NONE-SYS	NEUR
EGA (wk)	20 (18-21)	21 (19.25-22)*
Fetal weight (gm)	268 (183-358)	362 (250-453)*
Admission-Delivery time (hr)	10.25 (6.5-17.75)	19.25 (11.25-26)*
Peak pain score overall (NRS)	8 (5-9)	6 (5-9)
Immediate pre-analgesia peak pain score (NRS)	5 (2-8)	6 (0-7)
Immediate post-analgesia nadir pain score (NRS)	1 (0-4)	0 (0-1)**

Data expressed as median (IQR)
*$P < 0.05$ NEUR vs NONE-SYS
**$P < 0.05$ NEUR vs SYS



Abstract #:T-66

Retrospective study examining patient characteristics of women diagnosed with maternal sepsis, severe sepsis and septic shock

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Introduction: Sepsis is a leading cause of maternal death in the US and the UK (1, 2). However, there has been limited examination of maternal characteristics of women diagnosed with sepsis, severe sepsis and septic shock. Our primary aim was to describe patient characteristics and microbiological findings of hospitalized women diagnosed with maternal sepsis, severe sepsis or septic shock in a single tertiary obstetric center.

Methods and Materials: After gaining IRB approval we identified women with ICD-9 codes for sepsis, severe sepsis and septic shock who were admitted to a single tertiary obstetric center over a 7-year period (2007–2013). The diagnosis of sepsis, severe sepsis and septic shock was confirmed using criteria defined at the International Sepsis Definitions Conference (ISDC) (3). Based on medical chart review we abstracted demographic, obstetric and pathological data for women who met ISDC criteria for a clinical diagnosis of sepsis, severe sepsis or septic shock. Data are presented as number (%), mean (SD) and median [IQR].

Results: After reviewing medical records of women with ICD-9 codes for septic morbidities, 35 women met criteria for sepsis, severe sepsis or septic shock. Over the study period, the rates of sepsis, severe sepsis and septic shock were 69, 19 and 22 per 100,000 deliveries respectively. Demographic, obstetric and microbiological data are presented in Table 1. The majority of women presented with a septic diagnosis after cesarean delivery, with the genital tract identified as the most common infection source. A pre-existing medical illness or obstetric disease was common among women with a septic diagnosis. Fifty percent of women with sepsis and severe sepsis had negative microbiological cultures.

Discussion: In our study, the genital tract was the most common site of infection, which is consistent with national and international data (2). However, many patients with sepsis and severe sepsis did not have a confirmed infectious agent. Data from this study suggest that the prevalence of sepsis may be highest among postpartum women who deliver by cesarean with a medical and/or obstetric comorbidity. Surveillance studies are needed to confirm these findings and to identify risk factors for maternal sepsis before and after delivery.

References:

1. www.npeu.ox.ac.uk/mbrrace-uk
2. Obstet Gynecol 2015;125:5–12
3. Crit Care Med 2003;31:1250-1256

Abstract #:T-66

Table 1A: Maternal Demographics

Maternal age (years)	29 (7)
Weight (kg)	80 (19)
Gravida	2 [1-3]
Parity	1 [0-2]
Race:	
Hispanic	18 (51%)
Caucasian	7 (20%)
Pacific-Islander	4 (11%)
African-American	3 (9%)
Asian and Indian	3 (9%)
Pre-existing medical illness:	
Obesity (BMI > 30)	15 (43%)
None	13 (37%)
Diabetes mellitus	5 (14%)
Other	4 (11%)
Hypertension	3 (9%)
Congestive heart disease	2 (6%)
Renal or liver failure	2 (6%)
Obstetric-related disease:	
None	16 (46%)
GDM	11 (31%)
Pre-eclampsia	7 (20%)
HELLP	2 (6%)
Fatty liver or cholestasis	2 (6%)

Data presented as: number (%), mean (standard deviation), median [interquartile range]
GDM = gestational diabetes mellitus; BMI = body mass index; HELLP = hemolysis, elevated liver enzymes, low platelets

Table 1B: Sepsis-related Data

	Sepsis (n=22)	Severe Sepsis (n=6)	Septic Shock (n=7)
Diagnosis:			
Antepartum	4 (18%)	0	0
Postpartum	18 (82%)	6 (100%)	7 (100%)
Postpartum (days)	1 [1-6]	18 [1-29]	3 [1-5]+
Delivery mode:			
Vaginal	6 (27%)	2 (33%)	2 (29%)
Cesarean	12 (55%)	4 (67%)	5 (71%)
None	4 (18%)	0	0
Infection source*:			
Genital tract	15 (68%)	4 (67%)	2 (29%)
Respiratory	6 (27%)	1 (17%)	5 (71%)
Urine	4 (18%)	1 (17%)	0
Blood	2 (9%)	0	0
Central nervous system	2 (9%)	1 (17%)	1 (14%)
Unknown	2 (9%)	0	1 (14%)
Culture result:			
Negative	11 (50%)	3 (50%)	1 (14%)
Escherichia coli	6 (27%)	0	3 (43%)
Staph aureus	2 (9%)	0	1 (14%)
Influenza (H1N1)	1 (5%)	0	2 (29%)
Group B streptococcus	1 (5%)	1 (17%)	0
Staph Lugdunensis	0	1 (17%)	0
Candida	0	1 (17%)	0
Enterobacter	1 (5%)	0	0

Data presented as: number (%), median [interquartile range]
* Data totals >100% due to patients with >1 source; + Data missing for 1 patient

Abstract #:T-67

Perioperative management of a parturient undergoing discectomy for cauda equina syndrome

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Cauda equina syndrome (CES) is a neurologic condition in which damage to the spinal nerve roots below the Conus medullaris causes various degrees of sensory or motor nerve dysfunction. CES is a neurologic emergency that requires immediate surgical decompression of the spinal canal to avoid permanent deficits. Here, we describe the perioperative management of a 40 year old parturient at 24 wks EGA requiring emergency surgical decompression to relieve CES caused by an L5/S1 disk extrusion.

The patient presented to the emergency department with acute onset of bilateral leg and lower back pain, urinary retention, saddle anesthesia, and lack of rectal tone. MRI revealed a large disc extrusion with significant spinal canal compromise at the L5/S1 level. Given the presentation, the decision was made to proceed with emergent surgical decompression. Following a multidisciplinary family meeting, the plan was made to monitor fetal heart rate tracings (FHTs) throughout the operation. In the unlikely event of a nonreassuring FHT, the care team would undertake efforts to improve maternal hemodynamics and in turn fetal status, such as subtly changing the patient's position, or elevating her blood pressure with vasoactive medications. If these maneuvers failed, it was the explicit desire of the patient and her family not to proceed to an emergency cesarean delivery to resuscitate the fetus.

The patient was taken to the operating room and placed supine with left uterine displacement. Induction of general anesthesia and intubation were uneventful. The patient was placed in a prone position on a Jackson table, avoiding abdominal compression, and FHT monitoring was re-initiated. For this purpose, an obstetric nurse was sitting under the operating room table applying the FHT monitor manually to the abdomen of the patient throughout the surgery. The surgeons performed posterior partial laminectomies of L5 and S1 levels and a posterior discectomy of the L5/S1 disc. During the uneventful three-hour intraoperative course, anesthesia was maintained with desflurane and intermittent intravenous boluses of fentanyl, as well as an infusion of phenylephrine. Throughout, the FHT remained stable between 130 and 140/min.

A follow-up visit with her surgeon two weeks post-operatively revealed complete resolution of leg pain and autonomic dysfunction, while her sensory deficit at the S1 dermatome persisted. A follow up visit with her obstetrician at 26 wks EGA showed a vital and healthy-appearing fetus.

While multiple case reports describe emergency cesarean delivery followed by laminectomy in cases of CES during the 3rd trimester, to our knowledge this is the first reported case of continuous FHT monitoring for potential intrauterine resuscitation during lumbar discectomy. Based on this experience, we recommend considering continuous monitoring of the fetal heart rate, as it can alert the care team of fetal distress and allow early intervention by optimizing maternal status.

Abstract #:T-68

The influence of obesity on post dural puncture headache following dural puncture with a Tuohy needle

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Background: Existing studies have yielded conflicting evidence as to whether obese patients have a lower incidence of post dural puncture headache (PDPH) after dural puncture compared to non-obese patients. We therefore performed this study to assess whether the risk of PDPH varies according to body mass index (BMI).

Methods: We retrospectively reviewed our PDPH database between 1996 and 2014. This database contains prospectively collected data on parturients who experienced an inadvertent or intentional dural puncture with a Tuohy needle or developed PDPH. We searched for patients who had an obvious dural puncture as defined by witnessed CSF return through the needle or catheter during an epidural, combined spinal epidural, or continuous spinal placement using a 17 or 18 G Tuohy needle. Parturients were categorized into four groups according to BMI (kg/m2) (Non-Obese: BMI <30; Obese: BMI 30-39.9; Morbidly Obese: BMI 40-49.9; and Super Obese: BMI ≥50). The incidence (primary end point), severity (0-10 scale), and duration of PDPH, as well as the performance of a therapeutic epidural blood patch (EBP), were compared between these groups. Chi square, Wilcoxon rand sum, and Fisher exact tests were used for statistical analysis. Multivariate analysis was conducted to control for potential confounders.

Results: 190 patients were included in the analysis. Results are summarized in the table. The incidence of PDPH did not significantly differ between the four BMI groups (P=0.053). When controlling for spinal catheters and delivery by cesarean, cesarean delivery was a significant predictor of less PDPH (P=0.02) whereas BMI grade and spinal catheters were not significant predictors of PDPH (P=0.2 and 0.4 respectively). The severity of headache (maximum pain score) was significantly different between the groups, with the pairwise comparisons showing lower scores in those with BMI≥50 compared to other groups. There was no difference among the groups in duration of headache or performance of an EBP.

Conclusion: While our analysis did not show an overall statistically significant difference among the groups in the incidence of PDPH, the incidence appeared lower in those with BMI≥50. The severity of headache was also lower in this group of patients. Delivery by cesarean was protective against PDPH. This may explain the lower incidence in super obese patients who underwent more cesareans, which may be due to a lack of pushing during the second stage of labor.

	BMI< 30 kg/m^2 (n=75)	BMI 30-39.9 kg/m^2 (n=62)	BMI 40-49.9 kg/m^2 (n=29)	BMI≥50 kg/m^2 (n=24)	P-value
Age (yrs)	28.1 ± 6.3	29.4 ± 7.3	26.8 ± 5.8	30.9 ± 5.1	0.08
Height (cm)	163.1 ± 6.9	161.3 ± 7.8	162.1 ± 9.9	165.9 ± 6.8	0.09
Weight (kg)	68.1 ± 8.9	87.4 ± 12.3	116.1 ± 17.7	165.0 ± 25.7	<0.0001
BMI (kg/m^2)	25.6 ± 2.8	33.5 ± 3.1	43.9 ± 2.8	60.0 ± 9.8	<0.0001
Spinal catheter	50 (67%)	46 (74%)	26 (90%)	20 (83%)	0.07
Cosyntropin	16 (21%)	13 (21%)	4 (14%)	4 (17%)	0.8
Cesarean delivery	19 (25%)	22 (36%)	15 (52%)	18 (75%)	<0.0001
Post dural puncture headache	53 (71%)	44 (71%)	23 (79%)	11 (46%)	0.054
Maximum headache severity	5 (0, 9)	6 (0, 8)	7 (3, 10)	0 (0, 2)	0.047
Number of headache days	2 (0, 3)	2 (0, 3)	2 (1, 3)	0 (0, 6)	0.137
Epidural blood patch placement	30 (40%)	21 (34%)	9 (31%)	4 (17%)	0.209

Data are mean ± SD, median (IQR), or number (%).

Abstract #:T-69

Goal Directed Therapy in a Parturient with Double Outlet Right Ventricle for a Vaginal Delivery

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Double outlet right ventricle (DORV) is a rare congenital heart disease accounting for less than 1% of congenital heart defects. It is even rarer to encounter a patient without palliative surgical procedure in the obstetric population. We report successful management of a parturient with DORV during vaginal delivery.

A 30 year old G3P1101 with a DORV and mild pulmonary stenosis had induction of labor at 33(6/7) weeks due to headaches, vomiting, epigastric pain and increasing transaminases. Two previous vaginal deliveries were uncomplicated. Magnetic resonance imaging (MRI) of the chest showed dextrocardia with situs ambiguous, inversion of the origin and position of aorta and pulmonary artery, mild pulmonary stenosis, a large subaortic VSD with left to right shunt (L to R). Flow calculations on MRI showed a pulmonary to systemic blood flow ratio (Qp:Qs) of 2.5. Her SpO2 was 80% on room air.

A multidisciplinary team of MFM, obstetrics, obstetric and cardiovascular anesthesiology and adult congenital heart disease experts managed the peripartum patient care. A right radial arterial catheter was placed and connected to a pulse contour cardiac output monitoring device. The left Internal Jugular vein was cannulated with an oximetric catheter and the central venous oxygen saturation (ScvO2) was monitored. Oxygen delivery was titrated with an air-oxygen blender via a nasal cannula to avoid pulmonary vasodilation. A combined spinal-epidural (CSE) was performed for labor analgesia. Intrathecal narcotics alone were used during early first stage of labor. Analgesia during the late first stage was achieved with an epidural infusion of 0.125% bupivacaine with 2 mcg/ml of fentanyl. An intravenous phenylephrine infusion was titrated to maintain blood pressure at baseline to counteract the sympathectomy from the epidural infusion.

A male neonate was delivered and estimated blood loss was 900 ml. The ScvO2 decreased from a baseline of 83 to 76%, concurrent with the decreased cardiac output (CO). An appropriate response of increased ScvO2 and CO was seen with transfusion of packed red blood cells (PRBCs).

The successful management of this complicated patient warranted the collaborative efforts of a multi-disciplinary team. The consensus goals were 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. The oxygen supplementation was used cautiously in this patient as pulmonary vasodilation could worsen the L to R shunt decreasing systemic circulation and the utero-placental blood flow. Good outcome was achieved with the judicious use of CSE. Real time hemodynamic monitoring with pulse contour cardiac output and ScvO2 guided the therapy. We were able to provide early intervention via careful titration of IV fluids, vasoactive agents, cautious supplemental oxygen and PRBCs.

Reference:

E Lockhart et al;Anesthesiology 1999;90(1213-5)

Abstract #:T-70 & O1-06

Use of Real Time Transthoracic Echocardiography during Cesarean Delivery for Early Detection and Reversal of Shunt Flow across an Atrial Septal Defect in a Parturient with Severe Pulmonary Arterial Hypertension

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Pulmonary arterial hypertension (PAH) during pregnancy is associated with increased morbidity and mortality. We report the successful management of cesarean delivery (CD) in a patient with severe PAH with real time transthoracic echocardiography (TTE) and central venous oxygen saturation (ScvO2) and using timely targeted treatments. These tools aided in early detection and treatment of cardiovascular collapse in an awake patient under regional anesthesia.

A 35 year old G2P1001 with an uncorrected atrial septal defect (ASD) of 2.7 cm with a left to right shunt (L to R) leading to severe PAH was scheduled for an elective cesarean delivery at 35(5/7) weeks due to worsening dyspnea. The estimated pulmonary arterial systolic pressure (PASP) was 120 mmHg on TTE. Her therapeutic regimen consisted of intravenous epoprostenol and oral sildenafil, digoxin and furosemide. A multidisciplinary team of MFM, obstetrics, obstetric and cardiovascular anesthesiology, cardiology and pulmonology experts was involved in patient care. The anesthetic plan included lumbar epidural catheter placement for surgical anesthesia with invasive monitoring of arterial blood pressure, an oximetric central venous catheter to monitor ScvO2 and real-time TTE and pulse contour cardiac output monitoring.

The preoperative echo showed severe right ventricle (RV) dilation with severely reduced RV global systolic function. There was mild to moderate tricuspid regurgitation and right ventricular hypertrophy. The epidural was dosed with fractionated doses of 2% lidocaine and sodium bicarbonate without epinephrine. The patient was started on a low-dose phenylephrine infusion; titrated to maintain the blood pressure prior to delivery of the fetus. The initiation of surgical anesthesia was tolerated well; however after delivery of the fetus and placenta and an estimated acute blood loss of 1000 ml resulted in severe hypotension. TTE showed a very small LV with a large dominating RV with reversal of shunt flow across the ASD. This was promptly treated with 250 ml of 5% albumin. The phenylephrine infusion was substituted with low dose vasopressin and norepinephrine infusions to maintain the blood pressure after delivery. A healthy infant was born with Apgar score of 9 and 9.

Induction of anesthesia can be a vulnerable time due to changes in vascular tone and filling pressures. A carefully titrated epidural anesthesia induction proved invaluable in successful management of this patient. Intraoperative TTE allowed early detection of shunt flow reversal across the ASD. Early treatment resulted in prompt resolution of hypotension and an improved LV filling. The shunt flow returned to baseline L to R and systemic blood pressures normalized. We demonstrate a unique application of real-time intraoperative TTE in detecting and preventing acute cardiovascular collapse in this complex parturient with severe PAH during CD.

Reference:

Best Practice & Research Clinical Obstetrics and Gynaecology;28(2014)579-591

Abstract #:T-71

A Multidisciplinary Care Pathway for the Evaluation of Postpartum Headache

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Introduction: Anesthesiologists play an important role in the diagnosis and management of postpartum headaches. While the cause of headache may seem obvious in the setting of a dural puncture, there are other serious etiologies of postpartum headache. We present two cases of cerebral venous sinus thrombosis that have initiated the development of a multidisciplinary care pathway in the evaluation of postpartum headache at our institution.

Case Report: A 29 year-old G1 at term received an epidural for labor analgesia complicated by a dural puncture. The epidural was successfully placed on the second attempt and provided analgesia for an uncomplicated spontaneous vaginal delivery.

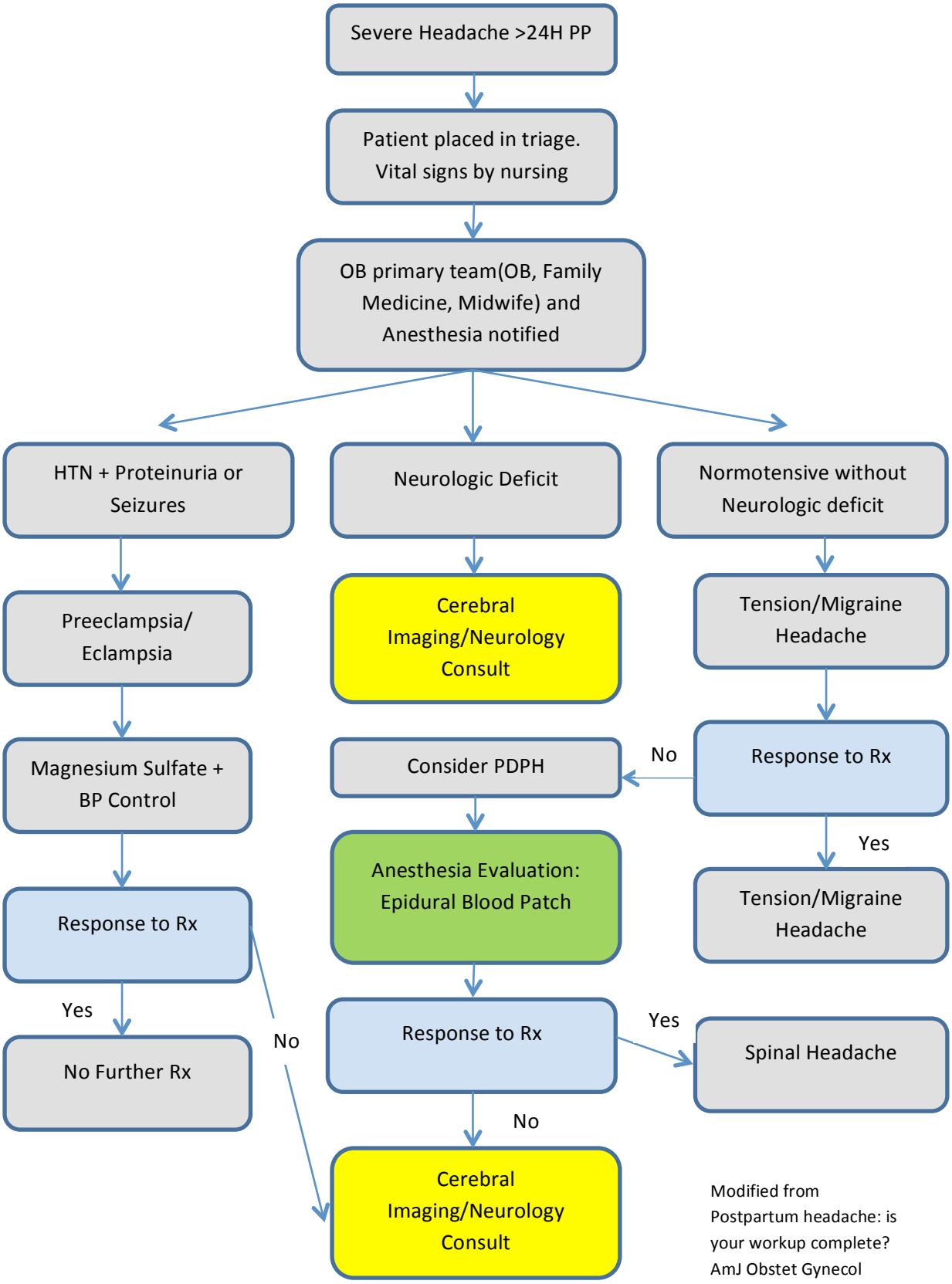
The patient developed a postural frontal headache, and an epidural blood patch (EBP) was performed on postpartum day (PPD) 1. She had complete resolution of her symptoms and was discharged home. She returned on PPD 4 with the same PDPH symptoms and was offered a repeat EBP, but the patient elected for conservative management.

She returned on PPD 8 with a 10/10 frontal headache and neck pain not relieved by laying supine. This prompted a CT scan of the head which showed an area of SAH. A MRI/MRV was then obtained, revealing a thrombus in the superior sagittal sinus.

The following week, a 24 year old G1 at term also received a labor epidural complicated by a dural puncture. She received an epidural blood patch on PPD 1 and immediate relief was noted. Her headache returned, and on PPD 3 neurology was consulted. An MRI/MRV was obtained based on their recommendation which showed a thrombus in the posterior sagittal sinus and parasagittal cortical veins. Both patients made a full recovery after starting anticoagulation.

Discussion: Postpartum headache has an incidence of almost 40% among all parturients. While typically benign, these two cases illustrate that there are serious etiologies of postpartum headache that must be evaluated fully. These two patients eventually received imaging and further neurology consultation, but the events leading to these decisions were different in each case. We realized our peripartum caregivers had no formal guidelines to evaluate postpartum headache, which led to the development of a care pathway for the evaluation of postpartum headache. The care pathway modifies an existing pathway available in the literature, and continues to be modified with input from all of our peripartum caregivers.

Abstract #:T-71



Modified from
Postpartum headache: is your workup complete?
AmJ Obstet Gynecol
2007;196:318.e1-318.e7

Abstract #:T-72

The Effect of Large Dose Oxytocin Infusion on Blood Pressure

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Introduction: Routinely used to minimize bleeding as an uterotonic, oxytocin has important adverse cardiovascular effects. Rosseland et al.1 reported a decrease of 28 mmHg after an IV bolus of 5 U oxytocin. However, when given as an infusion at 30 U/hr, Kim et al.2 noted no significant blood pressure (BP) changes. Because high dose oxytocin (80 U/hr) is the standard protocol at University of Alabama-Birmingham (UAB), we examined whether this infusion rate would affect maternal hemodynamics.

Methods: We conducted a retrospective review of patients scheduled for elective Cesarean sections with spinal anesthesia from November 2008 through June 2010 at UAB. Hypertensive disorders of pregnancy were excluded. To avoid confounding effects, we included patients who did not receive ephedrine or phenylephrine within 10 minutes prior and 10 minutes after the start of the oxytocin infusion (80U in 500 mL at 500 ml/hr). The following data: Systolic, mean, diastolic BP and body mass index (BMI) were extracted. Our sample size calculation indicated at least 119 patients were needed to detect a 5 mm Hg BP difference (SD 15 mmHg, alpha = 0.05, power = 0.95). A paired t-test determined whether observed changes in BP were significantly different from a hypothesized zero change.

Results: 294 patients fit our inclusion criteria. We observed statistically ($p > 0.001$) and clinically meaningful reductions in mean and diastolic BP (mean BP:-3.2±10.1 mmHg, diastolic BP: - 6.5±14.3 mmHg). The effect of oxytocin is a significant increase in pulse pressure by 7.9 mmHg with 25% of women experiencing an 17 mmHg or greater decrease in diastolic BP (95% CI: -7.8 mmHg, -4.5 mmHg), and a 10 mmHg or greater reduction in mean arterial BP (95% CI: -4.0 mmHg, -1.6 mmHg), as illustrated in Table 1. We observed no significant correlation of BMI and the degree of BP decrease.

Conclusion: Oxytocin, when administered at 80 U/hr, reduces BP significantly. Certain populations may poorly tolerate these physiologic alterations; examples are patients who experienced significant blood loss or those with cardiovascular diseases. This subset may benefit from a lower oxytocin concentration.

References:

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2. Kim TS, et al. Hemodynamic effects of cont. IV injection and bolus plus cont. IV injection of oxytocin in cesarean section. Kor J Anes. 2011;61:482-7

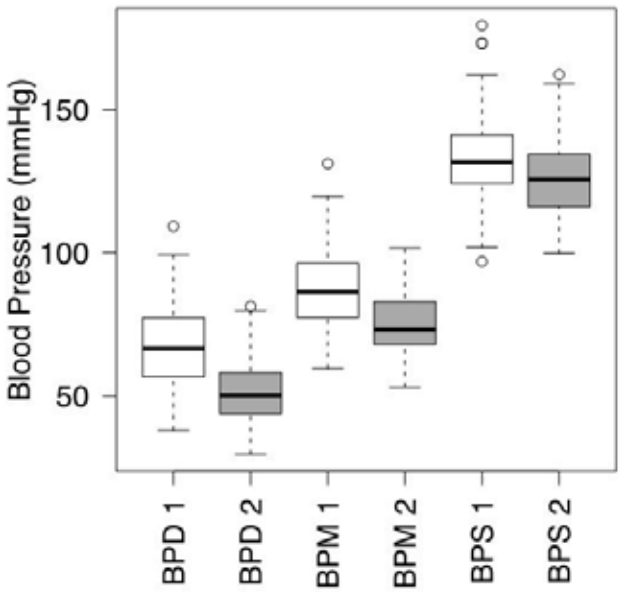

Table 1:

Paired boxplots for the subset of patients in the lower 25th percentile of diastolic blood pressure reduction.

BPD1...diastolic BP before oxytocin,
BPD2...diastolic BP after oxytocin,
BPM1...mean BP before oxytocin,
BPM2...mean BP after oxytocin,
SBP1...systolic BP before oxytocin,
SBP2...systolic BP before oxytocin.

Abstract #:T-73

Pulmonary vasodilators in the anesthetic management of a parturient with severe pulmonary hypertension for forceps-assisted vaginal delivery

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Pulmonary hypertension (PHTN) in pregnancy is associated with significant maternal morbidity and mortality. While no consensus statement regarding mode of delivery exists, cesarean section under general anesthesia (GA) is often performed to avoid cardiopulmonary failure during vaginal delivery, but this carries significant maternal risk(1). Vaginal delivery has been reported less frequently but may offer a safer alternative in the presence of vasodilator-responsive PHTN(2,3).

A 35 year-old G1P0 woman with idiopathic PHTN and a history of syncope related to AVNRT presented to our service for multidisciplinary delivery planning in the late 3rd trimester. Prior cardiac MRI identified no intracardiac defects and right heart catheterization demonstrated pulmonary artery systolic pressure (PASP) of 75 mmHg, cardiac output of 3.1 L/min, and wedge pressure of 5 mmHg. One week prior to planned induction, inhaled iloprost and tadalafil 40 mg/day were initiated. Two days later, she was admitted to the cardiac ICU in active labor at 3 cm cervical dilation. A pulmonary artery catheter was placed and a treprostinil infusion was started at 3 ng/kg/min which decreased her PASP to 36 mmHg. After 12 hours of labor with a patient-controlled epidural analgesia infusion of 0.0625% bupivacaine and fentanyl 2 μg/mL, she developed early preeclampsia and was taken to the cardiac O.R. for vaginal delivery. Inhaled nitric oxide at 20 ppm was started in the O.R. and treprostinil increased. Epidural lidocaine (200 mg) was given for supplemental analgesia and the patient delivered a healthy infant with forceps assistance. Postoperatively she was anticoagulated with a heparin drip and received diltiazem and magnesium for preeclampsia. She was discharged home on hospital day 10 on a combination of atenolol, nifedipine, tadalafil, warfarin, and treprostinil at 18 ng/kg/min with return to her baseline PASP of 45 mmHg. Both mother and baby were well 1 month postpartum.

Aggressive titration of vasodilator therapies and PASP monitoring allowed us to optimize the patient's cardiopulmonary function and offer the best opportunity for vaginal delivery while avoiding the risks of GA. Additionally, using the TeamSTEPPS-based multidisciplinary team briefing model allowed us to quickly and safely execute our care plan when she presented unexpectedly. Continued development of novel pulmonary vasodilator therapies may increasingly permit safe vaginal delivery closer to term, especially in the presence of drug-responsive disease. We also speculate that vasodilator and prostanoid-based therapies for PHTN might have contributed to initiation of her labor given the known roles of nitric oxide and prostaglandins in this process. Future studies may be warranted to investigate this.

References:

1. Bedard D, et al. Euro Heart J 2009 Feb;30(3):256-65.
2. Smedstad KG, et al. Can J Anaesth 1994 Jun;41(6):502-12.
3. Smith JS, et al. Lung 2012 Apr;190(2):155-160.

Abstract #:T-74

Interscapular Pain: A Case Series

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Some laboring women experience severe upper back pain, typically between the scapulae, after initiation of neuraxial labor analgesia. The etiology of this interscapular pain (ISP) is not well understood, but theories include high epidural space pressures (1), compression of the thoracic spinal cord (2), referred pain from abdominal viscera (3), or air in the epidural space (4). Management options include decreasing the epidural infusion rate, administering epidural or intravenous opioids, and withdrawal or removal of the epidural catheter (5). This case series describes three patients who developed ISP during labor.

Case 1: An 18 year old (y.o.), G1P0, with BMI 32 and gestational hypertension presented in labor at 37.1 weeks. She requested analgesia at 2.5 cm cervical dilation. Labor analgesia was initiated using a combined spinal-epidural (CSE) technique and maintained using patient-controlled epidural analgesia (PCEA) with an 8 mL/hr continuous infusion. She required three physician-delivered boluses for treatment of breakthrough pain. She received a total of 312 mL epidural local anesthetic. After 19 hrs of labor, she proceeded to cesarean delivery for arrest of dilation. Intense ISP developed during bolus administration of lidocaine 2% with epinephrine. Epidural fentanyl (100mcg) provided some relief; however, due to an inadequate sensory level (T7), the decision was made to replace the epidural catheter. She experienced complete ISP relief upon epidural replacement.

Case 2: A healthy 33 y.o. G2P1 with BMI 31 presented for induction of labor at 37.0 weeks. A CSE was requested at 1cm dilation, and a PCEA initiated. She developed moderate ISP and lower neck pain six hrs later. She had received 120 mL of epidural local anesthetic. Her pain decreased when sitting up in bed. She had similar pain with a prior labor epidural. Her PCEA infusion rate was decreased from 8 to 6 mL/hr and the bupivacaine concentration was increased from 0.0625% to 0.11%. Her pain resolved after 1 hr. Uncomplicated NSVD followed.

Case 3: A healthy 27 y.o. G3P0 with BMI 29 presented in labor at 40.1 weeks. A CSE was requested at 0cm dilation and a PCEA was initiated. The patient developed severe ISP 9.5 hrs later that worsened with PCEA demand bolus. She had received 116 mL of epidural local anesthetic. Her epidural bupivacaine concentration was increased from 0.0625% to 0.11%. Epidural fentanyl 100mcg was also administered. The patient experienced complete pain relief 1.5 hrs later. Uncomplicated NSVD followed.

This case series presents 3 parturients with ISP. All patients received relief with administration of epidural fentanyl, reducing the rate of the epidural infusion, or replacement of the epidural catheter. Future work should characterize at risk-patients, as well as delineate effective treatment options.

References:

1. IJOA 2011; 20: 196
2. IJOA 1993; 2: 190-2
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4. Anaesthesia 1989; 44:1014
5. Anesthesiology 2007; 107: A1780

Abstract #:T-75

Labor Analgesic Intent and the Use of Postpartum Opioids

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Introduction: Many studies have attempted to identify factors predictive of post-operative analgesic consumption. For example, type of surgery, patient age, and preoperative anxiety may predict postoperative analgesic use.(1) Unfortunately, little is understood about postpartum pain patterns. Some studies have attempted to identify predictors of postpartum pain after cesarean delivery;(2, 3) however, predictors of postpartum pain after vaginal delivery remain poorly characterized. This preliminary study aims to better characterize predictors of opioid use in the postpartum period after vaginal delivery. We hypothesized that nulliparous women who anticipated and ultimately received neuraxial labor analgesia would be more likely to use any opioid-based analgesic in the postpartum period compared to nulliparous women who did not anticipate or receive neuraxial labor analgesia.

Methods: Retrospective cross-sectional study. Electronic medical record data on all index vaginal deliveries over a 3-year period at Northwestern Memorial Hospital were extracted. On admission, patients self-identified their race/ethnicity, marital status, and anticipated analgesic use for labor. Extracted data included age, race/ethnicity, primary language, insurance status, gravidity, anticipated labor analgesic use and postpartum analgesic use. Patients were categorized into four groups based on anticipated and actual use of neuraxial labor analgesia. The primary outcome was the postpartum use of any opioid-based analgesics. We conducted initial bivariate analyses and estimated a multivariable logistic regression model of postpartum analgesic use after univariate selection using a $P<0.1$ for model entry.

Results: A total of 9,030 patients were included in the analysis. After controlling for confounding variables, women who did not anticipate or use neuraxial labor analgesia were less likely to use any opioid-based analgesics in the postpartum period than women who anticipated and used neuraxial labor analgesia (adjusted odds ratio [aOR] 0.44, 95% CI: 0.38 to 0.52). Women of Asian ethnicity were less likely to use postpartum opioids (aOR 0.79, 95% CI: 0.65 to 0.96), while women over 35 years of age were more likely (aOR 1.21, 95% CI: 1.11 to 1.33), after controlling for confounders.

Conclusions: Nulliparous women who anticipate and ultimately use neuraxial labor analgesia are more likely to use postpartum opioid-based analgesics compared to nulliparous women who did not anticipate and did not use neuraxial labor analgesia. These findings suggest that analgesic intent may influence postpartum analgesic consumption. Future work should validate this association.

References:

1. Anesthesiology 2009; 111:657–77
2. Acta Anaesthesiol Scand 2007; 51: 582–586
3. Anesthesiology 2013; 118:1170-9

Abstract #:T-76

Anesthetic Choice for Suspected Placenta Accreta and Maternal and Neonatal Outcomes

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Introduction: Equipoise may exist for the ideal type of anesthesia to be chosen for surgical management of suspected placenta accreta. This study aims to determine if the type of anesthesia induced for cases of placenta accreta correlates with severe maternal hemorrhage and neonatal compromise.

Design: In this IRB approved, single-center, retrospective observational cohort study, subjects with prenatal ultrasonographic diagnosis of accreta who delivered between 2007 and 2014 were identified. Pathology reports were used to cross-reference diagnoses and to identify cases detected late in prenatal care. All cases had antenatal anesthesia consultation and multidisciplinary preoperative planning. Severe hemorrhage was defined as estimated blood loss (EBL) ≥2 liters (L) and any requirement for transfusion. Neonatal compromise was defined as a 5-minte Apgar score of ≤6. Bivariate logistic regression analysis was performed to identify and adjust for factors that may have influenced anesthesia choice, risk for higher blood loss, need for transfusion, and lower Apgar scores. Fisher's exact test was used for categorical variables and Wilcoxon rank sum test for continuous variables. A $P < 0.05$ was considered significant.

Results: 51 cases were identified. Table 1 shows characteristics of women receiving neuraxial (NA) or general anesthesia (GA). The incidence of EBL ≥2L and transfusion was similar for both anesthesia groups (EBL <2L: GA = 26.1% v. NA = 73.9%; ≥2L: GA = 35.7%, NA = 64.3%, P=0.552. No transfusion: GA = 30.8%, NA = 69.2%; Transfusion: GA = 31.6%, NA = 68.4%, P>0.999). After adjusting for mode of delivery, anesthesia choice remained not significantly related to EBL or transfusion. GA was associated with lower 1-minute, but not 5-minute, Apgar scores compared to NA (1-minute Apgar ≤6: GA = 70.0% v. NA = 30.0%; >6: GA = 20.8% v. NA 79.2%, P=0.015. 5-minute Apgar ≤6: GA = 60.0% v. NA = 40.0%; >6: GA = 31.0% v. NA = 69.0%, P>0.319). Intraoperative conversion from NA to GA was not associated with increased EBL or transfusion (EBL <2L: GA conversion = 34.8% v. NA or GA = 65.2%; EBL ≥2L: GA conversion = 28.6% v. NA or GA = 71.4%, P=0.764. No transfusion: GA conversion = 23.1% v. NA or GA = 76.9%; transfusion required: GA conversion = 34.2% v. NA or GA = 65.8%, P=0.730).

Conclusions: Anesthetic choice for the surgical management of suspected placenta accreta does not appear to correlate with severe hemorrhage or neonatal compromise.

Abstract #:T-76

Table 1. Maternal, anesthetic, and obstetric features of women receiving neuraxial or general anesthesia

	Neuraxial anesthesia (n=35)	General anesthesia (n=16)	*P*‡
Maternal Characteristics			
Maternal Age	32 [7]	33.5 [10]	0.776
Morbid obesity (BMI ≥40)	7/32 (21.9)	2/14 (14.3)	0.701
BMI	32 [10.9]	28.5 [8.1]	0.064
Gravidity	4 [3]	4 [2.5]	0.398
Parity	2 [2]	2 [1.5]	0.584
Anesthetic Characteristics			
Anesthesiologist	Presented separately		**0.008***
Mallampati ≥3	2/35 (5.7)	1/16 (6.3)	>0.999
Malignant hyperthermia history	0/35 (0.0)	0/16 (0.0)	--
Obstetric Characteristics			
Multiple gestation	0/35 (0.0)	0/16 (0.0)	--
Polyhydramnios	2/35 (5.7)	0/16 (0.0)	>0.999
Chorioamnionitis	3/35 (8.6)	2/16 (12.5)	0.643
Prolonged labor	0/35 (0.0)	0/16 (0.0)	--
Tocolytics used antenatally	6/35 (17.1)	3/16 (18.8)	>0.999
Hextend intraoperatively	22/35 (62.9)	10/16 (62.5)	>0.999
Baseline hemoglobin	11 [1.5]	10.9 [1.9]	0.423
Abruption or preoperative bleeding	15/35 (42.9)	10/16 (62.5)	0.237
Placenta previa	27/35 (77.1)	11/16 (68.8)	0.730
Previous cesarean	33/35 (94.3)	16/16 (100.0)	>0.999
Number of previous cesareans	2 [2]	2 [2]	0.520
Previous myomectomy	0/35 (0.0)	0/16 (0.0)	--
Previous D&C/D&E	8/35 (22.9)	4/16 (25.0)	>0.999
Degree of placental invasion by pathology			
No	1/35 (2.9)	2/16 (12.5)	
Accreta	12/35 (34.3)	4/16 (25.0)	0.228
Increta	15/35 (42.9)	4/16 (25.0)	
Percreta	7/35 (20.0)	6/16 (37.5)	
Mode of delivery			
Scheduled cesarean	27/35 (77.1)	5/16 (31.3)	
Unscheduled cesarean	0/35 (0.0)	2/16 (12.5)	**0.003***
Cesarean with take back	1/35 (2.9)	1/16 (6.3)	
Other	7/35 (20.0)	8/16 (50.0)	

Abbreviations: BMI, body mass index; D&C, dilation and curettage; D&E, dilation and evacuation.

Data are presented as number (percentage %); median [interquartile range].

‡ Fisher's exact test for categorical variables and Wilcoxon rank sum test for continuous variables.

Abstract #:T-77

Surgical Anesthesia for Cesarean Delivery Using Transversus Abdominis Plane and Ilioinguinal-Iliohypogastric Blocks

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Introduction: Ultrasound-guided transversus abdominis plane (TAP) and ilioinguinal-iliohypogastric (IIIH) blocks are commonly used for post-cesarean analgesia, but have very rarely been described as the primary anesthetic.(1) We describe the use of ultrasound-guided TAP and IIIH blocks as primary anesthetic for cesarean delivery (CD) in a patient with spinal muscular atrophy (SMA) type II who had relative contraindications to both general and neuraxial anesthesia.

Case: 26 year old G3P2 at 36 weeks gestation presented for repeat CD and bilateral partial salpingectomy via vertical midline incision. Her medical history included SMA type II, severe scoliosis with thoracic and lumbar Harrington Rods, severe restrictive lung disease, and obesity. She strongly desired avoiding general anesthesia given history of a six week period of postoperative intubation and mechanical ventilation due to restrictive lung disease and muscle weakness after her back surgery. Neuraxial anesthesia had not been attempted previously, as she was not judged to be a good candidate given the likelihood of difficulty with patient positioning and block placement in addition to the fact that a surgical block likely would have led to respiratory compromise given her medical history. Two prior CDs were performed using local anesthetic field infiltration by the obstetricians, but the patient reported poor pain control during these procedures. Therefore, we developed an anesthetic plan to perform bilateral ultrasound-guided TAP and IIIH blocks with a sensory level to T10 or higher. This was deemed necessary due to a planned vertical midline incision. Ultrasound-guided TAP and IIIH blocks were completed with 20ml (total) of 0.5% ropivacaine per side. A T8-L1 sensory blockade to pinprick stimuli was confirmed prior to surgery. Sedation was maintained with low dose propofol and ketamine infusions, along with small intermittent fentanyl doses, being careful to maintain spontaneous ventilation. The peritoneum was infiltrated with lidocaine 0.5% by the obstetricians to help minimize visceral discomfort. Delivery of a healthy female infant was uncomplicated and she reported minimal pain both intraoperatively and postoperatively.

Discussion: Patients with SMA type II have a defect of the SMN protein necessary for the survival of motor neurons and commonly experience severe muscle weakness, spinal abnormalities including severe scoliosis, and restrictive lung disease. (reference) Our case presented a unique clinical dilemma because of the relative contraindications to general and neuraxial anesthesia. A 4 patient case series has described the effective use of ultrasound-guided TAP and IIIH blocks for CD as an alternative to local infiltration.(1) We found this unique approach to be effective, and suggest that combined TAP and IIIH blocks along with IV sedation may provide a reasonable alternative anesthetic in select patient cases.

Reference:

1. Anesth Analg. 2011;113:134-7.

Abstract #:T-78

Uterine relaxation for preterm cesarean delivery: comparison between nitroglycerin under spinal anesthesia and general anesthesia with sevoflurane

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Introduction: Delivery of fragile preterm fetus during cesarean delivery(CD) can be problematic due to relatively thick myometrium. Some obstetricians in Japan advocate uterine relaxation with sevoflurane. However, general anesthesia carries higher risk to the mothers. Alternatively, nitroglycerin (NTG) is a known relaxant for pregnant uterus, and we have reported its benefit under spinal anesthesia in preterm fetuses less than 26 weeks gestation. In this study, we aimed to compare the effects of NTG under spinal anesthesia and sevoflurane during general anesthesia (GA) for uterine relaxation to facilitate delivery of preterm fetuses.

Methods: After IRB approval, retrospective review of medical and anesthesia records were conducted on CDs for fetuses less than 26 weeks gestation from 2002 to 2014. We abstracted cases when either NTG or sevoflurane was used during CD, then compared uterine incision to delivery interval (UI-D interval), type of uterine incision, Apgar scores, umbilical artery pH, NICU survival discharge rate. NTG 50-100mcg bolus was administered upon obstetrician's request at the time of CD, 45 seconds prior to uterine incision, and repeated as needed until delivery of the infant. Data were compared by Chi-square or unpaired t-test whichever appropriate.

Results: There were 157 CDs less than 26 weeks. The number of cases in gestational weeks 22, 23, 24, 25 was 15, 27, 52, and 62 cases, respectively. NTG was used in 95 cases (73%) of spinal anesthetic, and sevoflurane was used without NTG in 18 cases (64%) under GA, which comprise 2 comparison groups. 10 GA cases used both sevoflurane and NTG. Median NTG dose was 100μg, range:50-350μg. Sevoflurane concentration was 3% in all cases until delivery of the infant. UI-D intervals and UA pH were 1.83 min vs. 2.06 min, 7.378 ± 0.08 vs. 7.254 ± 0.22 in NTG group and sevoflurane group, respectively. Uterine incision other than transverse incision was 54.7% vs. 72.2%, Apgar score less than 7 at 1 minute was 84.2% and 94.4% in NTG and sevoflurane group, respectively. These results and NICU survival discharge rates were not statistically different between the groups.

Discussion: In this study, we failed to show the benefit of NTG spinal anesthesia compared to sevoflurane GA to facilitate delivery of preterm fetuses during CD, even though the results tended to be better in NTG gruop. This may be partly due to the practice that NTG was administered at the discretion of anesthesiologists based on the obstetrician's request for uterine relaxation. Thus NTG groups could have been more difficult cases with regard to fetal extraction during CS. On the other hand, GA was chosen in fetal compromise more often than spinal anesthesia, which may have affected Apgar score and pH.

Conclusion: In order to facilitate delivery of preterm fetuses during CS, uterine relaxation with NTG under spinal anesthesia may be a good option to the mother and neonate when compared to sevoflurane during general anesthesia.

Abstract #:T-79

A Review of 48 Cesarean Hysterectomies for Abnormal Placentation at One Institution

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OBJECTIVES: The aim of this retrospective study was to review abnormal placentation cases and determine the prognostic factors effective on morbidity and mortality and to evaluate the strategy of anesthetic management. We will also review our multidisciplinary management protocol, including preadmission of patients at 32 weeks gestation, involvement of obstetrics, gyn-oncology, urology, neonatology, blood bank, interventional radiology, anesthesiology.

MATERIAL AND METHODS: 48 women with abnormal placentation scheduled for elective or emergency cesarean deliveries from 2010 to 2014 were examined. Patient demographic data, surgery and obstetric characteristics, anesthetic techniques, blood transfusions, and complications were recorded.

RESULTS: The total number of accreta, increta, and percreta deliveries has increased every year since 2010, with a 2.6 fold increase from 2013 to 2014. Notably, 42% of patients had one prior cesarean delivery and 10% of patients had no previous cesarean deliveries. Out of the 48, thirty-six deliveries were elective, 11 were emergency, and there was one urgent delivery. Five patients had an unknown diagnosis of abnormal placentation prior to surgery. Two patients had preoperative internal iliac artery balloon placements. 83% of cases were done with general anesthesia exclusively, 2 cases with combined-spinal epidural exclusively, 4 cases that began with CSE then converted to GA for hemodynamic instability, and 2 cases in which spinal anesthesia was performed for cystoscopy and ureteral stent placement, then converted to general anesthesia prior to incision and delivery. 45% of our patients had less than 1500 ml blood loss and did not require blood transfusion and 29% required massive blood transfusion. Aortic cross clamping was required for three patients. Of the patients who underwent GA; 91% were extubated in the OR, and 43% required postoperative SICU care. Four patients have returned to the operating room, two planned and two unplanned. Two intraoperative maternal mortalities occurred, for one emergency delivery and one elective delivery.

CONCLUSIONS: Anesthetic management is critical for parturients with abnormal placentation undergoing cesarean hysterectomy; this includes a multidisciplinary approach. We found that general anesthesia was our method of preference. The majority of patients did not require postoperative ICU care or reoperation. However massive hemorrhage can be unpredictable and rapid; necessitating thorough preparation for massive transfusion and advanced surgical hemostasis. This includes adequate large bore I.V access, invasive blood pressure monitoring, blood bank notification and readily available Trauma or Vascular surgeon.

Abstract #:T-80

Immune Signatures of Neonates

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Introduction: Neonatal immune systems have distinct cellular composition and functional capacity compared with the mature adult immune system. Both the innate and the developing adaptive immune systems are critical to infant health. However, the influence maternal immune traits have on neonatal systems is poorly understood. This study used mass cytometry to comprehensively map and interrogate the immune system of a cohort of neonates and their mothers (Gaudilliere, Sci Transl Med 2014) to test the hypothesis that specific functional responses in maternal immune cell lineages are associated with respective functional responses in sentinel neonatal innate and adaptive immune cell subsets.

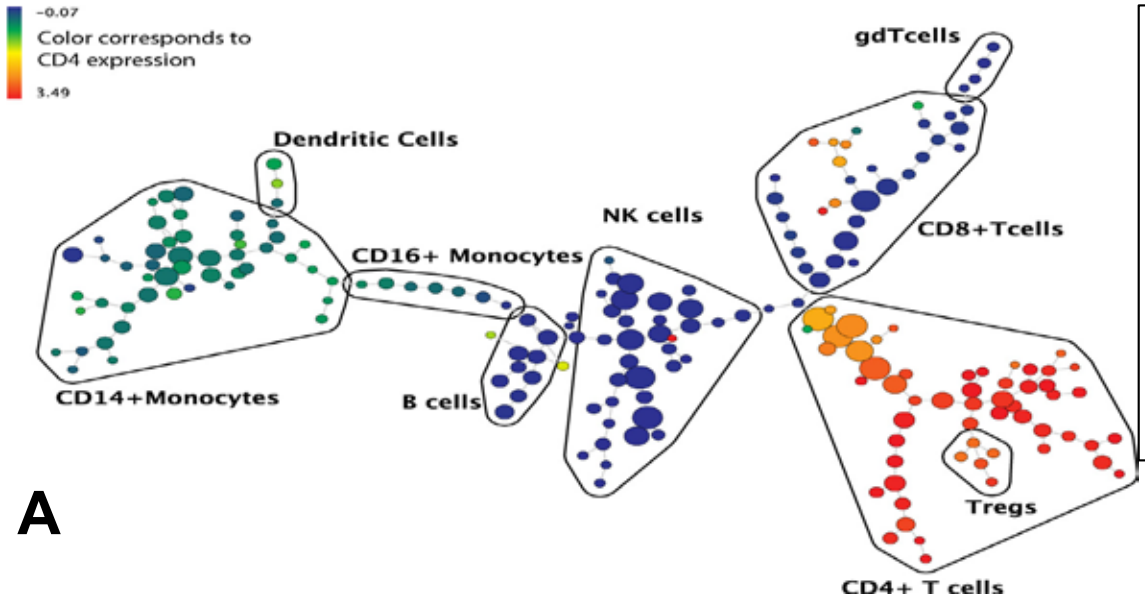
Methods: Umbilical cord blood samples from neonates (n=11) and peripheral blood from their mothers (n=10), were stained with 21 cell surface and 15 intracellular functional markers (STAT1, STAT3, STAT5, STAT6, CREB, NFkB, IkB, p38, MAPK, MAPKAP2, ERK, S6, FoxP3, T-bet, GATA3) at basal state and after stimulation with exogenous ligands (LPS; IL-2, IL-10, GM-CSF, and INFa) that activate intracellular signaling networks implicated in innate and adaptive immune responses. Correlation network analysis was applied to identify immune features that significantly correlate between related mother and neonate pairs.

Results: Hierarchical clustering provided functional maps of the maternal and neonatal immune systems and revealed cell-type specific signaling responses to exogenous ligands. One representative example is shown in the figure. Importantly, with ligand stimulation, both response sensitivity and magnitude in specific immune cell subsets to biologically relevant "stressors" could be inferred.

Complete analysis, available at the time of the conference, will focus on: 1) the potential and feasibility of applying novel mass cytometry at the "bedside" to study immunity at the maternal/neonatal interface, and 2) immune traits that are uniquely shared between a mother and a neonate.

Conclusions: We present a comprehensive functional interrogation of the neonatal and maternal immune systems. These results may help predict morbidity and mortality associated with impaired immune function and will provide a unique description of the biology at the interface of maternal and neonatal immunity. These findings may be relevant to obstetric anesthesiologists as procedures, medications, and other interventions throughout pregnancy may impact the maternal/neonatal immune interface.

Abstract #:T-80



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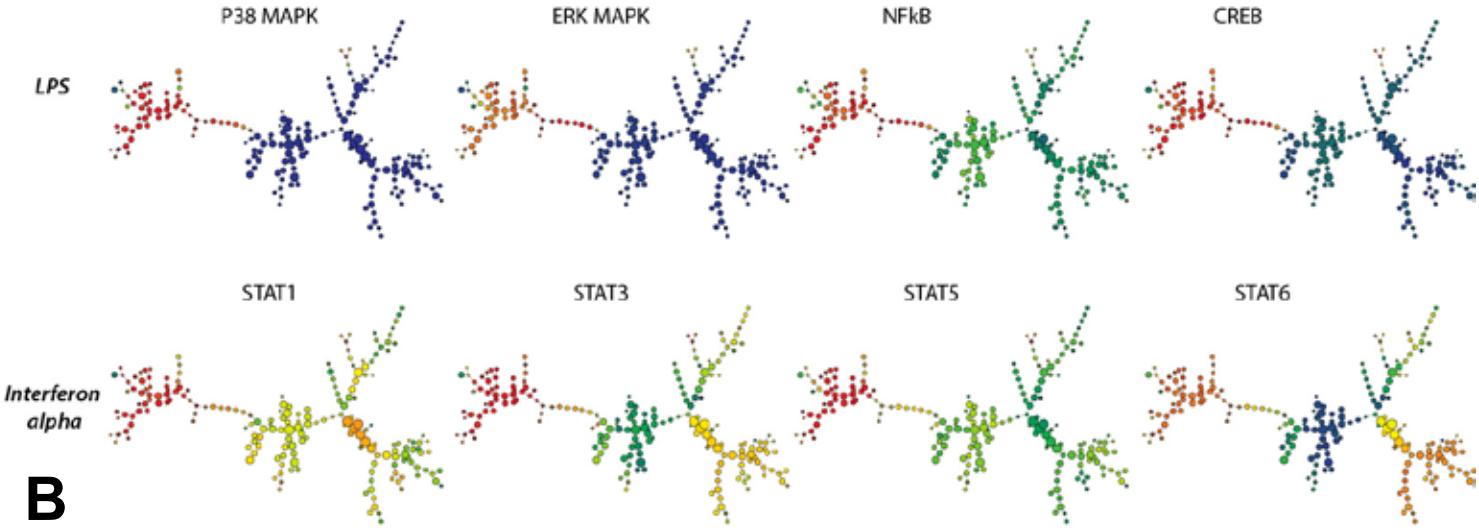

B

Figure 1. A) Example of a functional immune map generated from hierarchical clustering analysis. **B**) An exemplary analysis is depicted showing relative change in signaling responses of maternal immune cell types to exogenous ligands (LPS, INFa)

Friday, May 15, 2015

Abstract #:F-01

Local anesthetic systemic toxicity (LAST) and intralipid administration following 3% 2-Chloroprocaine inravascular injection during cesarean delivery

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Introduction: The use of neuraxial anesthesia for cesarean delivery is widely accepted as the anesthetic of choice for parturients but is not always without incident. Local anesthetic systemic toxicity (LAST) is a potentially lethal complication of regional anesthesia. The rapid hydrolysis of 2-chloroprocaine(2-CP)is thought to lower the potential of systemic toxicity. We report a case of LAST presenting with CNS toxicity after unintentional intravascular injection of 3% 2-CP through an epidural catheter. The parturient also successfully received intralipid for treatment of her presentation.

Case: A 36 yo G3P2 presented for repeat cesarean and BTL. She had two previous cesarean deliveries under spinal anesthesia without complication. Her BMI was 32.6 and physical exam was unremarkable. The anesthetic plan was a CSE. During placement of the block, the epidural space was located two times but each time no CSF returned via the spinal needle. Therefore, an epidural catheter was threaded with ease. A negative test dose was performed using lidocaine with epinephrine. 10cc followed by 5cc of 3% 2-CP was administered. Each dose was preceded by negative aspiration of catheter. The patient then reported feeling shaky became unresponsive and began having tonic-clonic seizure activity. Midazolam was administered and induction and intubation were performed with propofol and succinylcholine. Post induction, she was hypotensive, tachycardic and hypoxic. Approximately 3 min after seizure onset, intralipid was bloused. In less than ten minutes from seizure onset and intubation, a viable infant was delivered via emergent cesarean. The patient's vital signs soon stabilized and she remained stable throughout her intraop course. At conclusion of the case there was frank blood noted in the epidural catheter. The patient was taken to ICU postop for observation and was discharged on POD 4.

Discussion: Fortunately, the frequency of LAST has declined substantially in the last 30yrs secondary to increased awareness and safety steps practiced with regional anesthesia [1]. There are several mechanisms that place a parturient at increased risk for LAST such as epidural venous distention, increased cardiac output and neuronal susceptibility to anesthetics[2]. 2-CP is rapidly hydrolyzed via plasma cholinesterase resulting in a short intravascular half life. Despite this relative protective property, we still observed CNS toxicity related to an unintentional intravascular injection. Intravenous lipid emulsion has become a recommended treatment for LAST due to the multiple case reports and animal studies demonstrating successful resuscitation. To our knowledge there are no case reports describing an episode of LAST secondary to 2-CP in a parturient who received lipid therapy and both she and infant recovered without adverse effects.

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Abstract #:F-02

Subdural hematoma and TIA after CSE

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Case: A 37 year old G2P1001 at 38 weeks had an uneventful combined spinal-epidural for labor with normal vaginal delivery. On postoperative day (POD) 2, the patient complained of a severe frontal headache, worse when sitting with associated neck stiffness, not responding to conservative management. Pain service performed an epidural blood patch under fluoroscopy at L3/L4, with mild improvement of the symptoms and pain score going from 10 to 6. She was discharged home on POD 3 with Fioricet's prescription. The patient presented to the ER on POD 6 with worsening headache and neck stiffness. The headache was again described as positional, frontal, non-radiating, without any nausea, vomiting or fever. Examination of the back was non-tender, there was no focal neurological deficits and no signs of erythema, infection or bleeding at either of the epidural sites. Head CT revealed disproportionately enlarged ventricular, sulcal and cisternal spaces with dilated frontal CSF spaces. She was admitted for monitoring of presumed intracranial hypotension secondary to wet tap and CSF leak. Neurology recommended a second blood patch for intracranial hypotension treatment. Due to the ineffectiveness of the first epidural blood patch, the pain service recommended conservative management and monitoring. A MRI was obtained on POD 7 for persistent headache and revealed subdural fluid collections adjacent to the right and left cerebral hemispheres and in the cerebellar hemispheres bilaterally likely chronic subdural hematomas secondary to intracranial hypotension. A second epidural blood patch was then performed that day by the pain service under fluoroscopy with moderately headache's improvement. POD 11, the patient's sister-in-law revealed that the patient had had episodes of visual disturbances, word finding difficulties, upper extremity left-sided weakness, and severe headaches in both this pregnancy and previous pregnancy, prior to delivery. Those symptoms had not been reported before, bringing a new light to the case. She also mentioned multiple episodes of severe posterior headache, radiating to the front 1-2 times/month. At this point, the diagnosis of TIA episodes was suspected. POD 12, the stroke team were emergently called bedside as the patient had slurred speech, left arm paresthesia and weakness. MRI/MRA brain and neck revealed stable bilateral subdural collections with no other acute findings and TIA was suspected. POD 14, the patient was discharged home with resolved headache and no neurological deficits.

Discussion: While the risk of post dural puncture headaches is 2-3% after CSE, subdural hematoma is extraordinarily rare with only a few cases reported. The true incidence is unknown as most PDPH are treated conservatively or with EBP without imaging. This case is complicated by a history of TIA with headaches. We describe both common and rare complications of a CSE in a parturient and reveals the importance of a multi disciplinary team.

Abstract #:F-03

Anesthetic Management of Cesarean Section in a Parturient with Heterotaxy Syndrome and Severe Mitral Stenosis, a Case Report

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INTRODUCTION: Heterotaxy syndrome is a rare congenital disorder caused by embryonic failure to differentiate left-right asymmetry. There is little data regarding outcomes in pregnant women with this disorder. We present a case of a pregnant female with heterotaxy syndrome complicated by severe mitral stenosis for elective cesarean delivery (C/S) using combined spinal/epidural (CSE) anesthesia.

CASE: A 31 y/o G3P1101 female presented for C/S at 37 4/7 weeks with a history of heterotaxy syndrome and increasing shortness of breath. She had polysplenia, misaligned gastrointestinal organs (volvulus repair at 34 days), and an endocardial cushion defect (mitral valve annuloplasty as a child). She developed severe stenosis of the mitral annuloplasty site, moderate pulmonary hypertension, chronic congestive heart failure, and atrial flutter necessitating pacemaker placement and anticoagulation (SQ heparin). An ECHO showed an EF 40%, RVH, decreased RV function, mean PAP 55 mmHg, and elevated peak and mean mitral valve gradients (MV area 2.1 cm2). She was morbidly obese (BMI 37) with obstructive sleep apnea (OSA) requiring nasal CPAP. Prior to delivery, the abdominal pacemaker was converted from VVI to VOO mode and an arterial catheter was inserted. We placed a CSE (intrathecal bupivacaine 0.75% 10 mg, fentanyl 10 mcg, hydromorphone 100 mcg) and maintained her MAP within 20% of baseline during the uneventful C/S.

DISCUSSION: Heterotaxy syndrome is a serious congenital defect resulting from disorders of left-right axis determination during embryonic development (1). The incidence is 1 in 5,000-7,000 live births and factors that worsen prognosis include increasing A/V valve regurgitation, elevated pulmonary vascular resistance, and impaired ventricular function (2). Cardiac manifestations involve meso or dextrocardia, atrioventricular discordance, single ventricle physiology, AV septal defects, AV valve regurgitation, hypoplastic sinus node, congenital AV block, partial anomalous pulmonary venous drainage, and pulmonary stenosis or atresia. Extra-cardiac characteristics include symmetrically lobed lungs and bronchi, asplenia or polysplenia, malrotation of the intestine, midline liver, and bronchial cilia dysfunction.

Most patients with severe mitral stenosis are delivered via C/S using epidural anesthesia because of its hemodynamic stability (3,4). We chose a CSE using a reduced dose of intrathecal bupivacaine to minimize maternal hemodynamic fluctuations, provide intense motor/sensory block, and to allow an extended duration of action. We recovered our patient in the ICU, carefully monitoring cardiac function, volume status, and postoperative pain, instituting nasal CPAP to minimize airway obstruction.

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Abstract #:F-04

Plethysmography variability index for prediction of spinal induced hypotension

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Background: Hypotension occurs commonly following spinal anesthesia for cesarean delivery. The incidence of hypotension can be significantly reduced with a prophylactic phenylephrine infusion with rapid fluid co-loading. This strategy can be associated with reactive hypertension and reflex bradycardia. The hemodynamic response and dose requirements also vary among individual patients. Identifying women at greater risk for spinal induced hypotension might allow targeting prophylactic vasopressor therapy to those who need it. The plethysmography variability index (PVI), a continuous noninvasive measure of the respiratory variations in the pulse oximetry waveform, has been validated to predict fluid responsiveness in mechanically ventilated patients. Although PVI has not been validated in spontaneously breathing patients, it might predict hemodynamic changes induced by passive leg raising (PLR). Studies assessing PVI to predict spinal induced hypotension during cesarean delivery have yielded conflicting results. We performed this study to assess if baseline PVI and PVI/cardiac output (CO) changes induced by PLR can predict hypotension following spinal anesthesia for cesarean delivery.

Methods: Women scheduled for cesarean delivery under spinal anesthesia were enrolled in this study. Baseline blood pressure (BP) was obtained by taking the mean of 3 blood pressure readings 2 minutes apart. Baseline PVI and CO were measured using the Masimo Radical-7 device and PhysioFlow over 6 minutes. A PLR test was performed and the change of PVI and CO to PLR was recorded after 3 minutes. Patients received a standardized spinal anesthetic. BP was measured at 1-minute intervals and SBP decreases >20% were treated with phenylephrine boluses. Fluid therapy was standardized and consisted of 2 L crystalloid coload administered before delivery.

Results: 39 patients were included in the analysis. Mean (SD) baseline PVI was 25.8 (9.9) and 27.1 (10.5) after PLR (P=0.50). Baseline CO was 6.7 (2.3) and 7.0 (2.7) after PLR (p=0.63). Blood pressure decreased significantly after spinal (p<0.0001). Spinal induced hypotension occurred in 28 (72 %) patients before delivery and 19 (49%) after delivery. Overall, 33 (85%) patients needed phenylephrine. Mean (SD) PVI at baseline [35 (12) vs. 23 (8)] and after PLR [34 (13) vs. 25 (8)] were significantly higher in those who developed hypotension (p<0.05). There was however no significant correlation between baseline PVI, PVI change after PLR or CO change after PLR and change in SBP after spinal until delivery (Spearman correlation=0.31, p=0.058, 0.02, p=0.9 and -0.27, p=0.09 respectively) or after delivery. There was also no significant correlation between baseline PVI, PVI change after PLR or CO change after PLR with occurrence of hypotension, need for vasopressors or dose of phenylephrine given.

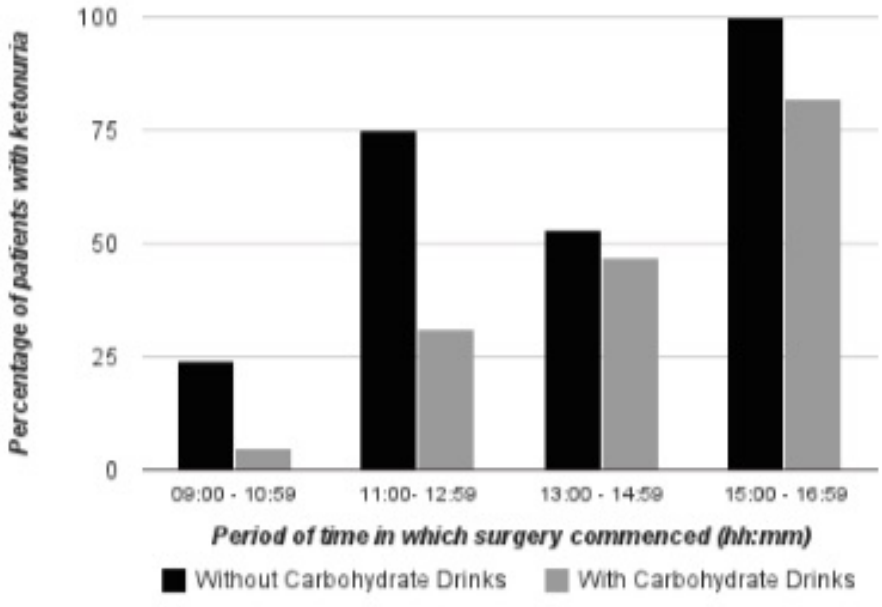

Figure 1: Incidence of ketonuria over the operative period.

Conclusion: PVI and change in CO induced by PLR did not predict hypotension in women undergoing cesarean delivery under spinal anesthesia.

Abstract #:F-05

Preoperative Carbohydrate Loading for Elective Cesaraen Delivery

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Fasting prior to elective caesarean delivery is associated with perioperative catabolism (1). For other major abdominal surgery preoperative oral carbohydrate loading improves patient well-being (2). We aimed to pilot this for elective caesarean delivery.

Methods: Ethics approval was waived by the ethics chair. Over a six week period, four carbohydrate drinks (Nutricia Pre-op, 50g carbohydrate) were distributed to mothers scheduled for caesarean delivery (excluding mothers with diabetes and severe gastroesophageal reflux disease). Instructions were given to drink two cartons at 10pm the night before and 7am on the morning of surgery. Presence of ketonuria, a marker of catabolism, was tested for at the commencement of surgery using urinalysis (Ketostix®, Bayer). An historical control group who fasted from midnight was used for comparison. Fisher's Exact Test (two tailed) was used for statistical analysis.

Results: Twenty-two (30 percent) of 76 mothers were ketotic compared to 51 percent in the control group ($p = 0.016$). The average time from solid food was 15 hours (range 10 - 21) inthe control and 15.8 (range 9 - 23) in the carbohydrate group. The spread of ketonuria over the operative period is displayed in figure 1.

Discussion: Ensuring the mother is in the best possible condition prior to surgery is a cornerstone of obstetric enhanced recovery: a new frontier for the obstetric anaesthetist (3). We suggest that preoperative carbohydrate drinks deliver optimum preoperative nutrition limiting the incidence of mothers undergoing surgery in the catabolic state. The Obstetric Anaesthetists' Association has awarded a grant to complete a randomised control trial to ascertain the effect of carbohydrate loading more clearly.

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Abstract #:F-06

Management of Parturient Presenting in the Third Trimester with Severe Pulmonary Arterial Hypertension

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Cynthia Navar M.D. - University of Illinois Chicago - Chicago, IL

We present a case of a 27yo G3P2 with severe PAH presented at 36 wks after being lost to follow-up following her previous pregnancy. During her second delivery in 2010, she became hypoxic, and subsequent work-up revealed severe PAH. Asymptomatic after delivery, she returned to normal activities and exercise routines. She made no mention of the diagnosis to her OB until 33+ wks gestation due to lack of understanding of the condition. She was referred to our institution for further management. At that time, she endorsed increased fatigue compared to prior pregnancies but denied reduced functional capacity. The decision was made to perform a right heart catheterization to assess her current status and direct admission to the MICU to initiate therapy was arranged.

Right heart cath confirmed severe pulmonary artery hypertension (PAP 81/26, mPAP 46). TTE showed normal LV function with an EF 55-60%. Given the risk for acute decompensation and sudden maternal or fetal death during labor and delivery, a multidisciplinary team consisting of cardiology, pulmonology, OB/GYN, and cardiac/OB anesthesiology coordinated care. A right IJ catheter was placed for treprostinil infusion, and an A-line for serial ABGs and BP monitoring.

On hospital day 6, with PA pressures optimized, the patient transferred to Labor and Delivery for induction. A labor CSE was placed early to minimize the sympathetic drive and desire to push, spinal portion narcotic only, slow titration of the test dose, then initiation of epidural infusion, 0.125% bupivacaine with 2mcg/ml fentanyl at 8ml/hr. As labor progressed, the patient became oxygen-dependent. Nitric oxide was initiated. SBPs dropped, and phenylephrine infusion begun by the anesthesia team. Planned assisted second stage was performed with vacuum. Patient transferred back to MICU immediately and was tightly monitored for post-partum fluid shifts.

Over the next day, phenylephrine and nitric oxide were weaned. She was started on inhalational treprostinil on PPD 2 and titrated up as treprostinil gtt was weaned and discontinued on PPD4. Sildenafil PO was begun on PDD 3. She was discharged home on PPD#5 after meeting a net -9L diuresis goal.

References:

1. P. G. Pieper and E. S. Hoendermis. Pregnancy in women with pulmonary hypertension. Neth Heart J. 2011 Dec; 19(12): 504–508.
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Abstract #:F-07

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

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Introduction: Neuraxial techniques are the most effective form of labor analgesia.[1] In addition to the standard epidural (EPL), combined spinal-epidural (CSE) and dural-puncture epidural (DPE) techniques have emerged in recent years.[2] To date, a comparison of all three techniques has not been performed. We hypothesized that onset of analgesia, in the order from fastest to slowest would be CSE>DPE>EPL, and that DPE would have fewer maternal and fetal side effects compared to CSE, while offering improved sacral and bilateral sensory coverage compared to EPL.

Methods: We designed a prospective, randomized, double blind study comparing CSE, DPE and EPL techniques in 120 term parturients in early labor (≤ 5cm cervical dilation). Attending and fellow anesthesiologists performed all techniques. Initial dosing for EPL and DPE consisted of 20mL of 0.125% bupivacaine 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. The primary outcome was analgesia onset (i.e., time to visual analogue score ≤3). Secondary outcomes included time to reach T10, sacral and motor blockade, and maternal and fetal side effects. Cox proportional hazard regression was used to analyze timed outcomes. Logistic regression and Fisher's exact test were used to analyze motor blockade, side effects and interventions.

Results: To date, 50 of 120 subjects have been recruited. CSE had the most rapid analgesia onset, T10 and sacral blockade ($p<0.001$); however, a higher incidence of pruritis was observed ($p=0.009$). The EPL and DPE groups had similar onset time, sensory blockade and maternal side effects, but EPL group had higher epidural reinforcement ($p=0.04$) and caesarean delivery rates ($p=0.02$). Significant motor blockade and fetal bradycardia occurred only in the CSE and EPL groups at similar rates.

Discussion: Labor analgesia onset was most rapid with CSE, with similar onset times between DPE and EPL. DPE may have an advantage over CSE with less maternal pruritis and fetal bradycardia; and an advantage over EPL with fewer epidural 'top-up' requirements and a lower cesarean delivery rate. Selection of optimal neuraxial labor analgesia technique requires consideration of anticipated maternal and fetal outcomes.

References:

1. Osterman M. Birth, 2009
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Abstract #:F-07

	Neuraxial Techniques			
	EPL (n=16)	DPE (n=15)	CSE (n=19)	p
Time (minutes) to Event Outcomes				
VAS ≤ 3, median (IQR)	11 (4-16)	10 (3-22)	0.5 (0.5-2)	<0.001[a]
T8 block, median (IQR)	9 (5.5-18)	10 (6-19)	2 (0.5-6)	0.003[a]
T10 block, median (IQR)	2 (0.5-7.5)	6 (4-17)	0.5 (0.5–2)	<0.001[a]
S1-S2 block, median (IQR)	7 (6-12.5)	6 (9 -12)	0.5 (0.5 –3)	<0.001[a]
Maternal Side Effects				
Nausea, n	2	2	2	NS
Pruritis, n	3	3	14	0.009[a]
Hypotension, n	1	1	7	NS
Motor Block ,n	8	1	4	<0.001[b]
Change in Temperature F (Placement to Delivery) mean,SD	0.3 (0.3)	0.2 (0.6)	0.2 (0.5)	NS
Fetal Side Effects				
Fetal Bradycardia, n	5	0	7	<0.001[b]
Interventions & Follow-ups				
Cesarean Delivery, n	8	1	5	0.02[c]
Epidural Reinforcement "Top-ups", n	9	3	7	0.04[c]
Postpartum Headaches, n	0	0	0	NS

a. EPL and DPE vs. CSE
b. EPL and CSE vs. DPE
c. EPL vs. DPE

Abstract #:F-08

Does Ultrasound-guided CSE (combined spinal epidural) improve midline placement of epidural needle with positive CSF flow through the spinal needle, compared to placement using palpation of anatomical landmarks?

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Purpose: To determine if Ultrasound guidance leads to increased positive CSF flow on first attempt at combined spinal epidural in parturients compared to anatomical landmark technique.

Methods: We conducted a randomized prospective trial on the Labor and Delivery unit of a busy New York City hospital. All parturients requesting neuraxial labor analgesia, and without obstetric complications or history of lumbar musculoskeletal abnormalities, were eligible for enrollment. A total of 48 patients were consented to receive combined spinal epidural with either ultrasound guided or anatomical landmark technique. Positive CSF on the first attempt was the primary outcome. Secondary outcomes were the number of spaces attempted and number of needle adjustments within the space, as well as presence of symmetrical anesthesia at 2 hours, and need for epidural replacement. The procedure was performed by experienced practitioners consisting of obstetric anesthesiology fellows and attending physicians.

Results: 48 patients were randomized to either the ultrasound or landmark group. 2 patients in the Landmark group were excluded from the study due to delivery within 2 hours of CSE placement. No statistical difference was found between groups for positive CSF flow on first attempt at CSE ($p = 0.6$). All secondary outcomes were statistically insignificant as well: number of spaces attempted ($p=0.71$ 95% CI -0.30 to 0.21), number of needle adjustments ($p = 0.09$, 95% CI -0.10 to 1.28), presence of symmetrical anesthesia at 2 hours ($p = 1$), and need for epidural replacement ($p=0.48$).

Conclusion: When placed by an experience physician, there is no difference in the successful placement of CSE on the first attempt with ultrasound versus traditional landmark technique.

Abstract #:F-09

Prediction of Perioperative Hypothermia and Response to Active Warming in Women Undergoing Scheduled Cesarean Delivery

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Introduction: Core-to-peripheral redistribution of heat is the major mechanism leading to early perioperative hypothermia after neuraxial anesthesia (1). The study aim was to determine if patient's preoperative skin temperature or skin-to-core temperature gradient predicted temperature decrease and hypothermia in women undergoing cesarean delivery with spinal anesthesia.

Methods: 46 healthy women undergoing scheduled cesarean delivery under spinal anesthesia (10-12.5 mg bupivacaine ± fentanyl) were enrolled in this randomized controlled study. Skin temperature and skin-to-core temperature gradients were measured preoperatively, intraoperatively (every 10 min), and for 1 hour postoperatively (every 15 min). Participants were randomized to receive active warming (warmed intravenous fluid co-load and lower-body forced-air warmer set to high intra-operatively) or no active warming. Outcomes included maximum perioperative core temperature decrease, incidence of shivering and hypothermia (<36oC), meperidine requirements, and thermal comfort scores. Univariate correlations and regression analysis and between-group parametric and non-parametric comparisons as appropriate were applied.

Results: There was no correlation between preoperative skin temperature or skin-to-core temperature gradient and maximum perioperative core temperature decrease (Figure 1). The mean ± SD preoperative skin-to-core temperature gradients of women who developed hypothermia compared to those who did not was 4.5 ± 0.9 and 4.7 ± 0.7 respectively (p=0.507). There was no significant correlation between preoperative skin temperature (R=0.195, p=0.216) or skin-to-core temperature gradient (R=-0.118, p=0.456) and intraoperative thermal comfort scores. Mean ± SD preoperative skin temperature of women who shivered and did not shiver intraoperatively was 32.7 ± 0.6 and 32.2 ± 0.8 respectively (p=0.041). Preoperative skin temperature and skin-to-core temperature gradients did not predict meperidine use or response to active warming.

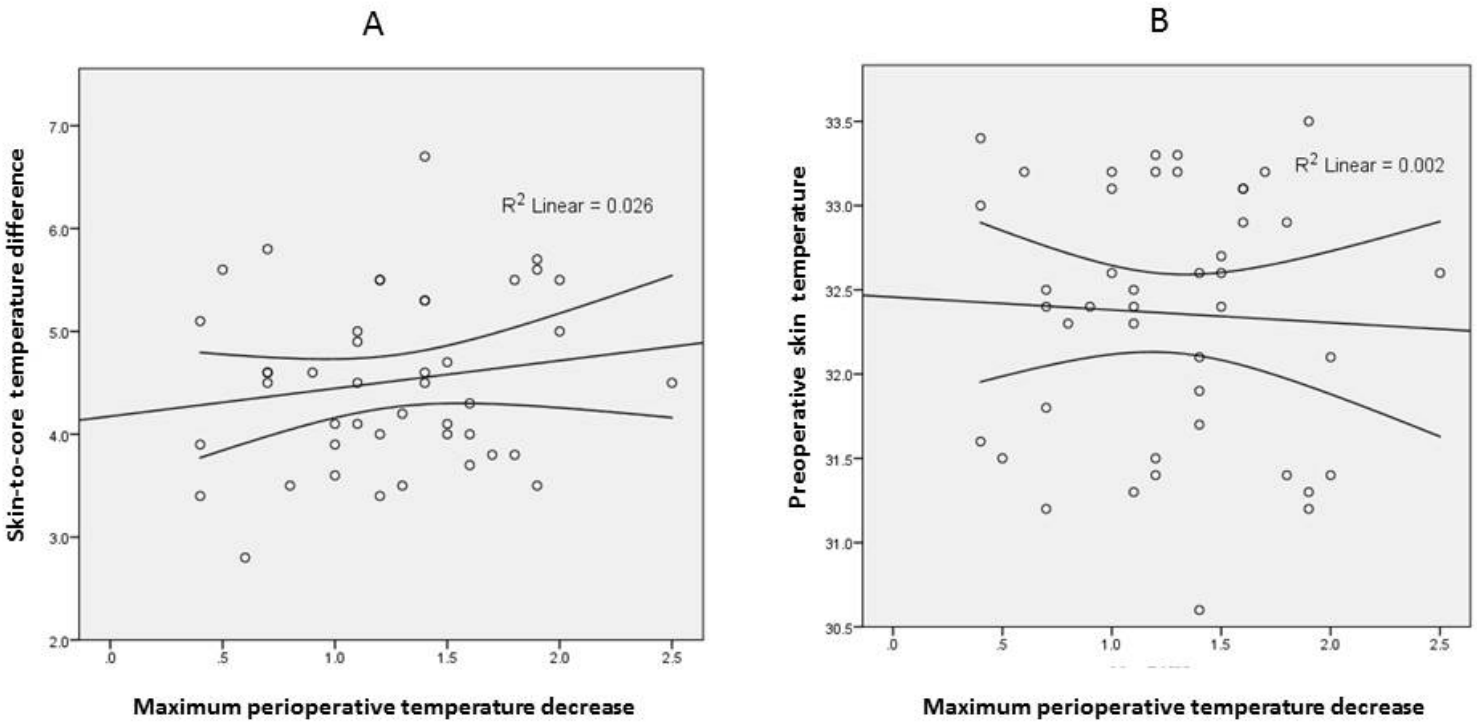
Conclusion: Preoperative skin temperature and skin-to-core temperature gradient D.O. not predict the development of maternal hypothermia or shivering, thermal comfort, or response to active warming. This is the first study trying to identify predictors of perioperative hypothermia and shivering in women undergoing cesarean delivery, with the aim of facilitating targeted application of active warming.

Reference:

1. Anesthesiology 1995; 83(5): 961-7

Abstract #:F-09

Figure 1: Correlation between preoperative skin-to-core temperature difference (A) and preoperative skin temperature (B) and the maximum perioperative temperature decrease in women undergoing cesarean delivery with spinal anesthesia



Abstract #:F-10

Ehlers-Danlos IV in pregnancy- leads to uterus in ventral hernia and necrotic small bowel.

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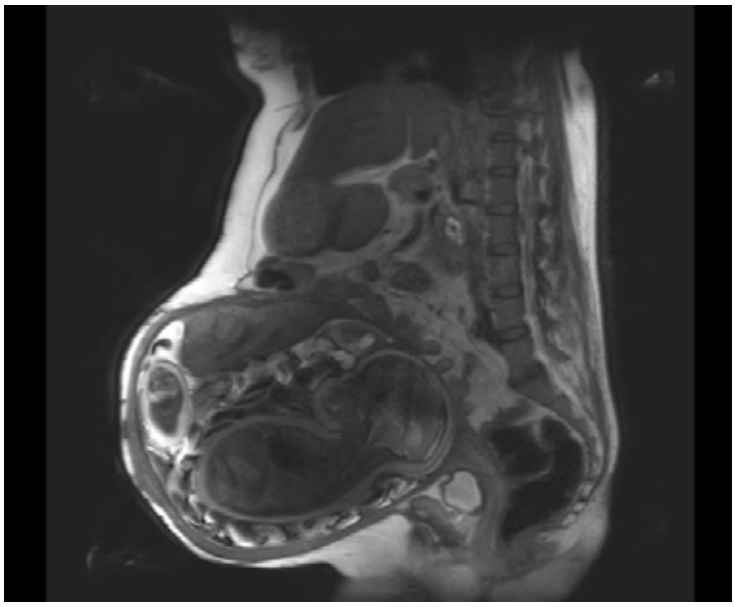
Christopher Ciliberto M.D. - University of Washington - Seattle, WA

Introduction: Ehlers–Danlos syndrome type IV-vascular type results from a mutation in the COL3A1 gene. Patients are prone to spontaneous rupture and dissection of arteries, bowel and uterus. Complications occur in 25% of individuals by age 25, 80% by age 40. Life threatening uterine rupture complicates > 6% of pregnancies (1). Since patients only synthesize type I collagen; their skin, intestine and blood vessels are fragile (2). Due to the high risk associated with labor and vaginal delivery, early term cesarean delivery is advised (3).

Preoperative assessment: A 31 year-old female at 31+6 weeks gestation complicated by E-D IV. She had a history of popliteal aneurysm ligation; right carotid artery aneurysm and left carotid occlusion (50%). She presented with a ventral hernia containing her gravid uterus and bowel, resulting in painful necrosis of abdominal wall. She had been taking increasingly high doses of narcotics. After six days of conservative management with IV hydromorphone PCA and betamethasone for fetal lung maturation, signs and symptoms consistent with small bowel obstruction developed and an ex-lap and caesarean delivery were indicated.

Intraoperative course: GA with thoracic epidural for post-op pain management was performed without complications. Delivery via classical incision was uneventful. Bowel revealed diffuse areas of distention and necrosis thought to have potential for improvement so no immediate resection was performed. Significant loss of domain resulted in inability to close fascia. . She was left intubated in the ICU until after the second procedure on POD #1.

Postoperative course: POD1, abdominal wash-out; POD2, mid-jejunum resection, mesh placed for hernia defect; POD3, IR for drain placement for anastomotic leak; POD4, TEP removed. Plan for PICC line for long term TPN and definitive repair.



Conclusions: Careful consideration of the patient's coexisting diseases, anxiety, high likelihood of a long procedure and an open abdomen with high risk of aspiration were balanced. The benefit of minimizing stress of catecholamine surge on arterial walls outweighed the risk of GA. TEP was provided for post-op analgesia, due to her probable long postop recovery and previous pain relief issues.

References:

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Abstract #:F-11

Predictors of Neuraxial Block Utilization Among Women undergoing Successful Vaginal Birth after Cesarean

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Introduction: The use of neuraxial labor analgesia is encouraged by obstetric societies for women planning vaginal birth after cesarean delivery (VBAC).(1,2) However, among women who undergo successful VBAC, predictors of neuraxial block (NB) utilization are not well described.

Methods: We performed a secondary analysis from the MFMU Cesarean Registry (3) to identify women who underwent successful VBAC with or without NB (epidural, spinal or spinal-epidural). Using multivariate logistic regression, we identified predictors for NB based on demographic, obstetric and intrapartum characteristics.

Results: Our cohort comprised 10,375 women who underwent successful VBAC; 9438 (87.9%) received NB. Predictors for NB use are shown in the Table. Compared to women with spontaneous labor, women undergoing inductions or augmented labor were more likely to receive NB. Multiparous women (aOR=5.1) and women with preterm labor (aOR=0.44) had a decreased likelihood of receiving NB. We also observed evidence of racial/ethnic disparities in NB utilization in our cohort (Table), with Hispanic (aOR=0.23) and African-American (aOR=0.22) women having a lower likelihood of receiving NB compared to Caucasian women.

Conclusion: In our study, the rate of NB use among women who underwent successful VBAC was high. Although we could not account for all potential confounders (such as patient-level, physician-level, and hospital-level factors) for NB use in our analysis, our findings suggest that obstetric factors and race/ethnicity influence utilization of NB among women undergoing successful VBAC.

Table. Predictors of neuraxial anesthesia among women undergoing successful VBAC.

	aOR	95% CI
Maternal Age (y):		
<20	1.41	0.98 – 2.03
20-34	Reference group	
>34	1.12	0.94 – 1.34
BMI at delivery:		
<25	Reference group	
25-29.9	1.03	0.82 – 1.29
30-34.9	0.98	0.78 – 1.24
35-39.9	1.09	0.84 – 1.41
≥40	0.91	0.70 – 1.20
Race:		
Caucasian	Reference group	
African-American	0.22	0.18 – 0.27
Hispanic	0.23	0.19 – 0.28
Other	0.36	0.26 – 0.51
Gestational Age at Delivery (wks):		
<37	0.44	0.38 – 0.53
37-41	Reference group	
>41	0.94	0.74 – 1.19
Prenatal care[a]:		
No	Reference group	
Yes	1.21	0.86 – 1.71
Parity:		
1	Reference group	
≥2	0.51	0.44 – 0.59
Hypertensive disease of pregnancy:		
None	Reference group	
Gestational HBP	0.91	0.57 – 1.48
Pre-eclampsia	1.05	0.71 – 1.54
HELLP or eclampsia	0.43	0.1 – 1.93
Type of Labor[b]:		
Induced	1.87	1.57 – 2.22
Spontaneous	Reference group	
Spontaneous, augmented	2.69	2.29 – 3.15

BMI = body mass index; HBP = hypertension

References:

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Abstract #:F-12

Survey of Anesthesia Practices to Facilitate External Cephalic Version

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Background: External cephalic version (ECV) is used for breech presentation in order to enable attempted vaginal delivery (1). Neuraxial block may increase ECV success rates (2) and is cost-effective (3), however the extent to which neuraxial anesthesia is used to facilitate ECV has not been assessed in the United States. The purpose of this survey study was to assess the frequency and characteristics of neuraxial blockade used to facilitate ECV.

Methods: We surveyed Society of Obstetric Anesthesiology and Perinatology (SOAP) members regarding their institutional ECV practice. An 18-question survey was developed by 3 obstetric anesthesiologists and tested for face validity on a cohort of practicing anesthesiologists. The survey was emailed on Jan 16th 2014 to the 1,056 SOAP members. We present descriptive statistics of the initial responses.

Results: The initial survey request was completed by 188/1,056 (18%) of the members. Of the respondents, 88% practice in the United States, and 73% of responders work in academic institutions. The frequency of ECV performance for breech presentation is <50% in 67% institutions, =>50% in 28% institutions and 3% of institutions D.O. not perform ECV. External cephalic version neuraxial block practice and ECV adjuncts are summarized in the Table.

Conclusions: Our interim analysis shows that neuraxial blocks are not universally offered to facilitate ECV, despite evidence for improved ECV success with neuraxial anesthesia. There is clear variability in neuraxial block technique and dosing to obtain anesthesia or analgesia levels. Initial results suggest that education of both obstetrician and anesthesiologist is necessary to remove barriers to care before widespread neuraxial use for ECV is realized.

Questionnaire Item	Respondents (%)
Annual Hospital Delivery Rate	
≤2000	17%
2001-4000	30%
>4000	53%
Adjuncts used for ECV procedure	
Tocolytics	51%
Neuraxial block	65%
Systemic opioid	19%
Other adjuncts (nitroglycerine, nitrous oxide)	2%
No adjuncts	22%
Setting for ECV procedure	
OR	39%
PACU	16%
Delivery Suite	34%
Clinic	0.5%
Frequency of neuraxial block use for ECV	
100%	5%
71-99%	17%
11-70%	31%
1-10%	26%
0%	14%
Type of neuraxial block used for ECV	
Spinal	17%
CSE	47%
Epidural	44%
Desired neuraxial block density	
Anesthesia	43%
Analgesia	36%
Barriers to use of ECV with neuraxial block	
MFMs discourage neuraxial block	47%
Other analgesics preferred for ECV	4%
Delayed discharge concerns	13%
Logistical barriers	26%

ECV=external cephalic version; CSE=combined spinal-epidural; MFMs=Maternal-Fetal Medicine Specialist; OR=Operating Room; PACU= Post-Anesthesia Care Unit

References:

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Abstract #:F-13

Labor Epidural Analgesia and Peripartum Depression: Association and Implications

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Introduction: Peripartum depression is a common psychiatric disorder affecting women and their families with an incidence of 11-20.4%.1 A recent study found that women choosing epidural labor analgesia had a lower incidence postpartum depression (PPD).2 However, one of the strongest predictors of PPD is antenatal depression (APD) which was not accounted for in the previous study.3 The aim of this study was to examine the association of receiving a labor epidural on PPD rates while accounting for APD.

Methods: This project was a secondary analysis of a prospective study that examined the association of blood biological markers and peripartum depression. Parturients (n=106) were evaluated for APD at 8-10 weeks and 24-28 weeks of gestation and 6-8 weeks postpartum using the Edinburgh Postnatal Depression Scale. Additional information collected included age, BMI, race, parity, gravida, relationship status with the father, income level, education level, history of psychiatric illness, and gestational age of the baby at delivery.

We examined the association between APD and request for labor epidural and the association of labor epidural with development of PPD. The association between labor epidural request and PPD was also evaluated controlling for the presence of APD. Statistical analysis was performed using logistic regression or Fisher's exact test.

Results: The rate of APD was 19.8%. Parturients with APD had 19 times the odds of experiencing PPD compared to mothers without APD ($P<0.001$; 95% CI=3.8-92). The majority of parturients requested epidural labor analgesia regardless of the presence (61.9%; n=21) or absence (62.4%; n=85) of APD ($P=0.97$). The rate of PPD was 20% (n=13/65). Parturients who received epidural labor analgesia had a 24% incidence of PPD compared to a rate of 6.7% among parturients who did not receive labor analgesia ($P = 0.27$). The relationship between epidural placement and PPD remain non-significant after controlling for APD ($P=0.28$).

Conclusions: APD was not associated with epidural labor analgesia utilization, but was a significant predictor of PPD. Additionally, a significant association between the development of PPD and request for epidural labor analgesia was not observed while accounting for APD. This study highlights the importance of prospective evaluation of depressive symptoms throughout pregnancy and postpartum. Our data contrasts the previous study by Ding et al., which found epidural labor analgesia to decrease the incidence of PPD.2 Additional studies are needed to ensure replication of these findings and not overlook a potential preventative intervention for the reduction of depression with postpartum onset.

References:

1. MMWR Morb Mortal Wkly Rep 2008; 57:361-6.
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Abstract #:F-14

A suggested plan for the perioperative anesthetic management of elective cesarean-hysterectomy due to placenta accreta

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Introduction: Placenta accreta is the most common indication for peripartum hysterectomy and a potentially life-threatening obstetric condition, requiring a coordinated multidisciplinary approach. The perioperative role of the anesthesiologist is extensive; however, the current literature lacks specific guidance for the anesthesiologist. Evidence-based guidelines intend to improve patient care and health outcomes by promoting interventions of proved benefit.[1] We aimed to produce perioperative anesthesia guidance for our tertiary obstetric center of excellence, with a vision to promote a standardized approach to the elective cesarean-hysterectomies due to placenta accreta.

Methods: The current literature was examined for the benefits and risks of regional and general anesthesia in this setting. Furthermore, the evidence for interventions to minimize blood loss (pharmacological and non-pharmacological); replacement of circulating volume (including crystalloid, colloid, blood product and autologous cell salvaged blood); optimization of analgesia (including pre-medication); and provision of aspiration prophylaxis was searched. In addition, local institutional practices and opinions were collated. The evidence was reviewed by collaboration within our department, and a consensus achieved.

Results: Figure. 1 depicts step by step the suggested perioperative anesthesia management, with the rationale or evidence for each step.

Discussion: There is limited guidance on the perioperative anesthesia management for elective cesarean-hysterectomies for placenta accreta in the current literature. Our institution has developed a suggested evidence-based guidance for the management of these cases to conform to a more uniformed and standardized practice. This provides an evidence-based algorithm on the provision of optimal intra and post-operative analgesia, replacement of circulating volume and maintenance of hemodynamic stability with fluid therapy and blood products, promotion of hemostasis with pharmacological therapy and blood products, and minimizing the risk of aspiration. Furthermore, at our institution, where 12-18 such cases are performed each year, this standardized approach will allow audit of our technique in the future.

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Abstract #:F-14

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ANESTHESIA GUIDANCE FOR ELECTIVE CESAREAN-HYSTERECTOMY IN PLACENTA ACCRETA

Placenta accreta is the abnormal adherence of the placenta to the uterine wall with invasion of the placental villi through the decidua.[1] It is further classified, depending on the depth of invasion:

- ***placenta accreta***: villi embedded directly in the myometrium in the absence of a defined decidual layer
- ***placenta increta***: villi invade through the full depth of the myometrium
- ***placenta percreta***: villi penetrate through the uterine serosa, and into local structures, eg. bladder.[1]

Placenta accreta is one of the two leading causes of peripartum hemorrhage and the most common indication for peripartum hysterectomy.[1]

Comprehensive planning by a multi-disciplinary team may result in a reduction in intra-operative blood loss and decreased maternal morbidity and mortality.[1]

Prior to scheduled surgery (preferably the day before)

Review the patient on the Antenatal Ward	
Undertake a full anesthesia assessment, including: • **grading of accreta (may need to review MRI or discuss with OB team)** • **physical assessment: airway and spine** • **check laboratory investigations including: Hb, platelets, coagulation screen, creatinine** • **confirm cross-match of 4 units of red blood cells**	• it is essential to be aware of the surgical technicalities of the operation, potential difficulties, and likelihood of massive blood loss • intra-operative conversion to GA may be required • a baseline Hb is necessary • the potential for transfusion is high

Consent for and explain the following procedures:
• **2 large bore intravenous (IV) catheters**
• **epidural insertion and anesthesia**
• **possible intra-operative conversion to GA**
• **blood transfusion: both autologous and allogeneic**
• **arterial line**
	• good IV access is required for preparation of massive transfusion
	• if there are no contraindications, regional anesthesia is our institution's primary technique of choice
	• one study has shown an intra-operative conversion rate of 29%[2]
	• both cell salvaged blood and blood-bank blood may be transfused
	• arterial access permits invasive BP monitoring and facilitates regular blood monitoring which helps provide:
	  ○ accurate haemodynamic assessment & stability
	  ○ Hb, haematocrit, clotting profile and acid-base status

If the OB team wish to site IV access for overnight, recommend that you will site the IV now	This will ensure that you can select the *best* vein for large bore access (and it is not compromised for a smaller gauge IV, or several attempts are made, compromising venous access the following day).
Inform Labour Ward & Night Anesthesia Team: • **ideally you will site the epidural**	• if due to time constraints, you will **not** be able to site the epidural, you will need to plan and request a colleague to undertake this (i.e. on-call staff/fellow)
Ensure the following are completed: • **anesthesia chart** • **ideally a dictated consult**	• inform *Transcription Services* to type a STAT dictation
Order STAT 600mg gabapentin per oral for 6:00am the day of the surgery	Preoperative gabapentin has been shown to reduce post-cesarean pain.[3] The neonatal team have no concerns with regards to this.

In the Labour Ward on the day of surgery (approximately 2-hours prior to scheduled surgery)

Site one large bore IV (if not already sited), and begin an infusion of Ringer's Lactate, to keep the vein open	
Order and ensure aspiration prophylaxis given: • **10mg IV metoclopramide** • **20mg IV famotidine**	This is to minimise insults secondary to aspiration in the event of total spinal anesthesia or the conversion to general anesthesia. You can find this in Powerchart, under "*orders*" and search for "*aspiration prophylaxis*".
Site the epidural, ideally T12/L1 or L1/L2	This will promote an adequate T4 block, in case of a vertical incision.
Give a test dose of 3mls 2% lidocaine (plain)	Do not load the epidural any further at this point.

In Interventional Radiology (IR) (approximately 1-hour prior to scheduled surgery)

Here the patient will have insertion of bilateral balloons, in the internal iliac arteries, under local anesthesia. At the end of the insertion, the radiologist will show you: • **how to access each balloon** • **how to inflate each balloon *if necessary*, and with the exact volumes required & how to deflate each balloon**	Occlusion of these arteries temporarily is one strategy to minimise intra-operative blood loss.[1] The insertion of these balloons allow temporary reduction of blood flow to the uterus, in the event of massive hemorrhage. The balloons will be sited and remain deflated, unless inflation intra-operatively is required.

On arrival in the OR (at the time of the scheduled surgery)

Administer 30mls per oral of sodium citrate to the patient	This is for further aspiration prophylaxis.
Site a second large bore IV access	
Ensure at least one of the IV's is connected to a blood-giving set and a fluid warmer	Massive transfusion is associated with hypothermia, and avoidance of hypothermia is essential in the prevention of coagulopathy.
Site an arterial line • **If you are unsuccessful, transduce one of the internal iliac balloon catheters, however this is less than ideal**	This will produce a waveform and allow aspiration of arterial blood (however, it may not function at all points during the surgery). Ensure you are aware of where to transduce it (ask the radiologist if unsure).
Establish full-monitoring: 5-lead ECG, IBP, NIBP, oxygen-saturations	
Begin incremental epidural anesthesia loading using: • **2% lidocaine, with 1:200,000 epinephrine** • **100mcg fentanyl**	

Abstract #:F-14

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Administer antibiotics: 2g of cefazolin, if not already given. Avoid in penicillin allergy (consider alternative). Re-dose 3-hourly.	
Confirm 4-units of cross-matched blood are immediately available in the fridge	Our institution has demonstrated, over a ten-year duration, a packed red blood cell transfusion range of 0 to 15 units.[4]
If cell salvage is to be used, discuss with the perfusionist and surgical team, the need for two suction devices • **one for the surgeons and direct surgical bleeding** • **one for a dedicated scrub nurse who should be tasked with washing blood soaked swabs in a sterile basin, with normal saline at room temperature.**	The use of autologous red cells can decrease the requirement for allogeneic transfusion.[1] • the major proportion of cell salvaged blood will be from blood soaked swabs.
Prior to surgery, undertake a World Health Organisation (WHO) "Time-Out". Check: • **that surgeons will need to inform you if any uterotonics are required (ensure all uterotonics are on hand)** • **that the balloons are accessible to you**	Excellent communication between all multi-disciplinary teams is vital for optimal management.

Intra-operative management

Maintain mean arterial pressures (MAP) to within 10% of baseline, until delivery of baby	It is important to maintain adequate uteroplacental perfusion, for fetal well-being.
Administer 1000mg of tranexamic acid (be aware of contraindications and inform the OB team – check as they may prefer this post-delivery)	This is for an anti-fibrinolytic effect, and to promote hemostasis.
Consider sending the following every hour: • **arterial blood gas** • **CBC** • **clotting profile, including fibrinogen**	In the context of massive haemorrhage and transfusion. • a Hemocue may also be useful for immediate Hb measurement
Fluid management: • **this should be guided by clinical judgement** • **for fluid expansion, upto 1-litre of colloid (Volulyte 6%) may be administered**	
Blood products: • **this should be guided by clinical judgement** • **for red blood cell transfusion, use either autologous (cell-salvaged blood) or allogeneic blood, or both.** • **following the administration of 4-units of allogeneic red blood cells, each additional unit should be matched with a unit of fresh frozen plasma (FFP).** • **also consider administration of platelets, cryoprecipitate in massive transfusion** • **In massive transfusion: call "*Code Omega*", consult Transfusion Medicine early and consider Factor VII**	• optimising FFP to packed red cell ratio reduces the risk of coagulation abnormalities during massive trasfusion.[1] • maintain: platelet levels > 50 x 10^9/L; monitor fibrinogen <4g/L closely; and replace fibrinogen when <2g/L with (cryoprecipitate or fibrinogen).
Be aware of electrolyte abnormalities associated with massive transfusion, and treat accordingly: • **hypocalcemia** • **hypomagnesia** • **hyperkalemia**	 • due to dilution and citrate binding • due to dilution and citrate binding • due to high concentration of potassium in stored red blood cells
The epidural may require further supplementation throughout: • **administer 2.5mg epi-morphine following delivery** • **top-up using either 2% lidocaine or 0.5% bupivicaine with epinephrine**	Due to the increased length of the surgical procedure • titrate small incremental doses

Immediate post-operative assessment in Interventional Radiology

Accompany the patient to IR, where the radiologist will assess if there are any bleeding points ameanable to embolization, and if the balloons need to remain in situ, or are safe to remove	This is to minimize the risk of post-operative bleeding, and to balance the risks and benefits of leaving the balloons in-situ.

Return of patient to the Labour Ward

Accompany the patient to the Labour Ward and re-institute blood pressure and vitals monitoring	
Handover to the nursing team: • **order and institute a continuous epidural infusion: ideally 0.125% bupivicaine plus 2mcg/ml fentanyl** • **consider 200mg gabapentin, t.i.d. for the next 48hrs, per oral** • **to re-check CBC, renal biochemistry and clotting profile**	• Excellent post-operative analgesia will maximize the post-operative rehabilitation of the patient.
Handover to Labour Ward Anesthesia team: • **brief summary of the case and management** • **on-going Pain Management Plan** • **to ensure CBC and clotting profile is checked prior to removal of epidural in the next 24-48 hours, as well as the timing of DVT prophylaxis**	• following massive hemorrhage, coagulation abnormalities are frequent, and increase the risk of a spinal or epidural haematoma, especially following manipulation of the catheter.[1]

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4) Nguyen-Lu N et al. Society for Obstetric Anesthesia and Perinatology **2013;**

Abstract #:F-15

Anesthetic Management of Patients undergoing Postpartum Tubal Ligation: A Retrospective Analysis

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Introduction: The optimal anesthetic technique and timing for postpartum tubal ligation (PPTL) remains controversial. (1, 2) The aim of this study was to evaluate the success rate of epidural catheter reactivation and compare anesthetic and analgesic outcomes among various anesthetic techniques.

Methods: We conducted a retrospective chart review of patients with ICD-9 billing codes for PPTL over a 2 year period (Aug 2012-Aug 2014). PPTLs at the time of cesarean delivery were excluded. Data collected included: demographic and obstetric characteristics; labor analgesia; timing of PPTL; anesthetic management; postpartum and postoperative pain scores and analgesic use.

Results: A flow diagram of PPTLs is provided in the Figure. 69 epidural catheters were dosed for PPTL; 18 (26%) failed to provide adequate anesthesia. Median (IQR;range) time since delivery was 20 hrs (9-27;1-36) and 13 hrs (6-19;1-50) respectively for the failed and successful epidural catheter reactivations (P=0.09). Age, BMI, epidural space depth, epidural labor analgesia duration, time since delivery, labor CSE vs. labor epidural, and obstetric vs. non-obstetric anesthesiologists were not found to be significant predictors of successful epidural catheter reactivation. There was a trend towards higher failed reactivations with more physician top-ups required during labor (P=0.07). Median [IQR] time to provide anesthesia for PPTL was 15 mins [12-21], 41 mins [33-54] and 19 mins [15-24] for successful epidural reactivation, failed epidural (with secondary anesthetic technique) and primary spinal techniques respectively (P<0.0001). There was no difference in PACU duration, hospital length of stay, pain scores, or analgesic use for any of the anesthetic techniques used.

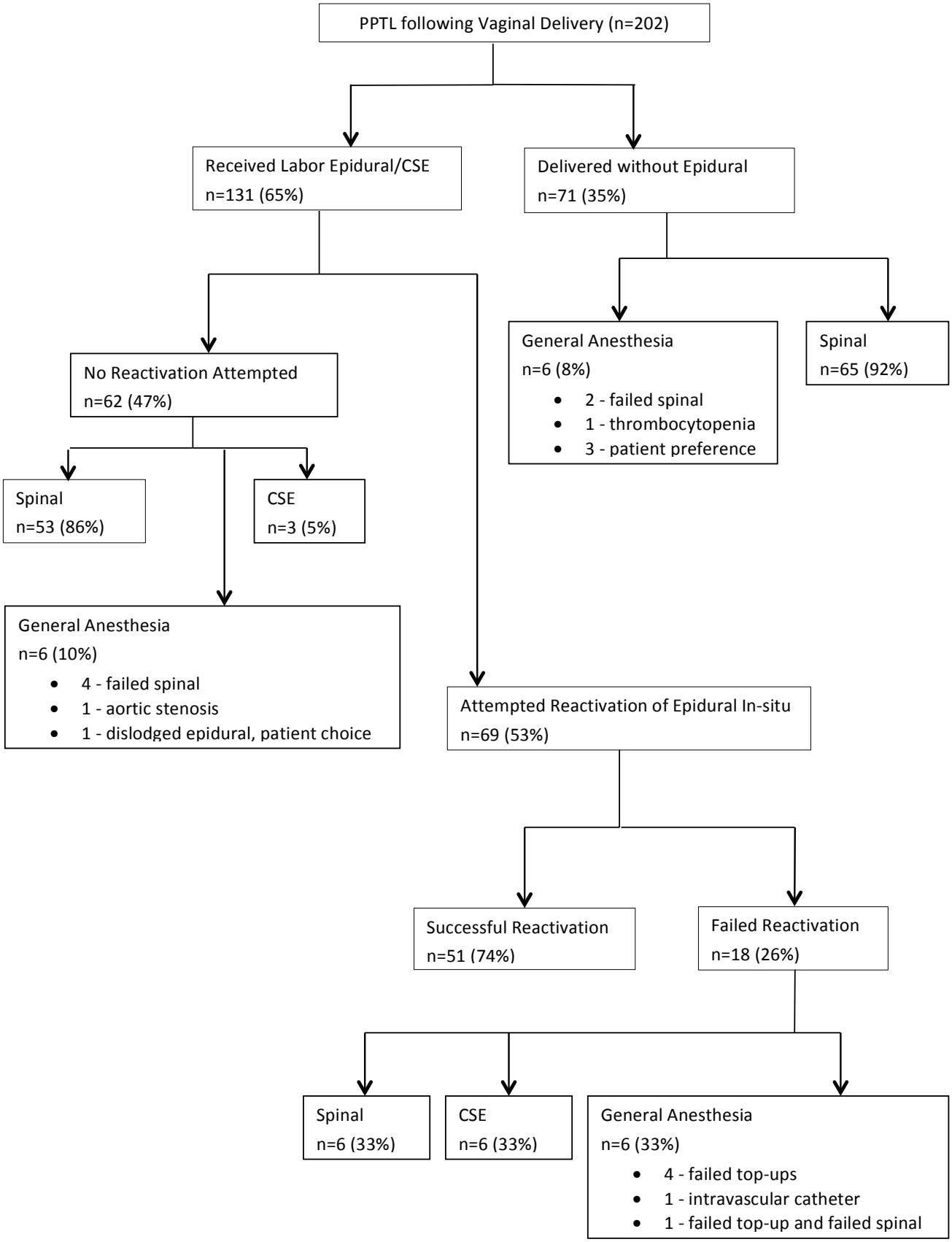
Conclusion: We found unexpectedly high epidural catheter reactivation failure rates despite our practice of limiting the time since delivery, confirming previously well-functioning labor epidurals, and checking catheter insertion and integrity of the dressing before attempting an epidural top-up for PPTL. Failed epidural catheter reactivations resulted in significant operating room delays and unnecessary general anesthetics. Given the high failure rate and lack of reliable predictors for successful epidural catheter reactivation, the practice of leaving labor epidurals in-situ for PPTL beyond the immediate post-delivery period should be challenged.

References:

1. J Clin Anesth 1995;7:380-383
2. Reg Anesth Pain Med 1998;23:258

Abstract #:F-15

Figure: Flowsheet of All Patients undergoing Postpartum Tubal Ligation Vaginal Delivery



Data presented as number (%)

PPTL = postpartum tubal ligation; CSE = combined spinal-epidural

Abstract #:F-16

Accuracy of a Non-invasive Device for Spot-check Hemoglobin Measurement after Cesarean Delivery

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Background: Postpartum anemia (PA) is an underappreciated hematologic morbidity, affecting up to 21% of women one week after delivery.(1) Non-invasive devices that measure venous hemoglobin (vHb) may be of value in screening for PA prior to hospital discharge. The Pronto-7 device (Masimo Corp, Irvine, CA)(2) is a non-invasive spot-check device that uses multi-wavelength spectrophotometry for hemoglobin (SpHb) measurement. There is limited data describing the accuracy/precision of this device among postpartum women.(3) We present an interim analysis describing the Pronto-7 device performance in hospitalized women after cesarean delivery (CD).

Methods: After IRB approval, we performed an interim analysis of 42 healthy term parturients undergoing elective CD with neuraxial anesthesia who were enrolled in an ongoing prospective study. vHb and SpHb measurements were performed at 24 hr and 72 hr after CD. SpHb spot-checks were performed with a Pronto-7 device. To assess the level of agreement between SpHb and vHb values, we calculated the bias (mean difference and 95% CI) and limits of agreement (LOA), corrected for repeated measurements using a linear mixed-effects model. By examining for interaction, we determined whether the bias was consistent over time. $P < 0.05$ as statistically significant.

Results: Mean (SD) vHb and SpHb values at 24hr post-CD were 10.4 (1.2) g/dl and 12.7 (1.0) g/dl respectively, and at 72 hr post-CD were 10.6 (1.1) g/dl and 12.8 (0.9) g/dl respectively. A Bland-Altman plot of individual SpHb and vHb values is shown in Figure. We observed a significant positive bias for the SpHb values compared to vHb (2.25 g/dl; $P<0.001$); the 95% CIs were 1.99 g/dl and 2.50 g/dl. The LOA were wide: - 0.06 g/dl and 4.51 g/dl. (Figure). We observed no interaction between bias and time of measurement ($P=0.57$).

Conclusion: In this interim analysis of SpHb and vHb values of post-CD women, the Pronto-7 had a high positive bias with wide LOA. Although this device may have potential value as a screening device for PA, further modifications are needed to improve accuracy and precision prior to clinical use in the early postpartum period.

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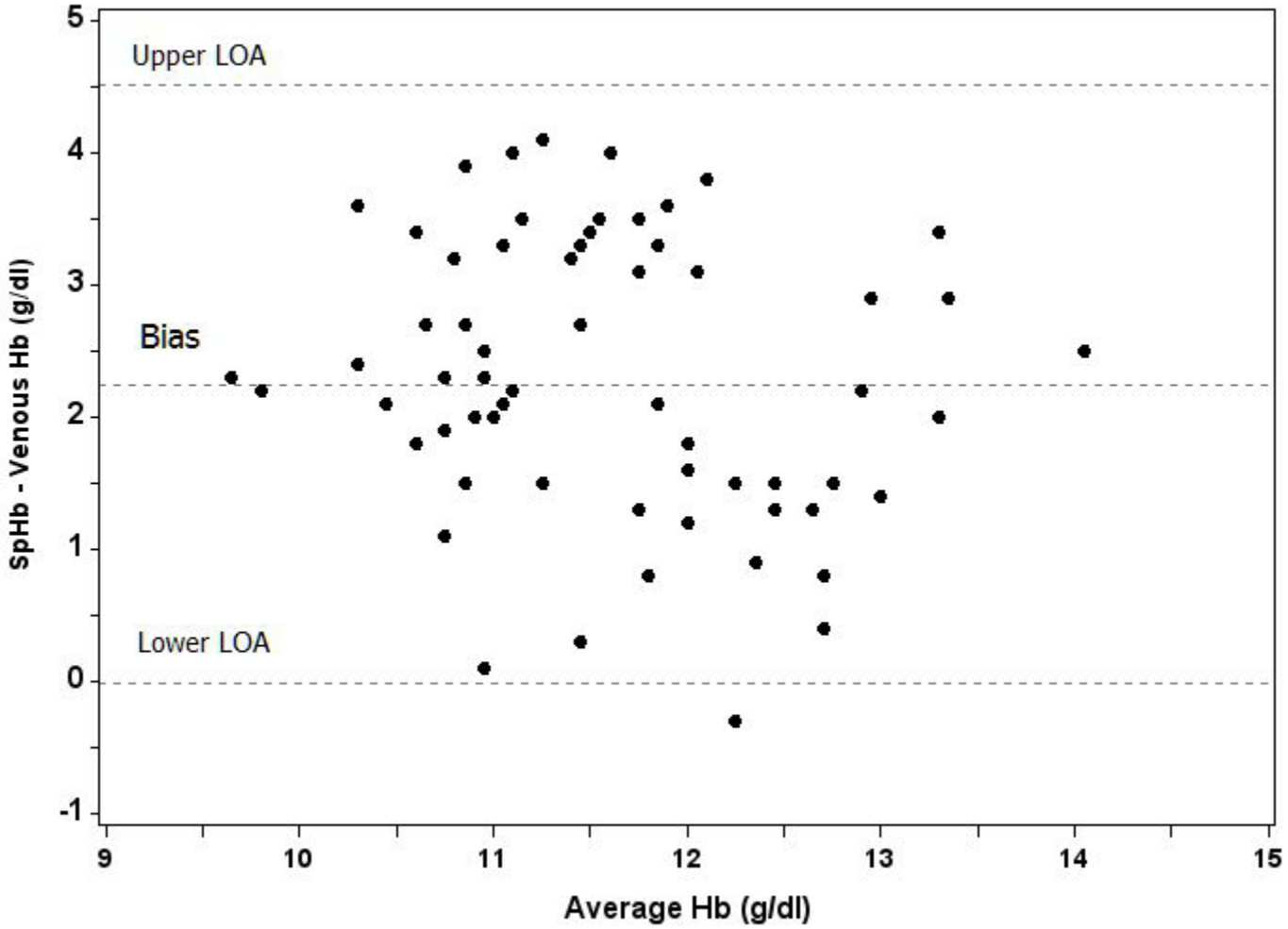
1. Ann Hematol 2011;90:1247-53
2. http://masimo.com/pronto-7/index.htm
3. Medical Devices 2014:7:11-16.

Abstract #:F-16



Abstract #:F-17

Programmed Intermittent Epidural Boluses Implementation for Labor Analgesia: A Retrospective Impact Analysis

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Introduction: Randomized controlled trials have demonstrated that programmed intermittent epidural boluses (PIEB) compared to continuous epidural infusion (CEI) reduce epidural local anesthetic consumption and increase maternal satisfaction with labor analgesia. [1,2] The aim of the study was to compare labor analgesic outcomes before and after the implementation of PIEB for labor analgesia in a busy academic hospital.

Methods: We conducted a quality assurance retrospective analysis before and after replacing the background CEI with PIEB for patient-controlled epidural labor analgesia (PCEA). Pre-PIEB pump setting: CEI 12 mL/hr with PCEA 12 mL every 15 mins. Post-PIEB setting: 8mL bolus every 45 mins with PCEA dose of 10 mL every 15 mins. At our institution, labor analgesia is initiated with either 15 mLs of epidural bupivacaine 0.125% + sufentanil 10 mcg or with intrathecal bupivacaine 2.5mg + sufentanil 5mcg for a combined spinal-epidural (CSE) technique. Our maintenance solution is bupivacaine 0.0625% + sufentanil 0.4 mcg/mL. We reviewed medical records of all women receiving epidural/CSE labor analgesia for 30 days before and after PIEB was introduced. Data collected included: parity; labor type; pain scores; physician top-ups; and timing of initial physician top-up. We excluded women with failed epidural or CSE blocks.

Results: Labor initiation technique (CSE/epidural), physician top-ups (number, total dose, and timing of initial intervention), and maximum pain scores post labor analgesia of the two groups were compared. (Table 1) We found no difference in any labor analgesic outcomes before and after PIEB implementation. Parity, CSE technique, and oxytocin administration for induction/augmentation were similar between the groups (Table 1).

Conclusions: Despite reducing our background dose (approximately 10ml/h with PIEB compared to 12 ml/h with CEI) and decreasing the PCEA dose (10 vs. 12 ml) we found that PCEA + PIEB provided similar analgesia compared to PCEA + CEI. The optimal PIEB with PCEA setting remains unclear. (2) This initial impact study analysis following the introduction of PIEB confirms potential local anesthetic sparing without compromising labor analgesia, however benefits appear to be modest.

Table 1: Obstetric characteristics and labor analgesic outcomes before and after implementation of PIEB for labor analgesia.

	PCEA + PIEB (n=173)	PCEA + CEI (n=194)	P-values
Parity (% primiparous)	57%	50%	0.21
Labor Type (% spontaneous)	28%	32%	0.56
CSE (%)	40%	31%	0.12
Maximum pain score*	2[0-6]	3[0-6]	0.97
Patients receiving top-ups (%)	28%	22%	0.23
Mean top-up dose (mg)**	26.3 ± 12.2	20.8 ± 14	0.05
Epidural/CSE to top-up (hours)	5.1 ± 4.2	7.5 ± 8.1	0.09

Data presented as means ± standard deviations, median [interquartile range] and percentages. PIEB=Programmed Intermittent Epidural Boluses; CSE=combined-spinal epidural; * Verbal pain scores (0=no pain, 10=worse pain imaginable) measured after successful initiation of epidural/CSE analgesia until delivery;**Mean dose of patients who received top-ups

References:

1. Anesth Analg 2013; 116(1); 133-134
2. Anesth Analg 2011; 112(4); 904-911

Abstract #:F-18

Non-invasive Hemoglobin Measurement during Cesarean Delivery: Has Device Performance Improved?

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Background: Pulse CO-Oximetry™ (PCO) uses multi-wavelength spectrophotometry for non-invasive hemoglobin (SpHb) measurement. In studies of women undergoing cesarean delivery (CD) first generation PCO technology was found to be too unreliable for measuring venous hemoglobin concentration (vHb).(1,2) In recent years PCO technology has been refined but it is uncertain whether device performance has improved in the obstetric setting. We present an interim analysis describing the accuracy of intraoperative SpHb measurement relative to vHb values during CD.

Methods: After gaining IRB approval and patient consent, 42 healthy term women undergoing elective CD with neuraxial anesthesia were enrolled in an ongoing prospective study. SpHb values were measured using Masimo Resposable probes (R1 25) and Radical-7 PCO (version 1.1.3.4). SpHb values were compared to vHb values, analyzed by laboratory CO-Oximetry (Beckman Coulter LH 780). To assess the level of agreement between SpHb and vHb, we calculated the bias (mean difference and 95% CI) and limits of agreement (LOA), corrected for repeated measurements using a linear mixed-effects model. We examined for interaction to assess if bias was consistent over time. P <0.05 as statistically significant.

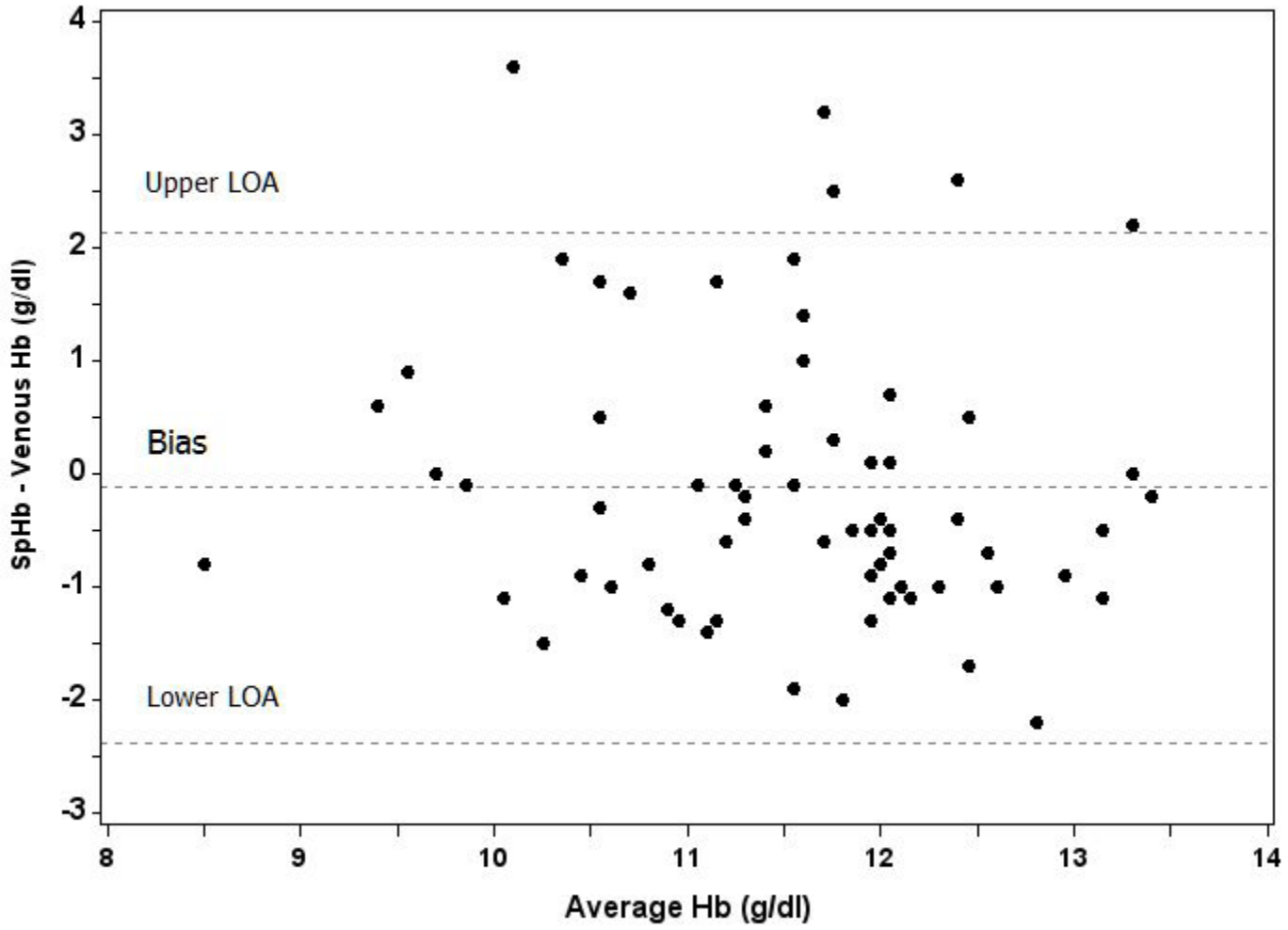
Results: Mean (SD) vHb and SpHb values at baseline were 12.0 (1.1) g/dl and 11.8 (1.0) g/dl respectively, and in PACU were 11.1 (1.2) g/dl and 11.8 (1.0) g/dl respectively. We observed no significant bias between SpHb and vHb (-0.12 g.dl; P=0.33); the 95% CIs were -0.37 and 0.13 g/dl. The LOA were relatively wide: 2.13 g/dl and -2.37 g/dl (Figure). We observed no interaction between bias and the time of measurement (P=0.85).

Conclusion: Refinements in PCO technology may have resulted in reduced bias between SpHb and vHb. However, as reported in prior studies, (1,2) the LOA were relatively wide therefore it remains uncertain whether PCO is clinically reliable during elective CD. Future studies are also needed to determine the accuracy/precision of PCO in the setting of severe maternal anemia and obstetric hemorrhage.

References:

1. Br J Anaesth 2012;108:271-7
2. Anaesthesia 2013;68:40-5.

Abstract #:F-18



Abstract #:F-19

Sequential CSE versus standard CSE in the morbidly obese parturient presenting for elective cesarean delivery

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Introduction: Concern exists regarding the appropriate dose and choice of neuraxial technique for spinal anesthesia in morbidly obese parturients undergoing cesarean delivery (CD). Although the ED95 for spinal bupivacaine has been demonstrated to be equivalent in obese and nonobese parturients(1), the consequences of inadvertent high spinal blockade in the morbidly obese patient undergoing elective CD are best avoided. The sequential combined spinal epidural (CSE) technique is a catheter based neuraxial technique, which allows for a slow, controlled induction of neuraxial anesthesia for CD. Direct comparison of sequential CSE versus standard CSE in the morbidly obese parturient may reveal the superiority of one technique over the other in this high-risk population.

Methods: Ours is a prospective, randomized, controlled, double blinded trial comparing sequential CSE to standard CSE technique in class III obese parturients presenting for elective CD. Each patient was randomly assigned to receive either 7.5 mg or 12 mg of 0.75% hyperbaric bupivacaine administered with fentanyl 10 mcg and morphine 150 mcg intrathecally. The primary endpoint was the number of epidural catheters requiring test dose administration. Secondary endpoints included spinal blockade level as determined by pinprick at five specific intervals, degree of hypotension from baseline, nausea and or vomiting, amount of epidural local anesthetic administered, dose of vasopressor given, and incidence of high spinal or block failure.

Results: Mean BMI was 47.3 ± 5.55 in the sequential CSE group (n=17) and 43.4 ± 2.53 in the standard CSE group (n=13). Median spinal blockade level at 15 minutes was T2 in the sequential CSE group and T1 in the standard CSE group. 47% of patients in the sequential CSE group and 15% in the standard CSE group required dosing of the epidural catheter (p=0.12) at an average of 55 and 91 minutes from the spinal dosing respectively (p=0.04). No difference in nausea and vomiting, hypotension from baseline, or vasopressor use was demonstrated between the two groups. There were no high spinals or block failures in either group.

Discussion: Although the sequential CSE technique has been shown to offer less hypotension during induction of neuraxial anesthesia, we have not been able to demonstrate this finding by reductions in hypotension from baseline, nausea, vomiting, or vasopressor use. We cannot recommend a decreased intrathecal dose of hyperbaric bupivacaine for CD in the morbidly obese parturient as part of a single shot spinal technique; further, our findings argue that class III obese patients should receive a catheter based technique for CD, as 15% of those receiving the standard CSE also required epidural supplementation, which seems to be related to the prolonged surgical time in the morbidly obese parturient. Data collection is ongoing.

References:

1. Curr Opin Anaesthesiol. 2009,22:341-46.
2. Anesthesiology. 2011;114:529-35.

Abstract #:F-19

Subject #	Weight (lbs)	Height	BMI	Age	Gestational Age	Bupivacaine Dose	Dermatomal level at 5 minutes	Dermatomal level at 10 minutes	Dermatomal level at 15 minutes	Dermatomal level at skin incision	Dermatomal level at skin closure	Test Dose given?	Epidural medications given?	Other IV analgesics/ anesthetics given?	N/V?	Vasopressors given and dose?
1	268	5'6"	43.28	25	39 & 0	7.5 mg	T6	T5	T5	T5	T6	Yes	Fentanyl 90 mcg	Toradol 30 mg; Versed 1 mg	No	Phenylephrine 300 mcg; Ephedrine 10 mg
2	263	5'5"	43.03	41	37 & 0	7.5 mg	T5	T4	T5	T5	T5	No	None	None	Yes	Phenylephrine 850 mcg
3	282	5'4"	48.38	31	39 & 4	7.5 mg	T6	T2	T2	T2	T4	No	None	Ketamine 20 mg; Versed 2 mg	No	Phenylephrine 400 mcg
4	249	4'11"	50.27	30	39 & 0	7.5 mg	T6	T5	T4	T4	T4	Yes	lidocaine 2% with epi 9 cc	Versed 2mg; meperidine 12.5 mg	No	Phenylephrine 2150 mg
5	255	5'2"	46.7	38	38 & 0	12 mg	T2	T1	T1	T1	T3	No	None	Toradol 30 mg	Yes	Phenylephrine 400 mcg
6	363	5'7"	56.84	39	39 & 6	7.5 mg	L1 on right; T12 on left	T7	T4	T4	T8	No	None	Toradol 30 mg	Yes	Phenylephrine 1000 mcg
7	282	5'7"	44.16	30	39 & 0	7.5 mg	T6	T5	T4	T5	T5	No	None	None	No	Phenylephrine 800 mcg
8	226.5	5'3"	40.13	23	39 & 1	12 mg	T4	T2	T1	T1	T4	No	None	None	No	Phenylephrine 1200 mcg
9	260	5'3"	46.07	24	39 & 0	7.5 mg	T6	C4	C4	C4	C4	Yes	Lidocaine 2% with epi 10 cc	Toradol 30 mg	Yes	Phenylephrine 1700 mcg; ephedrine 50 mg
10	228	5'2"	41.69	34	39 & 1	12 mg	T5	T3	C5	C4	T4	Yes	Lidocaine 2% with epi 5 cc	Toradol 30 mg	No	Phenylephrine 1400 mcg; ephedrine 20 mg
11	250	5'4"	42.89	28	37 & 6	12 mg	T6	T5	T4	T5	T6	No	None	Fentanyl 25 mcg IV: Toradol 30 mg IV	Yes	Phenylephrine 300 mcg
12	245	5'4"	42.03	36	39 & 3	7.5 mg	T5	T3	T3	T3	T3	No	None	Toradol 30 mg	Yes	Phenylephrine 1000 mcg; ephedrine 50 mg
13	333	5'11.5"	45.8	31	39 & 4	7.5 mg	L3	T4	T2	T2	T2	Yes	Lidocaine 2% with epi 15 cc	Toradol 30 mg	No	Phenylephrine 1300 mcg; ephedrine 20 mg
14	265	5'4"	45.46	32	39 & 1	12 mg	T10	T6	T3	T6	T6	No	None	Toradol 30 mg	Yes	Phenylephrine 900 mcg
15	311	5'7"	48.7	24	38 & 3	7.5 mg	T3	T1	T1	T1	T5	No	None	Toradol 30 mg	No	Phenylephrine 600 mcg
16	252	5'3"	44.65	38	39 & 5	12 mg	T9	T5	T2	T2	T9	No	None	Toradol 30 mg	No	Phenylephrine 1000 mcg; ephedrine 15 mg
17	244	5'3"	43.23	30	39 & 4	7.5 mg	T7	T5 R; T6 L	T4 R; T5 L	C4	C4	Yes	Lidocaine 2% with epi 22 cc	Fentanyl 40 mcg IV: Versed 1 mg IV	Yes	Phenylephrine 4600mcg
18	282	5'9"	41.63	31	39 & 1	7.5 mg	T5	T3	T1	T1	T2	No	None	Toradol 30 mg	No	Phenylephrine 1100 mcg
19	237	5'3"	41.99	27	39 & 5	12 mg	T5	T1	T1	T1	T7 R; T8 L	Yes	Lidocaine 1.5% with epi 5 cc; fentanyl 40 mcg	Fentanyl 50 mcg IV: Toradol 30 mg IV	No	Phenylephrine 1200 mcg
20	223	5'2"	40.78	32	39 & 3	12 mg	T6	T5	T3 R; T4 L	T4	T4	No	None	Toradol 30 mg	No	Phenylephrine 1100 mcg
21	240	5'4"	41.18	35	39 & 1	12 mg	T8 R; T6 L	T5	T4	T4	T4	No	None	Toradol 30 mg	No	Phenylephrine 1100 mcg; ephedrine 5 mg
22	296.7	5'6"	47.91	31	39 & 0	7.5 mg	C5	C5	C5	C5	T1	No	None	Toradol 30 mg	Yes	Phenylephrine 700 mcg
23	255	5'1"	48.21	25	39 & 6	7.5 mg	C5	C4	C5	C5	C5	No	None	Toradol 30 mg; Tylenol 1 gm	No	Phenylephrine 1000 mcg
24	294	5'7"	46.04	24	39 & 2	12 mg	T5	C5	C5	C5	T4	No	None	Toradol 30 mg; Tylenol 1 gm	Yes	Phenylephrine 1200 mcg
25	274	5'1"	51.8	31	39 & 4	7.5 mg	T6	T6	C5 R; T3 L	C5	T6	Yes	Lidocaine 2% with epi 3 cc	Fentanyl 90 mcg	No	Phenylephrine 2200 mcg; ephedrine 10 mg; glycopyrrolate 0.2 mg
26	250	5'5"	41.6	24	40 & 0	7.5 mg	C5	C4 R; C3 L	C4	C4	C5 R; T2 L	Yes	None	Toradol 30 mg	No	Phenylephrine 1900 mcg; ephedrine 25 mg
27	253	5'1"	47.83	21	37 & 2	12 mg	T5	T1	T1	T1	T1	No	None	Toradol 30 mg; Tylenol 1 gm	No	Phenylephrine 2000 mg
28	265	5'6"	42.79	31	40 & 0	12 mg	T6	T5	C5	C5	C5	No	None	Toradol 30 mg; Tylenol 1 gm	No	Phenylephrine 1800 mcg
29	217	5'1"	41.02	34	39 & 0	12 mg	T3	C4	C4	C4	T4	No	None	Toradol 30 mg; Tylenol 1 gm	No	Phenylephrine 2800 mg
30	338.2	5'2"	61.84	31	39 & 3	7.5 mg	T2	C7	T2	T2	T2	Yes	Lidocaine 2% with epi 13cc	Toradol 30 mg; Fentanyl 90 mcg	No	Phenylephrine 1100 mcg; Ephedrine 35 mg

Abstract #:F-19

Hypotension >10% from baseline?	Block Failure?	High Spinal?	Time between spinal meds given and procedure start	Time between spinal meds given and test dose given	Length of surgery	Time between spinal meds given and procedure stop	Surgeon	Notes
Yes	No	No	13 minutes	32 minutes	44 minutes	57 minutes	Byrd	Reason for test dose and epidural fentanyl: pressure (not sharp pain)
Yes	No	No	13 minutes	N/A	48 minutes	61 minutes	Drennan	
Yes	No	No	15 minutes	N/A	79 minutes	94 minutes	Hamilton	Reason for ketamine and versed: patient feeling pressure despite a T4 level.
Yes	No	No	16 minutes	53 minutes	95 minutes	111 minutes	Band	Reason for test dose and epidural lidocaine: Level decreased to T8
Yes	No	No	13 minutes	N/A	44 minutes	57 minutes	Cliff Moore	
Yes	No	No	17 minutes	N/A	48 minutes	65 minutes	Byrd	
Yes	No	No	12 minutes	N/A	43 minutes	55 minutes	Charbonnet	
Yes	No	No	15 minutes	N/A	63 minutes	78 minutes	Morris III	
Yes	No	No	23 minutes	82 minutes	102 minutes	125 minutes	Morris III	Patient had a large ovarian cyst removed which prolonged the procedure. Her level was at T8 1 hour and 22 minutes after the spinal medication were given and the lidocaine was given at that time.
Yes	No	No	21 minutes	71 minutes	57 minutes	78 minutes	Hamilton	
Yes	No	No	10 minutes	N/A	39 minutes	49 minutes	Parise	
Yes	No	No	15 minutes	N/A	34 minutes	49 minutes	Parise	
No	No	No	30 minutes	58 minutes	77 minutes	107 minutes	Hamilton	
Yes	No	No	10 minutes	N/A	51 minutes	61 minutes	Gillispie	
Yes	No	No	15 minutes	N/A	57 minutes	72 minutes	Cliff Moore	
Yes	No	No	19 minutes	N/A	86 minutes	105 minutes	Morris III	
Yes	No	No	29 minutes	62 minutes	97 minutes	126 minutes	Hamilton	
Yes	No	No	16 minutes	N/A	53 minutes	69 minutes	Byrd	
Yes	No	No	18 minutes	111 minutes	115 minutes	133 minutes	Morris III	
Yes	No	No	13 minutes	N/A	47 minutes	60 minutes	Parise	
Yes	No	No	18 minutes	N/A	54 minutes	72 minutes	Sargent	
Yes	No	No	12 minutes	N/A	52 minutes	64 minutes	Band	
Yes	No	No	15 minutes	N/A	77 minutes	92 minutes	Roberie	
Yes	No	No	18 minutes	N/A	77 minutes	95 minutes	Morris III	
Yes	No	No	26 minutes	69 minutes	83 minutes	109 minutes	Hamilton	
Yes	No	No	13 minutes	54 minutes	52 minutes	65 minutes	Sargent	
Yes	No	No	11 minutes	N/A	42 minutes	53 minutes	Byrd	
Yes	No	No	15 minutes	N/A	59 minutes	74 minutes	Gala	
Yes	No	No	17 minutes	N/A	60 minutes	77 minutes	Morris IV	
Yes	No	No	17 minutes	35 minutes	84 minutes	101 minutes	Gala	Patient did not have a high spinal, however patient did complain of weakness saying "I'm going to pass out". With reassurance she did well and experienced no complications.

Abstract #:F-20

A Pilot Study of a High-Fidelity, Low-Cost, and Simulation-Based Educational Intervention to Improve Obstetric Patient Safety and Teamwork in China

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Introduction: Simulation (SIM) is an educational tool that can help optimize crisis management. [1] We carried out inexpensive in-situ SIM training in China with the goal of improving interdisciplinary team performance in obstetric (OB) emergencies.

Methods: Four teams of Chinese obstetricians, anesthesiologists, midwives and nurses participated in two consecutive SIMs: STAT Cesarean delivery and post-partum hemorrhage. The SIMs were performed in real labor and operating rooms. A volunteer played the patient, but invasive procedures were acted out. Rudimentary SIM materials were: intubatable head, newborn doll, fake blood (tomato sauce), iPad, and the DART Sim™ app. After each SIM, participants reflected on their teamwork in facilitated debriefings. SIMs and debriefings were videotaped and reviewed. Latent errors were identified, and time stamps for "decision" (calling an emergent surgery) and "incision" were extracted to calculate "decision to incision" (DTI) time. Debriefings were analyzed for themes and opportunities for future research.

Results: Six of eight SIMs had complete data. The shortest DTI time was 4:44 (minutes:seconds), the longest was 7:48. Teams 1 and 3 improved DTI times between SIMs by 1:53 and 1:23, respectively. All participants enjoyed the SIMs and learned something that would change future practice. Identified latent errors included unsafe patient transfer, equipment blocking hallways, and lack of immediately available medications or equipment. Identified areas for improvement included team communication, role clarity, and parallel processing of urgent tasks.

Discussion: In this pilot feasibility study, OB emergency SIM training with rudimentary equipment was successful. Improved performance may be attributed to deliberate practice and "just-in-time training" to identify barriers to management. Limitations include a small N and differences in clinical implications between the two SIMs. Strengths include in-situ inter-professional training, deliberate assessment of learners' needs and rapid-cycle practice after a facilitated debriefing. Further studies are planned to study how low-cost SIMs can be used as an educational tool for improving team performance.

Acknowledgements:

Dr. Lingqun Hu (No Pain Labor & Delivery Program)

MGH Center for Global Health

Reference:

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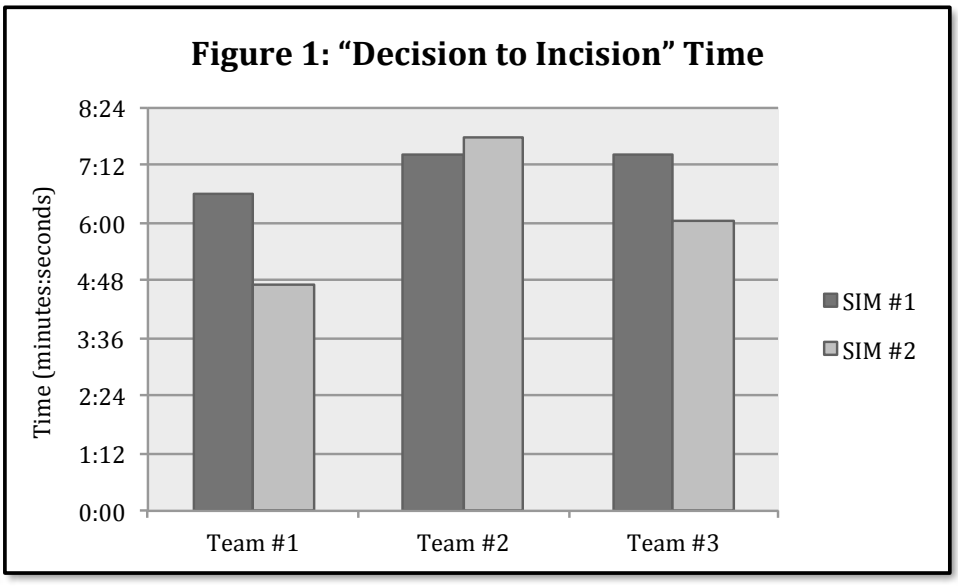

Abstract #:F-21

A High Pressure Delivery: Multispecialty Care for a Parturient with Primary Ciliary Dyskinesia

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Primary ciliary dyskinesia (PCD) is a rare genetic condition resulting in poor ciliary function, leading to bronchiectasis and chronic lung disease. Associated parenchymal changes and decrease in nitric oxide (NO) may lead to pulmonary hypertension (PH). These conditions carry significant peripartum mortality risk, partly due to the unique physiologic changes of pregnancy.[1]

A 30 year-old G1P0 with PCD complicated by end-stage obstructive and restrictive lung disease and suspected PH presented for care. For several years, she required home O2 and multiple admissions for pneumonia. With pregnancy, her functional status deteriorated to dyspnea at rest. Chest CT prior to pregnancy showed diffuse bronchiectasis. PFTs obtained during 3rd trimester of pregnancy, were FEV1 25%, FVC 33%, and FEV1/FVC 0.77, comparable to pre-pregnancy values, which included DLCO 16%. TTE revealed mild PH with estimated RVSP 37-47mmHg. Right heart cath was aborted after iatrogenic pneumothorax. At 36 weeks GA, she presented with preterm contractions. She was not in labor but was admitted for monitoring and aggressive pulmonary toilet to prepare for labor induction. Due to concern for rapid decline in cardiopulmonary status during labor, she was transferred to the SICU with invasive BP and CVP monitoring. A lumbar epidural was placed and vasopressin was used to maintain MAP>60mmHg. In the event of pulmonary collapse or right ventricular failure, NO, milrinone, and ECMO were on standby. At 37 weeks GA, in the SICU, she had a successful vaginal delivery. She required diuresis during stage II of labor but remained stable. She stayed in the SICU for 5 days of postpartum monitoring and repeated doses of diuretics for fluid management.

Early pulmonary optimization, avoidance of fluid overload, and hemodynamic stability were emphasized in the care of this patient. To accomplish these goals, adequate neuraxial labor analgesia was critical to minimize the sympathetic response to pain while avoiding high sensorimotor block that could be detrimental for her pulmonary status. This helped avoid systemic opioids, which blunt airway reflexes and respiratory drive, and avoid general anesthesia and intubation in a patient who would likely D.O. poorly with positive pressure ventilation and ventilator weaning. Vaginal delivery was recommended to minimize fluid shifts associated with C-section, the risk for intubation, and post-operative morbidities. Vasopressin was used due to its relatively favorable effects on pulmonary vasculature versus other vasopressors. General anesthesia and ECMO were available as part of contingency planning. Management of such a complex parturient requires coordinated multidisciplinary care to mitigate risks peripartum.[2]

References:

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2. Obican SG, Cleary KL. Pulmonary arterial hypertension in pregnancy. Semin Perinatol. 2014;38(5):289-294.

Abstract #:F-22

Massive OB Hemorrhage Protocol in Private Practice 2012-14: Results and Insights

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Background: Post-partum hemorrhage remains the major cause of obstetric mortality and morbidity. PPH increased 26% between 1994 and 2006 from 2.3% (n = 85,954) to 2.9% (n = 124,708; P<.001). In massive obstetric hemorrhages, implementation of a standardized massive transfusion protocol often lead to successful management of life-threatening hemorrhages. At Sharp Mary Birch hospital, we reviewed the data on obstetric patients who required emergency massive transfusion over a 3 year period from 2012 to 2014. At Mary Birch, a massive transfusion protocol for OB patients follows the California Maternal Quality Care Collaborative hemorrhage guidelines which specify a higher ratio of plasma to RBCs than trauma cases. The goal ratio of pRBCs : plasma: platelets is 4:4:1, with 2 cryoprecipitate, pooled, which is issued with the 4th massive transfusion pack, but may be ordered earlier if indicated.

Data analysis: Over the 3 years, there were total of 48 cases where emergency massive transfusions were invoked. These cases included both obstetric and gynecologic cases. Obstetric cases were mostly the result of uterine atony or invasive placenta. Amniotic fluid embolism and splenic artery aneurysm rupture were examples of less common causes of obstetrical hemorrhage. In 2012, there were 14 incidences, and on average, each patient required 10.9 units of pRBCs, 6.5 units of thawed plasma, 1.6 units of platelets and 1.7 units of cryoprecipitate, which is equivalent to a ratio of pRBC to plasma to platelets as 6.8 to 4 to 1 with 1 of cryoprecipitate. Of note, these numbers represent the number of products given during intraoperative and postoperative periods. In 2013, there were total of 17 cases, and on average, each patient required 5.2 units of pRBCs, 3.1 unit of plasma, 1 unit of platelets with 0.6 units of cryoprecipitate which is a ratio of 5.2 to 3.1 to 1 with 0.6 of cryoprecipitate. In 2014, there were 17 cases, and on average each patient received 9.7 units of pRBCs, 7.4 units of plasma, 2 units of platelets and 1.4 units of cryoprecipitate which is a ratio of 4.9 to 3.7 to 1 with 0.7 units of cryoprecipitate. Of interest, over an 8-month period from September 2012 to April 2013, there were 11 cases that required massive transfusion, and total of 11 pools of cryoprecipitate (each pool consists of 5 units) were wasted. This led to cryoprecipitate only being provided on the 3rd cycle of transfusion or if a measured fibrinogen level indicated its use.

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Abstract #:F-23

Delayed and Complicated Postpartum Diagnosis of Posterior Reversible Encephalopathy Syndrome

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Introduction: Though postpartum headaches (PPH) are common and usually benign, rare and serious causes must be considered when evaluating each patient. We report a complicated PPH case in which a number of serious causes were considered before the patient eventually suffered multiple seizures and MRI revealed a diagnosis of posterior reversible encephalopathy syndrome (PRES).

Case: A 30 year old G9P3 with a history of postpartum subarachnoid hemorrhage underwent a scheduled caesarean under epidural anesthesia. On PPD 4, she developed a headache with associated neck stiffness and hypertension. Over the course of 3-4 days and two hospital admissions, CTs, MRIs and CSF analysis were all unremarkable. Treatment with two separate courses of magnesium (Mg) for possible preeclampsia improved symptoms, but therapy was discontinued after each workup did not support the diagnosis. On PPD 9, worsening headache preceded multiple seizures and subsequent onset of blurry vision and photophobia. MR venogram was negative for thrombosis, but repeat MRI showed cerebral edema in right occipital and posterior temporal areas, supporting a diagnosis of PRES. Her headache, hypertension and vision changes resolved over the next 3 days after which she was discharged on phenytoin and beta blocker therapy.

Discussion: PRES is a rare neurologic disorder characterized by headache, confusion, vision changes, seizures and classic MRI findings of cerebral edema of the parietal and occipital lobes.1 Altered cerebrovascular autoregulation is thought to cause loss of blood brain barrier integrity and vasogenic edema. Usually PRES is self-resolving with supportive therapy, though irreversible neurological injury can occur with delayed recognition and treatment.

In our case, symptom presentation was atypical with delayed seizures and unchanged mental status. Furthermore, features of the patient's history and presentation were suggestive of other diagnoses that needed to be excluded; preeclampsia, intracranial hemorrhage, brain tumor, meningitis, venous thrombosis and PDPH were all considered. Ultimately, the presence of seizures, vision changes and supportive MRI findings confirmed diagnosis of PRES. Whilst unilateral MRI findings are atypical, varied imaging has been reported.2

Associated with various disease states, PRES is known to be precipitated by preeclampsia. 3 Though preeclampsia was not diagnosed in our case, the symptomatic improvement on Mg may be due to calcium channel blocking properties relieving vasospasm reported to contribute to PRES.4

PRES has also being reported following dural puncture,4 and authors hypothesize CSF loss may cause traction on posterior cerebral structures and induce vasospasm that results in PRES. Our patient did have a lumbar puncture and could have suffered unrecognized dural puncture during her epidural placement.

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3. Can J Anaesth. 1998;45:452-9
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Abstract #:F-24

Neuraxial Anesthesia in a Parturient on Antithrombin Concentrate

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Introduction: Antithrombin (AT) III deficiency is a rare disease affecting 1 in 600-1000 individuals. The high risk of thromboembolism (VTE) in pregnant patients with ATIII deficiency has prompted many obstetricians to recommend anticoagulation throughout pregnancy. However, current ASRA guidelines suggest holding treatment dose LMWH from 24 hours before placing an epidural to 4 hours following removal, a window which could pose a significant VTE risk. A potential alternative to LMWH is AT concentrate which has been shown in initial studies to be safe for use when anticoagulation is contraindicated.

Case Details: A 31yo G3P2 with a history of ATIII deficiency was admitted at 38 weeks for induction of labor. During her pregnancy she was anticoagulated with 120mg of LMWH BID, which had been held 24 hours prior to admission. On admission, baseline studies revealed AT activity of 61% (normal = 80-120%). She then received 2100 Units IV bolus of AT concentrate which increased AT activity to 94%. Induction of labor continued and 24 hours after admission she requested epidural placement. At that time, repeat laboratory studies confirmed a normal PTT and INR with AT activity of 80%. A lumbar epidural catheter was then placed without difficulty. A second bolus of AT concentrate was administered 24 hours after the first dose. Subsequently the decision was made to proceed to cesarean delivery due to arrest of descent. The existing epidural was used to obtain an adequate surgical level of anesthesia and the intraoperative course was uneventful. The epidural catheter was removed immediately postoperatively and subsequent follow-up did not reveal any neurologic changes or other concerning symptoms. LMWH was restarted the following day with plans to follow-up with outpatient hematology.

Discussion: Few case studies exist in the literature describing the use of neuraxial anesthesia in a patient receiving AT concentrate. Theoretically, the use of AT concentrate restores the patient to a normal coagulation state by correcting their innate deficiency, reducing the risk of VTE while posing no increased risk from neuraxial anesthesia. Induction of labor should be a coordinated effort between anesthesia, obstetrics, and hematology such that epidural placement would be requested at least 24 hours following the last dose of LMWH but following the initiation of AT concentrate so as to avoid either supratherapeutic or subtherapeutic anticoagulation at the time of epidural placement. While there have been no reported cases of significant effects from "overshooting" anticoagulation with AT concentrates, there is still fairly limited pooled experience with this treatment and a low baseline occurrence of such complications. Further studies are needed to fully elucidate whether any increased risk exists in these patients.

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Pamnani, A. et al. (2010) Journal of Clinical Anesthesiology 22:450-453

Rogenhofer, N. et al. (2013) Annals of Hematology 93:385–392

Abstract #:F-25

Type A Aortic Dissection Following Vaginal Delivery in the Setting of Severe Preeclampsia

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Aortic dissection is a rare but devastating complication of pregnancy and delivery. The majority of pregnancy-associated aortic dissection occurs in the third trimester or peripartum(1). Heart rate, stroke volume, and cardiac output peak immediately postpartum, and have the combined effect of increased arterial wall stress and intimal shear forces. Poorly understood pregnancy-related changes in aortic wall structure may predispose to dissection, and outflow obstruction caused by uterine contraction after delivery may contribute as well. There is limited data regarding aortic dissection associated with preeclampsia, however it is well described that poorly controlled peripartum hypertension can lead to adverse sequelae.

Our patient was a previously healthy 31 y/o G1P0 diagnosed with preeclampsia without severe features at 35 wks EGA. The following day she presented with in early labor with severe-range blood pressures (BP), headache, and low urine output. Magnesium was started and an epidural was placed. During labor her BP was poorly controlled with periodic systolic BP in the 190s. Following vacuum-assisted vaginal delivery, her hypertension resolved, and she was discharged on PPD 1. That night, she had sudden onset of chest pain, left facial droop, and loss of vision in her right eye. CT scan demonstrated Type A aortic dissection with extension into the proximal innominate and left common carotid arteries, resulting in near-total occlusion of these vessels. Her aortic diameter was 4.3 cm. She was transferred to a tertiary care center, where she underwent valve-sparing aortic root and hemiarch replacement, and antegrade endovascular aortic stent placement. She has made an excellent recovery, although her course has been complicated by HTN, left vocal cord paralysis, and persistent left-sided neurologic deficits.

Although rare, Type A aortic dissection during pregnancy is associated with high rates of morbidity and mortality for both mother and fetus. Risk factors include Marfan syndrome, Ehlers-Danlos syndrome, and bicuspid aortic valve. Average aortic diameter at the time of dissection is 4.8cm(1). Current recommendations for parturients with risk factors, including aortic root diameter >4cm, are for strict BP control, serial echocardiograms, and cesarean delivery under regional anesthesia(1). In this case, prompt diagnosis and rapid surgical intervention led to an excellent outcome in what is often a fatal condition.

Reference:

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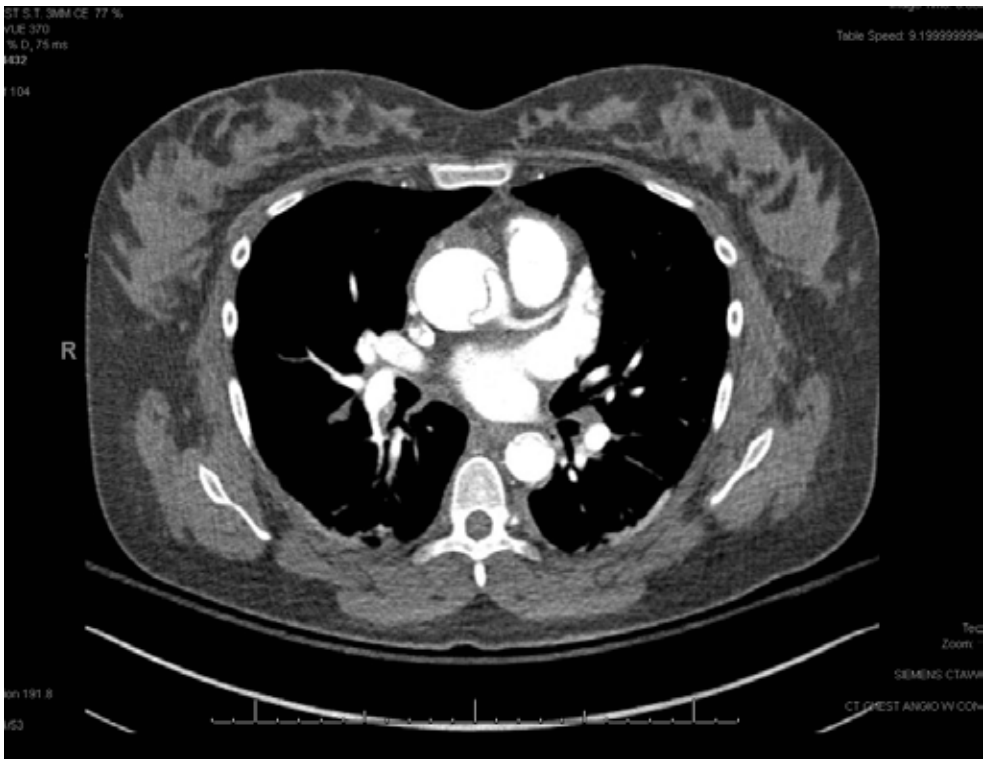

Abstract #:F-26

Effects on labor: A randomized trial of combined spinal-epidural versus lumbar epidural analgesia

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BACKGROUND: While traditional continuous lumber epidural analgesia has not been shown to affect the duration first stage of labor, combined spinal-epidural analgesia, although less studied, it has been suggested to shorten labor.

MATERIALS AND METHODS: Three hundred ten parturients were enrolled in this randomized control trial. Nulliparous women, 16-44 years age, with singleton pregnancies ≥ 37 weeks gestation and with cephalic presentations undergoing indicated induction of labor were eligible for participation in this trial. The primary outcome was the length of the labor, defined for this trial as time of analgesia to complete cervical dilation (onset of second stage of labor).

RESULTS: There were no differences in the duration of first stage labor in women randomized to combined spinal-epidural analgesia compared to lumbar epidural when analyzed using the log rank test and depicted using a Kaplan-Meier curve. Additionally, there were no differences in neonatal outcomes. In the combined spinal-epidural group, visual analog scale scores were lower over the labor course (P = 0.006) and less dense lower extremity motor strength scores (P = 0.001) were noted. Also, there was a 30% increase in cesarean deliveries in the combined spinal-epidural analgesia group secondary to fetal distress (P = 0.005).

CONCLUSION: Combined-spinal epidural analgesia does no effect the duration of the first stage of labor. While it offers superior pain relief and less of a lower extremity motor blockade, it is associated with a higher incidence of cesarean delivery due to fetal distress.

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2. Frigo MG, Larciprete G, Rossi F, et al. Rebuilding the labor curve during neuraxial analgesia. The journal of obstetrics and gynaecology research. Nov 2011;37(11):1532-1539.
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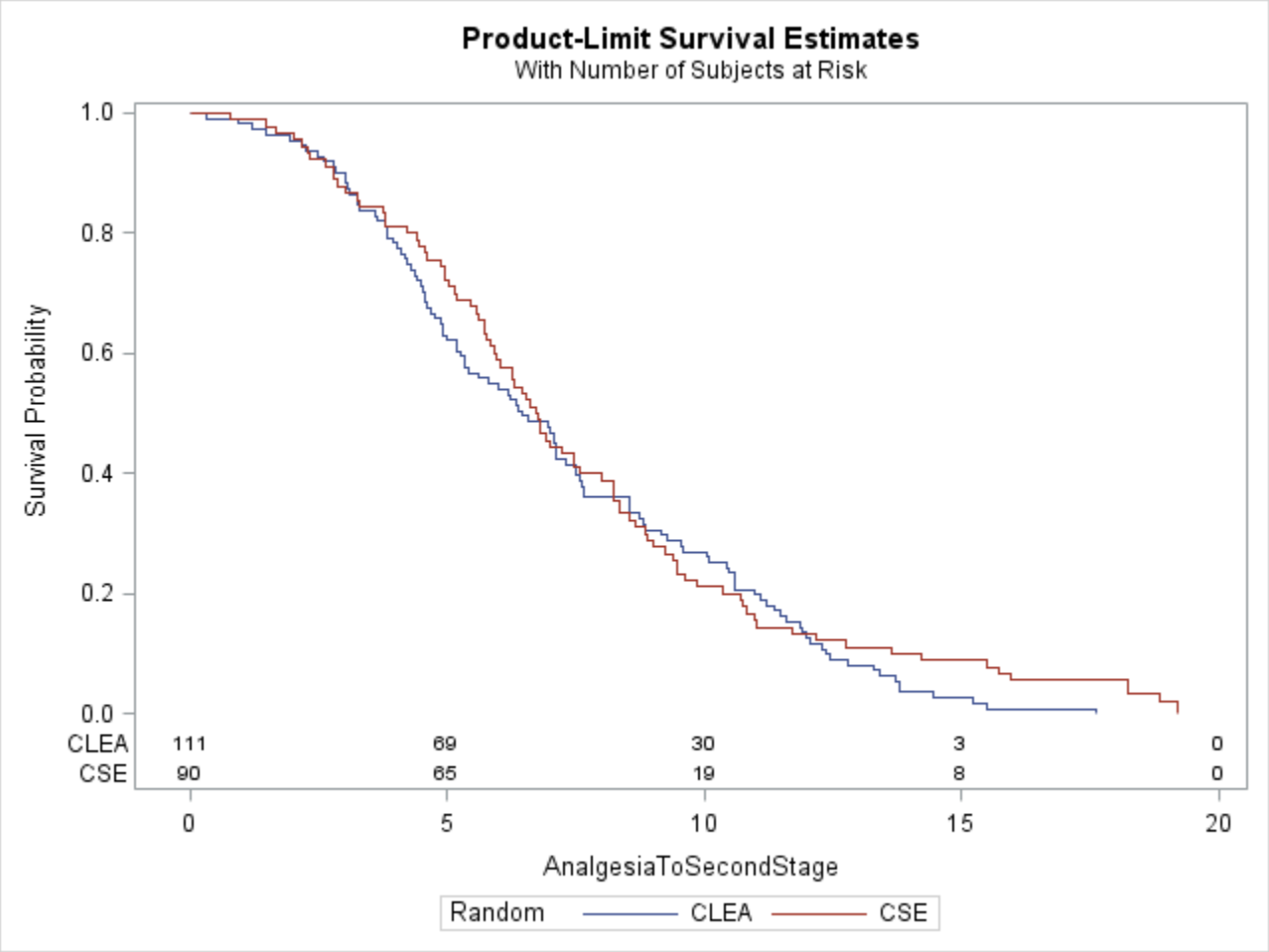
Abstract #:F-26



Kaplan-Meier curve of duration of labor from initiation of analgesia to complete dilation.

Abstract #:F-27

Sphenopalatine Ganglion Block vs Blood Patch for Accidental Post Dural Puncture Headache in Obstetric Patients - A Retrospective Observation

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Introduction: Postdural puncture headache (PDPH) is a relatively common complication after accidental epidural punctures(EP). Epidural blood patch(EBP), the standard of care for treatment of postdural puncture headache(PDPH) has numerous reports of side effects and complications, including motor and sensory defects, meningitis, seizure and hearing loss[1]. Sphenopalatine Ganglion Block(SPGB) has been applied successfully for headache for more than 100 years without significant side effects[2]. This retrospective study evaluates whether the effectiveness of SPGB for PDPH in obstetric patients was comparable with that of EBP.

Methods: We reviewed 78 records, from the past 15 years, of parturients without the previous history of primary headaches who had experienced the accidental PDPH from a 17g epidural needle. Group I (n=33), patients had SPGB before application of EBP. EBP was available for patients upon request. Cotton tipped applicators saturated in 5% water soluble lidocaine ointment were placed in each nostril for 10 minutes. Group II (n=39), patients had routine EBP for PDPH. Patients were followed up at ½ hr, 1 hr, 24 hr, 48 hr and 1 wk (by phone) increments after treatment.

Results: The two groups had the similar baseline characters, including ASA class, age, height, weight and BMI ($p>0.05$). At ½ hr after the treatment, 18 of 33 patients (54.55%) who received SPGB had recovered from headache, while 8 of 39 patients (20.51%) who received EBP had recovered from headache ($p=2.73 \times 10\text{-}3$). At 1 hr post treatment, 21 of 33 patients (63.64%) with SPGB had recovered from headache versus 12 of 39 patients (30.77%) who with EBP ($p=5.29 \times 10\text{-}3$). From 24 hr to 1 wk post treatment, the recovery rate was not significantly different between the two groups. Nine of 33 patients (27.27%) required EBP in SPGB group: 5 patients whose headache resolved ½ hr after the first SPGB, asked for prophylactic EBP to avoid returning with potential headache; 1 patient had headache resolution at 1 hr after the second SPGB also asked for prophylactic EBP; only 3 patients required the EBP for unresolved headache after second SPGB. Thirteen of 33 patients (39.39%) in SPGB group required a second SPGB: 9 patients had unresolved headache, 4 patients without headache feared headache relapse and asked for a second SPGB. Five of 39 patients (12.82%) in EBP group required a second EBP due to the unresolved headache. In SPGB group, no complications or ER visits were reported, while in EBP group, 9 patients had ER visits, 3 patients had backache radiating to the lower extremities, 1 patient had vasovagal reaction and 1 patient had temporary hearing loss that recovered in 30 minutes after the EBP procedure.

Conclusion: SPGB is a highly effective treatment for PDPH in obstetric patients. This is a non-invasive treatment with minimal side effects which relieves headache faster than EBP.

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2. G S. NY State J Med 1908

Abstract #:F-28

Obstetric anesthesia in Armenia: progress over an eight year journey

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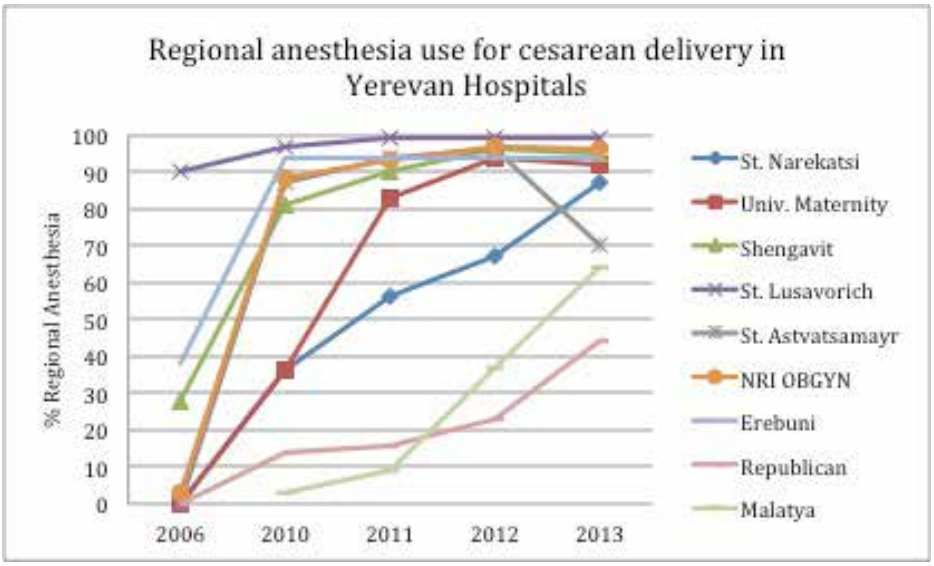
Background: The Republic of Armenia, a mountainous country in the South Caucasus, has a population of 3.3 million and was classified as a lower middle-income country by the World Bank in 2012.1,2 Currently 65% of the population lives in urban areas with 33% in the capital city of Yerevan.1

Cesarean delivery in Armenia has historically been conducted with general anesthesia and the use of epidural labor analgesia is uncommon. Kybele, a non-profit humanitarian organization, was invited to visit Armenia to conduct training in the standards and use of obstetric regional anesthesia. The aim of this report was to assess the impact of training on the use of regional anesthesia techniques for obstetrics in Armenia.

Methods: Kybele conducted five visits to Armenia between 2006 and 2014. The structure for each visit included a multi-national multi-disciplinary team, delivering a 1-2 day national conference in Yerevan and 2-5 day site visits to participating hospitals throughout the country. The Armenian Society of Anesthesiologists and Intensive Care Specialists collected data on the numbers of vaginal delivery, cesarean section, and regional anesthesia use in maternity units during the period. Data were analyzed with Fisher's exact test or Chi-square, as appropriate.

Results: In nine hospitals providing obstetric care in Yerevan, regional anesthesia use for cesarean delivery increased significantly ($p<0.0001$) between 2006 and 2013. There was also a significant increase in the use of labor epidural analgesia in seven of the nine hospitals ($p<0.0001$), although all but two hospitals had low utilization (<10%). In hospitals located outside the capital city, the use of regional anesthesia for cesarean delivery increased significantly more in hospitals that received an external visiting team than in those that did not ($p<0.0001$). Regional labor analgesia outside the capital city did not occur, except in one hospital located in the Nagorno-Karabakh Republic, where it was 4% in 2012 and 8% in 2013. Hospitals visited during the program accounted for over half the registered births each year in Armenia.

Conclusion: Through a targeted multi-year collaborative educational intervention the use of regional anesthesia for cesarean delivery consistently increased in Armenia, both within the capital city and in other parts of the country. Epidural labor analgesia also increased within Yerevan.



References

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Abstract #:F-29

Is The Patient Having A Stroke?

Presenting Author: Hamilton H. Shay M.D.
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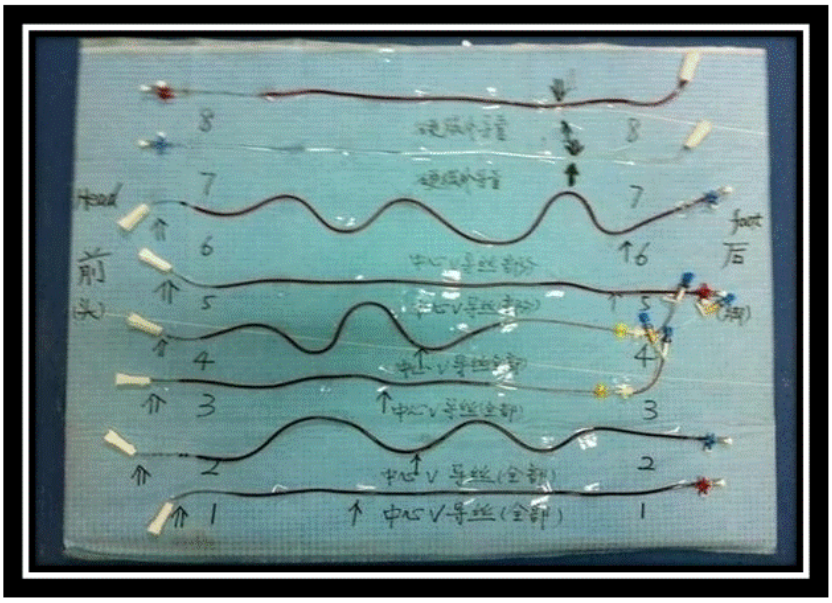
Divina Santos M.D. - Montefiore Medical center - Bronx, New York

Introduction: Labor and Delivery is a dynamic unit where things happen quickly. A case of ptosis one hour after epidural analgesia in a hypertensive patient resulted in a stat page for the Stroke Team and extensive work-up.

Case Report: A 32 year old G4P3003 BMI 35 with chronic hypertension for induction of labor at 37 weeks for suspected preeclampsia. Despite labetalol 200mg BID, BP 160/100. Uncomplicated epidural with 10mls 0.25% bupivacaine and continuous infusion of 0.0625% bupivacaine with fentanyl at 12mls/hr. An hour later, the husband noticed drooping of his wife's right eyelid. The OB resident noted BP 180/110, right ptosis, no other findings. The Stroke Team came, sent patient to MRI,epidural catheter removed, not MRI compatible. Thirty minutes after onset, ptosis resolved, patient had no deficits. No acute cerebrovascular or intracranial process. Three hours later epidural reinserted, no ptosis developed. A healthy boy was delivered spontaneously. She was discharged 2 days later. She was informed that the ptosis was due to transient Horner's syndrome sometimes seen during epidural anesthesia.

Discussion: Possible stroke had to be ruled out since her blood pressure rose further with anxiety. Clayton found an incidence of 1.3% of Horner's with labor epidural and 4% of patient undergoing a cesarean section, suggesting the volume of local anesthesia is a critical factor. The OB team, unaware that Horner's syndrome can occur with epidural, was understandably concerned about stroke. Since the epidural was discontinued, ptosis and other signs and symptoms of Horner's syndrome resolved. BPs returned to baseline when stroke was ruled out. Horner's or occulosympathetic palsy was first described in 1869, consists of ipsilateral miosis, ptosis,enophthalmos, flushing of the face, anhydrosis, and conjunctival injection. When associated with epidural anesthesia, it is benign, self-limiting and resolves without treatment. It is possible for Horner's to be associated with more serious medical conditions and should be investigated if it does resolve in a few hours. Anatomical and physiological changes during pregnancy favor cephalad spread of local anesthesia when engorgement of epidural veins compress the epidural space. Ferromagnetic wires and catheters are not MRI compatible. We conducted an in vitro study to determine what happens if they are subjected to MRI. All guide wires and epidural fragments migrated to MRI head at an alarming rate of ~50 cm/hour



There are eight testing units which consists of eight IV tubing , seven of them filled with human blood. Tubing 1 (T1) and T2, T3 and T4 contain full length central line guild wire. T 5 and T6 contain partial or broken central line guide wire. T7 and T 8 contain partial or broken catheter. T7 is filled with normal saline. All these tubing will then slides into MRI machine.

Abstract #:F-30

Atypical post-dural puncture headache complicated by a sub-dural hematoma in an unidentified dural puncture

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Co-Author: Elsje Harker M.D. - University of North Carolina at Chapel Hill - Chapel Hill, NC

Introduction: Patients with atypical presentation of post dural puncture headache (PDPH) can be difficult to diagnose, especially in the context of unidentified dural puncture. Subdural hematoma (SDH) is a rare but significant morbidity from dural puncture. This case describes a post-partum patient with PDPH, without evidence of accidental dural puncture, complicated by SDH requiring blood patch for treatment.

Case: A 33 year old G3P1011 was admitted at 38w5d in spontaneous labor. An epidural catheter was placed at L2-3 without difficulty when the patient requested analgesia at 2cm cervical dilation. Loss of resistance was at 3cm and the catheter was secured at 7.5cm. She was dosed with 3mg 1.5% lidocaine with epinephrine and 10 ml 0.125% bupivacaine. A T7 sensory level was maintained with a dilute bupivacaine/fentanyl infusion. Five hours later a viable infant was born vaginally without complication.

On PPD0, 9 hours after epidural placement, she complained of a headache. The headache improved overnight with acetaminophen, but worsened the next morning with standing. The anesthesia team evaluated the patient on PPD1 for headache and neck pain of pain scale 5/10 when supine and 8/10 when standing. The headache was located left-sided frontal/temporal and additional symptoms included nausea and vomiting. On PPD2 she noted a worsening headache with standing that now resolved when she was supine. She was offered a blood patch and declined. She was given butalbital/caffeine, 1mg IV cosyntropin, and acetaminophen. She was discharged on PPD3 feeling slightly improved.

She returned PPD5 with severe headache, nausea, vomiting, and hearing difficulty. A brain MRI was performed which showed a 3mm left sub-acute SDH and a very small likely right SDH with intracranial hypotension. Neurosurgery was consulted and recommended an epidural blood patch. She underwent an epidural blood patch at L3-4 with 20mL of autologous blood. One hour after the procedure her symptoms including headache, neck pain, and hearing difficulties were improved. She was discharged on HD3 in improved condition.

Discussion: Post dural puncture headache is the most common major complication after neuraxial procedures. These headaches are often initially treated conservatively with analgesics and bed rest. The most effective treatment for a post dural puncture headache, however, is a blood patch(1). Undetected accidental dural punctures account for a small percentage of PDPH. However, they may delay diagnosis and treatment of headache from an ADP. The incidence of a SDH from a dural puncture is unknown, but is a serious complication. The leakage of CSF lowers intracranial pressure, which can result in a caudal pull on the meninges and spinal cord(2). In cases of SDH, the bridging veins are stretched due to the caudal pull of the meninges and may lead to a tear at the weakest point.

References:

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Abstract #:F-31

Survey of drug shortages on academic obstetric anesthesiology floors

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Introduction: Drug shortages may result in patient harm1. No current evidence exists whether suggested strategies to deal with drug shortage actually reduce the number of shortages or improve patient safety2. The goal of our study is to survey academic obstetric anesthesiology unit directors to determine how drug shortages are being managed.

Methods: A survey was generated which addressed the impact of drug shortages as well as the mechanisms being used to manage these shortages. A list of academic obstetric anesthesiology directors was created and verified (93 total). The survey was distributed electronically (September 2014). Descriptive statistics were used to categorize survey responses.

Results: Sixty participants responded (response rate 65%). Fifty five percent of respondents indicated their unit was experiencing a shortage at the time of the survey and 76.3% indicated they had experienced a shortage in the last year. While 27.6% of directors indicated that at least one medication was being restricted to use on the obstetric floor, 11.9% indicated that there were medications that were restricted to other units. In order to conserve drug supply, 37.3% indicated that single dose medications were being divided for use on multiple patients and 11.9% responded this was being done by the anesthesiologists on the floor and not under sterile conditions. Medication errors/ near misses linked to drug shortages were reported by 15.3% of units. Anesthesiology consultation prior to drug changes by pharmacy was reported by 15.3% of respondents. Only 62.7% reported there was a mechanism in place to alert anesthesiologists of any changes in drugs manufacturers or concentration, , with e-mail notification being the most common mode of communication.

Conclusion: Drug shortages remain a concern for most obstetric units, with over 75% of respondents indicating that their unit experienced a drug shortage in the last year. In addition to medication errors, reported hazards included near-misses, the division of single dose vials for administration to multiple patients by anesthesiologists under non-sterile conditions, and the widespread practice of drug substitutions without anesthesiology consultation or notification.

References:

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Questions regarding impact of drug shortage	% responded "yes"	% responded "no"
Are you CURRENTLY experiencing drug shortage	55.0%	45.0%
Have you experienced drug shortage in LAST YEAR?	76.3%	23.7%
Are you currently restricting the use of any medication to your obstetric floor?	27.6%	72.4%
Are there currently any medications that are not available on your obstetric floor, but are available in other units?	11.9%	88.1%
Is your unit dividing single dose medications into multiple patient doses?	37.3%	62.7%
In the LAST YEAR, do you know of a medication error or near miss due to a drug shortage on your obstetric anesthesiology floor?	15.3%	84.7%
Questions regarding the use of suggested management strategies		
Does your unit have a designated anesthesiology drug manager who coordinates decisions and works with pharmacy prior to change implementation?	52.5%	47.5%
Are anesthesiologists consulted prior to any change in drug manufacturers or supplier changes?	15.3%	84.7%
Does your institution have a mechanism to alert anesthesiologists to medication formulations or appearance prior to drug distribution?	62.7%	37.3%

Abstract #:F-32

Surviving obstetric sepsis: A multi-facet approach to improving care of obstetric patients with sepsis.

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Introduction: The 8th Report of Confidential Enquiries into Maternal Deaths in the United Kingdom has shown that sepsis has become the leading direct cause of maternal death1. The Surviving Obstetric Sepsis (SOS) project was devised to explore and improve attitudes, knowledge and skills for dealing with maternal sepsis (S) as an extension to a hospital wide whole systems approach to sepsis care2.

Methods: A multidisciplinary survey of labour suite staff. The 1st survey was conducted in May 2013, with the repeat in January 2014. Interventions carried out in the intervening periods included obstetric seminars, midwife study days and specific delivery of S teaching at doctors' induction. Additionally posters, treatment stickers and S toolboxes were introduced into the obstetric clinical areas in line with the rest of the hospital.

Results: 50 surveys were issued at each survey, with a 100% response rate. Summarised results are in table1. Performance on the knowledge and treatment questions domains generally improved, however the number of responders confident in treating maternal S dropped by more than a third.

Discussion: Almost all responders knew of the 2011 Confidential Enquiries report, and were able to correctly identify S as the leading direct cause of maternal death, however a significant proportion of responders were not aware of the SOS campaign, nor were they aware they had previously encountered patients with S. Expectedly performance in the survey improved after the educational interventions. Use of posters, treatment stickers and S toolboxes were multipurpose aiming to improve publicity with novel visual and environmental aids, and to act as triggers to examine for and standardise care towards obstetric patients with S. The number of responders confident in dealing with severe S dropped after the intervention period, and it is speculated that the reason for this is increased insight into the nature of severe S in the obstetric population.

This initial study has shown promising improvement using techniques translated from a hospital wide strategy to improve care of patients with severe sepsis when applied to the obstetric population.

References:

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Abstract #:F-32

Total responders	1st survey 50	2nd survey 50
Knowledge of CMACE* report	45 (90%)	44 (88%)
Correctly identified sepsis as leading direct cause of maternal death	44 (88%)	44 (88%)
Knowledge of Surviving Sepsis Campaign guidelines	29 (58%)	35 (70%)
Acknowledges recognition and previous direct clinical experience of maternal sepsis	23 (46%)	40 (80%)
Correctly identifies treatment goals for severe sepsis	37 (74%)	25 (50%)
Confident in treating severe sepsis	34 (68%)	20 (40%)
Would find sepsis tool box useful	38 (76%)	49 (98%)

Table 1. Summary of survey. *CEMACE – Centre for maternal and child enquires. Results are in the format of number (%).

Abstract #:F-33

Epidural Pressure Waveform to Confirm Correct Positioning of the Epidural Needle in Laboring Pregnant Patients

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Introduction: Epidural analgesia is highly effective for labor pain relief. However, placement of the epidural needle can be challenging in pregnant patients due to lax tissue ligaments and edema, so that the loss of resistance method (LOR) used to find the space may be subtle, which can lead to retries, delay onset of analgesia and increased risk of complications. The ability to transduce a pulsatile pressure waveform from epidural needles placed in non- laboring patients correlates highly with successful blocks. We wish to evaluate the efficacy of obtaining a pulsatile pressure waveform with correct epidural needle placement in laboring women.

Methods: Written informed consent for case report was obtained from all patients. Patients were all ASA II and presented in the 1st stage of labor, cervical dilation of 4 cm. Case 1 - a 27-yr-old primigravida at 40 weeks gestational age (GA), initial pain Numeric Rating Scale (NRS) of 5. Case 2 - a 32-yr-old primigravida at 41 weeks GA, initial NRS of 8. Case 3 - a 29-yr-old multipara at 40 weeks GA, initial NRS of 6. For each case, standard monitoring was connected to the patient. An epidural anesthetic was then performed at the L3-4 level, using the LOR to saline technique. The needle was filled with 2-3 mL NaCl 0.9% and a high-pressure tubing extension leveled at L3-4 was connected to the needle and the pressure was transduced. Epidural pressure waveform was recorded for all patients at both a "rest" state (in between uterine contractions) and at an "active" state (during a contraction). Epidural catheters were threaded and all patients received a loading dose of 8-10 mL 2% lidocaine. Thirty minutes later, block levels and patient satisfaction (NRS) were recorded.

Results: For cases 1 and 2, a clear epidural waveform and pressure readings were obtained during both the "rest" and "active" states. During the "active" phase, an elevation of the systolic component of the epidural pressure was noticed (4 mmHg for case1, 3 mmHg for case 2). At 30 minutes, both patients had a bilateral block (T10/T11 and NRS of 3 for case 1, T9/T11 and NRS of 1 for case 2). For case 3, we unable to obtain an epidural pressure waveform. At 30 min, she had an inadequate block (L1/L2, NRS remained at 6).

Discussion: The presence of an epidural pressure waveform correlated with an adequate bilateral block 30 min after epidural loading dose.The absence of a waveform on the 3rd case was associated with an inadequate block.

Abstract #:F-34

Novel 3D-ultrasound-guided midline lumbar epidural placement, utilizing Epiguide needle guide in porcine model: a comparison of standard versus Pajunk epidural needles

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Introduction: We developed a real-time 3D ultrasound (3DUS) thick slice rendering technique and innovative Epiguide needle-guide as an adjunct to single-operator midline epidural needle insertions. Study goals: determine feasibility of the technique in a pig model and compare visibility of standard (SN) and echogenic needle (EN).

Methods: 37 lumbar needle insertions were performed on 6 intact porcine spines ex vivo. Puncture sites were first identified by palpation. The ligamentum flavum (LF) was then identified using 3DUS (Ultrasonix, Canada). Using the Epiguide, the needle was guided into the epidural space in the midline plane, watched in real-time on the 3DUS. Success was judged by achieving a loss of resistance (LOR) to fluid. Palpation site to puncture site distance, and insertion depth from needle tip to a zero-mark on the Epiguide were recorded. Needle visibility was rated by the anesthetist performing epidural using a 4-point scale^1 (0=cannot see, 1=poor, 2=satisfactory, 3=excellent). This was repeated at multiple randomly-selected lumbar levels using the SN and EN (Pajunk®, Germany). Images were saved and needle visibility was later rated by a blinded assessor. Calibrated 3DUS depth from zero point to LF was also measured.

Results: Successful LOR was achieved in 78% of needle insertions; 100% success when needle visibility was 'excellent' (Fig. 1). Needle visibility with EN (2.4±0.6, 94.4% satisfactory/excellent) was significantly greater than SN (0.6±0.7, 10.5% satisfactory/excellent) at $p<0.001$. Inter-observer agreement was good (Kappa=0.68). Mean distance between palpated puncture site and 3DUS guided insertion was 3.3±4.4mm. Insertion depth was greater than 3DUS depth to the LF (8.5±5.4mm).

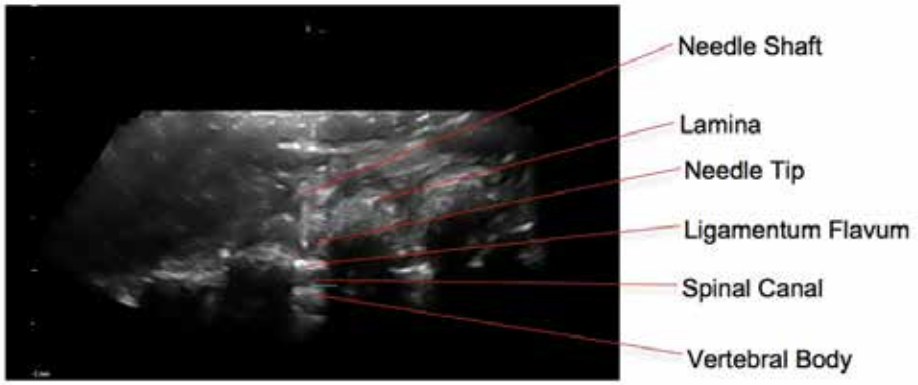

Figure 1. 3DUS of real-time midline epidural with EN visibility = 'excellent'

Discussion: It is feasible to perform 3DUS-guided real-time single-operator midline epidural insertions, with EN consistently improving both needle visibility and successful LOR. Insertion depth error is consistent with previous work on ultrasound^2, and can be explained by the thickness of the rendered LF (5.4±1.2 mm), and small overshoot of the needle past LF. It is recommended that 3DUS, together with Epiguide, be used to aid both the selection of puncture sites and the needle trajectory, but LOR should be used as the endpoint of insertion into the epidural space.

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Abstract #:F-35

Cardiogenic Shock in Pregnancy: Data from a Large Administrative Database

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INTRODUCTION: Over the past few decades, severe maternal morbidity due to cardiovascular causes has increased dramatically.(1) A greater percentage of maternal deaths are due to cardiovascular conditions as compared to other causes (hemorrhage, thromboembolic events, hypertensive disorders, sepsis) than previously noted. (2,3) The objective of this study was to determine the incidence and mortality of maternal cardiogenic shock (CS) and identify maternal risk factors.

METHODS: We obtained weighted estimates of the number of hospitalizations for deliveries complicated by CS (ICD-9 codes) obtained through the Nationwide Inpatient Sample (NIS) from 2004 to 2011. NIS is a federal database, which contains discharge data from approximately 20% of all annual US hospital admissions and is weighted to obtain national estimates for all US hospital admissions. The results are reported as proportions with 95% confidence intervals.

RESULTS: Among 29,220,488 deliveries, 303 were complicated with CS. Parturients with CS experienced a significantly higher mortality (23.9%) compared to healthy parturients (0.01%). The severity of the CS was manifested by the significant proportion of patients who received mechanical ventilation, an intra-aortic balloon pump, and/or extracorporeal membrane oxygenation. Maternal comorbidities most significantly associated with the development of CS were: congestive heart failure, peripartum cardiomyopathy, preeclampsia, amniotic fluid embolism, chronic hypertension, valvular disease, and acute myocardial infarction (See Table). Parturients with the above comorbidities who developed CS had an adjusted odds ratio of 334.40 (CI 109.62-1019.70) for death as compared to parturients with the same comorbidities who did not develop CS. The odds ratio was adjusted to incorporate the effects of hospital location, hospital size, obesity, race, and payer mix.

CONCLUSION: Maternal CS is associated with significant mortality. Based on our results, the most important contributory factors are: congestive heart failure, peripartum cardiomyopathy, preeclampsia, amniotic fluid embolism, chronic hypertension, valvular disease, and acute myocardial infarction. Identifying those patients most at risk for developing CS may allow us to modify care in a way that limits its morbidity and mortality.

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Abstract #:F-35

Characteristics of Patients with Cardiogenic Shock During Delivery Hospitalization				
		Cardiogenic Shock *Weighted N* (%)		**P-Value**
		Present	Absent	
Patient Characteristics				
Race	White	118 (47.32)	11923256 (52.08)	0.289
	Black	55 (21.89)	3030168 (13.24)	
	Hispanic	37 (14.62)	5506950 (24.06)	
	Asian or Pacific Islander	25 (10.00)	1132962 (4.95)	
Age (years)	10-19	19 (6.75)	1694289 (6.50)	0.902
	20-29	151 (52.39)	13781688 (52.84)	
	30-39	113 (39.13)	9815160 (37.63)	
Congestive Heart Failure		122 (40.89)	10236 (0.03)	<0.001
Peripartum Cardiomyopathy		88 (28.99)	6064 (0.02)	<0.001
Preeclampsia		55 (18.02)	1145482 (3.92)	0.010
Amniotic Fluid Embolism		54 (17.84)	1253 (0.00)	<0.001
Hypertension		34 (11.33)	522438 (1.78)	0.046
Valvular Disease		29 (9.62)	154084 (0.53)	0.019
Acute Myocardial Infarction		29 (9.55)	634 (0.00)	0.014
Treatment Effects				
Mechanical Ventilation		220 (72.63)	17049 (0.06)	<0.001
Intraaortic Balloon Pump (IABP)		68 (22.63)	64 (0.00)	<0.001
Extracorpeal Membrane Oxygenation (ECMO)		24 (8.03)	20 (0.00)	0.025
Outcomes				
Cardiac Arrest		98 (32.37)	205 (67.63)	<0.001
Death		74 (24.38)	1875 (0.01)	0.001

Abstract #:F-36

Unique Maternal Anesthetic Management for Twin Gestation Exit Procedure

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Background: Ex utero intrapartum surgery (EXIT) is performed when there is suspected fetal airway pathology requiring management of the airway while fetoplacental circulation is intact. Neonatal airway obstruction is associated with significant morbidity and mortality.1 Maintenance of placental support while the airway is secured requires multidisciplinary expertise to provide simultaneous surgical care to both mother and fetus. We present anesthetic management for an EXIT procedure with twin gestation. To our knowledge this is only the second report of EXIT procedure for twin gestation and the only report involving airway pathology in both twins.2 It is also the first successfully documented use of desflurane for uterine relaxation during an EXIT procedure.

Case: The patient was a 28 year old G5P3 at 30 3/7 wks gestation with monochorionic-diamniotic twins complicated by severe micrognathia in both twins. The patient was in preterm labor and scheduled for an EXIT procedure. Large bore intravenous access was obtained and an intra-arterial line placed. We performed a rapid sequence induction with propofol and succinylcholine and secured the maternal airway. Anesthesia was maintained using 100% oxygen at 10 L flow and 2.0 MAC desflurane to achieve uterine relaxation. A prophylactic phenylephrine infusion was administered to maintain MAP within 20% of baseline. A MAP > 60 mmHg was maintained throughout the procedure.

After uterine incision, Twin A was partially delivered and the airway was secured by the ENT surgeon; ETCO2 was confirmed, umbilical vessels were clamped and Twin A was fully delivered. The same sequence of events occurred for Twin B. Total time from uterine incision to delivery of Twin B was 30 minutes. Following delivery of Twin B, desflurane was discontinued. An oxytocin infusion was started and 250 mcg IM methylergonovine empirically given to prevent uterine atony. Two additional 200 mcg doses of carboprost tromethamine were administered. Total EBL was 2L. The patient recovered uneventfully and both neonates did well.

Discussion: This is the first report of an EXIT procedure for twin gestation involving airway pathology of both twins and the first report of successful use of desflurane for uterine relaxation during EXIT. We chose desflurane for uterine relaxation because it's low solubility and fast titratability. Twin B did well despite two required EXIT time periods and the need for phenylephrine infusion, as evidenced by the umbilical artery pH of 7.20. Communication and preparation are key components to a successful EXIT procedure to optimize maternal and fetal outcomes.

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Abstract #:F-37

Patient Satisfaction With the Use of Nitrous Oxide for Labor Analgesia

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BACKGROUND: Nitrous oxide is frequently administered for labor analgesia in several countries but is used in only a few hospitals in the United States. Some parturients D.O. not find nitrous oxide to be helpful or efficacious. Few studies have assessed patient satisfaction with the use of nitrous oxide for labor analgesia and no studies, to our knowledge, have correlated patient satisfaction withpatient demographics and obstetric parameters.

OBJECTIVE: The purpose of this study was to assess patient satisfaction with maternal use of 50% nitrous oxide (Nitronox, Parker/Porter) for labor analgesia and to determine if there were correlations between patient satisfaction and the following: age, ethnicity, gestational and parity status, length of nitrous oxide use, and cervical dilation and pain score at the start of nitrous oxide use.

METHODS: After the approval of the Institutional Review Board, this study was conducted at the University of North Carolina Women's Hospital in Chapel Hill, NC. from August 1, 2014 through December 31, 2014. Forty-five women completed a questionnaire assessing their reasons for choosing nitrous oxide, adequacy of pain relief, reasons for discontinuation, whether they would or would not choose nitrous oxide again, and their reasons for not choosing it again. Cervical dilation was ascertained from the intrapartum electronic medical record for the patient's most recent cervical exam.

RESULTS: 58% of our patients used nitrous oxide until delivery (8-575 minutes). The rest (42%) discontinued use of nitrous oxide due to inadequate pain relief (33.3%), difficulty holding the mask (9%), and drowsiness (2.2%). Twenty seven women (60%) would use nitrous oxide again and 18 women (40%) would not. The reasons women would not use nitrous oxide in the future include inadequate pain relief (78%), difficulty holding the mask (11%), dizziness (11%) and a dissociated feeling (6%). No statistically significant correlation was found between patient satisfaction and age, gestational status, parity status, ethnicity, cervical dilation at the start of nitrous oxide use, pain at the start of nitrous oxide use, and length of nitrous oxide use. Employing Wilcoxon-Mann-Whitney and Fisher tests, a statistically significant difference was noted between the perception of adequate pain relief and patient satisfaction (P=0.0009).

CONCLUSIONS: We were not able to identify patient demographic or obstetric parameters associated with a satisfactory experience with nitrous oxide. Inadequate pain relief was the most frequent reason patients discontinued use of nitrous and would not use it on a subsequent labor. Other studies have shown that women who use nitrous oxide for labor analgesia experience less labor pain than women who receive no intervention. The majority of these women experience less pain relief than women who receive an epidural. The majority of women in our study who would not use nitrous oxide again also found greater pain relief with an epidural.

Abstract #:F-38

Labor Analgesia in a Patient with Paroxysmal Nocturnal Hemoglobinuria Requiring Intrapartum Anticoagulation

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Introduction: Paroxysmal nocturnal hemoglobinuria (PNH) is a rare disorder characterized by complement-mediated RBC destruction. Patients with PNH have an increased risk of thrombosis as well as hemolytic crises during periods of stress(1). Anesthesiologists must balance the benefit of stress reduction with the risk of hematoma when using neuraxial anesthesia in the setting of anticoagulation. Reports of successful anesthetic management of laboring patients with PNH are important in establishing a safety record for this population.

Case: A 37 year-old G1P0 with a 9 year history of PNH presented to L&D with PROM at 38 weeks gestation. Given her risk of thrombosis, the patient was started on SQ fondaparinux at 6 weeks and switched to SQ heparin at 36 weeks in anticipation of delivery. The care team planned for intrapartum heparin infusion, to be discontinued 4 hours before anticipated delivery. During antepartum anesthesia consultation, the patient expressed a desire for epidural analgesia and exhibited clear understanding of the risk of neuraxial hematoma. Her last dose of heparin was 14 hours preadmission. aPTT was initially elevated; upon normalization an epidural catheter was placed atraumatically at the L2-L3 interspace. Following negative test dose, 10mL of 0.125% bupivacaine was given, and a 12mL/h infusion of 0.083% bupivacaine with 2mcg/mL fentanyl was started. A heparin infusion was initiated 2 hours later at a fixed rate based on the patient's preadmission requirement. Serial neurologic exams by nursing and anesthesia staff revealed no concern for excessive motor blockade. Approximately 9 hours after discontinuation of heparin, a healthy infant was born. Upon confirming normal aPTT, the epidural catheter was removed with complete resolution of the block. A heparin infusion was restarted 6 hours after delivery. Delivery EBL was 300mL. The patient was ultimately transitioned to enoxaparin and discharged without complication on postpartum day 2. She was very pleased with her labor analgesia.

Discussion: Maternal and fetal mortality rates in PNH are exceptionally high (11% & 7%)(2). A major cause of mortality is thrombosis, thus peripartum anticoagulation is common(1). If neuraxial anesthesia is offered, coordination between care teams is paramount. Factors to consider when determining candidacy for neuraxial anesthesia include the patient's desire for labor analgesia, dosing of anticoagulation, blood dyscrasias, and anticipated difficulty of intubation should a CD be required. Large-scale studies in this population are impractical; therefore, case reports are critical to our developing knowledge base.

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Abstract #:F-39

Patient Position and Hypotension after Spinal Placement for Cesarean Delivery

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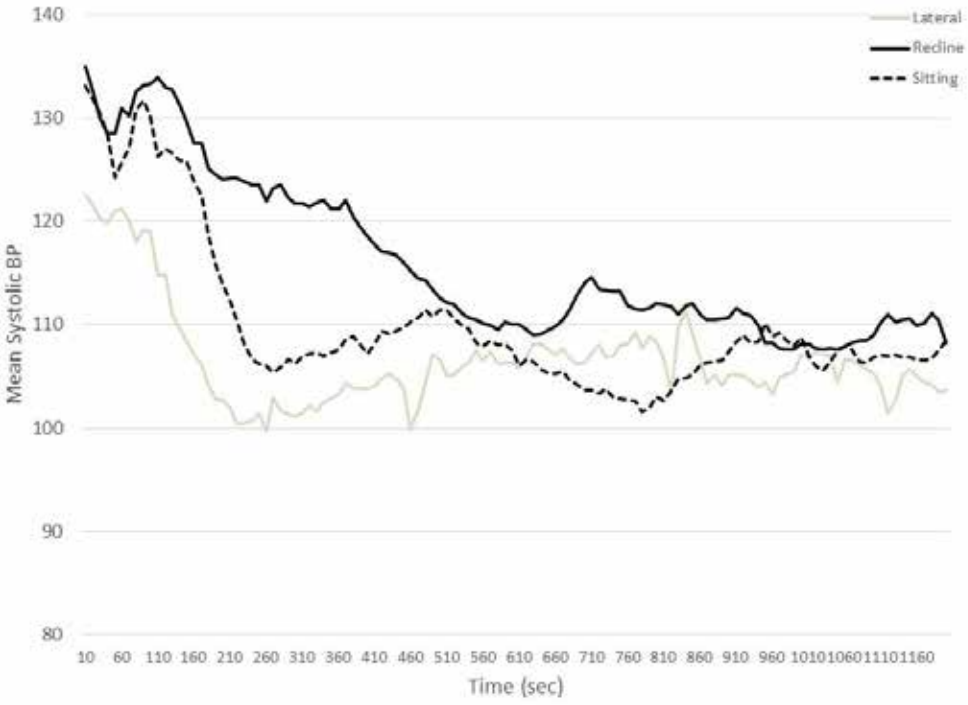
Background: Spinal anesthesia is associated with a high incidence of hypotension. The position after spinal injection affects the speed of onset of sympathetic blockade, and may also alter blood pressure changes. A previous study supporting the lateral position as more hemodynamically stable(1) conflicted with our clinical observations. We hypothesized that seated positioning would lead to slower onset and rise of spinal level and therefore less hypotension than the lateral position. In addition, we hypothesized that patients who were slowly reclined from a seated position would have even greater hemodynamic stability due to a slower rise in sympathetic blockade.

Methods: After IRB approval and written informed consent, patients undergoing elective cesarean delivery under spinal anesthesia were enrolled in a randomized controlled trial. They were allocated to receive a standard spinal in one of three positions: Lateral (L), Seated (S) or seated followed by a five-minute Recline starting at 30-degrees (R). Blood pressure was observed with a continuous, non-invasive CNAP monitor for twenty minutes and IV fluids and vasopressors were dosed based on a strict protocol. Secondary outcomes included the maximum height of the spinal blockade and the duration of the motor and sensory blockade.

Results: 105 patients were enrolled, 13 patients were excluded from the study for various protocol reasons. We found no difference in age, height, weight, gestation or fetal weight (P>NS for all). There was no difference in baseline BP in the holding area (p=0.78) but S and R groups had higher BP when in the OR (p=0.02). The Recline group required fewer fluid boluses and pressors than the lateral group (P<0.01) and fewer fluid boluses than the sitting (P=0.01) group. The lowest SBP and time to lowest BP (P<0.05 for both) (Figure) were lowest in the L group and greatest in the R group. 40% of patients experienced nausea and only 4 patients (4%) vomited (P=NS for all). There was no difference in the height of spinal level achieved at 15 minutes, surgical success, or the motor and sensory blockade duration.



Conclusion: A gradual recline after spinal injection improves BP stability and reduces the need for treatment. The maximum height and duration of the spinal anesthesia was not affected.

Abstract #:F-40

Profound hypotension in the absence of hypovolemia during cell salvage use in obstetrics.

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Introduction: Clinical experience of cell salvage in obstetric surgery is increasing and has been endorsed by several professional bodies. Leucocyte depletion filters (LDF) are advocated to improve safety by reducing the concentration of leucocytes, lipid particles and fetal squames in reinfused blood. We describe a case of significant hypotension during administration of LDF processed cell salvage blood.

Case report: A 28 year old female with a myometrial arteriovenous malformation at the anterior lower uterine segment underwent elective cesarean section under regional anesthesia, with radiologically placed intra-arterial balloon catheters as there was concern about significant uncontrollable hemorrhage at delivery. Cell salvage was used intra-operatively with a LDF (LeukoGuard RS, Pall Medical, New York, USA). Brisk blood loss was encountered at uterine incision, and total volume collected was 1474mls, with 350mls processed blood returned to the patient near the end of the procedure. 24 minutes after commencing blood reinfusion the patient reported significant nausea and dyspnea, coinciding with a precipitous fall in blood pressure, requiring several Phenylephrine boluses followed by reinstitution of a Phenylephrine infusion (5mg/hr). Concealed blood loss and hypovolemia were excluded. Blood gas analysis demonstrated a mild metabolic acidosis (base deficit: -4.6) and normal lactate (0.8). Serial thromboelastography failed to demonstrate coagulopathy, and sequential plasma tryptases were normal. Over a period of 30 minutes following discontinuation of cell salvaged blood, hemodynamic stability improved and vasopressors were weaned. Tentatively, the remainder of the salvaged blood was reinfused and no further significant compromise was noted. Transthoracic echocardiography performed at the end of surgery demonstrated normal left and right ventricular size and function, normal pulmonary arterial pressure and normal valves. Recovery was otherwise uneventful and the patient was discharged 4 days later.

Discussion: Reaction to the negatively charged LDFs has been previously reported and is putatively related to the generation of bradykinin and complement causing an anaphylactoid reaction. This may be most evident when blood is administered via LDF under pressure, at 37°C or with concurrent ACE inhibitor use. Hypotension related to cell salvage use in obstetrics may be attributed to a number of causes, including amniotic fluid embolus, but we felt that in view of normal investigations and temporal relation to reinfusion of processed blood to her relatively transient hypotension, an LDF reaction may have been responsible.

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Abstract #:F-41

Conversion from neuraxial to general anesthesia during cesarean hysterectomy for placenta accreta: What is the risk?

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Introduction: Patients with confirmed or suspected placenta accreta undergoing cesarean delivery are at increased risk for hysterectomy and major blood loss. The use of a neuraxial technique as the primary anesthetic for cesarean hysterectomy (C-hyst) has become increasingly common. However, concern for major hemorrhage, large-volume resuscitation, airway edema, and difficult conversion to general anesthesia (GA) remains. The reported incidence of conversion from neuraxial to GA for C-hyst cases ranges from 0-29% (1-3). We evaluated the incidence, indication, and outcome of conversions from neuraxial to GA during C-hyst for placenta accreta at an academic medical center.

Methods: After waiver of informed consent, medical records of patients receiving GA for C-hyst at a single tertiary medical center from 1997-2013 were reviewed. Mode(s) of anesthesia, timing of GA, indication for conversion from neuraxial to GA, induction and intubation techniques, intraoperative details, and disposition were analyzed.

Results: Of 113 patients undergoing cesarean delivery with confirmed or suspected placenta accreta, 73 required C-hyst. Of these 73 patients, 11 (15%) received GA as the primary anesthetic. Indications for GA included emergency (n=3) and anesthesia provider preference (n=8). Of the 62 (85%) C-hyst patients who started with neuraxial anesthesia as the primary anesthetic, only 13 (21%) required intraoperative conversion to GA. Indications for conversion included ongoing resuscitation (n=9), intraoperative patient discomfort (n=4), unclear length of surgery (n=2), and initial neuraxial failure (n=1). Those who required conversion from neuraxial anesthesia to GA were no more likely than those who had only neuraxial anesthesia to have placenta increta or percreta [11/13 (85%) vs. 30/48 (62%) p = 0.19, missing data for 1]. Intraoperative blood loss was not different between C-hyst patients who started with GA versus those who started with neuraxial anesthesia with conversion to GA (3164 + 2185 mL vs. 3323 + 1504 mL, p = 0.8). No complications with induction or intubation were noted in either group. Comparative analyses of patients in this database may identify predictors of intraoperative conversion GA conversion.

Conclusion: Our findings demonstrate that a great majority (85%) of patients undergoing C-hyst for placenta accreta over a 16-year period were managed with neuraxial anesthesia. While the conversion rate to GA was 21%, there were no airway complications or greater bleeding complications after conversion. Consideration of factors that may complicate conversion to GA, such as difficult airway history or morbid obesity, warrant consideration. However, the preference for GA as the primary anesthetic in patients with suspected of confirmed placenta accreta may be overstated.

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Abstract #:F-42

Catheter Failure Rates and Time Course with Epidural versus CSE Analgesia in Labor

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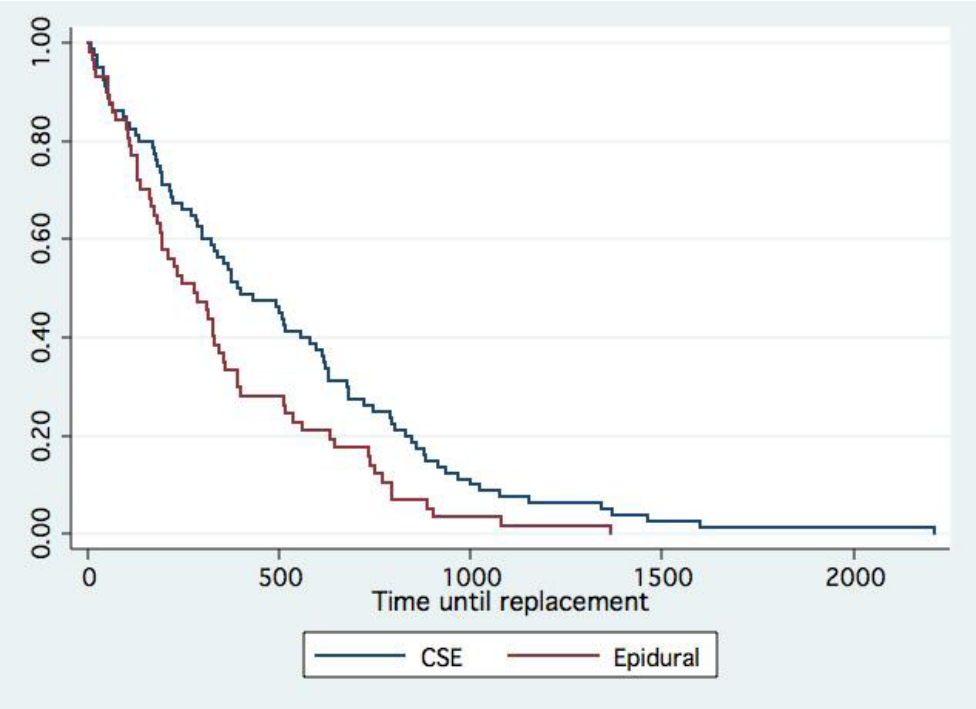
Introduction: The combined spinal-epidural (CSE) technique for labor analgesia has several advantages over the traditional epidural (EPI) technique, including faster onset, greater maternal satisfaction, and decreased need for physician boluses1. However, proponents of EPI criticize the CSE technique using the argument of the "untested catheter."1 We have compared the failure rates and time of failure between techniques in our tertiary care academic practice.

Methods: Data regarding failed catheters (FC) was collected prospectively from Oct. 2012-Sept. 2014 as part of our QA program. FC were defined as any catheter that was replaced after initially thought to be properly placed, and then determined to be: intravascular, one sided or resulting in poor maternal analgesia. Data collected included age, height, weight, BMI, gravity, parity, depth to epidural space, catheter mark at skin, number of physician boluses, and time between catheter placement and identification of the FC. Rates of failure between techniques were compared, Kaplan-Meier survival curves created and Cox proportional hazards analysis performed to determine if a difference exists between the times to recognize FC with CSE vs EPI.

Results: A total of 5487 analgesics were performed (1507 EPI; 3980 CSE). There were no differences between the groups in any demographic variable. 85 CSE (2.1%) and 59 EPI catheters (3.9%) were replaced during labor (P< 0.001). Data regarding time to replacement was available for 80 CSE and 57 EPI. Mean time to replacement was 434 min and 606 min for the EPI and CSE groups respectively (p=0.02). Median time to replacement was 281min (IQR 186,767) and 398 min (IQR 131, 578) for EPI and CSE groups, respectively. The time course for detection of failure differed between groups (Fig 1, p=0.014).

Conclusion: We were able to demonstrate that catheters placed using a CSE technique were less likely to fail during labor and that the time to detection of a FC was significantly longer in the CSE group. The time for the recognition of a failed catheter was much more than the 1-2 hour period during which the catheter from a CSE could correctly be viewed as "untested." These results are consistent with those of Gambling et al1 and Norris et al2. Our findings validate CSE as a reliable technique for labor analgesia and tend to refute the theory of the "untested catheter."



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Abstract #:F-43

Does the ratio of membrane rupture to labor duration predict maternal morbidity among women with a successful VBAC

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Objective: Prolonged labor course has been associated with adverse outcomes in women having a successful vaginal birth after cesarean (VBAC). However, the influence of rupture of membrane (ROM) duration on maternal morbidity is poorly understood. We hypothesized that the ratio of ROM: labor duration predicts maternal morbidity among VBAC cases.

Study design: Using the MFMU Cesarean registry, our cohort comprised of women with singleton, term pregnancies (≥37 weeks of gestation) who had a successful VBAC. Maternal morbidity was defined by at least one of the following: sepsis, chorioamnionitis, postpartum endometritis, intensive care admission, postpartum transfusion, uterine rupture, or maternal death. The ratio between ROM duration to labor duration was categorized into quartiles (<0.24; 0.24-0.29; 0.50-0.94; ≥0.95). Variables associated with maternal morbidity in bivariate analysis (P<0.1) were included in a stepwise multiple logistic regression model.

Results: Among 9,392 women with successful VBAC, 515 (5.5%) experienced maternal morbidity. Women with ratios in the upper quartiles (3rd and 4th) were at increased risk of morbidity (Table). Variables independently related to maternal morbidity were African American, Asian or Hispanic race/ethnicity; public insurance; BMI ≥25 and regional anesthesia.

Conclusion: Among women having a VBAC, a ratio of ROM duration to labor duration ≥0.5 was associated with the highest odds for maternal adverse outcome. Prospective studies are needed to assess the value of this ratio in predicting maternal morbidity in women attempting VBAC.

Abstract #:F-43

Table. Ratio of ROM-duration-to-labor-duration and the risk of maternal adverse outcome among women with successful VBAC.

Variable	Adjusted OR	95% CI
Ratio of ROM-duration-to-labor-duration (quartiles):		
<0.24	Referent	
0.24 - 0.49	1.86	1.33 – 2.64
0.50 – 0.94	2.87	2.07 – 4.04
>0.95	2.19	1.56 – 3.12
Race:		
Caucasian	Referent	
African American	2.39	1.74 – 3.31
Hispanic	4.15	2.98 – 5.81
Asian	3.03	1.52 – 5.58
Insurance:		
Private	Referent	
Public	2.01	1.53 – 2.64
None/self pay	1.93	1.36 – 2.64
Parity:		
0-1	Referent	
2	0.44	0.35 – 0.56
>=3	0.29	0.22 – 0.39
BMI at delivery:		
<25	Referent	
25-29.9	1.49	1.02 – 2.26
>=30	1.78	1.23 – 2.66
Type of labor:		
Spontaneous	Referent	
Induced	0.77	0.60 – 0.97
Regional anesthesia:		
No	Referent	
Yes	2.52	1.87 – 3.47

ROM, rupture of membranes
BMI, body mass index

Variables included in the final model: ROM-to-labor-ratio, maternal race, insurance, parity, BMI at delivery, type of labor and regional anesthesia

Abstract #:F-44

Anesthetic Management of a Pregnant Woman with Ehlers-Danlos Syndrome: Genotype versus Phenotype

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Introduction: Ehlers-Danlos syndrome (EDS) is a heterogeneous disease characterized by tissue dysfunction secondary to abnormal collagen production (1). Vascular type EDS has the potential for life threatening consequences in pregnant women, as visceral and vascular rupture rates increase with pregnancy (2). We describe a case of a term parturient clinically diagnosed with hypermobility type EDS, but later diagnosed with vascular type via genetic testing during her pregnancy. Patient written consent was obtained for this publication.

Case Report: Hypermobility type EDS had been diagnosed in this 26 year old term primigravida two years prior to her pregnancy, after she presented with concern of joint pain and hypermobility. Genetic testing revealed a heterozygous variant of the COL3A1 gene, classically consistent with vascular EDS. A multidisciplinary decision was made to rely on (or prioritize) the phenotype rather than genotype. An induced vaginal labor and deliver with instrumental assistance was planned. We elected to proceed with placement of an epidural catheter for provision of labor analgesia and delivery anesthesia. Excellent maternal and neonatal outcome resulted.

Discussion: Vascular EDS is an autosomal dominant disorder caused by a mutation in the gene coding type III collagen (COL3A1) and is estimated to occur in 1/10,000 to 1/20,000 births (3). Severe morbidity and mortality has been estimated to occur in 12-25% of parturients, owing to risk of bowel and/or uterine rupture, extensive perineal trauma, severe bleeding, and delayed wound healing(2). Recommendations against provision of neuraxial anesthesia have been made in light of the theoretical risk of spinal hematoma formation(2). Some have also recommended early delivery at 32-34 weeks gestational age via cesarean delivery under general anesthesia(4). Our patient's genetic mutation did not correlate with a typical clinical presentation of one with vascular EDS. Thus, previously noted recommendations made on the management of the parturient with vascular type EDS did not seem particularly relevant in this rare situation.

Conclusion: Consideration of phenotype rather than genotype alone was instrumental in the successful management of this patient. Genetic testing of patients who display features of EDS and/or who have a positive family history of the disease is important in preparation for labor and delivery due to the potential for catastrophic complications. However, in the absence of convincing phenotypical signs of vascular EDS as in our case, it may be rational to offer asymptomatic parturients neuraxial anesthesia and a trial of vaginal labor.

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Abstract #:F-45

Neuraxial Anesthesia for Cesarean Delivery in a Parturient with Critical Aortic Stenosis: A Case Report

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Introduction: Neuraxial anesthesia (NA) in patients with severe aortic stenosis (AS) has been considered contraindicated since fixed CO may not compensate the reduced preload and SVR to maintain hemodynamic stability. We present a case of sequential combined spinal-epidural (CSE) anesthesia for cesarean delivery (CD) in a parturient with critical AS.

Case: A 25 y/o, G2P0, was seen for OB anesthesia consult at 25 wks in gestation for h/o coarctation of aorta (CoA) and severe bicuspid AS. She had repair of CoA and aortic valvuloplasty at age 2 mo. and repeat valvuloplasty at age 4 and 18. She was asymptomatic until the current pregnancy. Previous pregnancy had been terminated due to her cardiac condition. Echo showed AVA 0.7cm2, peak pressure gradient (PG) of 123 mmHg, LVEF 81% and no residual CoA. IOL at 39 wks for assisted vaginal delivery was planned. However, she started deteriorating at 38 wks with SOB and orthopnea. Echo showed AVA 0.4cm2, PG up to 150 mmHg and reduced EF (63%). She was taken for CD at 38 3/7 wks with thorough preparation including CP bypass stand-by. A-line was placed preoperatively. Preop vitals were 120/80mmHg, SR at 78/min, SpO2 100%. After 700ml of IVF, sequential CSE was administered at L3-4 with initial hyperbaric spinal bupivacaine 6mg and fentanyl 15mcg. After positioning to supine with left uterine displacement, the initial level was T11. During next 35 min, after negative test dose, total 12ml of epidural lidocaine 2% was administered incrementally to obtain T4 level. She remained stable and did not require any vasopressor. Incision was made 43 min after initial spinal injection. After delivery of newborn, slow infusion of oxytocin (40 U/L) was started. PF-free morphine 3mg was given epidurally. She remained hemodynamically stable on SR throughout the case. Total IVF was 1500ml and EBL 700ml, respectively. Postop course was uneventful with adequate analgesia, improved clinical symptoms and reduced PG to 83mmHg on echo. She was discharged home on POD#4 and underwent uneventful AV replacement at pp week 7.

Discussion: The goal for anesthetic management in patients with severe AS should be hemodynamic stability by maintaining SR, adequate HR and preload, and avoiding rapid decrease in SVR. Although GA is believed the gold standard for CD in patients with severe AS, the best anesthetic is still a debating issue.[1,2] Sequential CSE should be considered the technique of choice even in a case with critical AS, because of its excellent controllability with slow titration, consequent hemodynamic stability, solid quality, and negligible incidence of PDPH.[3] In our case, early multidisciplinary involvement, perioperative hemodynamic stability with slowly titrated NA and thorough preparation for emergent cardiac intervention have contributed to the favorable outcome.

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Abstract #:F-46

NASA TASK LOAD INDEX –A Tool to Assess Stress level of Health-Care Providers During an Emergent Cesarean Delivery

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INTRODUCTION: The current survey is part of a study which aims at applying the Systems Engineering Initiative for Patient Safety (SEIPS) concept for management of human factors during emergency cesarean delivery (ECD).1,2 ECD is a timed event involving multiple health care teams and can be disorganized causing stress for all involved. The NASA Task Load Index (TLX), a subjective workload assessment tool for multiple operators has been used in health care to assess stress levels in ICU nurses.3 NASA TLX evaluates an individual's perceived task load over 6 categories: mental demand, physical demand, perception of being rushed, degree of success with task, difficulty to complete task and level of frustration. This is the first study to assess stress levels amongst the various teams involved in an ECD using the NASA TLX.

METHOD: NASA TLX survey was emailed to our institutional Labor and Delivery nursing personnel, obstetric and anesthesia faculty and residents who participated in an ECD within the past 12 months. Gender, age range, professional role and years of experience were also collected. Associations between the participant characteristics and six measures of task load were evaluated using ANOVA. Pairwise comparisons were also evaluated with Tukey's adjustment to control for multiple comparisons.

RESULTS: A total pf 114 personnel responded. Mental demand was significantly associated with age ($p = 0.005$); ages of 25-30 and > 50 reported significantly higher mental demand. Physical demand was associated with gender, age, and provider type ($p = 0.016$, $p<0.001$, and $p = 0.018$ respectively); females, ages of 25-30/subjects older than 50, and nurses reported significantly higher levels of physical demand. Age > 50 years reported feeling significant more rushed than 31-40 ($p = 0.015$). OB residents reported significantly lower levels of success relative to anesthesia fellows/faculty ($p = 0.045$). Perceived level of effort was not associated with participant gender, age range, provider type, or level of experience. Frustration was significantly associated with experience ($p = 0.047$); individuals with 5-10 years of experience felt significantly more frustration than > 10 years of experience ($p = 0.027$).

CONCLUSION: The results of the NASA TLX survey confirm that team interactions and tasks are stressful for providers during an ECD. We hope to use the SEIPS model, to a) define roles and responsibilities of the personnel performing the tasks; b) prioritize the tasks and identify physical environmental factors that could be sources of error and frustration; c) identify the characteristics of the tasks and organizational factors that hinder patient safety. Following implementation of the SEIPS model we hope to repeat the NASA TLX for improvement of stress levels amongst health care providers during an ECD.

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Abstract #:F-47

Seizure versus Subdural Catheter: Every Dose is a Test Dose

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Introduction: Subdural block is a rare complication of epidural anesthesia(1,2). Signs and symptoms can include relative hemodynamic stability, slow onset, high or patchy sensory block, variable motor block, and recovery within hours(1,2). Presentation is highly variable depending on spread of local anesthetic, often leading to a delayed or missed diagnosis.

Case: A 25 year-old term G1P0 woman received combined spinal epidural labor analgesia uneventfully at L3-L4 (spinal: bupivacaine 2.5mg, fentanyl 10mcg). Catheter aspiration was negative and an epidural infusion of bupivacaine 0.0625% and fentanyl 2mcg/cc at 12cc/hr was started.

Two hours later, pain returned. Aspiration of the catheter was again negative and 10cc of bupivacaine 0.125% was administered. Within minutes, the patient complained of lightheadedness and became unresponsive with intermittent slow jerking movements in all extremities. Blood pressure increased to 192/128, heart rate to 100, and oxygen saturation decreased to 87%. Bag-mask ventilation was initiated. Midazolam, ativan and keppra were administered for possible seizure. Twitches of the upper extremities and facial muscles persisted (BP 128/50, HR 120s-140). Despite a category 1 tracing, Cesarean delivery was decided and general anesthesia was induced. Epinephrine 15mcg was administered through the catheter with no change in HR.

After extubation, there were no neurological deficits and head CT was normal. Postoperatively, the patient could accurately recall all events that occurred prior to induction of GA. She described after the catheter bolus feeling onset of ascending weakness and numbness to the neck and that she could not breathe. She reported that during the event she was trying to move to signal that she was awake.

Discussion: The majority of radiographically-proven subdural catheters D.O. not aspirate CSF(2). Cases of subdural catheters presenting as uneventful initiation of anesthesia with later deterioration following bolus dosing have been reported(2). Iatrogenic dissection of the subdural space causes fissures with considerable variability in form that may explain the cervical block and relative sparing of ventrally-located sympathetic nerves and patchy sensory and motor block.

Initially, the myoclonic movements in this patient were attributed to a seizure, which was unlikely with no signs of preeclampsia and the small dose of local anesthetic given. Sudden apnea initially suggested an intrathecal catheter. In hindsight, hypertension, tachycardia, and the observed movements likely represented awareness, with attempts at voluntary muscle movement in a profoundly weak patient. While no imaging of the spine was done prior to catheter removal and therefore the cause of this patient's condition cannot truly be known, the combination of signs and symptoms makes a subdural injection of local anesthetic the most likely explanation.

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Abstract #:F-48

Assessment of Image Acquisition and Interpretation Skills in Anesthesia Residents Following Focused Cardiac Ultrasound Workshop

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INTRODUCTION: Focused cardiac ultrasound (FoCUS) is a safe, non-invasive method to investigate hemodynamic status in parturients. The principal competencies in developing FoCUS skills are image acquisition and interpretation. We studied the impact of an interactive workshop by measuring anesthesia trainee image acquisition quality and pre-load volume estimates on live models as compared to experts. Our hypothesis was that acquired image quality would improve with brief interactive training. A secondary hypothesis was that estimates of pre-load would demonstrate acceptable agreement with experts after training.

METHODS: After IRB approval and written consent, 33 senior trainees (CA2/3, fellow) voluntarily enrolled in a 3-hour basic FoCUS workshop. A quality of image (QOI) scoring process was developed incorporating anatomic structure inclusion, interface clarity and physiologic cycle timing. Trainees reviewed 3 videos in advance demonstrating basic FoCUS views. A 45-minute lecture highlighted FoCUS theory, practical techniques and clinical applications. 135 min hands-on sessions were conducted with live models with a 3 or 4:1 trainee:faculty ratio. Baseline testing was conducted on parasternal short axis (PSSA) and subcostal (SC) views using live models. QOI scores and measurements of left ventricular (end-diastole) [LV] and IVC (end-inspiratory) were recorded. Guided practice for PSSA and SC views was conducted. Post-workshop testing was completed on the same pre-test model with the same image quality rater. Workshop faculty conducted measurements on all models with composite average derived for expert consensus. QOI scores were compared pre- and post-workshop using the sign test. Bland Altman analysis was used to compare the LV and IVC measurements obtained by trainees to experts before and after workshop training with ±30% agreement deemed acceptable.1

RESULTS: The incidence of high QOI scores improved for IVC (pre: 61%, post: 91%, P<0.001) but not LV (pre: 58%, post: 76%], P=0.69). Agreement between trainee and expert LV and IVC measurements were acceptable and improved with training for LV but not for IVC (Figure). Magnitude of error was linearly related to the size of LV or IVC.

CONCLUSION: Anesthesia trainees can obtain high quality LV and IVC images, and estimates of preload which show acceptable agreement with experts. These observations will be used to further refine FoCUS training methodology.

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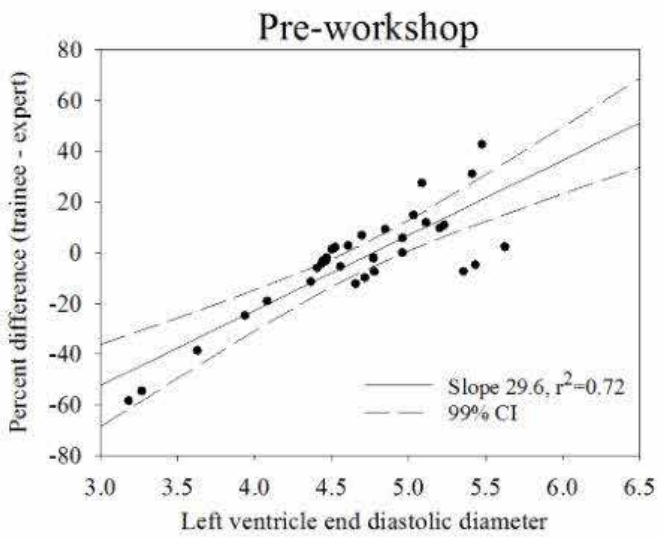
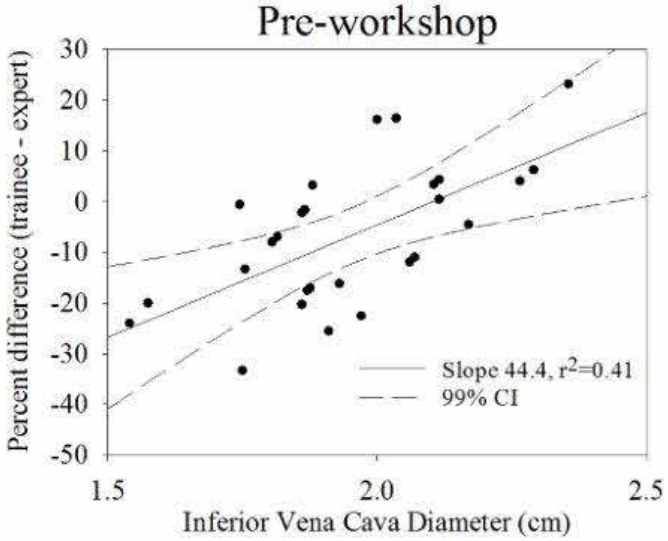
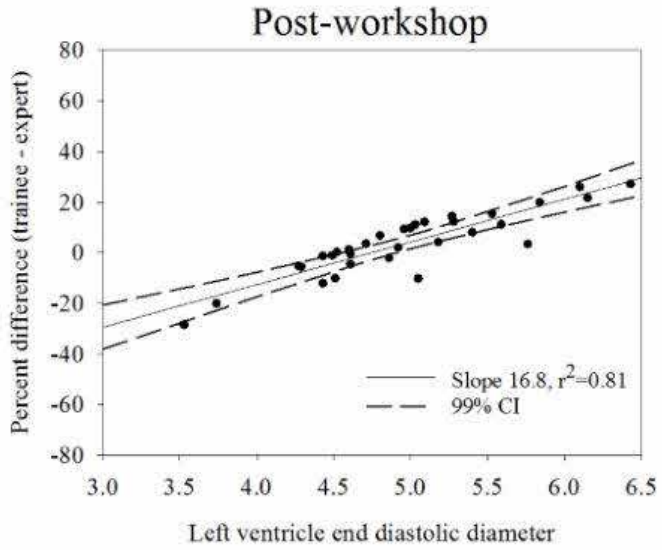
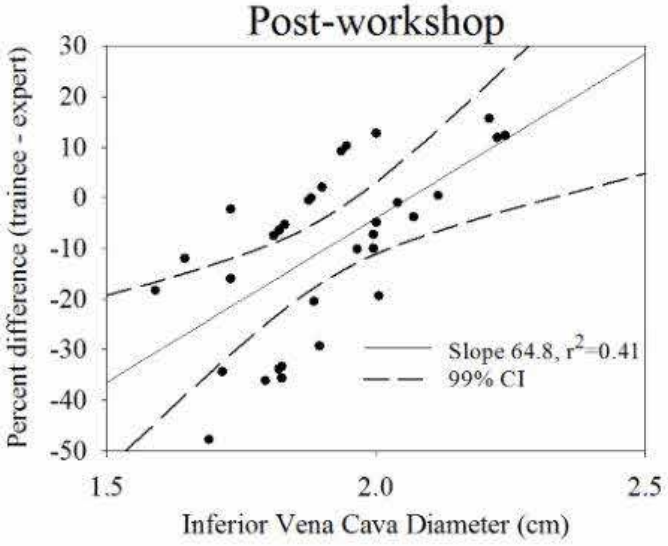
Abstract #:F-48









Abstract #:F-49

Case report: Anesthetic management of a pregnant patient with tuberous sclerosis.

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21 year old gravida 1 para 0 female at 36 weeks gestation, with past medical history of sickle cell trait and tuberous sclerosis with associated epilepsy, was admitted to the antepartum ward with intrauterine growth restriction. Despite antiepileptic medication, the patient continued to have weekly seizures. The patient remained in the antepartum unit for 2 weeks until she underwent a planned trial of labor with oxytocin, which occurred at 38 weeks and 1 day.

The patient received an epidural for pain control during her trial of labor. Due to failure to progress, the decision was made to proceed with a primary cesarean delivery. Unfortunately, the epidural was not working appropriately and the patient refused replacement of the epidural. So the anesthesia team elected to proceed with general anesthesia and endotracheal intubation. No imaging was performed during her admission and prior to interventions performed by the anesthesia team. The intraoperative course was complicated by right uterine artery extension and uterine atony, with an estimated blood loss of 1500mL. The patient received 15-methylprostaglandin F2 alpha and methylergonovine, which resolved the atony. For the duration of the procedure, the patient was tachycardic, but otherwise hemodynamically stable and able to maintain normal oxygen saturations. The patient was extubated in the operating room without difficulty and her post-operative evaluation revealed no apparent complications. The patient's postoperative course was unremarkable.

Tuberous sclerosis is an autosomal dominant genetic disorder that is characterized by epilepsy, cognitive deficits and/or learning disabilities, skin lesions, and benign tumors in multiple sites. The most common renal lesions are angiomyolipomas, which can lead to renal hemorrhage and kidney disease. Some patients may develop pulmonary lesions known as lymphangioleiomyomatosis, which can lead to pulmonary hemorrhage and pneumothorax intraoperatively. Similarly, hamartomas, tumors, and other lesions may develop in the central nervous system and are also at risk for bleeding (1,2). Few case reports exist regarding the anesthetic management of a pregnant patient with tuberous sclerosis. This case report highlights the potential complications that can occur during anesthetic management of these patients and the role of multidisciplinary management that would have allowed for appropriate imaging prior to induction of labor.

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Abstract #:F-50

The Different Impact of Morphine on Immune System

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The Different Impact of Morphine on Immune System Through Systemic or Neuroaxial Route

Morphine is the most common opioids for anesthetic analgesia delivered via intraveneous, epidural or spinal route to inhibit sensory neurons. Morphine-induced side effects include nausea, vomiting, or dysponea. Increasing evidences suggest morphine can also induce alterations in immune functions through inhibition of antibody production, immune cell activation and cytokine production which are associated with the increased risks for opportunistic infection, herpes viral reactivation and promoting tumorgenesis. These evidences suggested that interactions between morphine stimulation on neural cells and the peripheral tissues have impacts on immune responses. Current research is aimed to evaluate the morphine-induced effects on immune cell function and cytokine production in healthy individuals.

A total of 29 paired samples of fresh peripheral blood were collected. The samples were from healthy women before and after their delivery who had used morphine for anesthetic analgesia via intraveneous, epidural or spinal route. Isolated peripheral blood mononuclear cells were activated with mitogens and stained with fluorochrome-conjugated antibodies against CD4, CD8, IL-2 and IFN-g for flow cytometry analysis. Plasma samples from the same patients were also measured for cytokine prodection including IL-6, IFNa2, IL-10, IL-8, GM-CSF and MCP-1 by ELISA. We found that injection of morphine by either routes slightly decreased the percentage of CD4+ cells expressing IL-2 but no significant effect on CD8+ cells after activation. Intraveneous or epidural delivery of morphine tended to reduce the percentage of CD8+ cells expressing IFN-g. These results suggested that short-term treatment with morphine might inhibit T cell activation in healthy adults.

Results from the measurement of cytokine production in the plasma of patient after morphine treatment showed that intraveneous and spinal delivery of morphine significantly increased the level of IL-6 production whereas epidural morphine decreased the levels of IL-10 and GM-CSF production. Intravenous morphine also reduced MCP-1 production in the plasma. Altogether, these results have suggested that epidural morphine may cause less activation of neuronal cells and resulted in less inhibitory effects on immune function. However, invravenous and epidural morphine may increase the risk in inhibiting ontogenesis of granulocytes in response to bacterial infection compared to spinal morphine.

Information generated from this research is valuable since this is the first well-designed study to reveal morphine induced possible effects on immune function in healthy individuals. Long-term monitoring on morphine induced advert effects on immune related diseases as well as the development of proper strategies for pain management using morphine in cancer patients of anesthetic analgesia have to be seriously considered.

Key words: morphine, anesthetic analgesia, immune regulation

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Abstract #:F-51

Ethical and legal implications of informed consent for epidural anesthesia in an sixteen year-old obstetric patient with acute psychosis

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A sixteen year-old G1 patient at 36 4/7 weeks presented with a history of seven days' insomnia. According to the patient's mother, the patient's history was significant for bipolar I disorder with psychotic features and had been hospitalized four times. The patient's bipolar disease had been under good control for the past six months and she was not on any antipsychotic treatment. Because the patient was pregnant, she was brought to labor and delivery and was noted to be in labor at that time.

Review of symptoms were significant for distractibility, rapid speech, intermittent auditory and visual hallucinations, and delusional thinking. During the interview, the patient stated several times that "the devil wants to take her unborn child out and use him to get into Heaven." The patient was intermittently tearful and distressed, and responded to internal stimuli, interjecting responses to her auditory hallucinations throughout the interview.

The patient became uncooperative with the OB and nursing staff during the labor process. The OB staff and the patient's mother desired for the patient to undergo epidural anesthesia to improve the patient's comfort and to improve compliance with cervical checks. However, the patient refused.

The ethical and legal implications for caring for a gravid minor are complex and vary on a state-by-state basis. Many states specifically authorize minors to consent to contraceptive services, prenatal care and delivery services. However, our case provides additional layers of complexity due to the episode of acute psychosis, the lack of prenatal care and lack of documentation of the patients' preferences regarding delivery. Providers must determine the patient's capacity to provide informed consent and what role anti-psychotic treatment has in resolving acute psychotic episodes prior to performing procedures.

There is a paucity of literature concerning the ethical issues in the acutely psychotic obstetric patient. The approach of Beauchamp and Childress requires the principals of autonomy, beneficence, non-maleficence, and justice to be judged and weighed against each other. In our patient, the challenge is how to respect the patient's autonomy (her refusal for epidural placement) while also helping to prevent adverse consequences for her (provide for vaginal delivery). Additionally, both the patient and the anesthesiologist have beneficence-based obligations to the fetus. When patients are severely impaired, surrogate decision making can apply and a legal framework provided. But when patient's values are not known -- no prenatal care was obtained, no discussion with the patient prior to the psychotic episode occurred, and the patient lacks capacity -- clinical decision-making can be complex.

In this case, because the patient was thrashing about in the bed, a decision was made to not place an epidural and the patient later successfully delivered vaginally.

Abstract #:F-52

Cesarean section in a parturient with lumboperitoneal shunt for symptomatic idiopathic intracranial hypertension

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Introduction: Ideopathic intracranial hypertension (IIH) is a disorder of unknown etiology with incidence of 1-4:100000 in obese women of childbearing age. We describe the anesthetic management for cesarean section in a parturient with lumboperitoneal shunt (LPS) and symptomatic IIH.

Case: A 20 years old nulliparous caucasian woman with body mass index 36kg/m2 and known IIH with LPS was referred to anesthetic antenatal clinic at 26 weeks of gestation. She was treated with furosemide, acetazolamide and repeated lumber puntures followed by insertion of LPS prior to conception for her symptoms mainly headache and diplopia. A decision was made for cesarean section at 36 weeks of gestation due to worsening symptoms of constant headache, diplopia, visual disturbances, retro orbital pain, tinnitus and papilledema. Anesthetic assessment revealed a potential difficult intubation with mallampati class 3 airway. She had a hypertrophic paramedian scar on her back from 2nd to 5th lumber vertebrae due to LPS. Decision for GA with invasive monitoring, transversus abdominis plane (TAP) block were discussed in detail with her. An arterial line was used for invasive monitoring. Her baseline heart rate 85-95 beats/min, blood pressure 135-140/80-85 mmHg and SpO2 96-98% on room air were noted. After intravenous cefuroxime 1.5 gm and pre-oxygenation, 1µg/kg bolus of remifentanil was given over 30 seconds prior to rapid sequence induction with thiopentone (5mg/kg) and suxamethonium (1.5mg/kg). The neonatal team were informed about using remifentanil. She was grade 2a intubation with size 7 tracheal tube. A 3250 g female infant was born who remained apnenic for 6 min required bag mask ventilation by neonatologist. 40 U of oxytocin was administered via syringe pump. Estimated blood loss was 1000 ml and her heart rate and blood pressure remained stable and close to her baseline level throughout the procedure. Abdominal cavity was washed with warm saline prior to closure and paracetamol, morphine and ultrasound guided TAP block with 25 mls of 0.25% bupivacaine at each side were given for pain relief. She was admitted to high dependency unit after extubation and her neurological symptoms started to improve 6 hrs postpartum with complete recovery over 48 hrs after delivery.

Discussion: Shunt malfunction secondary to uterine enlargement during pregnancy and obstruction from clots after cesarean is also possible(1). Neuraxial anesthesia in IIH with LPS can be challenging and risk of shunt damage, introduction of infection and worsening neurology were the main concerns for us to consider GA in this case(2). A bolus of 1µg/kg remifentanil effectively attenuates hemodynamic changes on induction however, crosses the placenta and may cause neonatal depression.

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2. Aly EE, Lawther BK. Anesthetic management of uncontrolled IIH during labour and delivery. Anesthesia 2007;62:178-8

Abstract #:F-53

Eisenmenger Syndrome: A Recent Success

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Introduction: Pregnancy mortality in patients with Eisenmenger syndrome (ES) is reported to be 30-50%.1 Patients with ES are cautioned to avoid pregnancy, and termination is often suggested should the patient become pregnant.1 Regardless of the risks that pregnancy carries, Eisenmenger patients may sometimes choose to continue a pregnancy, posing great challenge to the anesthesiologist.

Case: A 33 year-old G1P0 with an unrepaired ASD with pulmonary pressures equal to systemic pressures resulting in ES and severely decreased RV function presented at 26 weeks gestation for management of the remainder of the pregnancy. Pulmonary hypertension (pHTN) was managed with O2, sildenafil PO, epoprostenol IV, and iloprost nebulizer.

At 33 weeks gestation, the patient developed progressively worsening hypoxia and thromboyctopenia (platelets 94K decreased to 58K) due to a pHTN crisis. Plans were made for urgent CD. PTT/PT/INR were normal. Rotational thromboelaastometry (ROTEM) analysis was performed to confirm that despite the thrombocytopenia, clotting ability was only moderately inhibited. Inhaled NO was initiated via high-flow nasal oxygen. A central line was placed. She was taken to a CT OR. Dobutamine was initiated (5 mcg/kg/min). Vasopressin and phenylephrine were titrated to maintain SBP>110 (monitored via arterial line) which resulted in oxygen saturation >97%. We performed a CSE (spinal: bupivacaine 2mg, fentanyl 10mcg). Epidural was dosed slowly to a T6 level, while catheters were placed to facilitate femoral VA ECMO access should it be needed. Uneventful CD was performed (1465g infant - Apgars 8,9). Epidural catheter was maintained for postoperative pain control.

On POD3 platelets reached a nadir of 33K. Due to concern for continued pHTN crisis, the critical care team desired to initiate systemic anticoagulation. ROTEM analysis was performed with results similar to the day of delivery. The epidural catheter was removed. Therapeutic anticoagulation was initiated 6 hours later. Pulmonary vasodilators, inotropy and vasopressors were continued through the first postoperative week.

Discussion: Outcomes of parturients with ES are poor. It is not known whether vaginal delivery or CD is safer, nor is the optimal anesthetic for CD known1. This patient required CD for the indication of pHTN crisis, remote from delivery. Despite thrombocytopenia, neuraxial anesthesia was utilized as it was felt that the hemodynamic changes associated with induction of GETA could result in cardiopulmonary collapse. With the initiation of inotropy and epidural blockade (decrease in SVR), the patient's oxygen saturation improved, perhaps indicating a need for decreased preload. ES carries a risk of thrombus formation thus systemic anticoagulation was crucial during the pHTN crisis2. ROTEM analysis can guide clinicians at the extreme limits of safe neuraxial manipulation.

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2. J Am Coll Cardiol. 2007 Aug 14;50(7):634-42.

Abstract #:F-54

Management of a cesarean delivery of an omphalopagus conjoined twin pregnancy

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Introduction: The frequency of conjoined twins has been estimated as 1 in every 50,000-100,000 pregnancies. Reports on pregnancy management in cases of conjoined twins are exceptionally rare, as many are terminated, 40 to 60% are stillborn, with an overall survival of 5-25%. Information on anesthetic management for delivery of conjoined twins is limited. We report a successful cesarean delivery of omphalopagus twins under neuraxial anesthesia.

Case Report: A 23 year-old (G2P1001) diagnosed with a conjoined twin pregnancy at 19+2 weeks gestation by ultrasound with further imaging revealing monochorionic, monoamniotic conjoined twins with a posterior placenta. Two small thoraces were noted each containing a heart, two separate hypoplastic lungs, joined at the upper abdomen and shared the medial portion of the diaphragm. One single large liver and gallbladder was noted, the majority of the liver in twin A. The small bowel and large bowel was shared. Each had two kidneys and shared a single urinary bladder. Each had a separate spine with severe scoliosis and two fully formed upper and lower extremities. An elective cesarean section was planned for 37 weeks however, she presented with preterm premature rupture of membranes (PPROM) at 36+2 weeks, dilated cervix with fetal feet palpated at the cervical os. A cesarean delivery was performed under a combined spinal epidural (CSE) at the L3/4 interspace in the lateral decubitus position with a spinal dose of 12mg of 0.75% bupivacaine, 20 mcg of fentanyl and 200 mcg of DuramorphR. Delivery was via a classical uterine incision. One fetus presented with an omphalocele accidentally ruptured at delivery. Each twin weighed 2300g, APGARs 81 and 85. They did not require intubation, were transferred to the NICU and subsequently to the children's hospital for further management and eventual surgical correction.

Discussion: Conjoined twins are classified according to the site of fusion. Thoraco-omphalopagus twins are most common and associated with the highest mortality mainly as a consequence of sharing a heart. Omphalopagus twins as in this case share a liver, and portions of bowel. Imaging can diagnose conjoined twin pregnancies early and usually by mid-pregnancy, the extent of conjoined areas can be defined. Few case reports describe the modality of delivery of conjoined twins, mainly by cesarean, however, the anesthetic management is limited. Scant case reports include CSE and general anesthesia for cesarean section. Intraoperative concerns include postpartum hemorrhage from large uterine incisions, uterine atony and the possibility for conversion to general anesthesia. We report a successful delivery of omphalopagus conjoined twins under CSE. A multidisciplinary approach with good communication and antenatal planning is essential for a successful outcome.

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Abstract #:F-55

Anesthetic Management of a Pregnant Patient with Poly Trauma for Spine Surgery

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A previously healthy 32 year old female presented while 17 weeks pregnant as a trauma following a motor vehicle collision. Her multiple injuries included a grade II liver laceration, bilateral (b/l) clavicular fractures, C1 transverse process fracture, T11 vertebral body burst fracture, multiple b/l rib fractures, b/l small pneumothoraces and right pulmonary contusion. Preoperatively, she required 2-3 liters of oxygen and had trouble clearing her secretions. Chest X-ray demonstrated complete collapse of the left lung. Because of the unstable spine fracture, it was decided to perform a posterior T9-L1 fusion under general anesthesia. General endotracheal anesthesia was induced without complication. Following intubation, bronchoscopy was performed to suction the airway given her preoperative X-ray. The radial artery was cannulated for hemodynamic monitoring. She was then positioned prone on an open frame Jackson table. Care was taken to avoid direct compression of the fetus and the abdomen. Fluoroscopy was limited to only essential parts of the procedure. Anesthesia was maintained with propofol and remifentanyl infusions and sevoflurane to facilitate neurologic monitoring. She remained hemodynamically stable throughout the procedure and was successfully extubated. She was subsequently discharged and delivered a healthy baby at term.

The anesthetic considerations of this case were many. This G1P0 patient required spine fixation surgery in the prone position. The gestational age of the fetus as well as the acute maternal injuries were taken into account. At 17 weeks gestation, delivery of the fetus was not a feasible option. Fetal heart tones were monitored and remained within normal limits pre and post operatively. Concerns about anesthetic effects on the developing human fetus have been considered, but there is no convincing evidence that any particular anesthetic drug is dangerous to the fetus. Anesthetic goals are to prevent fetal asphyxia by maintaining maternal oxygenation, ventilation and hemodynamic stability(1). As this patient had small pneumothoraces, there was concern for expanding, and even perhaps creating a tension pneumothorax with positive pressure ventilation. As such, she was ventilated with small tidal volumes and special attention was paid to peak airway pressures and plethysmography. Additionally, the general surgery team was made aware of the patient, and a chest tube kit was in the room. The management of an occult or clinically insignificant pneumothorax in acute trauma patients is debatable. There appears to be a growing recognition small that pneumothorax can be safely treated without placing a thoracostomy tube in even mechanically ventilated patients. Successful surgical intervention was performed with good maternal and fetal outcome due to thorough systematic assessment of individual issue and stratification of management priorities.

Reference:

1. Reitman E., et al. Br. J. Anaesth. 2011: 107 (suppl 1).

Abstract #:F-56

Peripartum Arrest- Is our team ready?

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Introduction: Obstetrical "code" situations are relatively infrequent, but preparedness of the entire labor and delivery staff to act quickly in such an event is imperative for optimal outcome. Delay in defibrillation is associated with worse survival in patients with ventricular fibrillation or pulseless ventricular tachycardia as may occur after massive pulmonary embolism or amniotic fluid embolism. Other institutions have recently found improvement in outcomes and have identified operational deficiencies through the use of simulation sessions.

Methods: On four different dates, we conducted in situ simulation sessions during which a team of nurses encountered a patient who experienced post-delivery loss of consciousness and ventricular fibrillation. We noted whether or not the participants called for help, placed monitors, and noted the abnormal rhythm. We then recorded the amount of time required to attain the code cart, attach defibrillator pads, and deliver a shock. Participants filled out pre and post simulation surveys and participated in a brief teaching session that focused on use of the defibrillator. Posters were placed around labor and delivery to reinforce key points after the initial teaching sessions. We attempted to have all participants attend the simulation on two different days approximately one month apart. We compared data from the first and second sessions to assess whether or not there was improvement in performance after our efforts at simulation and education.

Results: See table below.

Discussion: This study demonstrates a statistically significant improvement in performance in a code situation after simulation and education, including reduction in time to attain the code cart and defibrillate. While in situ simulation offers the benefit of realistic and applicable training, it poses challenges on labor and delivery where practitioner availability is unpredictable. The number of providers involved in our study was limited by high clinical volume on two of our simulation dates. The nurses who participated felt that these simulation sessions boosted clinical skills and self-confidence. Simulating other peripartum emergencies and creating a culture of multidisciplinary simulation (ie. involving obstetric and neonatal staff) is a future goal for our institution.

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Results: Critical Actions in OB Simulation

	Session 1	Session 2	Significance (p-value)[a]
Call Anesthesia provider, n	11/11	5/5	1.0
Oxygen placed on patient, n	6/11	4/5	0.59
Monitor placed on patient, n	2/11	1/5	1.0
Recognize arrest/unstable rhythm, n	11/11	5/5	1.0
Time to attain code cart, sec (SD)	**121 (40)**	**61 (23)**	**0.002**
Time to attach defibrillatory pads, sec (SD)	66 (26)	49 (22)	0.20
Time to debrillation, sec (SD)	**80 (51)**	**42 (13)**	**0.036**
Total Time, min (SD)	**4.45 (1.54)**	**2.52 (0.45)**	**0.002**

[a]Fisher exact test for counts and two-tailed t-test for continuous variables (Satterwaite method for unequal variances)
SD = standard deviation, n=number of teams

Abstract #:F-57

Handheld Ultrasound Guiding Postpartum Hemorrhage Resuscitation

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David J. Elkin M.D. candidate - Stony Brook University School of Medicine - Stony Brook, NY

The patient was a 25-year-old female whose baseline values were: blood pressure (BP) 134/83, pulse 74, temperature 98.3 F, weight 71 kg, hematocrit (HCT) 33. The patient had an uncomplicated pregnancy and after induction of labor, delivered a healthy infant at 13:57. Estimated blood loss (EBL) was 600 mL plus a returned clot of 150 mL. Soon after delivery, the patient became pale, confused, and then somnolent with BP 84/50, pulse 97, and temp 101.4 F. The time-of-day notes that follow correspond to the attached TTE images.

When anesthesiologists arrived, resuscitation had not begun. Initial TTE images at 14:10 revealed "kissing papillary muscles," suggesting an empty ventricle at end systole and severe hypovolemia. End diastolic diameter was 3.3 cm suggesting a left ventricular end diastolic volume of 44 mL as estimated by the Teichholz method. Anesthesiologists rapidly gave 2 L of Lactated Ringer's (LR) fluid. They also gave divided doses of ephedrine and phenylephrine, totalling 15 mg and 100 mcg, respectively, over a period of 10 minutes. The patient showed signs of endometritis so antibiotics were started. BP responded well to the fluids and vasopressors and within 10 minutes, systolic BP was 120. By 14:33, the patient's LVESV by TTE was 16 mL and LVEDV was 70 mL. BP continued to be within normal limits (wnl).

Despite a BP and pulse wnl, subsequent TTE at 14:59 again showed "kissing papillary muscles," and a LVEDV of 54 mL. Based on these findings, a 3rd liter of LR was given, and both blood and fresh frozen plasma transfusions were started. It was thought that the fluids given during the initial resuscitation had left the intravascular space. Labs showed a HCT of 28.2 and white blood cell count of 27.

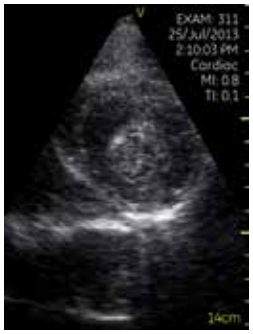
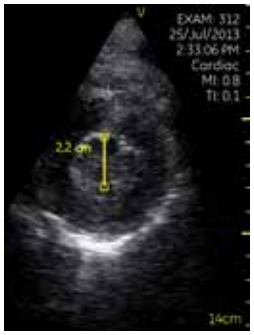
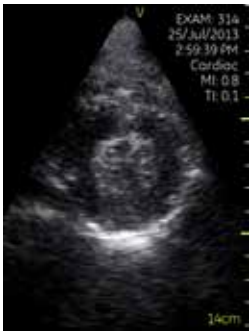
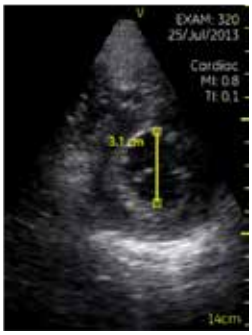
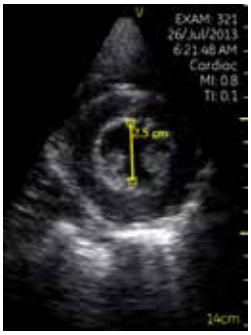
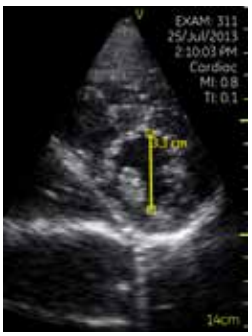
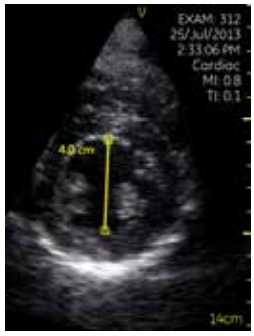
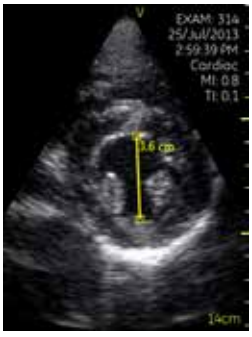
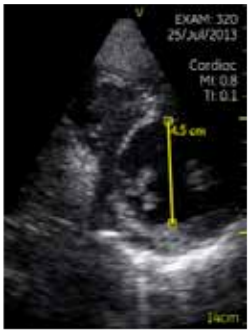
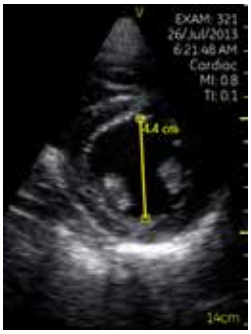
Over the next several hours, the patient received a total of 2 units of packed red blood cells (pRBCs) and 2 units of fresh frozen plasma (FFP). TTE images throughout this time, for example as seen at 16:09, consistently showed a LVESV of 38 mL and a LVEDV of 92 mL with BP wnl.

Later that evening, the patient was taken to the operating room for suspected retained products of conception. Uterine curettage under monitored anesthesia care was performed. BP and pulse remained wnl. TTE images continued to show LVESV of about 40 mL and LVEDV of about 90 mL throughout the surgery. EBL was 1,500 mL and HCT after surgery was 21. Post-operatively, the primary team gave 2 additional units of pRBCs and 2 additional units of FFP.

The following day, the patient was feeling well, ambulating, and eating. The HCT remained stable at 24 in the morning and evening. TTE in the evening showed a LVESV of 22 mL and LVEDV of 88 mL.

By showing the effect of fluids and blood products on cardiac filling in real time, TTE can give the team increased confidence in administering adequate resuscitation. A handheld TTE is not meant to replace a formal TTE study, but rather helps quickly evaluate volume status, contractility, and gross structural anatomy of the heart.

Abstract #:F-57

	2:10 PM	2:33 PM	2:39 PM	4:09 PM	P.O.D #1
End Systole:					
End Diastole:					

Abstract #:F-58

CVT: Curious Vein Thrombosis. A unique presentation of cerebral vein thrombosis.

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Background: Headaches are common during pregnancy and divided into two major categories: primary which are idiopathic; and secondary which result from underlying disease.1 Cerebral venous thrombosis (CVT), while rare in the general population with an incidence of ~1/100,0002, may be as common as 11.6/100,000 in pregnancy.3 Here we discuss a patient who presents with atypical headache eventually diagnosed as CVT.

Case: A 34 year old G1P0 woman at 38 weeks pregnancy presented with complaints of headache (HA). The headache's intensity increased with valsalva and recumbency and BP was 118/63. The patient was discharged to home on oral analgesics. The headache persisted and she was seen by neurology 2 days later. The neurologist found a non-focal exam before performing blocks of the greater occipital, supraorbital, supratrochlear, and auricotemporal nerves. The neurologist also started prednisone and scheduled an MRI. The following day the patient presented to the labor floor with a worsening headache and BP was 118/70. The neurologist again found a non-focal exam, but the MRI revealed bilateral occluded internal jugular veins suspicious for thrombus and the development of collateral vessels. The extensive collateral network suggested chronic occlusion that likely predated the pregnancy. The headache was felt to be related to the increased intravascular volume during pregnancy that was not being drained properly from the brain. The decision was made to perform an urgent cesarean delivery (CD) with further workup after delivery. At the time of CD, a neurologist performed a diagnostic and therapeutic lumbar puncture in the lateral position, measured a normal opening pressure, and collected CSF for analysis, which proved normal. The spinal anesthetic for CD was delivered by the anesthesiologist via the neurologist's large bore needle. The CD proceeded without complication, and the patient had an uneventful post-operative course with almost immediate headache relief. Subsequent MRIs demonstrated nearly complete resolution of her bilateral jugular occlusions over the next 3 months.

Discussion: The postpartum resolution of the jugular occlusion suggests that the patient had developed an acute onset of CVT due to the pregnancy. In hindsight, the collateral flow likely developed during the pregnancy and anticoagulation should have been initiated following the CD. This case demonstrates some prototypical aspects of CVT as well as CVT's variability, the need for a high index of suspicion in pregnancy, and the benefits of a multi-disciplinary approach to headache.

References:

1. Aegidius K, et al. Headache 2009; 49:851.
2. Coutinho JM, et al. Stroke 2012; 43:3375.
3. Lanska DJ, Kryscio RJ. Stroke 2000; 31:1274.

Abstract #:F-59

LABOR ANALGESIA IN A PARTURIENT WITH MAY-HEGGLIN ANOMALY

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May-Hegglin anomaly is an uncommon genetic condition manifested by significant thrombocytopenia and large platelets with preserved function. [1] Its inheritance pattern is autosomal dominant, but severity of thrombocytopenia and bleeding may vary; most heterozygotes are asymptomatic. [2] Despite thrombocytopenia, spontaneous bleeding may be mild. [3] Frequently, patients are misdiagnosed as having immune thrombocytopenia (ITP). [2] We present a case of a patient with known May-Hegglin anomaly.

A 20 year old G1P0 diagnosed with May-Hegglin anomaly at an outside hospital presented for evaluation prior to delivery. Medical records and complete blood count demonstrated her baseline platelet level ranged 20,000-30,000. She reported occasional nosebleeds, but denied spontaneous bleeding or bruising. She had received a platelet transfusion and had an uneventful appendectomy. Her mother endorsed similar history.

After evaluation, a multidisciplinary meeting was held to discuss delivery plans and labor analgesic options. Hematologists confirmed her diagnosis and excluded ITP. The timing and indication for platelet transfusion was discussed, prophylactic vs therapeutic. The safety of neuraxial anesthesia, with or without platelet transfusion, given thrombocytopenia but normal platelet function, was heavily debated.

The patient and MFM team preferred vaginal delivery, given the reduced risk for bleeding. The anesthesia team counseled the patient about her options, risks and benefits during a preoperative visit, regarding general anesthesia for cesarean section and neuraxial anesthesia-analgesia, after transfusion of platelets. After counseling, patient opted against neuraxial anesthesia.

She was admitted for induction at 38 weeks due to increased blood pressures at term. Per recommendations of the hematologists desmopressin acetate was given when active labor began. Platelet count was 45,000 upon admission, transfusion was unnecessary. Analgesia for delivery was with a fentanyl PCA, which patient considered adequate. Labor was unremarkable and patient delivered within 48 hours of admission, oxytocin 40 units and citotec were administered after delivery, estimated blood loss was 350mL. Newborn was evaluated in the NICU to rule out bleeding and thrombocytopenia. Both were discharged three days after delivery. Team work and multidisciplinary management and counseling of patient were demonstrated in this case.

Several cases of both vaginal and Cesarean delivery in patients with May-Hegglin anomaly have been described. Neuraxial techniques have been performed in such patients both with and without platelet transfusion, and no neurologic consequences have been reported. We present the clinical considerations as well as pros and cons of various labor analgesia management options for patients with May-Hegglin anomaly.

References:

1. Fishman B et. al. Anesth Analg 2009
2. Filanovsky K et. al. Eur J Haematol 2009
3. Hussein BA et. al. Blood Coagul Fibrinolysis 2013

Abstract #:F-60

Obstetric, Anesthetic, and Neonatal Outcomes Among Super-Obese Parturients:

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Introduction: Obesity has become a worldwide epidemic, reflected in an increased prevalence in women of reproductive age.1 Between 1986 and 2000, the prevalence of super obese (BMI > 50) U.S. adults increased five-fold.2 There is an increased risk of adverse outcomes in obese parturients, but limited data exist regarding the super-obese obstetric population.3 The aim of our investigation was to review anesthetic outcomes in super-obese parturients, and to compare them to their obese and non-obese counterparts.

Methods: In this IRB-approved study we used the Perinatal Database at the University of Chicago to identify all super obese (BMI > 50), obese (BMI > 30 and < 50) and non-obese (BMI < 30) parturients who delivered during the years 2011-2013. Data gathered included medical history, obstetric, anesthetic, and neonatal outcomes. We compared super-obese to obese and non-obese cohorts. Nominal data were analyzed using the Chi2 or Fisher exact test, as appropriate. Continuous data were examined for normality and analyzed using the Kruskal-Wallis test and Mann Whitney U test. $P < 0.05$ rejects the null hypothesis.

Results: We identified 150 super-obese, 2381 obese, and 2157 non-obese parturients. Demographics, comorbidities, and obstetric outcomes are in Table 1. Super-obese patients had higher BMI and age, and more diabetes (DM) and hypertension (HTN) than both cohorts. Obstetric outcomes demonstrated that super-obese had higher rates of cesarean delivery (CD) and operative vaginal delivery, and greater estimated blood loss (EBL) and hemorrhage compared to both cohorts; a higher rate of IUGR compared to the obese; and a higher rate of failed inductions requiring CD and longer labor duration compared to the non-obese. Infants of super-obese patients had lower arterial and venous pH and more NICU admissions than both cohorts. Ninety-three% of super-obese patients had anesthetic care; 4% received general anesthesia. The super-obese patients had an 8% rate of epidural catheter failure and a 5% rate of inadvertent dural puncture. There were no major airway complications.

Discussion: Super-obese patients have significantly more comorbidities and more peripartum and neonatal morbidity than obese and non-obese counterparts. Their anesthetic care is associated with acceptably low major complication rates.

References:

1. World Health Organization Geneva (Switzerland) 2000.
2. Prachand VN et al.: Ann Surg. 2006;244:611–619
3. Hood DD, Dewan DM: Anesthesiol 1993;79:1210-8

Abstract #:F-60

	% for BMI < 30 (n = 2157)	% for BMI 30-50 (n = 2381)	% for BMI >/= 50 (n = 150)
BMI (kg/m^2)	27 (24-28)	35 (32-39)†	55 (52-59)*#
AGE (yr)	26 (21-32)	28 (23-33)†	30 (25-34)*#
DM	72 (3.3%)	212 (8.9%)†	26 (17.3%)*#
HTN	175 (8.1%)	481 (20.2%)†	81 (54.0%)*#
Gravidity	2 (1-3)	3 (2-4)†	3 (2-5)*#
Parity	1 (0-2)	1 (0-2)†	1 (0-2)*#
Nullip	945 (43.8%)	865 (36.3%)†	43 (28.6%)*
EGA	38 (36-39)	38 (37-39)	38 (37-39)
IUGR	137 (6.4%)	118 (5.0%)†	13 (8.7%)#
IUFD	80 (3.7%)	81 (3.4%)†	3 (2.0%)
Induction	664 (30.8%)	946 (39.7%)†	63 (42.0%)*
CD	482 (22.3%)	878 (36.9%)†	96 (64.0%)*#
Induction to CD	99 (20.5%)	261 (29.7%)†	32 (33.3%)*
Operative vaginal delivery	111 (5.1%)	83 (3.5%)†	1 (0.7%)*#
Labor duration (min)	513 (294-849)	589 (335-991)†	708 (390-1329)*
EBL (ml)	300 (250-500)	400 (300-700)†	700 (350-1000)*#
Hemorrhage SVD/CD	135 (6.6%)	206 (8.2%)†	33 (22.1%)*#
Transfusion	43 (2.0%)	49 (2.1%)	0 (0.0%)

Table 1: Demographics, Comorbidities, and Obstetric Outcomes

* $P < 0.05$ super-obese compared to non-obese
# $P < 0.05$ super-obese compared to obese
† = $P < 0.05$ obese compared to non-obese

Abstract #:F-61

Patterns of obstetric anesthesia staffing and out-of-hours coverage at US academic obstetric centers.

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Introduction: There has been limited examination of obstetric anesthesia staffing for labor and delivery (L&D) units in the United States, especially within academic obstetric centers (1). It is also unclear whether institution-specific delivery volumes influence the type and degree of daytime, out-of-hours and weekend obstetric anesthesia coverage. We examined current patterns of obstetric anesthesia staffing at academic obstetric centers, including whether anesthesia coverage varies according to institution-specific delivery volumes.

Methods: We identified US academic hospitals with ACGME accredited anesthesia residency programs (www.acgme.org) 115 obstetric anesthesia directors were invited to complete an online survey, which contained questions about annual delivery volume and daytime/out of hours coverage by attending anesthesiologists. Hospitals were categorized into three groups based on tertiles of delivery volume. Data are presented as median [IQR] and n (%); data were analyzed using Fisher's test for categorical data.

Results: We contacted 113 obstetric anesthesia directors; 65 directors completed the survey (response rate=58%). Delivery volumes in low volume, medium volume and high volume L&D units were 1800 [1500-2000], 3000 [2500-3500], and 4500 [3950-7000] deliveries per year respectively (Table). The majority of the units (46/65 (70%)) had daytime coverage with one anesthesia attending. The number of daytime attendings significantly differed according to the delivery volume of each hospital. We also observed significant differences in the type of weekend daytime attending-level coverage according to hospital volume. We observed a non-significant trend towards higher volume hospitals having in-house dedicated attending midweek out-of-hours coverage or weekend nighttime coverage compared to lower volume hospitals.

Conclusion: This survey suggests that annual delivery volume may influence the degree of obstetric anesthesia daytime and out-of-hours coverage at US academic centers. High volume units are more likely to have a dedicated daytime in-house coverage compared to low volume institutions. As we could not assess maternal outcomes in this study, future research is needed to determine whether rates of obstetric morbidity are influenced by the type and quality of daytime and out-of-hours obstetric anesthesia coverage

Reference:

1. Anesthesiology 2005; 103:645-53

Abstract #:F-61

Table: Characteristics of obstetric anesthesia coverage at academic hospitals

	All hospitals (n=65)	Low volume hospitals (n=25)	Medium volume hospitals (n=20)	High volume hospitals (n=20)	P value
Number of deliveries / year	2700 [2000-3800]	1800 [1500-2000]	3000 [2500-3500]	4500 [3950-7000]	
Daytime OAAs per unit					<0.001
1	46 (70%)	22 (88%)	15 (75%)	9 (45%)	
2 or more	12 (19%)	0	2 (10%)	10 (50%)	
Unknown	7 (11%)	3 (12%)	3 (15%)	1 (5%)	
Midweek out-of-hours coverage					0.10
In-house dedicated to L&D	28 (43%)	7 (28%)	9 (45%)	12 (60%)	
In-house; cross-cover OR and L&D	24 (37%)	13 (52%)	8 (40%)	3 (15%)	
Unknown	13 (20%)	5 (20%)	3 (15%)	5 (25%)	
Weekend daytime coverage					0.04
In-house dedicated to L&D	28 (43%)	7 (28%)	8 (40%)	13 (65%)	
In-house; cross-cover OR and L&D	23 (35%)	12 (48%)	9 (45%)	2 (10%)	
Off-site coverage	1 (2%)	1 (4%)	0	0	
Unknown	13 (20%)	5 (20%)	3 (15%)	5 (25%)	
Weekend nighttime coverage					0.08
In-house dedicated to L&D	26 (39%)	6 (24%)	8 (40%)	12 (60%)	
In-house; cross-cover OR and L&D	25 (39%)	13 (52%)	9 (45%)	3 (15%)	
Off-site coverage	1 (2%)	1 (4%)	0	0	
Unknown	13 (20%)	5 (20%)	3 (15%)	5 (25%)	

Data presented as mean (%) and mean (SD).
L&D = Labor and Delivery Unit; OAA = Obstetric Anesthesia Attendings; OR = operating room; Daytime = Monday – Friday; 'normal' working hours

Abstract #:F-62

Hemoptysis and Respiratory Distress in the Postpartum Period: A Rare Presentation of Microscopic Polyangiitis

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Introduction: Microscopic polyangiitis during pregnancy is associated with a high risk of fetal and maternal complications. We present a case of microscopic polyangiitis diagnosed postpartum.

Case: A 26 year old primigravida from Burma presented with an episode of hemoptysis on postpartum day three. Her vaginal delivery at 40+ weeks was complicated by chorioamnionitis, postpartum bleeding and urinary retention requiring multiple catheterizations. Her past medical history included a positive PPD followed by 6 months of isoniazid. During this pregnancy, she had persistent hematuria and proteinuria.

The patient appeared anxious on physical examination. Her pulse rate was 116/min, blood pressure was 147/87 and oxygen saturation was 77-83% on room air. She was transferred to the labor floor for closer monitoring. On 7L O2 by face mask, her O2 saturation increased to 93%. CT angiography was planned to evaluate for pulmonary embolus (PE). She had another episode of hemoptysis of approximately 10ml. Infectious disease and pulmonary/ICU consults were performed. Bedside echocardiogram showed normal biventricular function with mild pulmonary hypertension. The ICU team began heparin treatment for presumed PE – a bolus was given and an infusion started. Minutes later, the patient had significant hemoptysis and respiratory distress. The heparin was stopped and she was taken to the operating room for emergent intubation.

Despite 100% oxygen therapy, she had periods of 02 saturations ranging from 70-80%. Tracheal tube suctioning yielded copious frank blood. Bronchoscopy revealed diffuse airway bleeding without any focal source. CXR showed bilateral consolidations. Transabdominal ultrasound and lower extremity dopplers were negative for retained placenta and deep vein thrombosis, respectively. Her hemoglobin was 7.1 g/dL (down from 12.8 g/dL peripartum). Two units of packed RBCs and one of FFP were transfused and she was transferred to the intensive care unit.

She was later diagnosed with p-ANCA vasculitis, specifically microscopic polyangiitis, manifesting as a pulmo-renal syndrome. She endured a prolonged ICU admission, with two rounds of plasmapheresis and multiple blood transfusions.

Discussion: Microscopic polyangiitis is a rare disease. The onset is usually abrupt, with hemoptysis, as well as other pulmonary symptoms, such as cough, occurring in over 80% of patients (1). Renal involvement, specifically rapidly progressive glomerulonephritis, is associated with poorer outcomes (2). The treatment includes steroids and rituximab. These patients are usually managed by multiple subspecialities: nephrology, pulmonary, and rheumatology.

References:

1. Wilke L, Prince-Fiocco M, Fiocco GP. Microscopic polyangiitis: a large single-center series. J Clin Rheumatol 2014; 20(4):179-182.
2. Croft AP, Smith SW, Carr S, et al. Successful outcome of pregnancy in patients with anti-neutrophil cytoplasm antibody-associated small vessel vasculitis. Kidney Int 2014 Oct.

Abstract #:F-63

A Rare and Unique Presentation of Amniotic Fluid Embolism during Dilation and Evacuation of a Missed Abortion at 15 weeks of Gestation in a Healthy Pregnant Patient

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Introduction: Amniotic fluid embolism (AFE) is a rare and catastrophic event with a reported incidence of 1.9 to 6.1 per 100,000. It is the number one cause of cardiovascular collapse and death in pregnant patient. Most reported cases are presented between 2 hours before and 4 hours after delivery. It is exceedingly rare for an AFE to occur in the second trimester. We present a rare case of AFE during routine dilatation and evacuation for intrauterine fetal demise (IUFD) at 15 weeks of gestation.

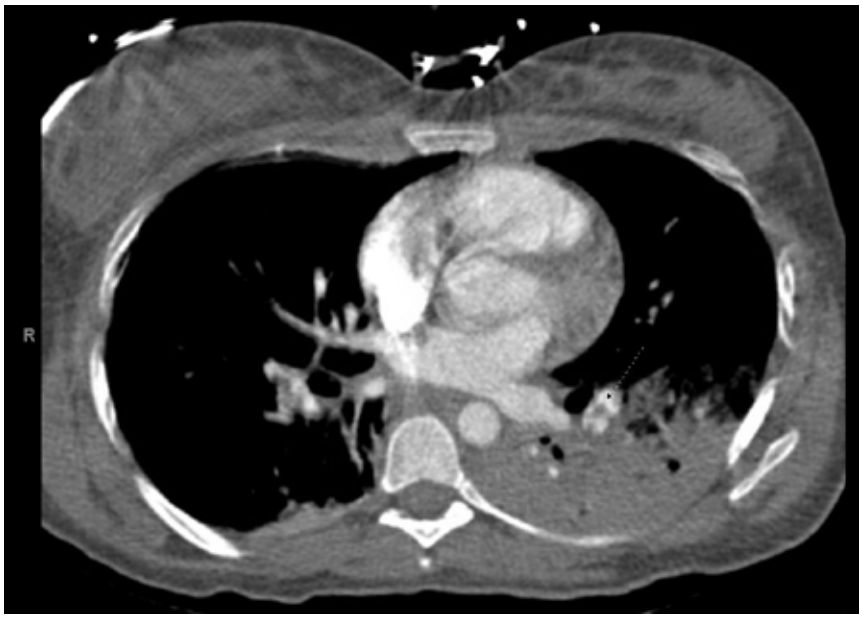
Case Description: A 28 year old G2P0 female presented for D&E for IUFD at 15 weeks of gestation. The patient had a past medical history of polysubtance abuse with a negative drug screen on day of surgery. The procedure started under GA and proceeded uneventfully for 35 minutes with stable vital signs; the products of conception with all fetal bony parts were removed. At this point, patient suddenly became hypoxic and hypotensive and did not respond to phenylephrine and 20mcg of epinephrine and proceeded to PEA cardiac arrest. ACLS was started and resuscitation continued for 20 minutes. The patient survived the initial insult and was taken to the ICU, where she developed acute DIC with PT >100, INR 8.9 and Fibrinogen <10. The CT chest image showed extensive bilateral segmental pulmonary emboli compatible with pulmonary hypertension and ground glass opacity in the lung bases. The patient is still in critical condition in ICU (27days) after the event. We believe that the patient suffered a massive amniotic fluid embolus, which caused cardiovascular collapse and PEA cardiac arrest, leading to DIC and ischemic brain injury.

Discussion: Although mortality has declined in recent decades, AFE still proves fatal in 40% to 60% of cases. Disruption of the maternal-fetal barrier and fetal tissue entering the maternal circulation is hypothesized to be the inciting event for signs and symptoms of AFE. Diagnosis of AFE is one of the exclusions after clinical observation and in many cases during autopsy. Usually AFE occurs in parturients during labor, cesarean section, or in the immediate post-partum period. The case that is presented here with the classical signs and symptoms of AFE at 15 weeks of gestation during D&E is exceedingly rare.

Reference

McDonnell NJ, Percival V, Paech MJ. "Amniotic fluid embolism: a leading cause of maternal death yet still a medical conundrum". Int J Obstet Anesth. 2013 Nov; 22(4):329-36

CT Chest image showing the Pulmonary Emboli



Abstract #:F-64

Intraoperative use of Point of Care Ultrasonography (POCUS) for Stat Cesarean Delivery with Refractory Hypoxemia

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Background: A 30-year-old, 131kg, BMI 43, G6P5 female at 24 weeks gestation presented with complaints of headache, hypertension and blurry vision. She was diagnosed with superimposed pre-eclampsia (SIPE) on chronic hypertension. An obstetrical emergency was called due to fetal heart rate decreasing to a nadir of 40bpm within 20 minutes of arrival. The patient was taken for an emergent cesarean delivery requiring general anesthesia.

Intraoperative Course: Prior to induction of anesthesia, the SpO2 was 92% on 6L O2 facemask and 93% on 100% mask preoxgenation. A rapid sequence induction was conducted with a successful intubation using a videofibroptic scope with end tidal CO2 confirmation and bilateral breath sounds. Oxygen saturation during laryngoscopy decreased to 80%. Immediately after intubation, SpO2 dropped to 71% on 100% Fio2. The patient was manually ventilated and she was given Albuterol endotracheally.The endotracheal tube was withdrawn 1 cm with reconfirmation of breath sounds. The oxygen saturation remained between 71-80% using manual ventilation. Peak airway pressure ranged from 25-38mmHg while an attempted machine ventilation. At that time, the differential diagnosis included bronchospasm, pneumothorax, pulmonary edema, cardiogenic congestive heart failure, hemothorax, atelectasis and pneumonia. In order to assist in diagnosing and planning further anesthetic treatment, a portable point-of-care ultrasound (POCUS) device was brought into the operating room. Using the Focused Assessed Transthoracic Echocardiography (FATE) protocol, windows obtained suggested that the patient had a small pericardial effusion, left ventricular hypertrophy and gross pulmonary edema as illustrated by multiple "b-lines" in pleural view (Images). Given the findings, 1:1 crystalloid replacement was undertaken rather than the traditional 3:1 replacement for crystalloid to blood loss ratio. The patient's SpO2 slowly improved and by the end of the surgical procedure as SpO2 was between 88-91%. Re-imaging of the pleural views revealed some improvement of interstitial pulmonary fluid. The patient remained intubated for the entire procedure and post-operatively.

Results and Postoperative Course: A chest radiograph postoperatively confirmed ongoing pulmonary edema and equivocal pleural and pericardial effusions. A transthoracic echo obtained on postoperative day (POD) 1 further supported the diagnosis. The patient was extubated on POD 2 and eventually discharged home. The patient was scheduled for follow-up care.

Conclusion: Peri-operative POCUS was used to help aid in a diagnosis of a emergent cesarean delivery with ongoing hypoxia. Multiple medical disciplines, including obstetrics, anesthesia and critical care, were able to visualize her problems and collaborate. The images obtained gave a focal point to continue her post operative care. Further study to broadening obstetrical anesthesia use of POCUS is required.

Abstract #:F-65

The Labor Pain Questionnaire: High Sensitivity to Change in Women Receiving Labor Epidural Analgesia

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Introduction: The Labor Pain Questionnaire(LPQ)is a 22-item health-specific psychometric instrument developed to measure women's pain experiences during childbirth. Our recent work showed excellent test-retest reliability, internal consistency, and adequate sensitivity to change and responsiveness of the LPQ and its subscales during early labor without pain relief. The current study examined the LPQ's sensitivity to change and validity in women receiving labor epidural analgesia.

Methods: After informed consent, ASA 1-2 laboring women with term fetuses were recruited. Women were fluent in English, >18 years of age, ≤6cm cervical dilatation and contracting ≥3 minutes apart. Participants answered the LPQ in mixed or standard item format during 2 test sessions. The first test session (T1) occurred within an hour prior to epidural insertion; the second (T2) was answered 20mins following epidural drug administration. Both tests were conducted by the same trained interviewer. Concurrently administered pain tools(NRS, verbal pain rating scale (VPRS),Pain Mastery Scale (PMS)) were also completed during each session, permitting assessment of their convergent validity with the LPQ. Changes in pain between tests were rated using the Patient Global Impression of Change Scale(PGICS). Raw scores were transformed to percentage scores to ensure even representation of subscales in LPQ composite/total scale scores. Sensitivity to change of the LPQ was examined using the t-statistic(paired-t test),Effect size (ES), and Standardized Response Mean(SRM) LPQ scores corresponding to response levels on the PGICS, VPRS and PMS were determined.

Results: 51 women completed the study; most (50/51)described much or very much improvement in their pain at 20minutes post epidural drug administration. Four women described minimal improvement;1 described no change in pain. Raw scores differed significantly between T1 and T2 for LPQ composite and all subscale scores(t-statistic(df-49) 3.8 to 12.2, $p<0.001$). Effect size values were large for raw LPQ composite(2.1)and subscale scores(Enormity of the Pain(1.4),Uterine Contraction pain(2.2), Backpain/Longhaul(2.0), Fear/Anxiety (1.1), and Birthing Pain(0.86)). Correlations between raw LPQ composite scores and subscale scores during Test 1 and Test 2 were r= 0.17 to 0.39. Standardized Response Means ranged from 0.65 to 1.9 and were interpreted as large based on study-derived ES thresholds using methods described previously. Strong correlations were found between raw LPQ composite and NRS scores at T1 (0.78)and T2 (r=0.83). Correlations were moderate to strong between LPQ composite and VPRS scores at T1(r=0.5) and T2(r=0.78) and between LPQ and PMS scores at T1(0.67) and T2 (0.82). All were statistically significant ($p<0.001$).

Conclusions: LPQ composite and subscale scores showed high levels of sensitivity to change and evidence of convergent validity with other pain tools in women receiving epidural analgesia during early labor.

Abstract #:F-66

Measurement of ChloraPrep® Drying Time before Neuraxial Anesthesia in Elective Cesarean Delivery. Prospective Observational Study

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Background: ChloraPrep® is a skin antiseptic commonly used before neuraxial anesthesia. It contains 2% chlorhexidine gluconate (CHG), 70% isopropyl alcohol (IPA), water, and an orange tint. CHG and IPA are neurotoxic.1 To avoid nerve damage, ChloraPrep® must be allowed to dry before the skin is punctured. The aim of this study was to measure ChloraPrep® skin drying time and to determine IPA drying time.

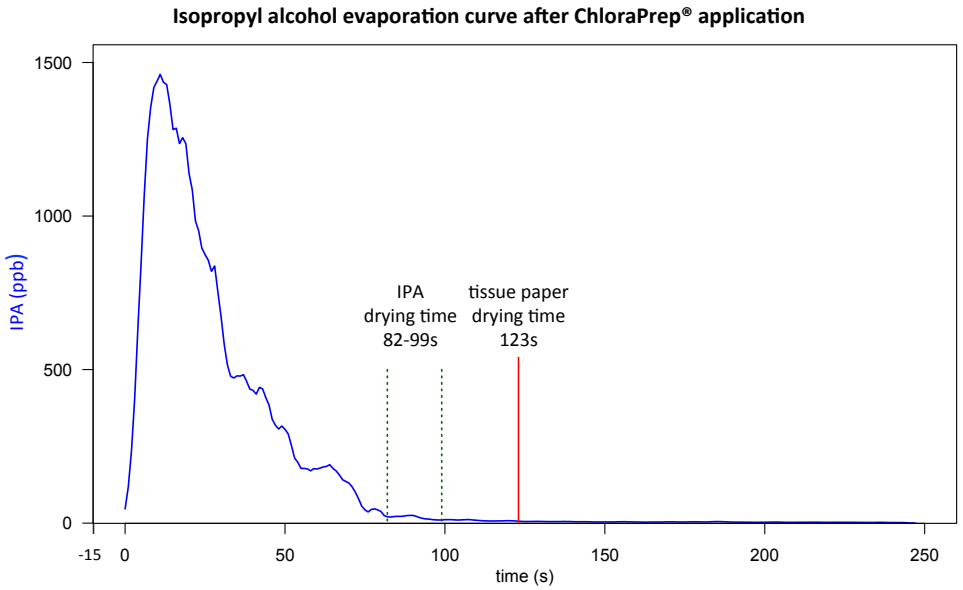
Methods: ChloraPrep® drying time was assessed in 18 consenting parturients before elective cesarean delivery. The ChloraPrep® applicator was weighted pre and post use. In the operating room, one researcher applied antiseptic evenly over a standardized area. Skin dryness was assessed by blotting the perimeter of the preparation area with tissue paper at 15-second intervals and observing for disappearance of the orange tint staining. IPA vapor concentration was measured continuously 1 cm above the center of the preparation area with a volatile organic compound analyzer (ppbRAE 3000, USA). Using linear breakpoint regression analysis, the onset of the plateau on the IPA evaporation curve was arbitrarily defined as 'IPA drying time'.

Results: ChloraPrep® drying time measured by blotting was 123 s (SD 32, 95%CI 107-140). The estimated IPA drying time was between 82 and 99 seconds. The mean ChloraPrep® amount applied was 1 g (SD 0.3).

Discussion: Our data supports waiting for at least 2 minutes after ChloraPrep® application to ensure skin dryness and to avoid seeding potentially neurotoxic agents deep into tissues. Copious ChloraPrep® application, presence of skin folds, and excessive lumbar hair may require a longer drying period.

Reference:

1. Bogod D. The sting in the tail: antiseptics and the neuraxis revisited. Anaesthesia. 2012:1305-9



x axis : time in seconds
y axis : vapor concentration of isopropyl alcohol (IPA) in parts per billion (ppb)

Abstract #:F-67 & MA-05

A meta-analysis evaluating the effect of low and high dose morphine on maternal and neonatal outcomes

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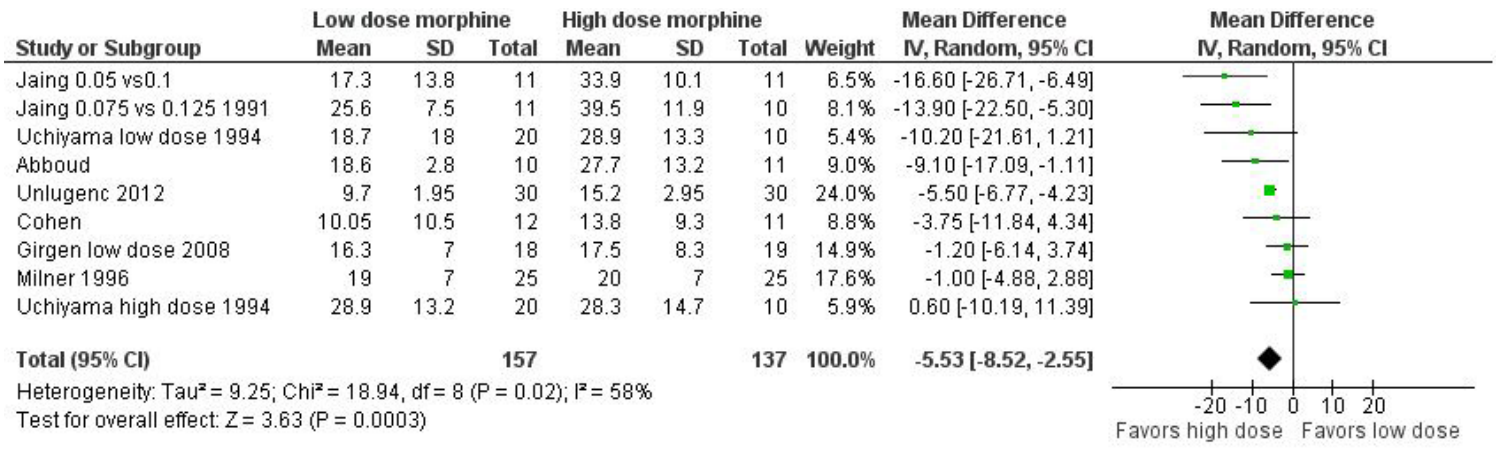
Introduction: The intrathecal morphine dose for elective cesarean delivery which provides optimal analgesia while minimizing side-effects has not yet been defined. The objective of this meta-analysis was to determine the optimal dose of intrathecal morphine for the provision of post-cesarean delivery analgesia.

Methods: A literature search (PubMed, EMBASE, MEDLINE, Scopus and CINAHL) was performed to identify randomized controlled trials involving patients undergoing elective cesarean delivery under spinal anesthesia comparing low dose (50 to 100 mcg) spinal morphine to higher dose (>100 to 250 mcg). Primary outcome was the duration of analgesia (defined as the time for first request for supplemental analgesia). Secondary outcomes included: pain scores, morphine usage and maternal side-effects (vomiting and pruritus), and neonatal outcome (Apgar scores). Mean differences / odds ratios / risk differences (M.D./OR/RD) were calculated with 95% confidence intervals. Data were analysed using Review Manager (version 5.1).

Results: Twelve articles met our inclusion criteria. A total of 604 patients were recruited in all study groups (320 in the low dose group and 284 patients in the high dose group). There was significantly greater time to first analgesic request in the high dose group (mean difference -5.53 [-8.52, -2.55]; p=0.0003). Pain scores (0-100) at 12 hours (M.D. 2.54 [-2.55, 7.63]; p=0.33), 24 hours (M.D. 1.00 [-2.26, 4.26]; p=0.55) and morphine consumption at 24 hours (M.D. 2.21 [-2.85, 7.27] p=0.39) were not different between groups. The incidence of vomiting (RD -0.13 [-0.21, -0.06]; p=0.0003) and pruritus (OR 0.41 [0.26, 0.66]; p=0.0002) were greater in the high dose group. Apgar scores <7 at 1 minute were similar between groups (OR 0.61 [0.07, 4.96]; p=0.64).

Conclusion: This meta-analysis shows that higher doses of intrathecal morphine prolong analgesia following cesarean delivery. However the additional 5.5 hours of pain relief must be balanced against the increased risk of maternal pruritus and vomiting. The trade-off between improved analgesia and increased side-effects should be appreciated by both care providers and women undergoing cesarean delivery. Results from this study can be used to fully inform patients of the benefits and side-effects of using higher doses of intrathecal morphine for cesarean delivery.



Study or Subgroup	Low dose morphine Mean	SD	Total	High dose morphine Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI
Jaing 0.05 vs0.1	17.3	13.8	11	33.9	10.1	11	6.5%	-16.60 [-26.71, -6.49]
Jaing 0.075 vs 0.125 1991	25.6	7.5	11	39.5	11.9	10	8.1%	-13.90 [-22.50, -5.30]
Uchiyama low dose 1994	18.7	18	20	28.9	13.3	10	5.4%	-10.20 [-21.61, 1.21]
Abboud	18.6	2.8	10	27.7	13.2	11	9.0%	-9.10 [-17.09, -1.11]
Unlugenc 2012	9.7	1.95	30	15.2	2.95	30	24.0%	-5.50 [-6.77, -4.23]
Cohen	10.05	10.5	12	13.8	9.3	11	8.8%	-3.75 [-11.84, 4.34]
Girgen low dose 2008	16.3	7	18	17.5	8.3	19	14.9%	-1.20 [-6.14, 3.74]
Milner 1996	19	7	25	20	7	25	17.6%	-1.00 [-4.88, 2.88]
Uchiyama high dose 1994	28.9	13.2	20	28.3	14.7	10	5.9%	0.60 [-10.19, 11.39]
Total (95% CI)			**157**			**137**	**100.0%**	**-5.53 [-8.52, -2.55]**

Heterogeneity: Tau² = 9.25; Chi² = 18.94, df = 8 (P = 0.02); I² = 58%
Test for overall effect: Z = 3.63 (P = 0.0003)

Abstract #:F-68

Genome-wide association analysis of early onset preeclampsia

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Introduction: Despite a strong heritable component, there are no genetic variants that have been robustly associated with preeclampsia. In an effort to shed light on the genetic basis for preeclampsia requiring delivery before 37 weeks, we performed an unbiased genome-wide association study in two populations of European ancestry.

Methods: We employed a case-control design using samples from preeclamptic patients and control women drawn from the same clinical sites as cases in US (290 cases and 786 controls) and in Finland (95 cases and 95 controls). Subjects were genotyped using a genome-wide SNP array containing 588,454 SNPs.

Single-SNP genetic association testing was completed using logistic regression, assuming additive effects for each risk allele present, and included principal components in the model to account for population structure. Statistical significance was judged at genome-wide significance threshold of p=5 x 10-8 to account for multiple testing.

Results: Interim analysis revealed suggestive association signals (p<10-4), including variants with consistent effects in both datasets in a non-coding RNA gene LINC01580 (OR=2.52 (95%CI 1.67-3.82) p=9.8x10-6 in Finnish samples, OR=1.18 (95% CI 0.97-1.43) p=0.097 in US samples. Association of a coding variant in lymphoid specific transcription factor ELF1 (OR=0.19 (95%CI 0.08-0.47) p=7.7x10-5) was also observed in Finnish samples, with the same signal conferring risk in previously reported GWAS of Crohn's disease and SLE.

Conclusion: GWAS in two early onset preeclampsia populations preliminarily identify suggestive association signals that may offer biological insights into the basis of preeclampsia. These signals need to be replicated in an independent population.

Abstract #:F-69

A retrospective analysis of effect of anesthesia on outcome of in vitro fertilization

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Background: Pain relief for transvaginal ultrasound guided oocyte aspiration for in vitro fertilization is provided by various anesthetic techniques like general anesthesia, sedation or locoregional anesthesia. There are concerns that different anesthetic drugs used may have potential adverse effects on outcome of pregnancy after this procedure. Present study was conducted to know the outcome of pregnancy after in vitro fertilization using different anesthetic techniques.

Methods: A retrospective analysis of data collected from medical records of patients who underwent transvaginal ultrasound guided oocyte aspiration from a tertiary care teaching institute in India from September 2007 to March 2013 was done. Data collected were demographic variables, details of the anesthetic technique, pregnancy outcome variables including number of oocytes retrieved, fertilization rate, embryo quality grading, biochemical and clinical pregnancy rate, live birth rate and other outcomes like miscarriage, ectopic pregnancy.

Results: After excluding 17 patients who were lost to follow up, data from 989 patients were analysed. Out of this 419 patients(group 1) received general anesthesia and 570 patients(group 2) received sedation. Age, BMI, duration of infertility were comparable between the two groups.There were no difference between number of oocytes retrieved per cycle, fertilization rate, embryo quality, clinical pregnancy rate or miscarriage rate between the two groups. Biochemical pregnancy rate (25.54% vs 19.82%,P=0.03) and live birth rate (18.61% vs 13.85%,P=0.04) were significantly higher for group 1 compared to group 2.

Conclusion: Pregnancy outcome was better in patients who received general anesthesia compared to patients who received sedation. More prospective studies are needed to confirm this finding.

Abstract #:F-70

A Comparison of Epidural Infusion Strategies for Labor Analgesia

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Background: Epidural analgesia has long been considered the optimal technique for control of labor pain. There is no conclusive evidence regarding the most effective dosing strategy that will minimize drug consumption while maintaining effective analgesia. The purpose of this study was to compare the effectiveness of three epidural infusion strategies for labor analgesia and to test the hypothesis that a lower basal rate with a higher patient controlled bolus will result in lower analgesic consumption.

Methods: In a randomized single-blind study, 120 laboring parturients received epidural analgesia using a standard solution of 0.125% bupivacaine with 2mcg/ml fentanyl and received the following infusion strategies: group 1: 12mL patient controlled bolus every 20 minutes with 4mL/hr basal rate; group 2: 8mL patient controlled bolus every 15 minutes with 7mL/hr basal rate; group 3: 5mL patient controlled bolus every 10 minutes with 10mL/hr basal rate.

Results: Mean hourly analgesic volumes for groups 1, 2 and 3 were 12.3 (SD 3.2), 14.5 (SD 4.9), and 15.7 (SD 4.4), respectively. Group 1 had significantly less analgesic consumption than groups 2 and 3 ($p's<0.05$). Mean Verbal Numeric Rating Scale (VNRS) scores at time 0 for groups 1, 2 and 3 were 7.29 (SD 2.1), 7.430 (SD 2.16), 6.36 (SD 2.58), respectively. Following epidural placement, VNRS scores on average ranged from 1 to 4 with no statistical significance between groups ($p>0.05$). Median Modified Bromage scores were 0 and 1 across all times; there was no statistical significance between groups ($p>0.05$).

Conclusions: Analysis shows no difference in pain scores, modified Bromage scores, requests for supplemental analgesia, or epidural pump delivery/demand data. Mean hourly analgesic volumes indicate that an epidural dosing regimen of an available 12 mL patient controlled bolus every 20 minutes with a 4mL/hr continuous epidural infusion is effective at reducing total analgesic consumption while providing equipotent analgesia.

Keywords: Bupivacaine, Epidural Analgesia, Labor Pain, Pain Management, Pregnancy

Abstract #:F-71

Response Patterns to the Electric Stimulation of Epidural Catheters in Pregnant Women: A Randomized Controlled Trial of Uniport Versus Multiport Catheters.

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Introduction: The trans-catheter electric stimulation test (TCEST) can confirm the placement of an epidural catheter within the epidural space (1,2). The most common response with a uniport catheter placed in the lumbar area is the unilateral contraction of the lower limbs (3), due to the positioning of the catheter on the left or the right of the epidural space. With a multiport catheter the current leaving through multiple orifices may be able to stimulate roots bilaterally at the same time and elicit a different motor response. We hypothesized that the incidence of bilateral muscle contraction would be higher with a multiport catheter as compared to the uniport catheter.

Methods: With institutional REB approval and patient consent, we conducted this randomized double-blind controlled study. We recruited laboring women requesting epidural analgesia. The epidural catheter was placed at L3/L4 as assessed by ultrasound. Patients were randomly allocated to receive either a 19 G uniport catheter or a 19 G multiport catheter (Arrow Flextip plus, Arrow International Inc., Reading, PA). The TCEST (frequency 2 Hz; pulse width 200 M.S.) was performed immediately after securing the catheter and at 5 minutes following a test dose with 3 ml of lidocaine 2%. Subsequently a loading dose of 10 ml of bupi 0.125% and fentanyl 50 mcg was administered, followed by a PCEA regimen with bupi 0.0625% with fentanyl 2 mcg/mL. Sensory level to ice was assessed at 20 min and at 2 h after the loading dose. Primary outcome was the motor response pattern to the TCEST.

Results: 63 women were approached, 53 recruited and 43 had data analyzed. Patient characteristics in both groups were similar. The incidence of unilateral response to the TCEST was 95.5 % and 95.2% in the uniport and multiport respectively (p= 0.99). The minimum current intensity (mean±SD) required to produce a motor response at baseline was 5.4±3.0 M.A. and 5.4±4.1 M.A. in the uniport and multiport groups respectively (p= 0.98). Sensory level to ice (median; IQR) at 20 min and 2 h were T8 (T6-T9) and T8 (T7-T9) in the uniport catheter and T8 (T8-T10) and T8 (T7-T10) in the multiport catheter (NS). The incidence of symmetrical block at 20 min was similar in the uniport and multiport groups (86.4% and 81% respectively, p=0.75); at 2 hours it was significantly lower in the multiport group (100% and 68.4% respectively (p=0.03). Analgesia was adequate in all patients.

Discussion: The results of this study show that the TCEST produced with a multiport catheter is similar to that produced with a uniport catheter. The unilateral contraction of the lower limbs is the most common response. Both catheters produce similarly effective analgesia. The different incidence of symmetrical block at 2 h may be a result of patient positioning and gravity effect during labor, which was not controlled in our study.

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3. Can J Anesth 2013;60:393

Abstract #:F-72 & MA-07

OBSTETRIC SOCIETIES' GUIDELINES FOR POSTPARTUM HEMORRHAGE; ONE SIZE FITS ALL?

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Introduction: Guidelines from national obstetric societies aim to inform practitioners of key strategies for the prevention and treatment of postpartum hemorrhage (PPH). However, it is unclear whether the content of national PPH guidelines is uniform and up-to-date.(1) We performed a detailed review to compare key aspects of PPH guidelines from five national obstetric societies.

Methods: We independently reviewed the most recent PPH guidelines from the United Kingdom (RCOG), United States (ACOG), Australia and New Zealand (RANZCOG), Canada (SOGC) and the combined guidelines from Germany, Austria, and Switzerland (DACH). We reviewed information sources used by each society for formulating guidelines. We compared the societies' recommendations for the prevention and treatment of PPH, including: pharmacological, medical and surgical interventions for PPH prevention and treatment.

Results: Key elements of the societies' recommendations are presented in the Table. Information sources are cited by all societies, but only the RCOG describe the methodological approaches used for constructing their guidelines. Based on our review, we observed notable differences between societies for the following: the definition of PPH, clinical signs accompanying PPH, and PPH preventive measures. All societies recommend multi-disciplinary management and clinical drills for optimizing acute care for women with severe PPH. However, only three societies (SOGC, RCOG, DACH) provide transfusion recommendations, with two societies (RCOG, DACH) providing information about a massive transfusion protocol.

Discussion: Based on our review, PPH guidelines of national obstetric societies are not uniform. In particular, recommendations for transfusion are poorly described and are not in keeping with contemporary hematologic and transfusion strategies for the management of major PPH.(2-3) PPH guidelines of national obstetric societies should be updated to reflect current expert recommendations for obstetric hemorrhage management.

References:

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2. J Thromb Haemost 2011;9:1441-51
3. Transfusion 2011;51:2540-8.

Abstract #:F-72 & MA-07

Summary of National Obstetric Societies' Postpartum Hemorrhage Guidelines

	ACOG- 2006	SOGC - 2009	RCOG – UK 2009	RANZCOG –2011	DACH –2014
Definitions of PPH	EBL > 500ml (VD) EBL > 1000ml (CD)	EBL > 500ml (VD) EBL> 1000ml (CD) EBL associated with hemodynamic instability	Minor PPH: EBL 500-1000ml; Moderate PPH: EBL 1000-2000ml; Severe PPH: EBL>2000ml*	EBL > 500ml Severe PPH: EBL ≥1000ml*	EBL>500ml VD or EBL>1000ml CD Severe PPH: EBL>1500-2000ml or >150ml/min or EBL>50% circulating volume within 3 hours
Management of patients at risk of PPH	Not discussed	Not discussed	Not discussed	Ensure rapid access to blood products. Correct prepartum anemia	Prepartum care by a specialist
Uterotonics for treating PPH	Oxytocin Carboprost Misoprostol Methylergonovine Dinoprostone	Oxytocin Carboprost Misoprostol Ergonovine Carbetocin	Oxytocin Carboprost Misoprostol Ergometrine	Oxytocin Misoprostol Ergometrine Prostaglandin F2α	Oxytocin Carboprost Misoprostol Intramyometrial prostaglandins Sulprostone
Intrauterine balloon tamponade	Yes	Yes	Yes	Yes	Yes
Hemostatic brace suture	Yes	Yes	Yes	Yes	Yes
Vessel ligation	Yes	Yes	No	Yes	Yes
Hysterectomy	Yes	Yes	Yes	Yes	Yes
Interventional radiology	Yes	Yes	Yes	Yes	Yes
Transfusion indications	Ongoing blood loss ± unstable vital signs	Not discussed	Yes – according to clinical picture	Not discussed	Yes – according to clinical picture
Massive transfusion protocol	Not discussed	Not discussed	Yes	Not discussed	Yes
Pharmacologic adjuncts for PPH	Not discussed	RVIIa not recommended	Tranexamic acid - not recommended. RVIIa with haematology approval	Tranexamic acid recommended. RVIIa as salvage treatment	Tranexamic acid and fibrinogen concentrate recommended. RVIIa as salvage treatment

RCOG = Royal college of obstetricians and gynaecologists, ACOG = American College of Obstetricians and Gynecologists, RANZCOG = Royal Australian and New Zealand College of Obstetricians and Gynaecologists, SOGC = Society of Obstetricians and Gynaecologists of Canada, DACH = Deutschland, Austria & Switzerland EBL = Estimated blood loss, VD = Vaginal delivery, CD = Cesarean delivery, RVIIa = Recombinant factor VIIa, PPH = postpartum hemorrhage

Abstract #:F-73

Pain Resolution and Opioid Cessation after Childbirth

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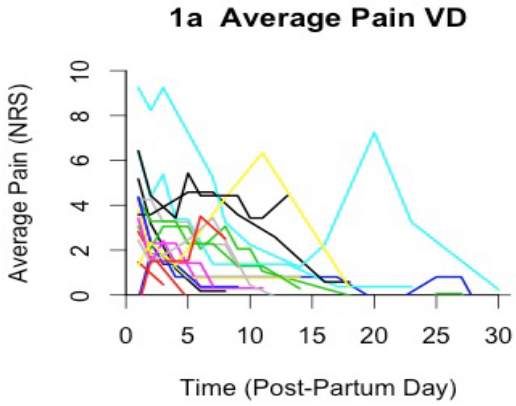
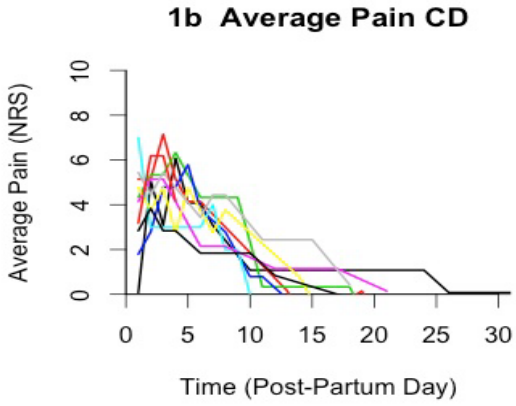
Introduction: Pain resolution after child birth has only been described by assessing pain at specific time points after child birth,1-3 and information regarding longitudinal pattern and characteristics of pain resolution after delivery and discharge from hospital is unavailable. The current study aims to establish norms for pain resolution, opioid use, and functional recovery after childbirth.

Methods: Healthy nulliparous women with singleton pregnancies (gestational age >35 weeks and no fetal co-morbidities) were enrolled in this prospective non-interventional study. Women were approached daily in hospital and then contacted telephonically each day until 1) Pain resolution, 2) Opioid cessation, and 3) Self-assessed functional recovery from delivery. Pain burden was measured as area under the curve (AUC) using pain NRS/days (Figure 1). Pain and functional recovery were compared between vaginal and cesarean deliveries (CD) with a t-test and opioid use was compared using Wilcoxon's summed rank test. Results are reported as mean +/- SD, median (95% CI), or range as appropriate.

Results: Following vaginal delivery (n=19), 39% of patients required opioid analgesics for 1-3 days. Following CD (n=11), all patients required opioids for analgesia for 2-9 days. Patients reported being pain-free 15 ±10, and 18 ± 5 days after vaginal and CD, respectively (P=0.39). AUC for pain days were 29 ± 29 for vaginal, and 44 ± 14 for CD (P=0.23; Figure 1). Opioids were required for 5 (3-6) days longer after CD compared to vaginal delivery (P<0.0001). Functional recovery was attained 19 ±13, and 25 ± 12 days after vaginal and CD, respectively (P=0.30).

Figure 1





Conclusion: We have demonstrated substantial inter-subject variability in pain and functional recovery after both vaginal and CD that is not accompanied by prolonged requirement for opioid analgesia. We did not observe clinically or statistically significant differences in times taken for pain-free recovery and functional recovery between vaginal and CD despite the fact that these recovery periods are considered differently by insurers and employers of parturients. The study also highlights the importance of looking beyond the hospital stay, the usual endpoint of studies, to obtain a true assessment of pain resolution and recovery.

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Abstract #:F-74

Pres Syndrome In Parturients- A Case Series

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Introduction: The diagnosis of Posterior Reversible Encephalopathy Syndrome (PRES) was introduced in the 1990s to describe a clinical, neuro-radiological syndrome, which presents with unique-pattern of vasogenic brain edema in a setting of various neurotoxic states. We present a acase series of parturients with PRES syndrome with varying presentations.

CASE REPORTS: We present three parturients with PRES after neuro-axial anesthesia complicated by postdural puncture headache (PDPHA). All three patients experienced severe, witnessed tonic-clonic seizures. The full–scope of interdisciplinary management and neuroimaging findings is described in this report.

CASE 1: 29 years G3P0 female,after normal spontaneous vaginal delivery with epidural anesthesia presented with five day history of positional headache, hypertension and subsequent generalized seizure in ED.

CASE 2: 20 years G1P1 female, after normal delivery with epidural anesthesia, PDPHA and epidural blood patch presented with generalized tonic-clonic seizure and visual disturbances.

CASE 3: 23years G1P0 female, unaware of 25 weeks of gestation, presented in unresponsive status post generalized tonic-clonic seizure, hypertensive emergency and generalized facial/body edema.

Conclusion: First recognized in patients with toxemia of pregnancy and allogeneic bone marrow transplant, PRES has also been described in severe autoimmune conditions, renal failure, high-dose chemotherapy etc. Presenting symptoms include altered mental status, seizures, paresis, visual disturbances, headache and hypertension. Neuro-radiological imaging features edema in the parietal and occipital lobes, as well as the frontal lobe, the inferior temporal-occipital junction, and the cerebellum. Common watershed areas are affected in three distinctly recognized radiological patterns (holohemispheric, superior frontal-sulcal, and primary parietal-occipital), emphasizing the vasogenic nature of the condition.

Cases of concurrent PRES and PDPHA are very rare in medical practice. In a setting of hypertension, 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.

Combination of toxemia and/or vasculopathy carries a considerable risk of permanent neurological damage and mortality. Immediate recognition and goal directed, expeditious management is essential for complete resolution of symptoms. This requires complex management and decision-making capacity by an interdisciplinary team of physicians. Early involvement of critical care, neuroimaging, neurophysiology, anesthesiology and obstetrical experts cannot be overemphasized. Such strategy was employed in our series and all three patients were discharged home without residual neurological symptoms.

Abstract #:F-75

Non-invasive cardiac output monitoring (NICOM) in a patient with cardiomyopathy secondary to Marfan syndrome undergoing cesarean section

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Introduction: Parturients with cardiomyopathy are at risk of heart failure from increased circulating blood volume during cesarean section (CS). Mean arterial blood pressure (MAP) trends D.O. not directly measure changes in cardiac output (CO) or stroke volume (SV). NICOM (Cheetah Medial Inc, Newton Center, MA) is a non-invasive external monitor that uses bioreactance to measure SV and is a valuable adjunctive monitor for high-risk parturients(1,2).

Case: A 24 year-old G1P0 woman with Marfan syndrome (MFS) s/p aortic arch and aortic valve (AV) replacements presented at 34 weeks gestation with an EF of 37% and an AV thrombus. Heparin infusion was started and she was scheduled for CS. We utilized NICOM as an adjunctive monitor for hemodynamic management. To our knowledge, NICOM use during CS under epidural anesthesia with maternal cardiomyopathy has not been reported. After discontinuing heparin, a L4-5 epidural catheter, radial arterial line, and two 18-gauge peripheral IVs were placed in the OR. After positioning supine with uterine displacement, NICOM electrodes were placed and CO/SV data taken every minute. The epidural was dosed incrementally with 20mL of 2% lidocaine to a T4 level. IV fluids were limited to 30 mL/hr after a 700 mL load during epidural placement. Baseline CO and SV were 6.5 L/min and 71 mL respectively.

Discussion: Three major hemodynamic trends were noted. CO and SV increased 31% and 49% from epidural dosing to incision, likely from anesthetic-induced decreased systemic resistance (Figure 1A). CO/SV then steadily declined back to near baseline despite a transient 6% increase in the first minute after delivery. Oxytocin (20 units/1L) was infused just after delivery and continued throughout the case. At 18 minutes post-delivery, CO/SV started trending up significantly to final values of 10.4 L/min and 126 mL, 60% and 77% above baseline. MAP was labile and HR trended down throughout the case (Figure 1B). Total IV fluid given was 1,700 mL and blood loss was 800 mL. She remained stable and did not develop signs of acute volume overload. CO correlated strongly with SV (r=0.96) suggesting that her myocardial contractile function was intact despite her cardiomyopathy. Titrating phenylephrine to maintain MAP did not appear to significantly improve CO. NICOM provides better insight into myocardial performance during CS than arterial blood pressure and HR monitoring alone.

References:

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Abstract #:F-75

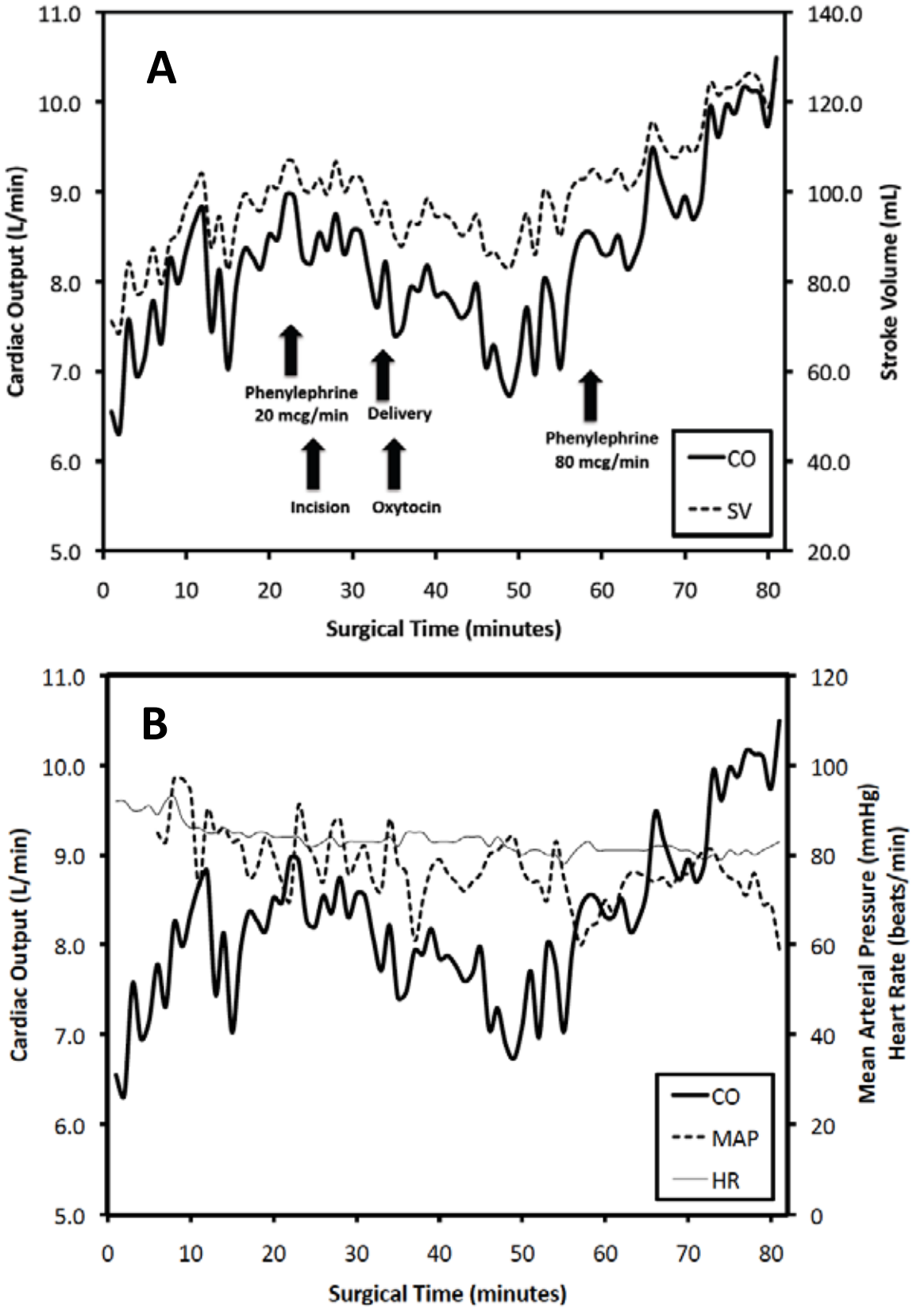

Figure 1: Intraoperative hemodynamic data obtained from NICOM and radial arterial line monitoring during cesarean section. (*A*) Cardiac output and stroke volume trends with key intraoperative events (black arrows). (*B*) Cardiac output, mean arterial pressure, and heart rate trends over time.

Abstract #:F-76

The role of preoperative dexamethasone on maternal temperature change during elective cesarean section under spinal anesthesia

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Introduction: Maternal hypothermia during cesarean section under spinal anesthesia has been well-described and may negatively impact neonatal birth outcomes(1). Because dexamethasone has been shown to attenuate post-anesthesia shivering, we were interested in its potential role in preventing maternal hypothermia during elective cesarean section (CS) performed under spinal anesthesia(2).

Methods: We recently completed a prospective, randomized, double-blinded trial investigating IV dexamethasone for prevention of maternal nausea and vomiting during elective CS under spinal anesthesia with 0.75% bupivacaine and fentanyl. We performed a retrospective analysis of temperature data for 81 women in this trial to determine the effect of dexamethasone vs. saline control on pre-operative to post-operative maternal sublingual temperature change. The Mann-Whitney U test and linear regression models were used where appropriate, with $P < 0.05$ considered significant.

Results: Both control (C, n=43) and dexamethasone (D, n=38) groups were similar with regard to patient age, body mass index, gestational age, intraoperative fluid administration, total operative time, and blood loss ($P > 0.05$ for all variables). Pre-operative to post-operative temperature decreases occurred in 87.6% of all patients. C and D patients had mean temperature changes of -0.42°C and -0.38°C respectively, but the difference between groups was not significant (P=0.71). Four of the 81 study patients (5%, Figure) demonstrated dramatic temperature changes of between -1.4 and -2.7°C, which may represent a subpopulation of women with severe opioid-induced refractory hypothermia that has been described in other studies(3). Multiple linear regression analyses failed to show any significant associations between maternal temperature decreases and intraoperative time, blood loss, fluid administration, BMI, or patient age.

Discussion: Hypothermia from neuraxial anesthesia is attributed to both redistribution of blood flow from core to peripheral tissues and to opioid-induced inhibition of thermoregulation at the hypothalamus. While dexamethasone limits temperature redistribution and shivering through inhibition of cytokines and other inflammatory mediators, it does not appear to have a significant role in temperature modulation during CS under spinal anesthesia.

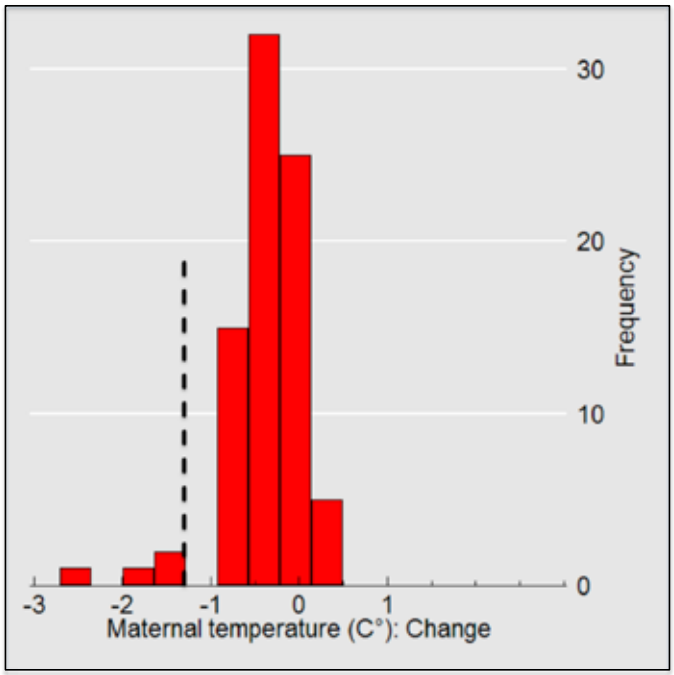

Figure: Distribution of maternal pre- to post-operative temperature change following cesarean section under spinal anesthesia among all 81 study patients. (Dashed line indicates 4 patients with severe temperature decreases.)

References:

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3. Int J Obstet Anesth 2005 Oct;14(4):279-83.

Abstract #:F-77

Massive Transfusion Protocol - A Survey of Academic Hospitals

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Introduction: Massive transfusion is defined as transfusion of 10 or more units of red blood cells (RBCs) in 24 hours, replacement of 50% of blood volume in 3 hours, and life-threatening hemorrhage(1). Previous studies have suggested an improvement in morbidity and mortality when plasma (FFP) transfusions are initiated earlier and in a closer ratio to the number of RBCs transfused during massive transfusion(2,3). As a result, many hospitals have developed massive transfusion protocols (MTPs) to help improve efficiency of blood product delivery, decrease costs, and ensure proper ratios(4). Implementation of MTPs improves patient outcomes compared to physician-driven resuscitation(4). However, no guidelines exist regarding details of MTP and what RBC:FFP ratio should be used. The purpose of our study was to determine the proportion of academic hospitals across the US that employ a MTP and to learn the details of commonly-used MTPs.

Methods: In this IRB-exempt study we designed a web-based survey inquiring about MTP practices and sent it to each of the 107 US academic hospitals with anatomic and clinical pathology residency programs.

Results: Fifty-six of 108 programs responded (52% response rate): all had a MTP in place, despite varying numbers of inpatient beds and trauma level statuses. The majority (n=48, 86%) of respondents had fixed ratio MTPs and 41 (73%) had goal RBC:FFP ratios of 1:1. Seven (13%) had a combination fixed ratio and lab-driven MTP and 1 (2%) was solely lab-driven. Most hospitals provided 6 units RBCs and 6 units FFP in the first MTP pack. Only 5 (9%) did not include any plasma in the first pack. Platelets were included in the first pack in 36 (64%) of protocols and cryoprecipitate was routinely included by only 1 (2%) institution. Thirteen of 51 hospitals with an obstetric service (25%) provide a separate protocol for labor and delivery, which often included more cryoprecipitate. Eighty-two percent of respondents felt their MTP was extremely or mostly effective.

Conclusion: MTPs are widespread in US academic hospitals across hospital size and trauma levels. Little variation in MTPs exists despite a lack of formal guidelines regarding recommended RBC:FFP ratios. The majority of the protocols have a goal RBC:FFP ratio of 1:1. MTPs are felt to be highly effective.

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1. Erber: Transfusion and Apheresis Science 2002; 27:83-92
2. Borgman: J Trauma 2007; 101:44-54
3. Holcomb: Hematology Am Soc Hematol Educ Program 2010; 2010:465-469
4. Malone: J Trauma 2006; 60:S91-6

Abstract #:F-78

Successful Spinal Anesthesia in a Parturient Patient with Transverse Myelitis.

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Introduction: Transverse Myelitis (TM) is a rare demyelinating syndrome sharing characteristics with Multiple Sclerosis (MS) in which affected patients manifest muscle weakness, sensory disturbances and autonomic dysfunction. Neuraxial anesthesia in patients with TM remains controversial mainly because of its rarity and the paucity of literature. We present the first case report of a parturient with TM undergoing a cesarean section (C/S) using spinal anesthesia without a post-operative exacerbation of neurological symptoms.

Case Report: A 35-year old G15P6 female presented at 39 3/7 weeks gestation with ROM and fetal breech position. Past obstetrical history included 5 vaginal deliveries and one C/S for a non-reassuring fetal heart tracing at 32 weeks, all using epidural anesthesia. Her medical history was significant for TM at age 2 with residual weakness in both lower extremities, followed by intermittent exacerbations requiring prolonged hospitalizations and inpatient rehabilitation; the last was 4 years ago. A repeat C/S under spinal anesthesia was planned as a neurology consultation confirmed she was without clinical signs of acute TM. Spinal anesthesia was placed at L3-L4 using 15mg of hyperbaric bupivacaine 0.75%, 200mcg hydromorphone and 10mcg fentanyl; the infant was delivered uneventfully with APGARs of 8 and 9. Immediately following delivery, uterine atony resulted in significant post-partum hemorrhage and prolonged hypotention. Multiple pharmacologic interventions with uterotonics met with little success. Limited surgical hemostasis was obtained and our patient received 8 uPRBCs, 6 uFFPs and 5L crystalloid for an estimated blood loss of 5.5L. Ultimately, she required uterine and iliac artery embolization postoperatively. She was discharged home on post-op day 4 without further complications or neurologic compromise.

Discussion: Historically, anesthesia providers have been hesitant to perform spinal anesthesia for patients with demyelinating disorders. It is postulated that local anesthetics may be neurotoxic to already demyelinated neural fibers in patients with TM or M.S. and may lead to exacerbation of clinical symptoms(1). In fact, diagnosis of TM has been reported following spinal and CSE analgesia although direct causality has not been consistently established(2). Our patient had a normal recovery despite severe blood loss and hypotension, which could have worsened her disease process through a vascular insult. Our experience suggests spinal anesthesia might be a safe option in patients with TM and significant risk factors for general anesthesia. The decision to perform neuraxial anesthesia in these patients should be made on a case-by-case basis. Here, early planning and close communication with an integrated team of Anesthesiology, Neurology and Obstetrics were essential for a safe and effective anesthetic.

References:

1. Int J Obstet Anesth 2010;19:98–101
2. Jha S, Kumar R. Neurol India 2006;54:425-7

Abstract #:F-79

Anesthetic management of Guillain-Barré syndrome in pregnancy

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Introduction: Guillain-Barre syndrome (GBS) is an immune mediated progressive demyelinating disorder characterised by acute or sub-acute proximal skeletal muscle paralysis. Reported incidence in general population is between 0.75 to 2 in 100,000 per year (1) . It is less common during pregnancy. We report the management of patient with GBS for emergency caesarean delivery.

Case Report: 24 year old primigravida presented at 20 weeks of gestation following chest infection with significant sensory symptoms and weakness, primarily affecting lower limbs. Following neurological assessment she was areflexic with reduced amplitude in motor studies of the both upper and lower limbs with sub-normal conduction velocity. Sensory responses were absent for median and ulnar nerves but no involvement of bulbar or the muscles of respiration occured at any point.

GBS was diagnosed. Her condition improved significantly with immunoglobulin treatment though residual left sided weakness remained throughout her otherwise uncomplicated pregnancy.

Management plan was to provide epidural analgesia in labour but she was admitted with significant antepartum haemorrhage requiring delivery by emergency caesarean section which was carried out under spinal anaesthetic at the level of L3/L4 with 2.4ml 0.5% hyperbaric bupivacaine and 300µg diamorphine. Boluses of sympathomimetic agents were administered and titrated to effect. Post natal review next day showed a full return to her previous function. Continued follow up into post partum period did not show any evidence of worsening neurology.

Discussion: Anaesthetic management of delivery and caesarean with active or resolving GBS is not well defined. Management is focused on maintenance of normal homeostatic mechanisms and avoidance of agents that possess the potential to exacerbate the condition. Regional anaesthesia is not contraindicated but sensitivity to local anaesthetics has been reported causing profound hypotension. Autonomic instability is possible during acute phase but rarely persists longer than two weeks. We planned epidural in labour to avoid the occurrence of this. Also epidural can be used to extend the block cautiously to attain surgical anaesthesia. But the urgency of this case did not give us sufficient time for epidural block.

Spinal anaesthesia has been used successfully in pregnant patients with GBS. Benefit of regional anaesthesia in pregnancy with GBS may outweigh the theoretical risk of further neurological damage. Medicolegal aspects of regional anaesthesia with pre-existing neurological condition should be taken into account and informed consent and documenting baseline neurological status is advisable.

If general anaesthesia required, avoid suxamethonium because of the risk of hyperkalaemia. They are sensitive to non-depolarizing relaxants and post-operative ventilatory support may be required.

Reference:

1. Kocabas S Anesthetic Management of GBS in pregnancy J Clin Anesth. 2007 Jun; 19(4):299-302

Abstract #:F-80

In situ simulation detects serious latent errors on the labour ward

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Introduction: In situ simulation improves teamwork and identifies latent errors and performance gaps in managing obstetric patients(1). We present our experience of in situ sumulation on the labour ward of a busy teaching hospital.

Methods: Unannounced simulated emergency drills involving maternal cardiac arrest using manikins were run monthly on our labour ward since August 2014. Midwives, obstetricians and anaesthetists on duty attended the drill which was videotaped and replayed during debriefing. Resuscitation skills, human factor approach and theoretical knowledge were critiqued. The session trainer completed a latent risk form following each exercise which identified the risk, categorised it and assigned a risk score using the NPSA risk analysis model(2) (low risk 1-3, moderate risk 4-6, high risk 8-12 and extreme risk 15-25) with details of the action taken.

Results: Our results are summarised in the accompanying table.

Discussion: Our in situ programme revealed persistent failure of teams to conduct a perimortem caesarean section (CS) within acceptable time frames, misplaced or unavailable vital equipment and missing drugs on our labour ward. A ready-to-use CS pack on all trolleys including in the accident and emergency department, immediate pharmacy input, urgent equipment replacement and complete overhaul of labour ward drug storage was instituted. Conventionally drills are used to refresh staff knowledge. Senior management 'buy in' and we believe our unique use of simulation as an environmental surveillance tool can reduce litigation costs and increase management support for educational activities. We recommend that in situ drills should be used by all units to identify and tackle latent risks to make the environment safer for patients.

References:

1. Pratt SD. Focused review: simulation in obstetric anesthesia. Anesth Analg 2012;114:186-90.
2. A risk matrix for risk managers. National Patient Safety Agency. January 2008.

Results:

Risk Identified	Category	Risk Score	Action Taken
No magnesium sulphate	Medication	20	Inform theatre coordinator
Perimortem caesarian section (CS) pack unavailable	Equipment	4	Inform labour ward midwife practitioner
Resuscitation trolley misplaced	Equipment	4	Inform obstetric consultant and midwife lead
Syringe drivers unavailable	Equipment	9	Inform ODP lead
Location of crash trolley not known	Training	9	Feedback to them and inform ward manager
Location where perimortem CS should be performed not known	Training	9	Feedback to them and inform ward manager
Cardiac arrest trolley was plugged in for simulation	Training	9	Feedback to them and inform ward manager
Maternal resuscitation algorithm knowledge	Training	4	Inform obstetric consultant and midwife lead
Location of intralipid not known	Training	20	Inform labour ward and anaesthetics clinical leads

Abstract #:F-81

"Otherwise Healthy…" An Ascending Aortic Aneurysm Diagnosed at Term

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Richard Smiley M.D., Ph.D. - New York Presbyterian Hospital - Columbia University - New York, NY

Introduction: Aortic root dilation is one of the most feared cardiovascular changes in pregnancy. Peripartum hemodynamic control is essential to prevent further aortic dilation or rupture. Cesarean delivery (CD) performed prior to the initiation of spontaneous labor is the recommended delivery mode for patients with aortic diameters >4.5cm 1,2.

Case: A 29yo G2P0 at 39 weeks presented to a community hospital with decreased fetal movement. Throughout pregnancy, BP had always been measured on the left arm with readings ~100/60. History was notable for MVA (blunt left arm and chest trauma) 5 years prior to presentation and Harrington rod placement at age 16 for scoliosis. Review of systems was negative except for occasional left arm weakness. At presentation, right arm BP was 200/100, left arm BP 110/60, Mallampati class IV. Calf BP was 210/100. CT revealed a 5cm ascending aortic aneurysm with near occlusion of the left common carotid (LCC) and left subclavian (LSC) arteries. She was transferred to our medical center. Echocardiography revealed severe concentric LVH suggestive of long standing HTN. PEC labs were normal.

CD was done in a CT OR with spinal anesthesia (SA) (bupivacaine 12mg, fentanyl 20 mcg, morphine 0.2mg) with the chest prepped and CT surgery/perfusion on stand-by. BP decreased appropriately after the SA and a phenylephrine infusion was used to maintain SBP 90 to 120 (monitored via R radial arterial line). Esmolol infusion was at 500mcg/kg/min to maintain HR <70. An infant with Apgar 6, 9 was delivered. The patient was transferred to the surgical ICU for continued BP control. CTA demonstrated arterial wall thickening suggestive of Takayasu's arteritis. Aortic repair was scheduled for 6 weeks after delivery.

Discussion: Diagnosis of an aortic aneurysm obstructing flow to the LCC and LSC arteries was worrisome for impending aortic dissection, rupture or cerebrovascular accident. The patient likely had chronic HTN due to poor flow to the left carotid sinus resulting in systemic catecholamine release. Regional anesthesia (RA) was preferred over general anesthesia (GA) for several reasons, including the class IV airway. Induction of GA and intubation can cause hemodynamic instability that can lead to aortic dissection. Given the LCC artery occlusion, the mental status of the patient served as an assessment of cerebral perfusion in the presence of the relative hypotension tolerated to avoid aortic shear stress. Combined spinal-epidural anesthesia was considered so as to avoid conversion to GA in an emergent, non-controlled setting. However, epidural catheters can be unreliable in patients with Harrington rods 3. SA was deemed to be the best option for dense, reliable surgical anesthesia, especially with the anatomic spinal abnormality. Aggressive hemodynamic control prevented further aortic compromise during the peripartum period.

References:

1. Cox. Arch Gyn Ob. 2014
2. Hagen. Best Pract Res Clin Ob Gyn. 2014
3. Crosby. Can J Anaesth. 1989

Saturday, May 16, 2015

Abstract #:S-01

Obstetric Anesthetic Considerations for Epidermolytic Hyperkeratosis: A case report.

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Weike Tao M.D. - University of Texas Southwestern - Dallas, TX

A 30-year-old G1P0 with epidermolytic hyperkeratosis (EHK) at 38 weeks gestation was admitted and induced with oxytocin in the anticipation of spontaneous vaginal delivery after premature rupture of membranes. She had significant epidermal dehiscence with generalized scaling. Intravenous catheter placement was difficult due to the thickness of her skin and inability to visualize the veins and required non-adhesive gauze for securing. A decision was made to perform an emergent cesarean delivery due to non-reassuring fetal heart tones. In operating room, the EKG leads were selectively placed in areas with the least wound dehiscence and the blood pressure cuff and pulse oximetry were placed without any difficulty or damage to the skin. Routine spinal anesthesia was performed after skin preparation with povidone-iodine and local infiltration with lidocaine and an appropriate level was obtained. The surgical field was prepared with chlorhexidine and cesarean delivery was completed without maternal complications. The male newborn required an emergency dermatology consultation due to evidence of the same skin condition and required immediate treatment with antibiotics and moisturizer to reduce the chance of infection.

The patient was monitored closely for wound healing. She was discharged home on the third post-operative day but returned two days later with complaints of fever up to 40 degrees Celsius and purulent drainage from the incision. Spinal anesthesia was performed in the same fashion for wound exploration. A massive wound infection was identified and general anesthesia with endotracheal intubation was performed upon the decision to remove the infected uterus. The wound healed well after the hysterectomy and she was discharged on post-operative day eight.

EHK is a rare autosomal dominant disorder of keratinization (1). EHK usually presents with generalized erythema, blisters, and erosions, which could become sources of infection. Patients later develop hyperkeratotic scaling (2,3). Anesthesia challenges include the difficulty to find and secure intravenous catheters, as well as, the decision of whether or not to proceed with regional anesthesia due to the fact that patients with this disease are prone to delayed wound healing and infection. Ultimately, in this case there were no complications regarding the spinal anesthesia most likely due to the meticulous antiseptic technique completed during each placement. However, the risks of general versus regional anesthesia in a patient with EHK must be weighed carefully on an individual basis.

References:

1. Arin MJ et al. Expanding the keratin mutation database: novel and recurrent mutations and genotype-phenotype correlations in 28 patients with epidermolytic ichthyosis. Br J Dermatol. 2011. 164:442.
2. Kwak J et al. Epidermolytic hyperkeratosis. Dermatology Online Journal. 2006. 12(5):6.
3. DiGiovanna JJ et al. Epidermolytic hyperkeratosis: applied molecular genetics. J Invest Dermatol. 1994; 102: 390.

Abstract #:S-02

Intrathecal Catheter Management Outcomes-a review of 5 years of practice at Columbia University Medical Center

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Inserting an epidural catheter into the intrathecal (IT) space after inadvertent dural puncture (IADP) avoids another IADP and may reduce the risk of postdural puncture headache (PDPH) and need for epidural blood patch (EBP). Clinicians have worried about the risk of neurologic injury, inadvertent drug overdose, failed block, and infection. There are few reports of outcomes with IT catheters in parturients.

Methods: A retrospective chart review was performed for patients with IT catheters from 2/09–11/13.

Results: We identified 58 IT catheters; 4 were not initially recognized. Smiths Medical Portex® Combined spinal/epidural (CSE) kits (Smiths Medical, Keene, NH, USA) (17G Tuohy/19G Duraflex® epidural catheter, closed end, 3 eyes) were used. Mean (SD) age and BMI were 31 (5.8) yrs and 31.4 (7.3) kg/m2. Mean loss of resistance (LOR) to saline was 4.5 (0.9) cm, with insertion to 3.2 (2.2) cm. Of 46 placed for labor analgesia, only 1 was intentional. In the OR, 11 were placed during attempted CSE for cesarean section (CS) and 1 during attempted CSE for external cephalic version. There were no assisted vaginal deliveries and 14 laboring patients delivered by CS.

Labor analgesia was typically initiated with 0.25% bupivacaine (0.5 – 1 ml) and fentanyl 10 -20 µg. Maintenance was with bupivacaine 0.0625% with fentanyl 2 µg/ml at 1-3 cc/hr, with no patient-administered boluses in 44 cases; 2 patients had no infusion. No failures occurred for labor analgesia. No top-up doses were required in 14 patients; 32 got 1 – 6 top-up doses.

For surgical anesthesia, hyperbaric 0.75% bupivacaine (9-12.5 mg) in divided doses was used in most cases. No high blocks occurred. Total 20.6 mg isobaric bupivacaine 0.5% was required in 1 case. Failures occurred in 2/11 catheters placed in the OR. Among catheters used for labor, 1/14 failed for CS and 1 for postpartum tubal ligation.

Catheters were in situ 0.5 – 29.1 hrs postpartum. Saline was injected in 33 cases (usually 10-15 ml) during use or removal. Saline 2ml/hr for 20 hrs postpartum was given in 1 case. That patient did not have EBP and reported a 5/10 PDPH.

EBP was performed in 23 (40%) cases, in 2 prior to any complaints of PDPH, and in 6 after discharge. In 4 cases, 2 EBPs were needed. The PDPH rate was 66%, with 33% rating their pain as severe (score ≥ 7/10). There was no effect on the incidence of PDPH or EBP related to BMI, time of placement, duration of insertion, volume of saline injected, or mode of delivery.

A patient with an unrecognized IT catheter had a high block after bolus during labor. Postpartum, 2 catheters were found disconnected at the hub, with CSF leakage.

Conclusion: Our review indicates IT catheters are safe and effective for labor analgesia, with no failures or replacements needed. Only 1/14 failed for CS (comparable to our 8% epidural catheter failure rate). It is intriguing that 2/11 catheters placed for CS failed, but the sample size is too small for conclusions to be drawn.

Abstract #:S-03

Second Stage Pushing and the Risk of Post-dural Puncture Headache

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Introduction: Post-dural puncture headache (PDPH) can be a debilitating complication of neuraxial anesthesia in obstetric patients. Previous reports have attempted to evaluate the effect of bearing down during labor on the incidence of PDPH, but results are conflicting (1, 2). The goal of our study was to determine if pushing during labor increased the risk of PDPH in parturients noted to have obvious dural punctures during placement of neuraxial anesthesia using 17 or 18 gauge Tuohy needles.

Methods: We reviewed our PDPH database from 1999 to 2014 to identify patients who had obvious dural punctures, as defined by return of cerebrospinal fluid through the Tuohy needle and/or catheter during placement of epidurals, combined spinal-epidurals, and/or continuous spinals with 17 or 18 gauge Tuohy needles. Patients were divided into two groups: those who pushed before delivery (including women who pushed before cesarean section), and those who did not. The primary outcome was the presence of headache. Secondary outcomes included number of days of headache, maximum headache score (0-10), and epidural blood patch placement. Data was analyzed using Wilcoxon rank sum test and chi-square test as appropriate. Multivariate analysis was performed to control for potential confounders.

Results: 190 women were included in our analysis. Results are summarized in the table. Compared to women who did not push, women who pushed during labor had significantly increased risk of PDPH (p=0.02), significantly increased number of days of headache (p=0.02), and significantly increased epidural blood patch placement (p=0.02). Women who pushed also had significantly lower BMIs, fewer spinal catheters placed after dural puncture, and fewer cesarean deliveries than those who did not push. In a multivariate analysis controlling for BMI and spinal catheter placement, pushing was no longer associated with increased risk of headache (p=0.12).

Conclusions: Pushing before delivery was associated with an increased risk of PDPH in our analysis, but the effect was no longer statistically significant after adjusting for potential confounders. A larger study is needed to investigate these factors.

References:

1. Can J Anesth 1999; 46(9): 861-866.
2. Anaesthesia 1993; 48: 247-255.

Table 1: Participant Characteristics by Pushing Status

Variable	Pushed (N=120)	Did not push (N=70)	p value
Age (years)	28 (23, 33)	31 (26, 36)	0.01[1]
Height (cm)	163 (158, 168)	164 (158, 170)	0.21[1]
Weight (kg)	78 (67, 91)	103 (75, 140)	<0.01[1]
BMI (kg/m2)	30 (26, 35)	39 (30, 50)	<0.01[1]
ASA score	2 (2, 2)	3 (2, 3)	<0.01[1]
Spontaneous vaginal delivery	104 (87%)	0 (0%)	<0.01[2]
Assisted vaginal delivery	12 (10%)	0 (0%)	<0.01[2]
Cesarean section	4 (3%)	70 (100%)	<0.01[2]
Actual headache	90 (75%)	41 (59%)	0.02[2]
Number of days of headache	2 (1, 3)	1 (0, 3)	0.02[1]
Maximum headache score (0-10)	6 (0, 9)	4 (0, 8)	0.06[1]
Spinal catheter inserted	83 (69%)	59 (84%)	0.02[2]
Cosyntropin given	23 (19%)	15 (21%)	0.71[2]
Epidural blood patch performed	47 (39%)	16 (23%)	0.02[2]

Data are median (IQR) or number (%)

[1]Wilcoxon rank sum test

[2]Chi-Square test

Abstract #:S-04

Blood conservation strategies in a blood refusal parturient with placenta previa and placenta percreta

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Introduction: Abnormal placentation can lead to massive postpartum hemorrhage. For blood refusal patients, blood conservation methods must be utilized. Acute normovolemic hemodilution (ANH) can be a useful technique to manage these challenging patients.

Case: A morbidly obese 35-year-old G3P1 Jehovah's Witness with placenta previa and percreta presented at 35 weeks gestation after initial work-up at an outside hospital, where she was deemed high-risk and referred to our center after being treated with one dose of erythropoietin and intravenous iron. After multidisciplinary review, she underwent a cesarean delivery in an operating room with capability for intraoperative interventional radiology. A radial arterial line, large-bore peripheral intravenous access and a right internal jugular central venous catheter were obtained prior to the placement of a combined spinal epidural anesthesia. Right femoral arterial access was obtained by interventional radiology. ANH was performed by collecting 900ml of the patient's whole blood via the central venous catheter into citrate-phosphate-dextrose bags, which were kept in closed circuit with the patient while oscillated at room temperature. Preoperative hemoglobin (Hb)=12.5 g/dL and post-ANH Hb =10.1 g/dL. Other blood conservation techniques included use of tranexamic acid and cell salvage. The patient then underwent cesarean delivery of a vigorous infant. After manual inspection of the uterus, the decision was made to delay hysterectomy due to the extensive placental invasion through the uterus into the broad ligament and the likelihood for massive blood loss. The placenta was left in situ, the hysterotomy was closed and the uterine arteries were embolized with an estimated blood loss of 700 ml. Postoperatively, the patient recovered on the obstetric unit while awaiting interval hysterectomy. She was treated for anemia (post-operative Hb nadir =8.4 g/dL) with a 13-day course of erythropoietin 300 units/kg daily, in addition to two doses of intravenous iron dextran 1000 mg. On post-operative day 26, with Hb =13.5g/dL, the patient underwent hysterectomy. A thoracic epidural was placed for postoperative analgesia prior to induction of general anesthesia. A radial arterial line and central venous access were obtained. 1350ml of autologous whole blood was removed for ANH with post-ANH Hb =11.3 g/dL. Cell salvage and tranexamic acid were also used. After surgical hemostasis was achieved, the estimated blood loss was 1200ml and the patient's Hb =10.1 g/dL. The Hb increased to 11.8 g/dL after return of the autologous blood. She had an uneventful recovery and was discharged home on hospital day 34, post-operative day 4 following hysterectomy.

Discussion: We describe the successful use of ANH, along with other blood conservation strategies and delayed hysterectomy in a parturient with placenta percreta refusing blood transfusion.

Abstract #:S-05

Apnoeic oxygenation in pregnancy: a modelling investigation

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Introduction: General anaesthesia in the parturient carries increased risk of failed intubation and a faster time to critical desaturation during apnoea, when compared to the non-pregnant population. Oxygenation can occur during apnoea due to continued uptake of oxygen at the alveolar level, provided that there is an open airway. Supplemental oxygen via nasal cannula during apnoea can increase the time to critical desaturation in obese patients. (1) This study looks at the effect of apnoeic oxygenation in a virtual parturient.

Methods: The Nottingham Physiology Simulator is a computational model of the respiratory and cardiovascular system, validated for the investigation of apnoea in pregnancy. (2) The virtual subject was created using published physiological data and, where that was not available, values were inferred from studies in non-pregnant subjects or from physiological theory. (2)

The virtual subject was pre-oxygenated for 3 min of tidal breathing using 100% oxygen. Apnoea was then initiated and continued until desaturation occurred. During this study, data were collected at 0.025s intervals on SaO_2, $PaCO_2$ and pH. The simulation was repeated introducing oxygen at increasing concentrations at the open glottis.

Results: After pre-oxygenation, increasing FiO_2 at the open glottis increased the time taken to desaturate during apnoea. (Figure 1) The increase in apnoea time is greater at higher oxygen concentrations. $PaCO_2$ increased and pH decreased in a linear fashion during apnoea with pH 7.0 and $PaCO_2$ 19.8kPa at 11min of apnoea.

Conclusion: Delivering supplemental oxygen at the open glottis in this simulation prolongs the time taken to desaturate during apnoea. The time to desaturate at high oxygen concentrations exceeds that needed to create clinically significant respiratory acidosis. Increases in concentration of glottic oxygen may be seen via the delivery of oxygen via nasal cannula. During quiet respiration 10-15l/min O_2 via nasal cannula can deliver FiO_2 0.35-0.4. (3) A recent study in patients with difficult airways showed that nasal OptiFlow™ prolonged the time for SpO_2 >90% during apnoea with less significant respiratory acidosis. (4) Our study suggests a benefit in delivering supplemental oxygen to the apnoeic parturient during the induction of anaesthesia. Further work needs to determine the glottic FiO_2 provided by different nasal oxygen delivery devices, at varying flow rates, during apnoea.

References:

1. J Clin Anesth 2010; 22:164-168
2. Anaesthesia 2008; 63(3):264-9
3. Anaesthesiology 1976; 44:71-74
4. Anaesthesia 2014 doi:10.111/anae.12923

Figure 1:

The relationship between FiO_2 delivered at the open glottis and time to desaturation to SaO_2 90% during apnoea

FiO_2 delivered at the open glottis	0.21	0.24	0.28	0.35	0.4	0.6	0.8	1.0
Time to desaturate to SaO_2 90% (min:s)	3:31	3:39	4:03	4:39	5:12	8:30	15:54	51:30

Abstract #:S-06

Do US academic hospitals provide online information for patients about obstetric anesthesia?

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Introduction: Studies indicate that patients increasingly turn to the internet to access medical information.(1) However there has been limited examination of the presence and quality of patient electronic health information (EHI) about obstetric anesthesia.(2) In this observational study, we reviewed the websites of US academic hospitals with obstetric anesthesia fellowship programs (OAFPs) to assess the presence and readability of patient EHI related to obstetric anesthesia.

Methods: We identified 50 US hospitals with OAFPs from the SOAP website. For each institution, 2 non-physicians independently searched for EHI related to labor analgesia and anesthesia for Cesarean delivery on hospital websites with OAFPs. EHI was subsequently assessed for text readability using the Flesch-Kincaid grade formula (FKGF) and Flesch Reading Ease (FRE) tools. The FKGF indicates the grade level needed to comprehend written text. The FRE score (on a scale of 0-100) represents ease of reading, with the extremes of 0-30 "very difficult" and 91-100 "very easy". Calculations are shown in Table 1. Inter-rater agreement was assessed using the kappa statistic. Data presented as n (%) and median [interquartile range].

Results: The 2 raters were able to locate EHI for obstetric anesthesia on 27 (54%) and 33 (66%) hospital websites respectively; kappa = 0.72. The raters located a specific obstetric anesthesia website or webpage with patient EHI for only 6 (12%) and 9 (18%) hospitals respectively; kappa = 0.71. Readability statistics for the 33 hospitals with obstetric anesthesia EHI are shown in Table 2. The median FKGF was 10th grade. The median FRE was 42.3, indicating a "difficult" ease of reading.

Conclusions: In this observational study, we observed that at least one third of hospitals with OAFPs lack online EHI about obstetric anesthesia. In addition, the FKGL level is higher than recommended by the American Medical Association and National Institute of Health; both organizations recommend patient education material should be no higher than 6th grade level.(1) Of the available EHI, the majority of content is difficult to read and requires reading comprehension level several grade levels above national guidelines for patient information. These data suggest that academic hospitals need to improve the quantity and quality of patient web-based EHI.

References:

1. JAMA 2005;165:2618-2623
2. SOAP 2014 Meeting: Abstract T53.

Table 1: Readability tools and calculations

Assessment Scale	Variables	Formulas
Flesch Reading Ease (FRE)	Average number of syllables (SY), average number of words per sentence (W), average number of sentences (S)	206.835-((84.6 x (S/W))-(1.015*(W/S))
Flesch Kincaid Grade Level (FKGL)	Average number of syllables per word (SY) and average number of words per sentence (W)	(11.8 x SY) + (.39 x W) – 15.9

The Flesch Reading Ease result is inversely related to the Flesch-Kincaid grade equivalent result; a text with the high score on the reading ease test has a lower score on the grade-level test.

Flesch, R. (1979). http://pages. stern.nyu.edu/~wstarbuc/Writing/Flesch.htm.

Table 2: Readability statistics of available electronic health information on obstetric anesthesia

Readability Statistics	Academic Program Websites, N=33	Recommended for 6th Grade Reading Level(4, 5)
Flesch Reading Ease	42.3 [41.9 – 49.6]	80-90
Flesch Kincaid Grade Level	10.5 [10.3 – 11.4]	6th
Sentences per paragraph	4 [3.2 – 4.2]	3
Words per sentence	14.8 [12.8 – 17.6]	13
Characters per word	5 [4.7 – 5.2]	5

Data shown as median [interquartile range]

Abstract #:S-07

Respiratory Failure in a Preeclamptic Parturient with known history of Methamphetamine Abuse: A Case Highlighting the Potential Impact of Rising Methamphetamine Use on the Hypertensive Conditions of Pregnancy.

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32 y/o G2P0A1 female, with history of methamphetamine abuse, coexistent tobacco and marijuana abuse, and morbid obesity, presented with the complaint of shortness of breath. Coinciding symptoms included pleuritic chest pain and productive cough. Upon admission, the patient's respiratory status quickly declined and she was diagnosed with severe preeclampsia. After treatment of the severe preeclampsia and supplemental oxygen for respiratory insufficiency, cardiology was consulted and transthoracic echocardiography determined her shortness of breath to most likely be non-cardiogenic pulmonary edema in origin. Despite treatment, her respiratory status and severe preeclampsia continued to worsen. Emergent cesarean delivery was performed with general anesthesia and endotracheal intubation. Ventilation was difficult throughout and signs of acute pulmonary edema were evident. The patient remained intubated for 3 days and required intensive care unit admission afterward.

Hypertensive disorders of pregnancy affect 6-8% of parturients. Preeclampsia, itself, has increased 47% between 1990 and 2005. Research demonstrates that pulmonary complications of these disorders can be particularly severe(3).

The prevalence of methamphetamine abuse has more than doubled since the 1990's. Data suggests not only a rise in methamphetamine usage, but a decline in alcohol and cocaine usage among parturients(4). Methamphetamine users had 2x the hypertension, 3x the preeclampsia, and 2x the severe preeclampsia when compared nonusers(2). Furthermore, the histological findings related to systemic endothelial dysfunction and the hormonal changes related to increases in the serotonin and norepinephrine levels are observed in both preeclampsia and chronic methamphetamine abuse(1,5).

In this case, we postulate that not only was this patient's progression to severe preeclampsia more likely because of her methamphetamine abuse, but that her respiratory failure predictably progressed quickly and was more severe because of pulmonary changes observed in both severe preeclampsia and methamphetamine abuse. These two factors hypothetically may have created a double hit phenomenon that will need further research. This case report seeks to highlight the need for further research regarding parturients who are chronic methamphetamine users and its impact on the severity of the hypertensive disorders of pregnancy.

References:

1. Chin KM et al. Is meth use associated with idiopathic pulm arterial hypertension? Chest. 2006 Dec; 130(6): 1657-63.
2. Gorman MC et al. Outcomes in pregnancies complicated by meth use. Am J Obstet Gynecol. 2014 Oct; 211(4):429.e1-7.
3. Motwani MM et al. Pulmonary edema in severe pre-eclampsia. J Postgrad Med. 1989 Jul; 35(3): 183-5.
4. Terplan M et al. Meth use among pregnant women. Obstet Gynecol. 2009 Jun; 113(6): 1285-91.
5. Wang Y et al. Involvement of serotonin mechanism in meth-induced chronic pulmonary toxicity in rats. Hum Exp Toxicol. 2013 Jul; 32(7): 736-46.

Abstract #:S-08

Exposure to prescription opioid analgesics in-utero and the risk of neonatal abstinence syndrome: A population-based cohort study

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Background: The use of prescription opioids for treating pain in pregnancy is common and increasing. While the risk of neonatal abstinence syndrome (NAS) in the offspring of women who either illicitly use opioids or who are on opioid maintenance therapy is well recognized, the risks associated with prescription opioid use are less well characterized.

Methods: Data were derived from the Medicaid Analytic Extract (MAX) which contains information on Medicaid beneficiaries from 46 states. We defined a cohort of women who filled at least one outpatient prescription for an opioid analgesic at any time during pregnancy. Opioid exposure characteristics including duration of therapy (short-term (<30 day supply) or long-term (≥ 30 day supply)), and timing of use (early use (only in the first two trimesters) or late use (extending into the third trimester)) were assessed. The primary outcome was a diagnosis of NAS among the live-born infants of these women.

Results: A total of 1,705 cases of NAS were identified among the infants of 290,605 pregnant women filling opioid prescriptions. Long-term opioid use during pregnancy resulted in higher risk of NAS (reported per 1000 deliveries (95% confidence interval)) in the presence of additional risk factors of known opioid abuse (220.2 (200.8 to 241.0)), alcohol or other drug abuse (30.8 (26.1 to 36.0)), exposure to other psychotropic medications (13.1 (10.6 to 16.1)), and smoking (6.6 (4.3 to 9.6)) than in the absence of any of these risk factors (4.2 (3.3 to 5.4)). The corresponding risk estimates for short-term use were 192.0 (175.8 to 209.3), 7.0 (6.0 to 8.2), 2.0 (1.5 to 2.6), and 1.5 (1.0 to 2.0) per 1000 deliveries, respectively; the risk associated with short-term use in the absence of additional risk factors was 0.7 (0.6 to 0.8). Late use of prescription opioids in pregnancy generally resulted in higher NAS risk compared with early use.

Conclusion: This large, population-based cohort study indicates that short-term use of prescription opioids for treating acute pain during pregnancy is associated with a very low risk of NAS in the absence of other additional risk factors.

Abstract #:S-09

Balancing Thromboembolic Risk of a Mechanical Valve in Postpartum Hemorrhage

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A 38-year-old G8P5 obese (BMI 36) woman presented with postpartum vaginal bleeding after undergoing IOL for IUFD at 16 weeks gestation. She had a history of severe coronary artery disease that required percutaneous angioplasty and stenting, followed by a 2-vessel CABG and mechanical mitral valve replacement. Postpartum, she was placed on an enoxaparin bridge to warfarin, with a target INR of 2.5-3.5. Six days later, she presented with heavy vaginal bleeding and lightheadedness. Presenting hemoglobin/hematocrit were 8.6/28, respectively, and INR was 2.4. Warfarin and enoxaparin were discontinued, and an infusion of standard heparin was initiated. The patient continued to have heavy vaginal bleeding and hemoglobin/hematocrit decreased to 6.8/22. She required transfusion of 2 units of pRBCs, and a decision was made to perform hysterectomy for continued bleeding in the setting of a need for continued anticoagulation.

Weighing the risks and benefits for this patient, the heparin infusion was discontinued 6 hours before hysterectomy, which was performed with general anesthesia. Peripheral access was favored over central access given the potential for thrombosis and/or hematoma development. A radial arterial catheter was placed and connected to LidCo to monitor CO, stroke volume variation, and other hemodynamic parameters. Cerebral oximetry was utilized as an additional monitor given her risk for embolic stroke from the mechanical valve. The surgical procedure was uncomplicated with an EBL of 150ml. She required no colloid or blood products and remained hemodynamically stable both during and after surgery.

This case presented the unique challenge of balancing the risk of severe intraoperative hemorrhage and maintaining appropriate anticoagulation for thromboprophylaxis in a patient with a mechanical valve. Withholding anticoagulation in patients with a mechanical heart valve increases the thromboembolic risk by 3.7 fold(1). Surgery itself adds additional thrombotic risk perioperatively(1). Continuing anticoagulation with heparin in the perioperative period is often utilized for the ability to rapidly change the plasma concentration in the event of increased hemorrhage. There is currently no consensus for an optimal approach to perioperative anticoagulation in these patients.

Reference:

1. Cannegieter SC, Rosendaal FR, Briet E. (1994). Thromboembolic and bleeding complications in patients with mechanical heart valve prostheses. Circulation, 89(2):635-41.

Abstract #:S-10

Abnormal placental implantation (accreta cases) delivered by Cesarean-Hysterectomy (C-Hyst): a comparison of main operating room versus L&D operating room outcomes.

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Background: In most institutions, suspected or confirmed cases of abnormal placentation (accreta cases) are scheduled as cesarean-hysterectomy (C-Hyst) in the main operating room (mOR) rather than in L&D OR,1 to facilitate access to massive transfusion, embolization, specialized surgical interventions and technical support if needed.2 However, unsuspected or emergency cases are often safely and effectively managed in the L&D OR, and there is currently no consensus on where these cases should occur, whether urgent or not. We decided to compare the management, outcomes and resources in C-Hyst performed in both locations at our institution, bearing in mind that the Obstetric Anesthesia team manages all accreta cases irrespective of location.

Methods: We conducted a retrospective chart review from 2009-2014, based on ICD-9 and CPT codes and analyzed all hysterectomies performed in L&D OR, and all C-Hyst brought to mOR. Maternal and obstetric data (previous cesarean, uterine surgeries or previa), surgical outcomes (procedure, duration, blood loss), anesthetic management (general, neuraxial or combination), intraoperative management (monitoring, vasopressors, fluids & blood products), postoperative outcomes (ICU admission & length of stay) and cost were recorded.

Results: During the 5-year interval, 14 C-Hysts were performed in the L&D ORs and 35 scheduled in mOR, out of which 12 (34%) did not require a hysterectomy (Table). There were no differences in demographic data, except for gestational age at delivery. The likelihood of having a C-Hyst in the mOR was increased with a diagnosis of placenta previa and previous CD. The rate of neuraxial anesthesia converted to GA and GA for the entire case was similar for C-Hyst in mOR and L&D. The length of stay was longer with mOR C-Hyst and so was the total cost (Table).

Conclusions: Overall, maternal management & outcomes were similar irrespective of location and urgency. Of importance, 34% of cases scheduled in the mOR for possible accreta ended up not requiring a hysterectomy. Since the cost is substantially higher (almost double) when a cesarean delivery with or without hysterectomy is performed in the mOR, further evaluations seem indicated to provide a clinical algorithm to help providers decide of best location to reduce unnecessary and unjustifiable higher costs related with main OR utilization.

References:

1. Perez-Delboy, BJOG 2014;121:163-70.
2. Fawcus, Best Pract Res Clin Obstet Gynaecol 2013;27:233-49

Abstract #:S-10

	C-Hyst in L&D OR N=14	C-Hyst in main OR N=35	
		C-Hyst N=23	Cesarean delivery N=12
Maternal Characteristics			
Age (years)	33.9 ± 5	34.2 ± 5.3	30.9 ± 4.8
Weight (kg)	82.5 ± 17.3	78 ± 14	88.5 ± 13.5 *
Gestational age (weeks)	36.1 ± 4.2 #	33.6 ± 2.5	33.7 ± 3.7
Nuliparous (N=)	4 (28%) ##	0	0
Obstetric Data			
Number of previous CD (N=)	1.2 ± 0.6 ##	2.1 ± 1.1	2.1 ± 1.1
Placenta Previa (N=)	3 (21%) #	16 (70%)	7 (58%)
Previous uterine surgery (N=)	4 (28%) #	1 (4%)	1 (8%)
Surgical procedure			
Elective case (N=)	1 (7%)	14 (61%)	9 (75%)
Surgical duration (min)	248.9 ± 50.7	278.1 ± 79.1	167 ± 31.8 **
EBL (ml)	3742.9 ± 1712.4	3578.5 ± 2245.9	1566.7 ± 1241.2 *
Anesthesia			
Neuraxial for entire case (N=)	5 (36%)	8 (35%)	10 (83%) **
GA for entire case (N=)	2 (14%)	4 (17%)	2 (17%)
Neuraxial & GA (N=)	7 (50%)	11 (48%)	0
Management			
Arterlal line (N=)	10 (71%)	22 (96%)	9 (75%)
Central line (N=)	1 (7%)	2 (9%)	0
Phenylephrine Infusion (N=)	11 (78%)	20 (87%)	7 (58%)
Cristalloids (ml)	5292.9 ± 2517.5	6157.6 ± 3848	2908 ± 1245 *
Colloids (ml)	750 ± 424.9	1055.6 ± 583.6	750 ± 0
RBC (ml)	1473 ± 987	1465 ± 1029	916 ± 629 **
FFP (ml)	1327 ± 587	952.9 ± 507.9	1250 ± 0 *
Platelets (ml)	501.3 ± 2.5	376.3 ± 158.6	500 ± 0
Cryoprecipitate (ml)	444 ± 279 #	242 ± 143	0
Interventional radiology (N=)	0	0	2 (17%)
Post-Operative Outcomes			
ICU admission (N=)	4 (29%)	3 (13%)	1 (8%)
ICU lenght of stay (days)	1.8 ± 1.5	2 ± 0.6	2 ± 0
Total length of stay (days)	5.9 ± 4.7 #	28 ± 25.7	15.6 ± 14.5
Cost Analysis			
Indirect	$8,999.3 ± 4,500 #	$18,271.5 ± 14,076.6	$14,396 ± 8,215.5
Direct	$15,000 ± 7,850.7 #	$27,113.8 ± 18,514.9	$19,295 ± 9,991
Total cost	$23,999.3 ± 12,265.6 #	$45,385.3 ± 32,203.3	$33,691 ± 18,036.5

Data presented as mean ± SD unless otherwise indicated, p significant if <0.005

Direct cost is the cost that is attributable to the patient and service provided (supplies, hospital stay, medical resources).

Indirect cost is the cost affected by institutional cost (operating room, staff) as whole and cannot specific to patient or product

* p < 0.05 - different between C-Hyst in the main OR vs CD in the main OR

** p< 0.001 - different between C-Hyst in the main OR vs CD in the main OR

# p < 0.05 - different between C-Hyst in L&D vs C-Hyst in the main OR

p < 0.001 - different between C-Hyst in L&D vs C-Hyst in the main OR

Comparisons between C-Hyst in L&D and CD in main OR where not performed

Abstract #:S-11

Epidural labor analgesia in a parturient with intradural extramedullary spine tumor - case report

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INTRODUCTION: Literature on neuraxial instrumentation in parturients with spinal cord tumors is scarce. We describe epidural labor analgesia in a patient with a known intradural extramedullary (IDEM) tumor.

CASE REPORT: 34 year-old, G3P2 with myasthenia gravis, psoriasis and chronic back pain requested neuraxial labor analgesia. Lumbar MRI showed IDEM mass posterior and inferior to the conus medullaris at L1-L2, measuring 8x6x7mm, deemed likely a schwannoma. Repeat imaging a year after diagnosis revealed tumor size was unchanged. Prior to IDEM mass diagnosis, the patient had undergone neuraxial techniques for both Cesarean and vaginal delivery.

On admission, a round psoriatic lesion was noted over the L1-L3 spinous processes. To avoid both psoriatic and IDEM lesions, ultrasound (US) imaging was performed to identify the L4-L5 interspace prior to attempting epidural placement. Subsequently, the epidural space was uneventfully identified by a loss of resistance to saline technique. A catheter was threaded 5 cm into the space and 10 mL of bupivacaine 0.0625% with fentanyl 3 mcg/mL was administered, followed by infusion of this solution at 12 mL/hr. The patient obtained a T10 sensory level bilaterally and was comfortable throughout labor. The remainder of her course was uneventful.

DISCUSSION: IDEM tumors account for 40% of all spinal tumors and originate within the dura but outside the spinal cord. [1,2] Schwannomas are slow-growing, benign, encapsulated tumors that originate sporadically from Schwann cells in the myelin sheath of nerve fibers. [3,4] Pain is the most common presenting symptom. Treatment is directed at surgical resection. [2,4]

Neuraxial techniques in such cases present significant risks including tumor spread, epidural hematoma, medullar coning, local anesthetic toxicity, alteration of pressures within epidural and intrathecal spaces resulting in neurologic deficits, and inadequate neuraxial block.

Our patient presented two potential contraindications to neuraxial analgesia: a spinal mass and a psoriatic lesion. We successfully used US imaging to identify a lumbar interspace below both lesions. This approach allowed for a safer neuraxial technique.

The choice to pursue a neuraxial technique in this case was based on several factors: tumor size and location below the conus medullaris, which reduces the likelihood of neurological consequences as a result of intrathecal pressure changes due to neuraxial instrumention, a lack of neurologic symptoms to indicate cord compression, and the ability to identify the desired lumbar interspace by US. Labor analgesia consisted of a low concentration local anesthetic to minimize motor blockade and make neurologic change promptly identifiable.

In the presence of an unobstructive spinal mass, US imaging can invaluably allow for a safer neuraxial technique.

REFERENCES:

1. CurrProblDiagnRadiol 2007;36:185-8
2. AnesthAnalg 1992;75:844-6
3. Neurosciences 2011;16:366-8
4. LancetOncol 2007;8:35-45

Abstract #:S-12

Israeli National Survey of Anesthesia Practice Related to Placenta Previa and Accreta

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Background: Anesthesia practices for placenta previa and accreta may impact hemorrhage management and other supportive strategies. (1) We conducted a national survey of anesthesia practice patterns for placenta previa (PP), low suspicion placenta accreta (PA) and high suspicion (or recognized) PA in Israel.

Methods: Following Institutional Board Waiver we contacted the directors of obstetric anesthesia in all Israeli hospitals that offer Labor and Delivery services and have an intensive care unit (N=23). Directors were contacted by email with follow-up telephone calls using a specifically constructed survey (after face validation by anesthesiology colleagues) that inquired about annual number of PP and PA cases, pre-operative, intra-operative and post-operative strategies and institutional resources. Our primary outcome was anesthesia mode for abnormal placentation. Univariate statistics were used for survey responses using counts and percentages.

Results: The survey was performed between Jan-May 2014 and had an 100% response rate. Over half the directors surveyed (12 (52.2%)) manage more than 5 PA cases annually. Massive transfusion protocols and TEG are used in 19 (82.6%) and 14 (60.9%) units respectively. A cell saver is available in 5 (21.7%) units but used routinely in only 2 (8.7%) units for PA cases. Ultrasound is used in all units to diagnose PA; MRI is used in only 9(39.1%) units. Neuraxial anesthesia is used in 17 (73.9%) units for PP, 7 (30.4%) for low suspicion PA and 1 (4.3%) for high suspicion PA. Elective cesarean delivery for high suspicion PA is scheduled at <36 weeks in 6 (26.1%) units, 36-38 weeks in 16 (69.6%) units, and >38 weeks in 1 (4.3%) unit. Multidisciplinary antenatal planning occurs in 18 (78.3%) units prior to cesarean delivery for high suspicion PA. Pre-operatively, blood products are brought into the operating room for PA cases in 21 (91.3%) units. The table summarizes peri-operative anesthesia management strategies for PP and PA.

Conclusions: We found wide variations in practice patterns, specifically with regard to anesthesia mode, multidisciplinary management, timing of delivery, transfusion and hemorrhage strategies. Although neuraxial anesthesia is the most popular anesthesia choice for placenta previa, general anesthesia was overwhelmingly the most widely used anesthesia technique for suspected placenta accreta in Israel.

Abstract #:S-12

Table. Peri-operative Management Strategy Patterns for Placenta Previa and Placenta Accreta (N=23 units)

	Placenta previa	Low suspicion placenta accreta	High suspicion placenta accreta
What anesthesia mode do you use?			
General	6 (26.1%)	16 (69.6%)	22 (95.7%)
CSE	1 (4.3%)	2 (8.7%)	0
Spinal	16(69.6%)	5 (21.7%)	1 (4.3%)
No. units that bring PC to the operating room prior to surgery	14 (60.9%)	19 (82.6%)	21 (91.3%)
How many IV are placed pre-operatively?			
1	8 (34.8%)	1 (4.3%)	0
2	15 (65.2%)	19 (82.6%)	16 (66.6%)
3	0	3 (13.0%)	7 (30.4%)
No. of units that place an AL	2 (8.7%)	14 (60.9%)	20 (87.0%)
No. of units that place central venous access	0	2 (9.1%)	4 (18.2%)
No. of units that place a WBC	3 (13.0%)	7 (30.4%)	14 (60.9%)
No. units that use Level One	8 (34.8%)	12 (52.2%)	17 (73.9%)
No. units that use cell saver	1 (4.3%)	5 (21.7%)	5(21.7%)

Key: Presented data are number of units (%). IV = intravenous line; PC = packed cells units ; AL =arterial line; CSE = combined spinal epidural; WBC = wide-bore cannula for rapid infusion.

Abstract #:S-13

Anesthetic Management of Postpartum Tubal Ligation: A Survey of Current Practice in United States' Institutions with Obstetric Anesthesia Fellowship Programs

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Introduction: Approximately 50% of tubal ligations in the United States (U.S.) are performed in the postpartum period. [1] The optimal timing and anesthetic technique for postpartum tubal ligation (PPTL) during the early post-delivery period is controversial. The aim of this study was to survey standard practices at key institutions for the management of PPTL.

Methods: A list of obstetric anesthesia fellowship directors in the U.S. was obtained using the Society of Obstetric Anesthesia and Perinatology's directory. A survey comprised of 19 questions related to the timing, perioperative anesthetic, and postoperative analgesic management of PPTL was created by 3 obstetric anesthesiologists. Reliability and validity were tested on a cohort of general anesthesiologists. The survey was electronically sent to 47 directors and responses collected anonymously.

Results: 26 responses were received. Selected data from the survey is presented in the Table. 21 (81%) respondents felt comfortable performing a PPTL (with neuraxial technique) immediately or ≤ 2 hours post-delivery, however these timing preferences differed from the scheduling of cases (Table). 15 (58%) would typically leave the labor epidural catheter in-situ if PPTL was planned. Although only 2 (8%) respondents would attempt to use an epidural catheter for a PPTL that had been in place for > 24 hours post-delivery, there was significant variability in timing thresholds (Table). Spinal anesthesia was the most commonly applied technique (n=25, 96%) if there was no epidural catheter in-situ. The application of general anesthesia for PPTL is outlined in the Table.

Discussion: The survey showed significant variability in the timing, utilization of in-situ epidural catheters, and general anesthetic practice for PPTL among training institutions surveyed. Given the consequence of a missed procedure and the limited timeframe for performing the procedure, ACOG has made recommendations to consider a PPTL an "urgent" procedure [2]. The variability of the survey responses suggests that recommendations are needed to guide anesthetic management for PPTL, in order to balance patient and institutional needs with safe clinical practice.

References:

1. Fertil Steril. 2000;73:913-22
2. ACOG Committee opinion no. 530. July 2012

Abstract #:S-13

Table: Postpartum Tubal Ligation Survey Results

How soon after an uncomplicated vaginal delivery are PPTLs at your institution typically scheduled? n=26	
0-8 hours post-delivery	13 (50%)
9-23 hours	8 (30.8%)
24-48 hours	2 (7.7%)
Other (0-24 hours, 6-48 hours, and at the discretion of OB)*	3 (11.5%)
How many hours after delivery will you no longer attempt to use an in-situ epidural catheter for a PPTL? n=26	
2-8 hours	9 (34.6%)
12-24 hours	9 (34.6%)
>24-48 hours	2 (7.7%)
Rarely or do not use epidurals	6 (23.1%)
How soon after an uncomplicated vaginal delivery are you willing to provide a GA for a PPTL? n=25	
0-2 hours	6 (24%)
>8 hours	7 (28%)
>24 hours	5 (20%)
>48 hours	2 (8%)
No elective GA offered	5 (20%)
If performing a GA for a PPTL, in a non-obese, healthy, appropriately NPO patient would you routinely…? n=26	
Intubate with succinylcholine	19 (73%)
Intubate with NDMR	1 (4%)
Use a SGA	0 (0%)
I will not perform a GA	5 (19%)
No routine GA, but after 18 hours, SGA or ETT	1 (4%)
How long after delivery would you consider using a SGA as opposed to intubation for a PPTL GA? n=25	
Never	4 (16%)
18 hours	2 (8%)
24 hours	3 (12%)
48 hours	2 (8%)
1 week	1 (4%)
2 weeks	5 (20%)
4 weeks	1 (4%)
6 weeks	7 (28%)

Data presented as number (%)

PPTL = postpartum tubal ligation; OB = obstetrician; GA = general anesthetic; NPO = Nil per oral; NDMR = non-depolarizing muscle relaxant; SGA = supraglottic airway; ETT = endotracheal tube

*Additional comments included “discourage overnight cases” and “timed not to delay discharge”

Abstract #:S-14 & MA-01

Pregnancy Related Spontaneous Coronary Artery Dissection (SCAD): A Comprehensive Review of the Literature

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Introduction: Although rare, SCAD usually occurs in young healthy women.(1) Over a quarter of the cases are pregnancy-related (PSCAD).(2) Still unknown is the ideal treatment as well as the exact mechanism of pathogenesis, although several theories have been proposed.(2)

Methods: A comprehensive PubMed search was executed, finding all published case reports of PSCAD. This was conducted using the terms "spontaneous coronary artery dissection" and "pregnancy". The following elements were collected for cases published after the last review from 2010-2015: age, gravity & parity, presenting symptoms, EKG findings, comorbidities, timing of event, coronary arteries involved & management strategies.

Results and Discussion: Our review of the literature yielded 33 cases of PSCAD from mid 2010 to early 2015. With this data, we can preliminarily report a total of 151 published cases of PSCAD since 1952. This diagnosis is becoming more frequent, likely due to improved and more readily available diagnostic techniques. The average age was 34 with a range between 25-45. Where gravity and parity were reported, 100% of the patients were multiparous. This and advanced maternal age have previously been identified as risk factors for PSCAD.(1) The most frequent presentation was chest pain (96%). However, since these patients are most often healthy young females without cardiac risk factors, more than once were they discharged from the ED, after a normal workup, with diagnosis and management delayed due to decreased awareness. It is essential to have a low threshold for considering PSCAD in this patient population.(2) Timing can range throughout pregnancy to the distant PP period. Our earliest reported case was at 23 weeks gestation and the latest was 7 months PP. In 79% of the cases the dissection was diagnosed in the PP period. Concerning the coronary arteries involved, 64% involved a single artery, with the LAD being the most commonly involved in 73% of the cases and only 2 cases presenting with involvement of the 3 main coronary arteries (LAD, LCx & RCA). Mortality is improving with only one reported death since 1999. The previous mortality rate was as high as 38% prior to 2001.(3) Improved awareness and diagnostic tools along with advances in treatment options have significantly diminished morbidity and mortality rates for this disease.

References:

1. Exp Clin Cardiol. 2009; 14: e8-e16.
2. Heart Views. 2012; 13: 53-65.
3. Catheter Cardiovasc Interv. 2001; 52: 88-94.

Abstract #:S-14 & MA-01

Case number	Author	Year	Age	Parity	Comorbidities	Presentation	Time	EKG	Coronary	Treatment
1	Petrou	2014	39	G2P2	Hashimoto's	CP, dyspnea	postpartum	STEMI	LM,LAD, LCx	Thrombolytics, IABP,CABG, ECMO
2	Pullivarthi	2014	32	multip	Dyslipidemia, Gest DM	CP	2 weeks PP	STEMI	LAD	Medical
3	Nizamuddin	2014	35	G2P1	Nail Patella Syndrome, Gest DM, Vitiligo, Hashimoto's, GERD	CP, SOB	30 weeks gest	STEMI	LAD, diagonal	Stents
4	Vijayaragharan	2014	34	G2P2	not reported	not reported	10 days PP	STEMI	LAD	Stents, CABG
5	Vijayaragharan	2014	40	G2P2	not reported	not reported	10 days PP	NSTEMI	LAD, diagonal	CABG
6	Vijayaragharan	2014	37	G2P2	not reported	not reported	9 days PP	NSTEMI	LAD	Medical
7	Jofre	2014	38	G5P5	Hypothyroid	CP	7 days PP	NSTEMI	LM, LCx, Marginal	IABP,CABG
8	Khan	2014	27	G4P2	none reported	CP, SOB	24 weeks gest	STEMI	LM	CABG
9	Buppajarntham	2014	32	not reported	Preeclampsia, dvt	CP	3 weeks PP	STEMI	LM, LCx, LAD	CABG
10	Jain	2013	45	G2	Hyperlipidemia	CP	2 weeks PP	NSTEMI	LCx	Medical
11	Dalmia	2013	26	G3P2	migraine	CP	23 weeks gest	STEMI	LCx	Medical
12	Weinberg	2013	33	G3P2	none reported	CP, Tachypnea	37 weeks gest	STEMI	LM	CABG
13	Shahzad	2013	29	G?P5	none reported	CP	3 weeks PP	NSTEMI	OM of the LCx	Medical
14	Aprigliano	2013	38	not reported	none	CP	8 weeks PP	NSTEMI	LM	Stents
15	Vecchio	2013	41	not reported	Gest HTN	CP	6 days PP	STEMI	LAD, LCx, RCA	Stents/IABP
16	Higgins	2013	25	not reported	PCOS	CP	5 days PP	STEMI	LM, LAD, Diag	CABG, LVAD, Heart Tx
17	Cenkowski	2012	35	G2P2	none reported	CP, diaphoresis	7 months PP	STEMI	OM	Medical
18	Brantley	2012	32	2 previous preg	Thyroid cancer	CP	1 week PP	NSTEMI	LAD	CABG
19	Sharma	2012	33	G3P2	no cardiac risk factors	CP, SOB	36 weeks gest	STEMI	LAD. LCx and interm	IABP,CABG
20	Newell	2011	37	G2P1	Migraines, IBS	Hypotension	37 weeks gest	STEMI	LAD	Medical
21	Ito	2011	30	not reported	none reported	not reported	4 weeks PP	STEMI	LAD	Medical
22	Ito	2011	30	not reported	not reported	not reported	14 days PP	NSTEMI	LAD, LCx	Medical
23	Ito	2011	35	not reported	not reported	not reported	19 days PP	UAP	LAD, LCx, RCA	CABG
24	Ito	2011	36	not reported	not reported	not reported	7 days PP	STEMI	LAD	Failed rheolytic thrombectomy
25	Ito	2011	37	not reported	not reported	not reported	5 months PP	NSTEMI	LAD	CABG
26	Ito	2011	39	not reported	not reported	not reported	12 days PP	STEMI	LM, LAD, LCx	CABG
27	Ito	2011	39	not reported	not reported	not reported	10 days PP	NSTEMI	LAD	Stent
28	Dhakam	2011	30	multigravida	not reported	CP	11 days PP	STEMI	LM	Stent
29	Martins	2010	28	G2P?	not reported	CP	36 weeks gest	STEMI	LAD	CABG, ECMO
30	Marcoff	2010	32	G2P2	not reported	CP	5 days PP	NSTEMI	LAD	CABG
31	Singh Pabla	2010	35	not reported	not reported	CP	8 weeks PP	STEMI	LAD, LCx	Dead
32	Our case	2013	29	G3P2	Anemia	CP	13 days PP	NSTEMI	LAD, LM, LCx	IABP, CABG
33	Our case	2014	29	G3P3	Cholelithiasis, Hgb C trait	CP	23 days PP	NSTEMI	LM, LAD, LCx	Stents, IABP

Table 1. Cases of spontaneous coronary artery dissection during pregnancy and the postpartum (PP) period from 2010-2015

Abstract #:S-15

A survey of Serbian anesthesiologists' use of regional anesthesia for labor analgesia and cesarean delivery

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Introduction: Regional anesthesia (RA) is infrequently used for labor analgesia and for cesarean delivery (CD) in Serbia.1 Kybele is dedicated to improving childbirth care and since 2012, has conducted 3 visits to Clinical Center Vojvodina (CCV) for clinical training of anesthesia providers working at CCV. During the visit in September, 2014, a five day didactic and hands-on clinical training experience was offered to anesthesiologists from across Serbia. A survey of practitioners' prior experience in OB RA techniques both during anesthesia residency and in practice within Serbia was performed.

Methods: Following the clinical training experience, a 6 item survey was given to all participants. Survey items included: years in practice following residency, hospital type (Serbian hospitals in smaller communities offer combined general surgical and OB services, while specialty hospitals in larger cities conduct either OB or surgical services), and experience using epidural analgesia (EA) for labor, spinal analgesia (SA) for labor, and RA for CD (categorized by: 0, <10, 10 – 50, >50 total career experiences).

Results: 18 Surveys were completed (See Chart 1). All participants were trained in Serbian teaching hospitals with Health Ministry approved anesthesia training programs. The use of OB RA increased with practitioner experience. Most of the experience in RA appears to have occurred after completion of residency among providers with less than 5 years' experience; 7 of 9 reported no experience with EA for labor, all 9 reported no experience with SA for labor, and 5 of 9 reported no experience with RA use for CD. The use of EA for labor is low among practitioners in community hospitals regardless of years of experience. The use of SA for labor is low, although one anesthesiologist in practice for many years reported an extensive experience. The use of RA for C/S increased with practitioner experience, but a significant minority of persons with >10 yr practice reported limited experience.

Discussion: The survey found that experience in use of RA for obstetrics is low among trainees and practitioners. Kybele should specifically include anesthesia trainees during clinical education outreach experiences involving OB RA. Kybele should also work with the leadership of local residency programs to increase the exposure of anesthesia residents to regional techniques for L&D and CS.

Reference:

1. Petakovic,et al. Medciniska Revija 2011;3:233.

Abstract #:S-15

Years in Practice	Hospital Type	Obstetric RA Experiences (18 Practitioners)											
		EA Experiences				SA for Labor Experiences				RA for C/D			
		Experiences											
		0	<10	10-50	>50	0	<10	10-50	>50	0	<10	10-50	>50
< 5 y (N=9)	General (N=6)	4	1	1		6				4	1	1	
	Non OB Specialty (N=3)	3				3				2	1		
5 – 10 y (N=2)	General (N=2)		2			2					2		
> 10 y (N=7)	General (N=5)		1	1	3	3	1		1		1	1	3
	Non-OB Specialty (N=1)		1			1					1		
	OB Specialty (N=1)				1		1						1

Table 1: Practice Experience of Serbian Anesthesiologists in Regional Anesthetic Techniques for Obstetrics (OB)

General Hospitals serve moderate sized cities and routinely have obstetric services; Non-OB Specialty Hospitals serve larger cities and offer surgical specialty care

N = Number of practitioners; EA = Epidural analgesia; SA = Spinal analgesia; RA = Regional anesthesia

Abstract #:S-16

Novel use of Magnesium to treat Refractory Status Epilepticus after accidental intrathecal injection of tranexamic acid

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We present a case of accidental injection of tranexamic acid during spinal anesthesia for an elective caesarian section that was effectively treated with magnesium sulfate after other appropriate interventions failed. Immediately following intrathecal injection of 2 ml of solution, the patient complained of severe back pain, followed by muscle spasm and tetany. After failure of spinal anesthesia, a used ampule of tranexamic acid was found on the spinal tray, having similar appearance to the vial of 0.5% hyperbaric bupivacaine. General anesthesia was induced. Muscle spasm and tetany persisted until non-depolarizing neuromuscular blockade was administered. Hemodynamic instability, ventricular tachycardia, and status epilepticus developed, which were refractory to phenytoin, diazepam, thiopental infusion, midazolam infusion, and amiodarone infusion. Magnesium sulfate was then administered postoperatively in the ICU, which successfully terminated her seizures. Unfortunately, the patient's condition deteriorated on postoperative day three and she died after suffering a cardiopulmonary arrest due to mechanical complications unrelated to her treatment. This is the first report describing the use of magnesium sulfate to terminate refractory status epilepticus due to intrathecal tranexamic acid.

Abstract #:S-17

A Survey of Postpartum Hemorrhage Preparedness in New Jersey and Georgia Hospitals

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Background: Postpartum hemorrhage (PPH) is a leading cause of preventable maternal morbidity and mortality. A recent survey of academic medical centers suggested that approximately one-third of hospitals D.O. not have a PPH protocol in place.[1] There are no published studies, to our knowledge, that have assessed in a multi-state sample the presence or absence of the full range of elements that comprise PPH preparedness.

Methods: 38 elements essential to PPH preparedness were defined by an expert panel convened by the Association of Women's Health, Obstetric and Neonatal Nurses that included nurses, an obstetrician, an anesthesiologist, a blood bank director, and a biostatistician. Key informants from all hospitals performing deliveries in states of Georgia and New Jersey were surveyed electronically to determine which elements of preparedness were available at their hospital. A linear regression model was created to identify hospital-level predictors of the number of hemorrhage preparedness elements that were in place.

Results: Of the 136 hospitals contacted, 95 hospitals (70%) submitted completed surveys. The mean number of the 38 preparedness elements present in New Jersey hospitals was 23.9 and in Georgia hospitals was 22.5. Only 2 of the elements (misoprostol and carboprost) were reported to be available at 100% of the hospitals. Of the remaining 36 elements, 4 (methylergonovine maleate, uterine balloon tamponade, blood warmer, and fluid warmer/fluid warmer cabinet) were reported to be available at >90% of the hospitals. Many elements of PPH preparedness were not consistently present. For example, a PPH risk assessment on admission was reported to be routine in only 45 (47.4%) of the hospitals. Only 39 (41.1%) of hospitals reported having a massive transfusion protocol. Simulation drills were performed in only 55 (57.9%) of hospitals. B-Lynch sutures were reported to be available in only 53 (55.5%) hospitals. None of the hospital characteristics assessed, including delivery volume, Cesarean rate, teaching status, or hospital profit status, were independently associated with the number of preparedness elements.

Conclusion: Many elements associated with PPH preparedness are not present in hospitals in these two states. Quality improvement initiatives should focus on ensuring hospitals have the resources, staff, and protocols in place that will facilitate rapid and appropriate responses to PPH events.

Reference

1. Anesth Analg. 2014 Oct;119(4):906-10

Abstract #:S-18

Anesthesia For Minimally-Invasive Fetal Surgery: A Retrospective Review

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Introduction: Fetal surgery offers options for treatment of twin-to-twin transfusion syndrome (TTTS) and twin-reversed-arterial-perfusion sequence (TRAP) and often utilizes selective fetoscopic laser photocoagulation (SFLP) and radio-frequency ablation (RFA) respectively. If untreated, TTTS carries a >80% fetal mortality rate with significant morbidity in surviving neonates. TRAP results in a nonviable "recipient twin" with a viable twin mortality rate > 50% if untreated. Currently, these minimally-invasive fetal surgeries are completed under either MAC or spinal anesthesia, largely based on provider and institutional preference alone. Our aim was to compare the association of anesthetic choice and a variety of fetal and maternal outcomes to determine if one may be more beneficial.

Methods: Following IRB approval, we reviewed all minimally invasive fetal surgeries at our center from 2011-2014. Records of patients with either TTTS or TRAP who underwent RFA or SFLP were identified and reviewed. We collected patient demographic information (age, weight, BMI, baseline vitals, and gestational age at time of surgery), intra-operative data (anesthetic type, procedure times, pressor administration, fluid administration, hemodynamic variation, and conversion to general anesthesia) and fetal outcome (death within 24-hours of surgery). Data were analyzed utilizing univariate methods.

Results: Cases (n=85) included 54 spinal anesthetics and 31 under MAC with significant associations between spinal anesthesia and SFLP and MAC with RFA ($p<.0001$). Although there was no difference between anesthetic choice and fetal death within 24-hours ($p=0.36$) or need for conversion to general anesthesia ($p=1.0$), we did find a significant relationship between the use of spinal anesthesia and intra-operative hypotension, increased fluid administration, and greater pressor use (see Table).

Discussion: Although no significant difference between MAC and spinal anesthesia regarding fetal demise or conversion to general anesthesia was noted, the association between spinal anesthesia and greater intra-operative hypotension, greater fluid administration and greater use of pressors suggests that the effect of anesthetic technique on the fetus are potentially significant during surgical manipulation of the fetal blood supply. These results highlight the need for further investigation of anesthesia considerations for minimally invasive fetal procedures.

Abstract #:S-18

Table 1. Demongraphics and Summary Data

	Spinal	MAC	ALL	P Values
N	54 (63.5%)	31 (36.5%)	85 (100%)	
Age (years)	29.5± 6.0	31.7± 7.0	30.3 ±6.4	0.12
Weight (kg)	76.1 ± 18.1	74.9 ± 12.2	75.7 ± 16.2	0.80
Gestational Age (months)	20.9 ± 2.7	20.1 ± 2.3	20.6 ± 2.6	0.25
Times (minutes)				
Anesthesia start to incision	49.5 ± 12.3	32.1 ± 10.9	43.2 ± 14.5	<0.0001
Surgical	39.9 ± 12.3	43.5 ± 17.2	41.2 ± 14.3	0.57
Conversion to GA	1 (1.9%)	1 (3.2%)	2 (2.4%)	1.0
Fetal Demise	10 (18.5%)	3 (9.7%)	13 (15.3%)	0.36
Surgery Type				<0.0001
RFA	5 (9.3%)	24 (77.4%)	29 (34.1%)	
SFLP	44 (81.5%)	6 (19.4%)	50 (58.8%)	
MAP				
Lowest intraoperative MAP (mm Hg)	64.8 ± 10.0	70.4 ± 9.4	66.8 ± 10.1	0.011
Largest decrease in MAP (%)	31.8 ± 24.7	21.7 ± 18.3	28.1 ± 23.0	0.064
Total Fluids (mL)	982 ± 459 (n=48)	466 ± 244 (n=22)	820 ± 469 (n=70)	<0.0001
Pressors				
Any Pressor	42 (77.8%)	3 (9.7%)	45 (52.9%)	<0.0001
Total Ephedrine (mg)	1.9 ± 4.4	0.8 ± 3.2	1.5 ± 4.0	0.10
Maximum Penylephrine (mcg/min)	25.4 ± 20.5	0.1 ± 0.2	16.2 ± 20.4	<0.0001

Data are mean ± SD or n (%)

Abstract #:S-19

Effect of Epidural Analgesia on Transthoracic Echocardiographic Parameters of Diastolic Function in Term Parturients

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Background: Echocardiographic assessment of diastolic function during pregnancy has demonstrated that LV compliance deteriorates from early gestation to term.[1] The exact mechanism of this is not known, but activation of the sympathetic nervous system has been shown to contribute to impairment of LV performance in congestive heart failure, ischemic coronary disease and other hypertensive or pre-hypertensive disorders. Neuraxial analgesia invariably blunts the sympathetic output to the peripheral vasculature and can change peripheral and central hemodynamics, but the effect of neuraxial local anesthetics on maternal LV compliance has not been reported. We hypothesize that blunting of the sympathetic output might change LV diastolic function and propose to use trans-thoracic echocardiography (TTE) to investigate the existence and magnitude of such changes in a prospective, observational study.

Methods: After IRB approval and written informed consent, healthy term parturients were recruited and divided into two arms consisting of 34 patients each. One arm consisted of patients who receive continuous lumbar epidural (CLE) analgesia and, the other arm, patients who receive combined spinal-epidural (CSE) analgesia. Baseline data included: blood pressure (BP), heart rate (HR), fetal gestational age (EGA), maternal body mass index (BMI), pain score and IV fluids received . Prior to neuraxial analgesia, an apical 4-chamber(A4C) view of the LV was obtained using TTE. Pulsed-wave doppler measurments of peak early (E) and late or "atrial" (A) mitral inflow velocities were recorded and the E-deceleration time from peak flow of the early wave measured. Using the A4C view, tissue doppler measurment of early diastolic flow was obtained at the septal and lateral mitral annulus (e'). Approximately 1 hour after CSE or CLE, these measurements were repeated in the same subject. BP, HR, pain scores, vaso-active medicines (e.g. ephedrine) and IV fluids received were also recorded after CLE or CSE. E/A, E/e'and E-deceleration time was compared in each patient before and after neuraxial analgesia using a paired t-test.

Results: To date 19 patients have been enrolled. Two patients has no post-neuraxial data measured for obstetric reasons. Of the remaining 16 women, 9 had CSE and 7 had CLE. There were no differences in BP, HR or BMI between those receiving CLE vs. CSE. For those who got CSE, E/e'was lower after CSE (6.441 vs. 5.433, $p<0.05$). For those who got CLE, E/e'was not significantly different (5.223 vs. 6.431, $p = 0.33$). E/A ratios were not significantly different before and after either CSE or CLE.

Discussion: To date this study indicated that CSE but not CLE may reduce the E/e'ratio one hour after initiating the block in healthy term parturients. This suggests that in term parturients, CSE may be a more effective modality than CLE at improving diastolic compliance.

Reference:

1. Zentna D et al. Clin Sci 2009; 116: 599-606.

Abstract #:S-20

Pressures Differences Generated by a CADD-Solis Programmed Intermittent Bolus Pump at Infusion Rates of 100, 175, and 300 cc/hr

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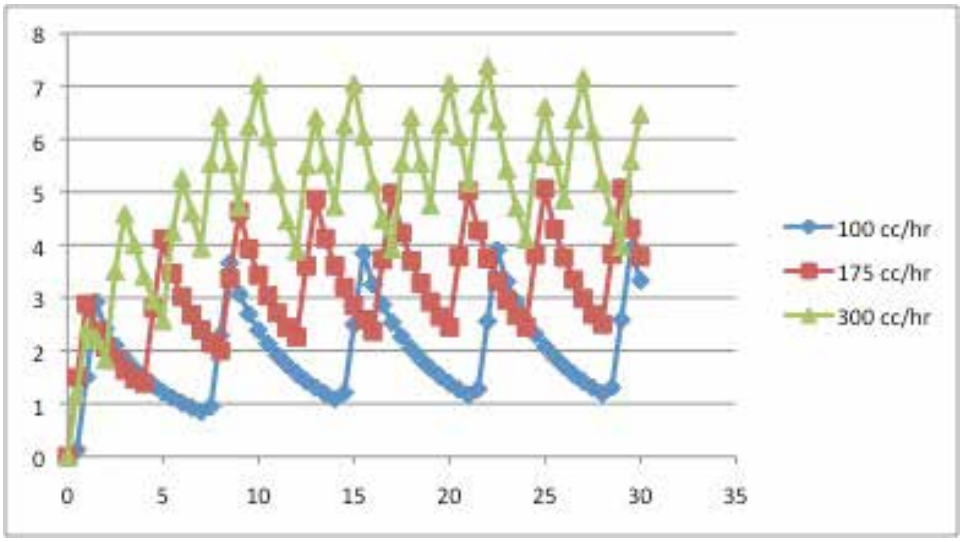
Introduction: Epidural infusion pumps capable of delivering timed boluses of local anesthetic with PCEA recently became commercially available. Several infusion rates are available for delivering the timed bolus, and the optimal bolus rate is unknown. Previous studies have examined pressure waveforms produced by epidural infusion pumps at infusion rates of 5, 10, 15, 50 and 99mL/hr (1, 2); however, infusion rates as high as 300mL/hr may be used in clinical practice. The objective of this in vitro study was to determine the pressure generated by a programmed bolus delivered by a CADD-Solis Programmed Intermittent Bolus (CADD-PIB) pump at infusion rates of 100, 175, and 300 cc/hr.

Methods: A CADD-Solis PIB pump was connected to a three-way adapter connected to a 17G single orifice epidural catheter and a pressure transducer (BC Group DPM-2300). No epidural filter was used. The pressures were recorded by computer. Calibration runs were performed at 100, 175, and 300 cc/hr until peak pressures generated at each flow were within 10%. Three runs at each flow were performed. The experiment was repeated with a second 17G single orifice epidural catheter for validation. Differences in the peak and mean pressures were compared among flows using analysis of variance.

Results: The mean peak pressure generated at 100cc/hr was 3.84 ± 0.24 pressure per square inch (psi), at 175cc/hr was 5.00 ± 0.23 psi, at 300cc/hr was 7.31 ± 0.48 psi. The average mean pressures were 2.02 ± 0.12 psi at 100 cc/hr, 3.42 ± 0.18 psi at 175 cc/hr, and 5.55 ± 0.30 psi at 300 cc/hr, respectively. There was a difference among flows in both the peak and mean pressures generated ($P<0.001$ for each). A schematic diagram representing pressure waveforms is shown (Figure).

Conclusions: This study demonstrated that as flow increases, the peak and mean pressures increase as well. This is in contrast to the findings of previous studies which found no change in peak pressure with increases in flow; however, the flow rates in those studies were less than 100 cc/hr. Pressure may vary with epidural catheters of different sizes, with different infusion tubing, and with different pump characteristics. Understanding the pressure generated during infusion may assist with calibration of pressure-triggered catheter occlusion alarms, and also serve as a comparison for other programmed intermittent bolus pumps.



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Abstract #:S-21

Do shorter parturients have a higher incidence of nausea and vomiting from intrathecal fentanyl during combined spinal epidural anesthesia for cesarean section? - A retrospective observation

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Introduction: Nausea and vomiting (N&V) are common problems in obstetric patients undergoing cesarean section (C/S) with combined spinal epidural anesthesia (CSE). Opioids exert emetogenic effects through the central "vomiting center" in the medulla oblongata[1]. Lipophilic fentanyl, a relatively selective μ-receptor agonist, has demonstrated a rapid rostral spread following intrathecal injection[2]. We hypothesize that shorter parturients may have a higher incidence of N&V compared with taller parturients.

Methods: We reviewed 272 records of parturients who underwent C/S with CSE from 2010-2014. All patients received the standard intrathecal injection of 10 mg 0.5% isobaric bupivacaine, 20 mcg fentanyl and 100 mcg epinephrine with one mL CSF. We recorded N&V at four distinct points during the procedure: after administration of the neuraxial medications, after eversion of the uterus, after replacement of the uterus and through arrival in PACU. An Apfel score was used to predict the risk of experiencing intra-operative N&V. Group I (n=72), the control group, patients did not receive antiemetics nor electrical median nerve stimulation prior to CSE. Group II (n=124), patients received 10 mg metoclopramide and 8 mg ondansetron immediately prior to CSE. Group III (n=76), patients received electrical median nerve stimulation placed on the right forearm over the P6 acupressure point prior to CSE. We compared the incidence of N&V between shorter (≤60 inches) and taller (>60 inches) parturients in each group. The student's t-test, chi-test, Fisher's exact test were used for statistical analysis. P value <0.05 is considered as statistically significant.

Results: The shorter and taller parturients had the similar baseline characteristics, including ASA class, age, weight, gestational age, Apfel score, incidence of hypertension, hypotension, hypoxia, blood loss, efficacy of sensory block for C/S, N&V treatment satisfaction and overall satisfaction. No significant difference of the incidence of N&V between shorter and taller parturients was identified during all four recorded points (Table 1).

Conclusion: We suggest that intrathecal fentanyl rostral spread is rapid, earlier than our selected observation points during the procedure. Therefore no significant difference of the incidence of N&V between shorter and taller parturients during CSE for C/S in our study.

Table 1. The incidence of N&V between shorter and taller parturients.

	Group I - Control			Group II - Medication			Group III - Nerve stimulator		
	Ht ≤ 60in N=11 (%)	Ht > 60in N=61 (%)	*p* value	Ht ≤ 60in N=11 (%)	Ht > 60in N=61 (%)	*p* value	Ht ≤ 60in N=11 (%)	Ht > 60in N=61 (%)	*p* value
N&V after epidural	6 (54.55)	34 (55.74)	1.00	2 (8.70)	18 (17.82)	0.36	6 (42.86)	15 (24.19)	0.19
N&V after eversion of uterus	1 (9.10)	8 (13.11)	1.00	3 (13.04)	9 (8.91)	0.70	4 (28.57)	9 (14.52)	0.24
N&V after replacement of uterus	2 (18.18)	13 (21.31)	1.00	2 (8.70)	16 (15.84)	0.52	4 (28.57)	9 (14.52)	0.24
N&V upon arrival to PACU	1 (9.10)	4 (6.56)	0.58	2 (8.70)	6 (5.94)	0.64	1 (7.14)	3 (4.84)	0.57

Reference:

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Abstract #:S-22 & MA-02

Syringomyelia in pregnancy: A retrospective study and systematic review of the literature

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Introduction: Syringomyelia is a rare, slowly progressive neurological condition characterized by the presence of a syrinx within the spinal cord. Consensus regarding the safest mode of delivery and anesthetic management remains controversial and thus presents management dilemmas. The aim of this study was to review cases of syringomyelia at our institution and undertake a systematic review to guide management decisions.

Methods: The study was conducted as a retrospective review of cases at our hospital from 2002 to 2014 and a systematic review of the literature from 1946 to 2014. For chart review, electronic database and patient's charts were identified using ICD10 codes for syringomyelia. A systematic review of electronic databases including PubMed, Cochrane and Embase in addition to a hand search of references using keywords "syringomyelia", "syringobulbia" and "pregnancy" was performed. There was no restriction to language or publication year. For both chart and systematic review, data were collected on patient demographics, neurological symptoms, labor and mode of delivery, type of anesthesia, and maternal/neonatal outcomes.

Results: Chart review: 13 deliveries were identified in 9 women with syringomyelia (Table 1). 10 deliveries occurred by cesarean section [CS] (general anesthesia [GA] n=8, epidural n=1, spinal n=1) and 3 by vaginal deliveries (epidural n=2, IVPCA n=1). There were no maternal or neonatal complications.

Systematic review: 524 articles were identified, of which 25 articles with 28 cases were included (Table 1). 21 deliveries by CS (GA n=10, epidural n=6, spinal n=2, unknown n=3) and 7 had vaginal deliveries (epidural n=4, unknown n=3). All epidurals were administered using small volume, titrated boluses of drug to achieve desired sensory level. Complications were reported after GA in 2 cases: one had worsening of neurological symptoms postpartum and one had prolonged muscle paralysis after atracurium. No neurological complications were noted with neuraxial blockade.

Discussion: In our case series and systematic review, we found that 76% of women had CS (GA 61%, neuraxial 32%), and 26% had vaginal deliveries. Inspite of concerns regarding aggravation of the syrinx with vaginal delivery, this mode of delivery has never caused any documented worsening of neurology. All techniques of anesthesia have been carried out successfully without major complications; however, titrated regional anesthesia appears to be a safer alternative.

Abstract #:S-22 & MA-02

Table 1: Syringomyelia Case series and systematic review

Author (publication year)	Syrinx level	Arnold-Chiari	Signs/ Symptoms	Gravida Para	Gest age (wk/d)	Delivery	Anesthesia	Rational for delivery and anesthesia	Anaesthesia complications/neuro status	Discharge day postdelivery	Apgars 1, 5 mins
Case Series	**Garvey et al.**	***-2015***									
Patient 1	T4-T8, T11-L1	No	Pain in middle of back, shoulder, hands and neck	G1 P0	38 +0	CS	General	Multidisciplinary meeting, neurosurgeons advice	Nil	2	8,9
Patient 2	C3-thoracic	No	Pain and tingling in hands	G2 P0	39 +4	CS	Spinal	Avoidance of valsalva	Nil	4	9,9
Patient 3	C4 -T1	No	Pain in upper back, loss of temperature sensation and weakness left arm	G3 P1	39+3	CS	Epidural	Patient's choice, was cleared by neurosurgeons for either operative or vaginal delivery	Nil	3	8,9
Patient 4	C2-T11	No	sensory loss right arm (pinprick and temperature)	G4 P0	38+5	CS	General	Antepartum hemorrhage at term; neurosurgeons advised not to labor	Nil	3	6,9
Patient 4	As above	No	As above	G5 P1	34+4	CS	General	Presented in preterm labor with previous CS	Nil	5	8,9
Patient 4	As above	No	As above	G6 P2	36+4	CS	General	Presented in labor - 2 previous CS and syringomyelia	Nil	3	7,9
Patient 5	C7-T2	No	Left knee numbness	G1 P0	39+1	CS	General	Syringomyelia	Nil	3	8,9
Patient 5	C7-T2	No	As above	G5 P1	39+1	CS	General	Avoid increases in ICP associated with labor	Nil	3	8,9
Patient 6	C5-conus	Yes	Complete paraplegia, reduced pain, temperature and proprioception from nipples down	G1 P0	36+3	CS	General	No valsalva or regional as per neurosurgeon	Nil	4	5,9
Patient 7	C4-T11	No	Weakness and numbness in left hand	G1 P0	38+2	CS	General	Literature search and departmental discussion, felt general anesthetic safer	Nil	2	9,9
Patient 8	Cervicothoracic	Yes	Slight loss of temperature and pain left forearm, hand and left foot	G1 P0	35 +4	SVD	Epidural	As per neurosurgeons	Nil	2	9,9
Patient 8	Cervicothoracic	Yes	As above	G2 P1	38+4	SVD	Epidural	As per above	Nil	3	8,9
Patient 9	C1-T11	Yes	Early Brown-Sequard syndrome, advised for syrinx drainage but patient refused.	G1 P0	27 +4	Vg-vacuum	IVPCA remifentanil	Was advised CS by neurosurgeon, but patient refused	Nil	1	4,5
Systematic Review											
Parker (2002)	NA	NA	Headaches, sensory changes	G1 P0	38	CS	Epidural	Presented in labor with worsening neurological symptom. CS chosen as fastest way to deliver given new symptoms	Symptoms resoved within 24 h postpartum	NA	NA
Daskalakis (2001)	Cervical	NA	Sensory and motor changes, depressed reflexes, ataxia	G1 P0	37	CS	General	Combination of CS and general anesthetic "least likely to aggravate the syrinx"	Nil	5	8,9
Nel (1998)	C2 - T8	Yes	Neck pain, sensory changes.	G2 P1	38	CS	Epidural	Least likely to aggrevate the syrinx "interdisciplinary" neurologist and neurosurgical opinion	No change in neuro symptoms 7days postpartum	4	NA
Margarido (2001)	C4 - T1	NA	Decreased sensation below C2. Motor changes arms	G3 P1	39+3	CS	Epidural	Potentially difficult airway therefore neuraxial thought to be safer	Nil	3	8,9
Agusti (2004)	NA	Yes	Sensory changes C4 - L1, areflexia, bilateral trophic changes	G1 P0	NA	CS	General	Breech presentation, concerns about complications of epidural and spinal, particularly in presence of coexisting ACM	Prolonged action of atracurium, no neurological deterioration	7	"healthy"
Nawaz (2010)	C6 - T9	Yes	Sensory changes face, chest and limbs	G1 P0	37	CS	General	NA	Nil	NA	6,1
Murayama (2001)	T3	NA	Headache	G1P0	38	CS	General	NA	Nil	NA	NA
Honemann (2014)	T6 - T8	NA	Chronic persistent back pain	G1 P0	36	CS	Spinal	Patient did not want general anesthesia	Nil	NA	NA
Honemann (2014)	T6 - T8	NA	Chronic persistent back pain	G2 P1	36	CS	Spinal	Patient did not want general anesthesia	Nil	NA	NA
Gredilla (2004)	C4 - Counus	NA	Kyphoscoliosis, spasiticity, sensory loss, loss of patellar reflexes and urinary incontinence	NA	NA	CS	General	Due to severity of neurological symptoms	Nil	7	6,8
Jayaraman (2011)	T12 - L5	No	Motor, sensory and trophic changes left leg, limping gait	G1 P0	NA	CS	General	Cephalopelvic disproportion and breech presentation	Nil	5	NA
Yturralde (2005)	T4 - T6	No	Pain in leg, difficulty walking, lumbar pain, dizziness	G3 P2	39	CS	NA	Concernes about aggravting neurological syptmoms with expulsive efforts	Nil	NA	9,9
Yturralde (2005)	C2 - T2	No	Sensory changes in hands, neck and shoulder	G2 P0	39	CS	NA	Concernes about aggravting neurological symptoms with expulsive efforts	Nil	4	9,9
Ghaly (2012)	Cervical to lumbar	NA	Paraesthesia, headaches, neck pain, poor balance	G2 P1	38	CS	General	Advised by neurosurgeon given residual ACM 1	Nil	4	9,9
Roelofse (2012)	NA	NA	Anesthetic areas on body	NA	NA	CS	General	For medicolegal reasons, concerns about spinal or epidural	New areas of anesthesia on body - resolved within 24 hours	NA	NA
Hayashi (2011)	C3	NA	Dizziness	NA	38	CS	Epidural	NA	Nil	8	"healthy"
Neilsen (2011)	C6-7, T4/5-T9	No	Back pain, motor weakness and sensory changes lower limbs	G2P1	35	CS	General	CS expedited to ensure quick neurosurgery	Planned decompressive laminectomy and syringosubarachnoid shunt postdischarge	NA	6,9
Hinojosa (1996)	Cervical	NA	Sensory changes C5 and C6 dermatome, trophic changes, decreased reflexes, orthostatic hypotension	G4	38	CS	Epidural	CS To avoid valsalva in labor. Epidural to avoid GA - concerns with neck extension, muscle relaxation, hyperkalaemia	Nil	NA	NA
Cantú Esquivel (1994)	Cervical	NA	Numbness left hand	G4P1A1	38	CS	Epidural	Concern that valsalva could increase intercranial pressure	NA	NA	8,9
Diez (2009)	Thoracolumbar	NA	Headache, back pain, parathesia of lower limbs	NA	37	CS	General	Literature consenus - possibility of neurological deterioration with labour and effort of second stage	Nil	3	9,9
Castello (1996)	Cerebellar tonsils to C7	Yes	Previous motor and trophic changes. Resolved	NA	35	CS	General	Based on literature search	Nil	NA	9,9
Parker (2002)	NA	Yes	Asymptomatic	G1 P0	39	Vg-forceps	Epidural	NA	NA	NA	NA
Meuller (2005)	Cervicothoracic	Yes	Headache, dizziness, vision changes, dyspnoea, sensory changes upper limbs	G2 P1	32	SVD	Epidural	NA	Nil	NA	NA
Meuller (2005)	Cervical	Yes	Headache, tinnitus, neck pain, fatigue, numbness mid thoracic	G1 P0	NA	SVD	NA	NA	NA	NA	healthy'
Baker (1947)	Cervical	No	Thoracic kyphosis, sensory, trophic and motor changes upper limbs, motor changes lower limbs, sensory changes right side of body, nystagmus	G3P2	39	SVD	General	NA	Nil	NA	"healthy"
Lopez (2007)	C3 - T4	Yes	NA	NA	38	SVD	Epidural	NA	Episode of fainting postepidural, weakness all extremities, N/V	NA	9,9
Lopez Torres(2011)	C3 - T4	Yes	Asymptomatic	G1 P0	41	Vg-vacuum	Epidural	NA	Nausea and vomiting	NA	8, 9
Natarajan (2012)	cervical - T11	Yes	Sensory changes T12 - L2, ocassional paraesthesia upper limbs	G1P0	NA	Vg-vacuum	Epidural	Maternal request and detailed discussion with neurologist and obstetrician	MRI unchanged 2 wks postpartum	NA	NA
Yaskin (1932)	Cervical, upper dorsal	NA	Motor and sensory left side, limping gait, abnormal reflexes, Horner's syndrome, affected cranial nerves, scoliosis	G2P1	38	SVD	NA	NA	8 months post delivery, improved power left hand, loss of vibratory sense left legs to iliac crest	NA	NA

CS=cesarean section; SVD= spontaneous vaginal delivery; Vg=vaginal; NA=not available

Abstract #:S-23

Clinical Predictors of Cell Salvage Blood Collection Transfusions

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Introduction: Postpartum hemorrhage (PPH) is the leading cause of maternal death in China and the world. Cell salvage blood transfusion in obstetrics has been used as a means of reducing allogeneic transfusions. However, cell salvage is not indicated for all procedures, as most patients D.O. not have PPH or require allogeneic transfusions. The current study was designed to investigate predictors of cell salvage blood collection (CSBC) transfusion in cesarean delivery parturients at high risk for PPH.

Methods: The data were collected retrospectively from electronic medical records at the Ningbo Women and Children's Hospital, Zhejiang, China. Patients who underwent cesarean delivery and had CSBC only or CSBC transfusion (identified from the billing case log in the Department of Anesthesiology) during the 26-month study period (August 2012 – September 2014, CSBC transfusions use accounted > 45% of all blood transfusions) were included in the study. The clinical practice was to transfuse CSBC when the Hgb < 10.0 g/dL. The primary outcome was CSBC transfusion. Patient and laboratory variables were compared between subjects with and without CSBC transfusion using $\chi 2$, Student t-Test, or Mann-Whitney U test. Variables with $P<0.10$ were entered into a stepwise logistic regression analysis model. Model validation was performed by bootstrapping and performance was evaluated using the c-statistic. Sensitivity, specificity, positive and negative predictive value of the model for predicting CSBC transfusion were calculated. $P<0.05$ was required to reject the null hypothesis.

Results: A total of 873 cesarean delivery parturients with high risk of PPH were selected for cell salvage; the CSBC units were transfused in 435 cases and wasted in 438 cases. Clinical characteristic of the groups are shown in the Table 1, along with possible predictors of CSBC transfusion. The positive predictors included neonatal weight, placenta increta/percreta, complete placenta previa, placenta previa with previous uterine surgery; negative predictors were placental abruption and preoperative lab studies (Hgb, platelet count, and fibrinogen). The model predicted 77% of CSBC transfusion improved by 27% from the current 50% of wasted CSBC. The sensitivity and the specificity were 65% and 74%, respectively.

Conclusions: The model developed in study, if validated, may help decrease CSCB wasting and improve cost effectiveness of the transfusion practice.

Abstract #:S-23

Table 1. Predictors of Autologous Red Cell Salvage Collection (CSBC) Transfusion

Variables	Data Description		Univariate Regression Analysis			Stepwise Logistic Regression Analysis#		
	Wasted CSBC (n=438)	Transfused CSBC (n=435)	P-Value	Coefficient	Crude OR (95%CI)	P-Value	Coefficient	Adjusted OR (95%CI)
Maternal age(years)	30(18-44)	30(16-45)	0.178	0.018	0.99(0.73,1.33)			
Body mass index (kg/m2)	27(18-42)	26(17-38)	0.003	-0.064	1.25(0.79,1.97)	0.025	-0.057	0.94(0.90,0.99)
Gestation age (weeks)	37(23-44)	36(26-42)	0.047	-0.052	0.98(0.74,1.30)			
Total Neonatal Weight (kg)	3.10(0.48-6.60)	2.95(0.90-8.00)	0.058	-0.116	0.99(0.73,1.33)	0.002	0.250	1.28(1.09,1.51)
Parity ≥ 2	226(52%)	252(58%)	0.717	-0.033	1.25(0.79,1.97)			
Multiples ≥ 2	112(26%)	77(18%)	0.008	-0.425	0.98(0.74,1.30)			
D&E ≥ 1	260(59%)	295(68%)	0.096	0.080	0.99(0.73,1.33)			
Previous Cesarean Birth ≥ 1	128(29%)	150(34%)	0.178	0.151	1.25(0.79,1.97)			
Gestational DM	88(20%)	68(16%)	0.086	-0.305	0.98(0.74,1.30)			
Preeclampsia	59(13%)	35(8%)	0.010	-0.576	0.99(0.73,1.33)			
Placenta Increta/Percreta	41(9%)	163(37%)	<0.001	1.758	0.98(0.74,1.30)	<0.001	1.524	4.59(3.03,6.97)
Placental Abruption	62(14%)	24(6%)	<0.001	-1.038	0.99(0.73,1.33)	0.012	-0.726	0.48(0.28,0.85)
Marginal Placenta Previa	52(12%)	40(9%)	0.198	-0.285	1.25(0.79,1.97)			
Partial Placenta Previa	89(20%)	67(15%)	0.058	-0.337	0.98(0.74,1.30)			
Complete Placenta Previa	68(16%)	128(29%)	<0.001	0.819	0.99(0.73,1.33)	<0.001	0.792	2.21(1.47,3.33)
Placenta Previa with Previous Uterine Surgeries*	35(8%)	95(22%)	<0.001	1.169	1.25(0.79,1.97)	<0.001	1.018	2.77(1.70,4.51)
Antepartum Bleeding	102(23%	169(39%)	<0.001	0.739	0.98(0.74,1.30)			
Emergent Cesarean Birth	152(35%)	161(37%)	0.477	0.100	0.99(0.73,1.33)			
Intrapartum Cesarean Birth	4(0.9%)	2(0.5%)	0.993	0.006	1.25(0.79,1.97)			
Liver Dysfunction	21(5%)	13(3%)	0.172	-0.491	1.25(0.79,1.97)			
Preoperative Hgb (g/dL)	11.5(6.4-16.8)	11.0(5.7-14.9)	<0.001	-0.347	0.98(0.74,1.30)	<0.001	-0.337	0.71(0.64,0.80)
Preoperative INR	0.99(0.84-1.35)	1.00(0.86-1.29)	0.001	3.65	0.99(0.73,1.33)			
Preoperative Platelet Counts	189(58-525)	190(50-429)	0.073	-0.002	0.998(0.996,1.000)	0.003	-0.003	0.996(0.993,0.998)
Preoperative Fibrinogen (mg/dL)	370(184-575)	360(40-554)	0.001	-0.003	0.997(0.995,0.999)	0.049	-0.002	0.998(0.996,0.999)
Blood Type A	140(32%)	134(31%)	0.712	-0.054	0.95(0.71,1.26)			
Blood Type B	120(27%)	118(27%)	0.928	-0.014	0.99(0.73,1.33)			
Blood Type AB	37(8%)	45(10%)	0.337	0.224	1.25(0.79,1.97)			
Blood Type O	141(32%)	138(32%)	0.882	-0.022	0.98(0.74,1.30)			

Model Validation (%, 95% CI)	
Area under ROC curve	0.77
Sensitivity	65%, 61% - 70%
Specificity	74%, 69% - 78%
Positive predictive value	71%, 67% - 76%
Negative predictive value	68%, 64% - 72%

Note: * It is a separated category in China without overlapping with any of other placenta previa
The Model Constant = 5.461

Abstract #:S-24

Retrospective review of the routine use of videolaryngoscopy with the Storz C-MAC video laryngoscope in obstetric patients

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Introduction: It is well established that pregnant patients have higher rates of difficult direct laryngoscopy(DL) during endotracheal intubation. Videolaryngoscopy has been used with success in other populations with anticipated difficult airways1. The Storz C-MAC videoscope is designed for DL with a traditional Macintosh blade, but has the option of using a screen for indirect videolaryngoscopy. We implemented a standard protocol that every obstetric patient is intubated with the Storz C-MAC. DL with the C-MAC blade is first attempted and ETT placed if cords are visualized. If DL is unsuccessful, the C-MAC screen is used to assist with cord visualization and intubation. This study aims to examine the need for rescue via videoscope and the patient comorbidities that may require videoscope endotracheal intubation.

Methods: We obtained billing data for all obstetric cases under general anesthesia (May 12th 2012-January 11th, 2015). Records were hand searched for inclusion criteria of general anesthesia on the day of delivery and greater than 20 weeks GA. From each record, patient demographics, comorbidities, urgency for surgery, and intubation details were collected. Groups were compared with descriptive, univariate, and bivariate statistics and logistic regression modeling.

Results: 167 subjects were identified, 39 did not meet inclusion, 5 intubations were via other techniques, and 19 were excluded due to protocol violations. In the remaining 104 subjects, 88 (85%) were successfully intubated via DL with the Storz C-MAC. 16 subjects (15%) required rescue with the Storz C-MAC screen, indicating difficult intubation. Storz C-MAC (Successful DL) and (Rescue with Screen) groups were compared and no statistical difference was found between the groups in patient BMI, rate of pre-eclampsia, urgency of surgery or Mallampati class.

Conclusion: In our study, 15% of our patients were considered to be "difficult direct laryngoscopy" and required rescue with videoscreen, but all patients were successfully intubated with the Storz C-MAC. Patients requiring rescue had smaller mean BMIs, lower rates of pre-eclampsia, and equivalent urgency of surgery and MP class. This study indicates that the routine use of Storz C-MAC is effective in obstetric patients and traditional markers of difficult airway may be less predictive in the obstetric population.

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Abstract #:S-24

Storz C-MAC intubation						
		Rescue with screen (n%)	**Successful DL (n%)**	**OR**	**P Value**	**CI**
BMI						
	> 35	25	34	0.98	0.586	0.92-1.049
	< 35	75	66			
Delivery prior to GA						
	Yes	12.5	9	1.844	0.508	0.3-11.31
	No	87.5	91			
Mallampati Class						
	1	18.75	11.39	*3 vs 1* 0.93	0.946	0.12-7.18
	2	56.25	56.96	*4 vs 1* 2.0	0.633	0.11-35.00
	3	18.75	25.32			
	4	6.25	6.33			
Pre-eclampsia						
	yes	12.5	23.86	0.45	0.358	0.084-2.45
	No	87.5	76.14			
Urgency						
	Emergent (3)	50	66.27	*2 vs 1* 0.3	0.208	0.046-1.95
	Urgent (2)	25	25.3	*3 vs 1* 0.26	0.127	0.047-1.46
	Elective (1)	25	8.34			

Abstract #:S-25

Midazolam may induce immediate retrograde amnesia during Cesarean delivery

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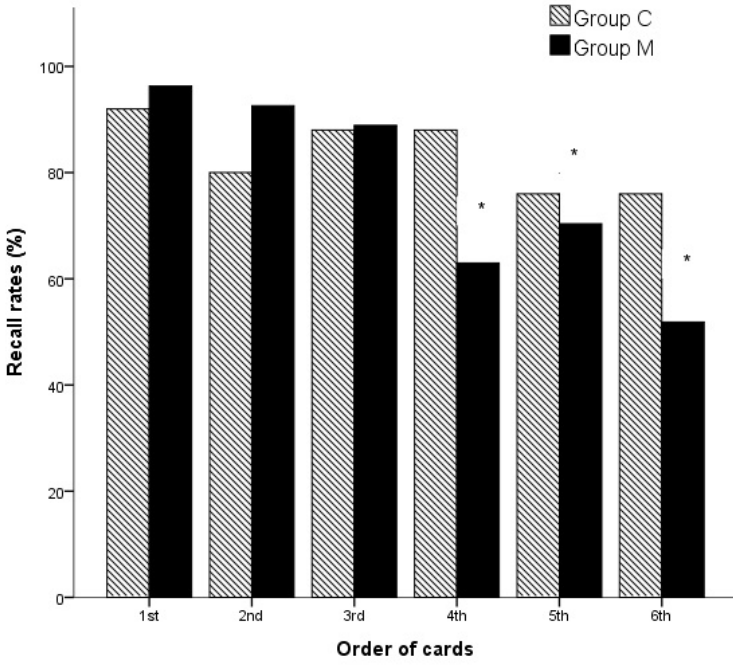
Background: The aim of this study was to determine the effects of midazolam on retrograde amnesia during Cesarean delivery.

Methods: This study was designed as a prospective, case-control study on parturients undergoing Cesarean delivery during spinal anesthesia. Patients were divided into two groups; midazolam group and control group. Analysis of retrograde amnesia was performed with a card recall test, where 7 picture cards were shown after the birth of the baby in 1 minute intervals. Patients in the midazolam group received midazolam (0.1mg/kg IV), 1 minute after the 6th card was shown, whereas patients in the control group did not receive any injection. Objects in the cards were recalled 30 minutes after the operation using open questions and the number of correct objects recalled was recorded. Statistical analysis was done using Mann-Whitney test and Fisher's exact test.

Results: A total of 52 patients participated in this study; 27 in midazolam group and 25 in control group. Results of individual card recalls at respective time points between the two groups did not differ significantly, with the exception of the 7th card shown after midazolam administration; 19 patients of the control group recalled the 7th card, whereas none of the patients in the midazolam group recalled the 7th card (OR 165, 95% CI 8.766-3105.9, p<0.0001). After dichotomization of the cards into first 3 cards, and latter 3 cards before injection, however, significant decreased recall of the latter 3 cards was observed in midazolam group compared to control group (OR 2.48, 95%CI 1.205-5.105, p=0.0143). Within the midazolam group, when compared to the 1st card, the recall rates of 4th, 5th and 6th were significantly decreased (Fig. 1).

Conclusions: The present study suggests that midazolam may induce immediate retrograde amnesia (<3minutes). Decreased or impossible communication should be considered in exchanging important information with patients, especially the period immediately prior to midazolam administration.



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Abstract #:S-26

Information and Consent for Elective/ Planned Caesarean Section

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Following an incident at a UK district general hospital related to regional anaesthesia(RA) for an elective Caesarean section(eCS), the National Health Service Litigation Authority(NHSLA) made recommendations on how women are consented for eCS. These included documenting all risks discussed with the woman; ensuring that all women have had an opportunity to read written material explaining the choices, benefits and risks of anaesthesia(A) for eCS; that all women having an eCS should be routinely offered a general anaesthetic(GA).

We wanted to know if, how and when other units provided parturients with written information regarding eCS, which risks were discussed and whether a GA is routinely offered to all women undergoing eCS.

A national survey using the Obstetric Anaesthetist's Association (OAA) survey tool with 7 questions addressing the above issues was sent to all OAA members.

1930 members were invited; 45% complete responses were received. 73% of respondents were consultants.

50% of responses confirmed that ALL women receive written information regarding A for eCS. 76% of responses confirm that this information is given to women at booking or at A clinic. Nearly 100% of responses confirm that women receive verbal information prior to receiving A. When consenting for RA before eCS only 12.7% of respondents warn women about failure of RA and conversion to GA.

76% of respondents D.O. not routinely offer GA for eCS. When consenting for GA for eCS only 5% of respondents routinely warn about the risk of awareness and 12.9% warn about airway complications and the risk of aspiration.

Only 50% of respondents could confirm that all women receive written information regarding A for eCS and only 76% can confirm that they receive it before attending labour suite on the day of surgery. The AAGBI Consent for Anaesthesia Guideline recommends that every obstetric unit should provide antenatal advice for women concerning analgesia and A during labour and delivery prior to its occurrence. We should emphasise the point of this guideline and try to improve current practice.

Under 13% of responding anaesthetists in the UK warn women about the risk of conversion of a RA to GA and only 24% offer GA for eCS routinely. This does make us question how valid the NHSLA recommendation on offering a GA to all women undergoing an eCS would be, particularly if tested under the Bolam and Bolitho principles, and in light of the most recent 5th National Audit Project which shows an incidence of awareness of 1/670 in the obstetric population. We are also wary of the risks attached to GA in the obstetric population for CS incl the increased risk of difficult and failed intubation; potential for uterine relaxation with increased blood loss; and inferior postoperative analgesia. Along with the majority of respondents to our survey, we believe that GA should not be routinely offered for eCS.

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Abstract #:S-27

The Influence of an International Teaching Program 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 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). CCV is the largest obstetric hospital outside the capital Belgrade with approximately 6500 deliveries per year. Initially, training was provided to CCV faculty, but now education extends to resident physicians and to faculty from surrounding hospitals. 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 7-10 day visits to CCV to provide didactic and hands-on training. In September 2014, a Kybele team of 3 obstetric anesthesiologists, visited CCV for 7 days to conduct training in RA and neuraxial analgesia for labor (NAL). As in previous years, 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. NAL use was also recorded. The use of RA for CS was compared between years using Chi square with Bonferroni correction.

Results: The interval and annual use of RA for CS in conjunction with the Kybele visits made in 2012-2014 is shown in the table 1. The annual increases in RA for CS are statistically significant. NAL increased from 161/4312 vaginal deliveries (VD) in 2012 to 253/4330 VD in 2013 (57% increase over 2012) to 360/4500 VD in year 2014 (42% increase over 2013).

Conclusion: The collaboration between CCV and Kybele increased the use of RA for CS during the period of visitation compared to the previous year's percentage and for some time intervals afterward. Long term increases in use of RA for CS and are less than the 84% increase reported by Kopic1 but have consistently increased one year to the next. Significant increase in the use of NAL was also noted. There remains limited availability of trained anesthesiologists and a lack of patient education on the benefits of RA and NAL. Future Kybele team visits for training of practitioners beyond CCV to increase RA and NAL utilization are planned.

Reference:

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Abstract #:S-27

Interval	2012	2013	2014
R1	16%	22%	21%
R2	33%*	42%^	38%^
R3	22%	39%	16%
R4	24%	16%	29%
R5	30%+	19%	26%
Yearly Percentage C/S under RA			
1/2011 – 12/2011	14%		
1/2012 – 12/2012	16%+		
1/2013 - 12/2013	18%*		
1/2014 - 12/2014	26%*		

Table 1: Percentage of cesarean deliveries performed under Regional Anesthesia (RA) at Clinical Center Vojvodina (CCV) Calendar Years 2012 – 2014

R1 = week before Kybele visit
R2 = week during Kybele visit
R3 = week after Kybele visit
R4 = 2 weeks after Kybele visit
R5 = 2 months after Kybele visit *P = 0.05 for comparison between R2 and R1;
+ P = 0.03 for comparison between interval R5 and R1;
^P = 0.04 for comparison between R2 and R1;
+ P = 0.05 for comparison 2012 and 2011;
*P < 0.001 for comparison between 2013 and 2011; 2014 and 2013;

Abstract #:S-28

Case Report: Pulmonary and Laryngeal Tuberculosis in a 25 week Parturient

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A 35 year old, Caucasian, parturient at 25 weeks gestation was admitted to our hospital with a 6 week history of odynophagia, severe GERD, and 11 pound weight loss. Her symptoms initially began as nasal congestion and cough which were treated by her primary physician empirically with azithromycin. Outpatient ENT and Gastroenterology consultants diagnosed her with laryngopharyngeal disease due to reflux and prescribed zantac with little improvement in symptomatology. Inpatient ENT evaluation revealed a swollen epiglottis and bilateral false vocal cords with small white plaques, pooling secretions, visible aspiration, normal and mobile true vocal cords, and normal mucosa. ENT and GI consultants recommended upper endoscopy for suspicion of esophageal mass vs. webs, as well as concern for fungal infection. The risks and benefits of the procedure and general anesthesia were discussed with the patient and her family and she agreed to the procedure with general anesthesia and intubation due to concern for aspiration with advanced pregnancy. The patient had a class II mallampati score and otherwise unremarkable airway exam. In light of the ENT/ Anesthesia evaluations, a difficult airway was not anticipated, and general anesthesia was induced with propofol and succinylcholine with RSI technique. Direct Laryngoscopy was grade 4 on two attempts and revealed a normal appearing epiglottis with severe mucosal edema of the posterior oropharynx. Third attempt with the glidescope allowed improved visualization and revealed severe mucosal edema of the supraglottic structures preventing visualization of the vocal cords and intubation. The patient desaturated to the 70's and was mask ventilated with cricoid pressure. The decision was made to abort the procedure and wake up the patient due to the severity of the supraglottic swelling and concern for worsening the edema with repeated manipulation. Saturations did not improve as quickly as expected, an LMA was placed to improve ventilation and saturations improved to low 90's. R>L chest wall excursion was noted as well as rhonchi with decreased breath sounds over the left lung field. The patient emerged from anesthesia, was screened into the ICU for respiratory monitoring, and a portable chest xray was obtained. Chest Xray revealed left upper lobe cavitary lesion suspicious for TB. Subsequent AFB cultures and genotyping returned positive for Tuberculosis. Previously, the patient denied fever, night sweats, and cough, though her family stated that her cough did not seem to improve after initial treatment. She has not traveled to an endemic region recently, though visited Malaysia in 2009. This case highlights that typical constitutional symptoms such as fever and night sweats may not be present in the pregnant patient with TB. Additionally, though laryngeal TB is rare, the symptoms and signs are quite vague and the potential for a difficult airway should be suspected in patients with advanced infection.

Abstract #:S-29

Unanticipated Post Partum Right Ventricular Heart Failure

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Introduction: The parturient undergoes significant cardiovascular and physiologic stress in the peripartum period, however the vast majority tolerate labor well. We present a rare diagnostic conundrum in obstetric anesthesia,; a patient with no known cardiac history develops acute and florid right ventricular heart failure post spontaneous vaginal delivery with epidural analgesia.

Discussion: Appropriate consent was obtained directly from the patient to publish this case report. We describe the case of a 32 year old female, G6P4 presenting in active labor at term. She had four previous uneventful spontaneous vaginal deliveries, all with intermittent intravenous analgesia. The patient did not describe any prior history of cardiac issues. She requested an epidural for analgesia, which was placed by the obstetrical anesthesia fellow after appropriate consent was obtained. Starting immediately post partum she had progressive bilateral leg swelling and periorbital edema. A chest X ray was obtained which showed an unusually enlarged and globular shaped heart. She was noted to have the clinical signs of florid right heart failure and borderline hypoxic with room air sats of 91% and a P02 of 66. The obstetrical anesthesiology fellow performed a bed side echocardiogram without doppler color images which revealed a moderately dilated right ventricular with no other obvious pathology. Cardiology was consulted for stat formal echo, and a CT to rule out PE was ordered. Pending consultations and tests, the decision was made to start IV heparin anticoagulation for the high index of suspicion that a large post partum pulmonary embolus was causing right ventricular failure. The CT chest eventually showed no evidence of pulmonary embolus, and the formal echo confirmed a moderately dilated right ventricle with normal valves and left sided function. It was noted however the patient had a 11-19mm atrial septal defect with significant left to right shunt, enough to explain the right ventricular failure. Her heparin was discontinued, she was diuresed with furosemide, and arrangements were made to have a percutaneous closure of her atrial septal defect once she was clinically stable.

Results and Discussion: Although common complications such as pulmonary embolus should continue to remain high on the differential for pregnant patients, Anesthesiologists and Obstetricians should keep a broad differential that includes rare cardiovascular conditions when managing the peripartum complications of labor and delivery. This also serves to highlight the diagnostic role of bed side echocardiography in obstetric anesthesia.

Abstract #:S-30

A high index of suspicion: the key to an early diagnosis of heterotopic pregnancy.

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30 year old G3P0 at 8 weeks gestation presented to the emergency department with complaints of nausea, vomiting, and abdominal pain for one month. Her past medical history was significant for previous gonorrhea infection and ruptured left sided ectopic pregnancy. Sonographic examination confirmed an intrauterine pregnancy and a mass in the right fallopian tube. The differential diagnosis for the mass included a possible ectopic pregnancy.

The patient was admitted, observed, and later discharged once her symptoms abated with timely outpatient follow up arrangements. She returned within hours of discharge with severe abdominal pain, dizziness, and hemodynamic instability. Her initial blood pressure was 74/26, heart rate was in the 140s, and the FAST ultrasound showed free fluid in the upper quadrants bilaterally. She underwent an emergent exploratory laparotomy, which revealed massive hemoperitoneum and bleeding in the right fallopian tube, with its contents consistent with decidual tissue. The patient was stabilized after a right salpingectomy with an estimated blood loss of 2200ml for which she was appropriately transfused. The patient did well postoperatively and a repeat transvaginal ultrasound was positive for cardiac motion, indicating a viable intrauterine pregnancy. Her perioperative course was unremarkable and she was discharged on post-operative day 4.

This case demonstrates the difficulty of definitively diagnosing a heterotopic pregnancy. The incidence of heterotopic pregnancy is 1:30,000 pregnancies, although the incidence can be much greater in some high-risk groups (1). Patients who undergo assisted reproductive techniques (ART) are at greater risk for heterotopic pregnancies. One study reported a heterotopic pregnancy incidence of 1.5 per 1,000 ART pregnancies when looking at all registered ART pregnancies in the United States from 1999 to 2002 (2). Other risk factors include history of ectopic pregnancies, prior pelvic surgery, and pelvic inflammatory disease. Undiagnosed heterotopic pregnancies are unfortunately quite common; with one literature review reporting that 25% (n=80) were definitively diagnosed by ultrasound and 75% were diagnosed at laparoscopy or laparotomy (3). Using beta-human chorionic gonadotropin as a diagnostic tool is obscured by the presence of the intrauterine pregnancy (IUP). Despite the difficulties in diagnosing heterotopic pregnancies, performing early transvaginal sonograms and maintaining a higher index of suspicion in patients with multiple risk factors and tailoring anesthetic management to address the need for resuscitation, can reduce the number of poor outcomes from this rare condition.

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Abstract #:S-31

Successful Epidural Analgesia in a Patient with Recent Epidural Blood Patch

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We report a patient who had successful epidural analgesia for labor six days after receiving an epidural blood patch. A 40-year-old woman, with no significant past medical history, presented for external cephalic version at 37.3weeks gestation. Initial attempts at version by her obstetrician were unsuccessful. Epidural anesthesia was requested to facilitate external cephalic version. During epidural placement with a 17 g Touhy needle, an inadvertent dural puncture occurred at L3/4. This needle was withdrawn and an epidural catheter was placed at the L2/3 space. Epidural anesthesia was provided with 15 mL of Lidocaine 2% to obtain a T6 level. External cephalic version was successful.

Two days after the version, the patient presented to labor and delivery with a postdural puncture headache. An epidural blood patch was performed at the L3/4 space and with 25 mL or sterile blood. Her headache symptoms resolved, and she was discharged home.

Six days after her blood patch, our patient presented in labor. An epidural catheter was placed at the L2/L3 space using a 17 g Touhy and loss of resistance technique with saline. Interestingly, a very small blood clot came out of the Touhy needle when in the epidural space. Successful analgesia was provided using our routine medications (Epidural bolus with 10 mL of bupivacaine 0.25%, followed by PCEA with bupivacaine 0.625% and fentanyl 2 mcg/mL at 7 mL/hour with 7 mL demand bolus every 7 minutes).

Higher success rates have been reported for external cephalic version with epidural anesthesia.(1) With an increasing use of epidural anesthesia for external cephalic version, obstetric anesthesiologists may see an increasing number of these patients with inadvertent dural puncture requiring an epidural blood patch while they are still pregnant. Previous studies have shown successful epidural analgesia after an epidural blood patch during previous pregnancies (mean time interval 33 months). (2) In conclusion, we present the successful use of epidural analgesia for labor in a patient with a recent epidural blood patch.

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Abstract #:S-32

Anesthetic Management of a Parturient with Neurosarcoidosis

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Neurosarcoidosis is a rare neurologic manifestation of the systemic disease sarcoidosis. Patients with neurosarcoidosis can have manifestations in cranial nerves, meninges and spinal cord. This case report will present the management of a nulliparous parturient with neurosarcoidosis involving the spinal cord that successfully underwent a Cesarean section with epidural anesthesia.

A 42yo G1P0 who presented at 39 weeks for induction of labor. Past medical history is significant for pulmonary and neurologic sarcoidosis. Her symptoms included pain and numbness from the waist downward on the left side and intermittent headaches. An MRI revealed lesions in her lung, thoracic spine and pons. She had taken prednisone for approximately one year that had lead to shrinkage in the size of her spinal cord lesions. Due to concerns over teratogenicity, she did not take prednisone during her pregnancy. Physical exam was significant for left sided lower extremity weakness (3/5) compared with the right side (5/5) and decreased sensation to light touch and pinprick in all dermatomes of her left lower extremity vs. the right. She had a Mallampati class III airway with normal dentition.

The patient required a cesarean section due to failure to progress. Prior to the cesarean section, an epidural was placed at the L3/L4 level. A lumbar epidural was chosen because her lesions were in the thoracic spine. Loss of resistance to air technique was used to locate the epidural space. LORTA occurred at 6cm from the skin, a catheter was left at 11cm. The epidural catheter was dosed with Lidocaine 2% with Epinephrine to obtain a T4 level. There were no intra-operative complications. The catheter was removed 24 hours after delivery and within subsequently the patient was back to her neurologic baseline.

Sarcoidosis is a systemic inflammatory condition. Neurological involvement occurs in less than 10% of patients with sarcoidosis, and of those with nervous system involvement, the spinal cord is involved in 6-8% of those patients. It is an important condition to consider in the parturient because those who are affected are commonly females of child bearing age.

Neurosarcoidosis can affect both the central and peripheral nervous systems. Symptoms of neurosarcoidosis affecting the spinal cord include weakness, paresthesias, myelopathy, bowel/bladder disturbances and radicular pain. The only definitive method to diagnose neurosarcoidosis is with tissue confirmation showing the presence of non-caseating epithelial granulomas. Management of patients with neurosarcoidosis involves immunosuppression, most frequently with prednisone. However prednisone in the parturient is risky because it carries a Class C teratogen risk. In this case we demonstrate successful management of a parturient with spinal neurosarcoidosis with a lumbar epidural.

Abstract #:S-33

Temporal Trends in Anesthesia-related Adverse Events in Cesarean Deliveries in New York State, 2003-2012

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Background: Cesarean delivery (CD) is associated with significantly increased risk of anesthesia-related adverse events (ARAEs), non-anesthetic perioperative complications (NAPCs), and mortality compared with vaginal delivery (Deneux-Tharaux et al. Obstet Gynecol 2006; 108:541-8). Temporal trends in these adverse outcomes remain unknown despite efforts of anesthesiologists to improve maternal safety. This study examines temporal trends in ARAEs, NAPCs, and mortality in CDs in New York State between 2003 and 2012.

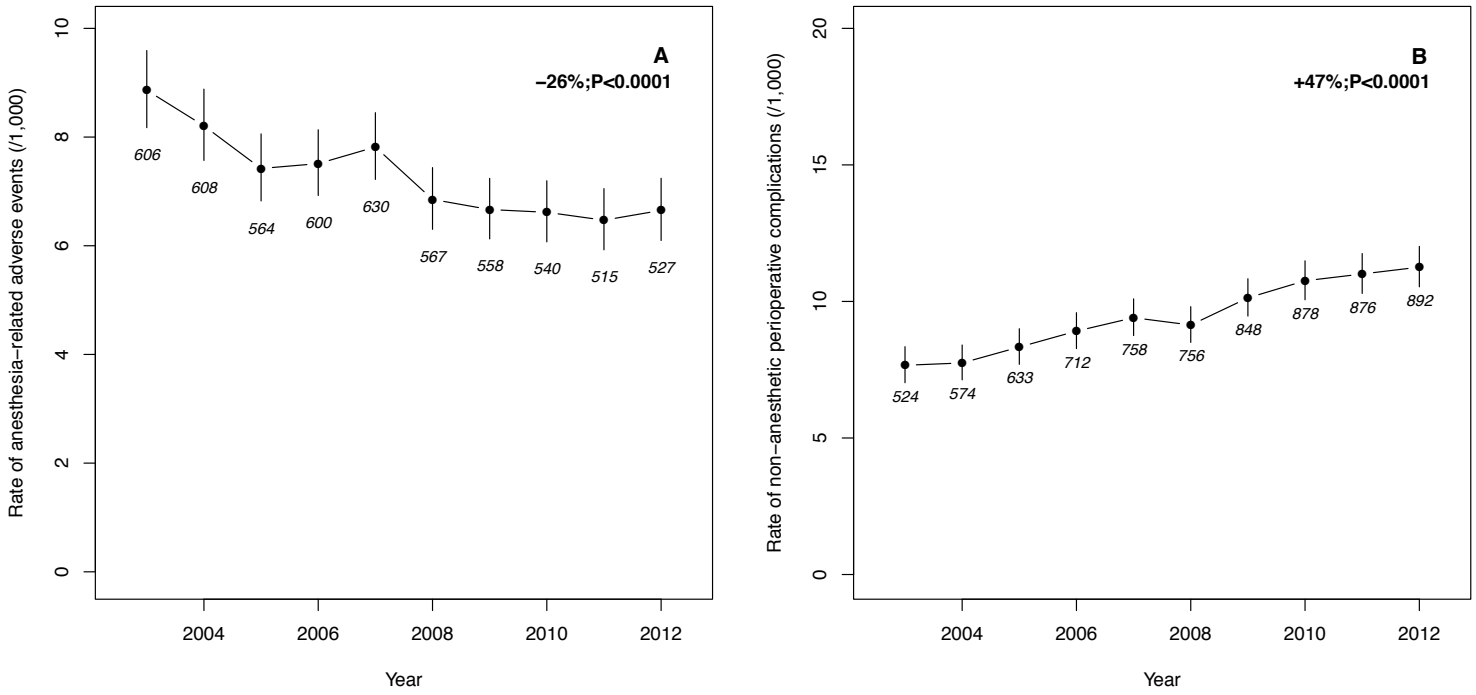
Methods: Data are from the State Inpatient Database (SID) for New York from 2003 to 2012. ARAEs and NAPCs (myocardial infarction, heart failure, respiratory failure, venous thromboembolic disease, disseminated intravascular coagulation, renal failure, sepsis, and stroke) were identified through International Classification of Diseases, Ninth Revision, Clinical Modification codes. Death was recorded directly from SID data. The annual rates of ARAEs were analyzed according to the type of CD (planned or unplanned), the type of anesthesia (general or non-general), and 3 hospital characteristics: annual volume of CDs (low-, intermediate- or high-volume hospital), presence of a residency program (yes or no) and location (urban or rural). Adjusted logistic regression was used to assess the statistical significance of changes in rates.

Results: Of the 785,854 CDs studied, 362,192 (46.0%) were planned, 5,715 (7.3/1,000) had at least one ARAE, and 7,040 at least one NAPC (8.9/1,000); 179 maternal deaths were recorded (0.2/1,000). The annual rate of ARAE decreased from 8.9/1,000 in 2003 to 6.6/1,000 in 2012 (-26%, $P < 0.0001$) (Figure 1A), regardless of the type of CD and the 3 hospital characteristics. There was no decrease in the rate of ARAEs in CDs performed under general anesthesia (10.7/1,000 in 2003 and 11.0/1,000 in 2012; $P = 0.68$) but a decrease was observed in CDs performed under non-general anesthesia (from 8.7/1,000 in 2003 to 6.5/1,000 in 2012; -25%; $P < 0.0001$). The rate of NAPCs increased by 47% ($P < 0.0001$) (Figure 1B) and overall mortality decreased by 51% ($P < 0.0001$).

Conclusions: Anesthesia-related outcomes in CDs appear to have improved significantly across hospitals in New York State in the past decade but NAPCs remain a serious healthcare issue. Further options to increase the safety of general anesthesia should be explored.

Abstract #:S-33

Figure 1: Rate of anesthesia–related adverse events (1A) and non–anesthetic perioperative complications (1B) in cesarean deliveries in New York State from 2003 to 2012. The vertical lines indicate the exact 95%CI and the number the number of events for the corresponding year.



Abstract #:S-34

Management of labour and delivery in congenitally corrected transposition of great arteries

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Case report: A 28-year-old primigravida presented with a diagnosis of congenitally corrected transposition of great vessels and dextrocardia. She had good exercise tolerance and stable vital signs. Echo showed 50% ejection fraction (EF) and mildly reduced systemic (morphologic right) ventricle. A multidisciplinary meeting between Obstetrics, Cardiology, Anaesthesia and Intensive care unit (ICU) team was held to decide on optimal obstetric management. Induction of labour was planned.

At 37 weeks she developed palpitations, increasing shortness of breath and peripheral edema. Repeat echo showed moderate ventricular dysfunction with EF 40%, severe systemic atrioventricular regurgitation and severely enlarged left atrium.

Prior to labour induction, an arterial line was inserted and continuous cardiac output monitoring was performed using arterial pressure waveform analysis with the FloTracTM monitor. Haemodynamic optimization was guided by stroke volume variation and goal directed fluid therapy. A lumbar epidural was then inserted followed by rupture of membranes and oxytocin infusion. Fluid balance was closely monitored continuously using FloTracTM system. First stage of labour was uneventful and 2nd stage was shortened using vacuum assisted delivery of a healthy baby. Cardiac condition was stable apart from persistent tachycardia throughout labour. Postpartum, she spent 24 hours in ICU with similar monitoring. Her tachycardia settled spontaneously. She was discharged home on day 4.

Discussion: Patients with congenitally corrected transposition have a thin-walled right ventricle as the systemic circulatory pump. The stress of increased cardiac output can cause failure, atrioventricular regurgitation and arrhythmias. We used minimally invasive continuous cardiac output monitoring using FloTracTM system, fluid balance optimization and good maternal pain control to prevent decompensation and achieve vaginal delivery with a good foeto-maternal outcome.

Conclusion: Continuous CO measurement is probably most beneficial in patients with structural cardiac disease. Women with transposition complexes carry extra risk during pregnancy and delivery. We used minimally invasive continuous cardiac output monitoring, fluid balance optimization and good maternal pain control to prevent decompensation and achieve vaginal delivery with a good foeto-maternal outcome.

Abstract #:S-35

Double Trouble: A case of subglottic stenosis and thrombocytopenia in a parturient

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A 39 y/o G2P1 at 30 wks EGA with h/o subglottic stenosis and immune thrombocytopenic purpura (ITP) presented for antepartum consultation. ENT examination revealed decreased vocal cord abduction, posterior glottic stenosis, and an anterior glottis web, all presumed secondary to prolonged neonatal intubation. During the visit, she was hoarse with dyspnea on exertion and had a Mallampati I with good mouth opening and jaw protrusion.

After multidisciplinary discussion, a scheduled cesarean delivery at 39 wks was planned with regional anesthetic if platelet levels were adequate and ENT on hand as airway backup. At presentation for delivery, patient's platelets were 44k necessitating general anesthesia. She was adequately NPO with aspiration prophylaxis and received dexamethasone in anticipation of a difficult airway. A C-MAC provided a Grade I view, but a 5.0 MLT would not pass. ENT attempted passage of 4.5 ETT over flexible laryngoscope but could not maneuver the scope anteriorly through the cords. Ultimately, ENT performed direct laryngoscopy with a Miller, and successfully placed a 4.5 ETT with mild difficulty. Throughout, she was easy to mask with sats >85%. The case was uneventful and the patient was extubated.

Mild stridor and hoarse voice were noted POD #0, but the patient remained stable and was weaned to room air by discharge on POD #3. Approximately four months postpartum the patient was seen by ENT and determined stable to undergo a microdirect laryngoscopy with excision of the anterior glottis web.

Tracheal stenosis is rare during pregnancy, with fewer than 20 cases documented in literature. Patients can present with difficulty breathing or wheezing that is often misdiagnosed as asthma unresponsive to bronchodilators. Tracheal stenosis may be congenital or acquired. Acquired etiologies include trauma, prolonged intubation, GERD, and Wegener's. Physiologic changes of pregnancy such as decreased FRC, increased oxygen consumption, airway mucosal swelling and weight gain can exacerbate tracheal stenosis symptoms.

There is no consensus on the optimal management of pregnant patients with tracheal stenosis. Some suggest that the safest method is insertion of tracheostomy tube under local anesthesia, while others describe successful bronchoscopic dilations during pregnancy.

On the other hand, thrombocytopenia is the second most common hematologic abnormality encountered during pregnancy after anemia. However, less than 1% of parturients present with platelets <100k. Minimum platelet count for neuraxial anesthesia depends on provider; however few are likely to place a neuraxial at <50K.

The combination of thrombocytopenia and tracheal stenosis during pregnancy is exceedingly rare, with no documented cases in the literature and such patients require intense multidisciplinary collaboration. Ultimately, we felt the safest plan was to avoid neuraxial anesthesia and proceed with general anesthesia with ENT on standby.

Abstract #:S-36

A Multidisciplinary Protocol for Antenatally Diagnosed Placenta Accreta: A Retrospective Case Series

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Introduction: The recent increased frequency of cesarean delivery has been accompanied by an increased incidence of placenta accreta, a potential cause of massive obstetrical hemorrhage. With advances in radiologic techniques, placenta accreta has become diagnosed earlier in pregnancy and more accurately. Cesarean hysterectomy is a common strategy for management of placenta accreta, and several interventional radiologic (IR) procedures have been utilized to reduce post-partum hemorrhage. Newer management approaches for addressing placenta accreta necessitate a multidisciplinary approach. The team at our institution consists of the obstetrical, gynecologic oncology, obstetric anesthesiology, neonatal intensive care, transfusion medicine, IR, labor and delivery nursing, and operating room management teams.

Objective: To evaluate the potential benefits and success of a multidisciplinary approach to managing antenatally diagnosed placenta accreta cases.

Methods: This is a retrospective review series of fifteen cases of antenatally diagnosed placenta accreta at our institution between 2011 and 2014 that underwent our placenta accreta protocol for cesarean delivery. Patient demographics, calculated blood loss, transfusion requirements, type of anesthetic technique and quality measures were assessed and evaluated. We utilized estimated blood loss as a reflection of the anesthesiologist's assessment of estimated blood loss, and used the theoretical dilution theory and transfused red blood cell volume to calculate blood loss.

Results: We successfully managed 67.7% of antenatally diagnosed placenta accreta cases with regional anesthesia. The average calculated blood loss for cases performed with regional anesthesia was 1409mL and 6412mL for cases utilizing general anesthesia (p-value < 0.05). In addition, the difference between calculated blood loss and clinically estimated blood loss was 570mL (p-value 0.53).

Conclusions: The multidisciplinary team management approach to the cesarean delivery of patients with antenatally diagnosed placenta accreta can lead to fewer cases of general anesthesia and subsequently less blood loss. Clinically estimated blood loss does not significantly underestimate calculated blood loss.

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Abstract #:S-36

Table 2. Blood Loss

Patient #	Anesthetic	Start Hct (%)	Post-Op Hct (%)	Calculated Blood Loss (mL)	Clinically Estimated Blood Loss (mL)	Difference Calculated – EBL (mL)	PRBC Units
1	GA	35.9	34.2	5029	3500	1529	8
2	RA	33.9	27.9	1147	1000	147	0
3	RA	35.0	29.7	954	1500	-546	0
4	RA/GA	34.0	27.7	4372	3000	1372	5
5	RA	33.0	31.1	1030	1500	-470	1
6	RA	31.3	32.5	1692	2500	-808	3
7	RA/GA	33.5	28.9	8573	7000	1573	12
8	RA	31.5	33	3653	2400	1253	6
9	RA	33.5	27.3	1083	1000	83	0
10	GA	30.7	27.3	3998	2400	1598	5
11	RA	35.0	32.7	390	800	-410	0
12	RA	36.6	26.7	2852	2000	852	2
13	RA/GA	37.8	33.5	10087	6000	4087	16
14	RA	29.5	27.4	865	2000	-1135	0
15	RA	32.3	31	427	1000	-573	0
Average		33.6	30.1	3077	2507	570*	3.9

*p value 0.53; GA = General Anesthesia; RA = Regional Anesthesia

Abstract #:S-37

Awake Craniotomy for A Parturient with Thalamic Intracranial Hemorrhage and Frontal Lesion: The Role of Neuro-Obstetric Anesthesiologist for Maternal Fetal Medicine

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Case Report: A 37 year-old G2P1 31 weeks pregnant female presented to an outside hospital with on week of persistent headache. CT scan revealed a 3.4cm right thalamic intracranial hemorrhage with a 1.2cm hemorrhagic lesion in the left subcortical front lobe. Patient developed nausea and vomiting with right pupil dilation and increased somnolence. Neurosurgical team performed a left external ventricular drain to release the obstructive hydrocephalus. She was given dexamethasone 6mg q6h for both fetal lung maturity and prevention of brain edema. She was subsequently transferred to our Neuro ICU for further workup with the concern of a metastatic source and definitive care for the immature fetus. Upon arrival, she presented with dilated right pupil and right ptsosis with category-I fetal heart tracing. Initial obstetrical plan was to delivery the fetus via cesarean upon completion of steroid treatment followed by neurosurgical team performing a craniotomy and left frontal lesion biopsy in order to facilitate further workup of the intracranial lesions. A multidisciplinary meeting with representation of neurosurgical, ICU, obstetrical, neuro-obstetric anesthesia teams were gathered, during which the neuro-obstetric anesthesia team offered awake craniotomy for neurosurgeon to remove the frontal lesion while obstetrical team performing intra-operative continuous fetal heart monitor and standby for stat cesarean delivery in case of fetal distress. The plan was unanimously taken by all teams. Awake craniotomy was performed with intravenous infusion of propofol, dexmedetomidine, remifentanil, phenylephrine and ephedrine with patient's blood pressure maintained at baseline level. Fluid volume repletion was directed with Vigileo FloTrac EV-1000 monitor. Neurosurgical team was able to perform an excisional biopsy of the entire frontal lesion while the fetal heart tracing was stable throughout the procedure. At the time of this abstract submission, both maternal and fetal conditions are stable. We are waiting for surgical pathology report.

Discussion: Ethical dilemma frequently raises in complicated maternal fetal medicine cases. To balance the risk and benefit of maternal and fetal factors around obstetrical vs neurosurgical approaches require an overall view of the patient's conditions. Anesthesiologists are often strategically placed in the center of this frame of team work, which may lead to a better resolution. In this case, obstetrical team worries that further diagnostic study may harm the fetus and prefers an preemptive delivery. Neurosurgical team worries any potential hemodynamic swing may trigger secondary bleeding intracranially. With all this concerns, an awake craniotomy was elected by all team to be the best approach. While patient's vital signs closely monitored and maintained, excision of the frontal lesion was performed safely.

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Abstract #:S-38

Cesarean delivery under neuroaxial anestheisa for patient with large thoracic mass

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Introduction: Mediastinal mass in pregnancy is rare. We present a woman admitted in her third trimester with severe orthopnoea, dysphonia and dysphagia who had an emergency cesarean delivery under neuraxial anesthesia.

Case report: A 26-year-old Afro-Caribbean woman (G1P0) of 37+5 weeks gestation presented with sudden onset of dyspnoea when lying flat and dysphagia following a two week history of hoarse voice. Medical and obstetric history was unremarkable. Examination showed a bulky neck and no stridor. Nasendoscopy demonstrated left-sided vocal cord palsy. Oxygen saturations and respiratory rate when sitting were normal. Blood tests were unremarkable. Sitting bedside echocardiogram showed no vessel compression. PA chest radiograph showed an abnormality of the left upper mediastinal contour consistent with an anterior mediastinal mass. A CAT scan was advised after delivery. Given her worsening symptoms and orthopnoea, a multidisciplinary team decision (M.D.T) led to category 3 cesarean delivery. She had a combined spinal and epidural (CSE) in the sitting position (intrathecal dose of 2 milliliters plain marcaine 0.5% with 300 micrograms diamorphine). Block height was adequate and no epidural top up was required. The operative procedure took place in a 30-degree head up position with both consultant anesthesiologist and obstetrician present. There was minimal blood loss and the patient remained asymptomatic throughout. The post-operative period was uneventful and investigations were consistent with lymphoma, which was treated with chemotherapy.

Discussion: Mediastinal mass remains an anesthetic challenge with variable clinical presentation ranging from lack of symptoms to severe cardio respiratory compromise. General anesthesia can lead to loss of muscle tone and tumor compression syndrome obstructing the mediastinum causing either airway obstruction or reduction in venous return and loss of cardiac output with sudden cardiac arrest.1 We decided on neuraxial anesthesia to avoid these risks. Inability to lie flat is often cited as a contraindication to regional anesthesia for cesarean delivery however both good operating conditions and patient comfort were achieved in a 30-degree head up tilt using CSE anesthesia with plain marcaine. An M.D.T approach is required for these rare complicated patients.

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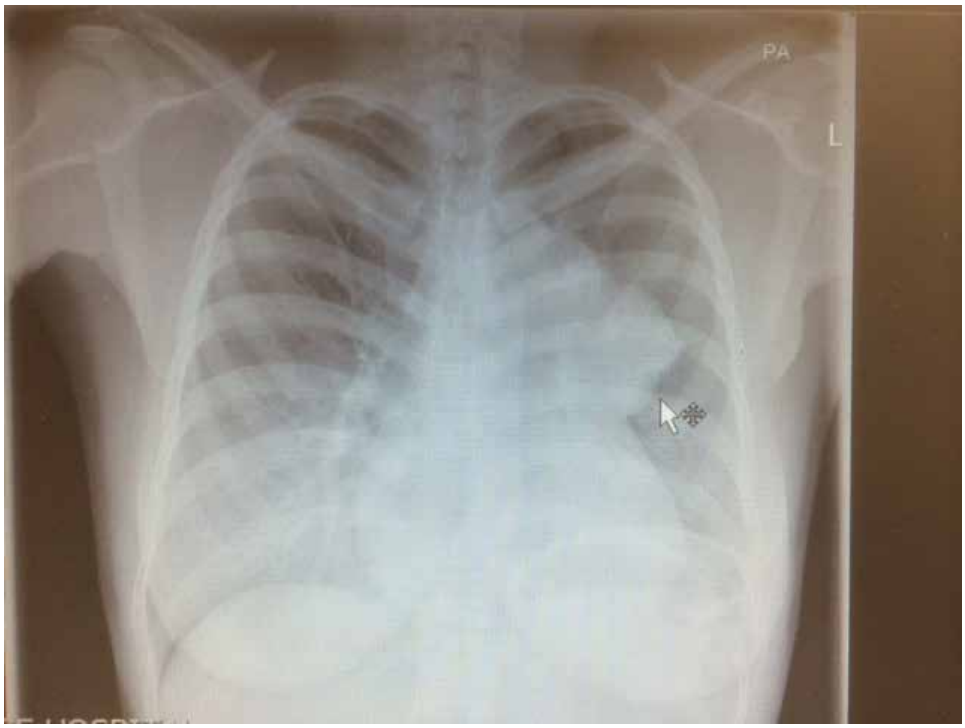

Abstract #:S-39

Epidural clonidine for pain management of parturients on buprenorphine therapy

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Introduction: Opioid dependence during pregnancy is associated with obstetrical and neonatal complications. Pharmacological treatment of opioid dependence with methadone and buprenorphine improve both maternal and fetal outcomes with reports concluding that neonates exposed to buprenorphine have better outcomes than their methadone counterparts. Given the excessive opioid requirements for those on buprenorphine therapy, alternate analgesic use is warranted. The following cases demonstrate the use of epidural clonidine.

Case One: A 22yo G1P0 on buprenorphine maintenance presented in active labor. An epidural was inserted, bloused, and a PCEA infusion of bupivacaine 0.1%+clonidine 2mcg/mL+epinephrine 0.0012mg/mL was started at 10mL/hr. Both the parturient and fetus remained hemodynamically stable throughout labor, pain was controlled and a spontaneous, non-assisted vaginal delivery resulted. The epidural was removed approximately 4 hours post-partum with no complaints of pain. She was continued on her buprenorphine therapy throughout her hospitalization and her postpartum pain regimen consisted of acetaminophen and NSAIDs.

Case Two: A 25 year old G2P0 on buprenorphine therapy presented in active labor. An epidural was placed and an infusion of bupivacaine 0.125%+fentanyl 2 mcg/ml was started. Six hours later, the obstetrician called for an emergency cesarean section. The epidural was continued for postoperative pain control employing bupivacaine 0.0625%+clonidine 4 mcg/ml. Buprenorphine was maintained throughout. The epidural was removed 22 hours later with reports of adequate pain control with NSAIDs and oxycodone/acetaminophen therapy.

Discussion: Given buprenorphine's unique mechanism of action, women on this therapy present challenges in pain management both during labor and after a cesarean section. Both women presented here had low pain scores without excessive opioid use suggesting that the non-narcotic adjuvant of epidural clonidine is effective for those parturients on buprenorphine maintenance.

Conclusion: Our experience thus far suggests epidural clonidine is a useful adjunct for pain management in parturients undergoing buprenorphine therapy. Further investigation of use and optimal dosage is warranted.

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Abstract #:S-40

Influence of position and mode of uterine displacement on the hemodynamic status of third trimester pregnant women

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Introduction: Current guidelines for resuscitation of the pregnant woman suggest manual uterine displacement as the ideal method of alleviation of the aortocaval compression. If this proves to be unsuccessful, providers are encouraged to pursue the left lateral tilt position at 27-30 degrees (1). Such recommendation is based on manikin studies that have shown that chest compressions in the left-lateral tilt position are feasible, although they may be less effective than in the supine position (2). No study to date has looked at the full array of positions and aortocaval alleviation methods using a continuous assessment of hemodynamics.

Methods: This was a prospective observational study. With REB approval and written informed consent we recruited non-laboring women ≥ 34 weeks gestational age. We excluded ASA 3/4, BMI >35, multiple gestation, cardiac disease, hypertension or preeclampsia, renal disease, anemia Hb < 10 g/dl, IUGR and abnormal placentation. Participants were monitored with a bio-reactance based non-invasive cardiac output monitor (NICOM). The system was allowed to equilibrate with women in the left lateral position (LL) for 2 minutes, after which the hemodynamic data collection was initiated. Participants were moved into the following positions: left lateral (LL); 30 degree left tilt (LT); supine (S); supine with left manual displacement (LMUD); 30 degree right tilt (RT); right lateral (RL). Participants remained in each of the positions for 5 minutes and data for analysis was collected during the last 3 minutes. The hemodynamic variables were: systolic (SBP), diastolic (DBP), mean arterial pressure (MAP), heart rate (HR), stroke volume (SV) and stroke volume index (SVi), cardiac output (CO) and cardiac index (CI), total peripheral resistance (TPR) and total peripheral resistant index (TPRi). The primary outcome was the CI in different study positions.

Results: We approached 32 women, recruited 31 and analyzed data from 30. There were significant changes in SBP; DBP; MAP; TPR; and TPRi ($p<0.01$). The mean values increased as the patients moved from LL thru the different positions until they were placed in RL. There were no significant changes in CO, CI, HR, SV and SVi across all positions. One patient (not included in the analysis) presented severe symptoms of aortocaval compression while supine accompanied by abrupt decreases in SV, CO and CI, and increases in HR and TPR, and only improved with LL position.

Discussion: In the absence of anesthesia, most pregnant women tolerate various positions with minor hemodynamic consequences, primarily by increasing peripheral resistance; in these women LMUD does not change the hemodynamic profile. Some women, however, will exhibit severe symptoms and hemodynamic changes associate with aortocaval compression; in these women, LMUD or LT may not be sufficient to attenuate/correct these changes.

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Abstract #:S-41

Ilioinguinal and iliohypogastric nerve blocks for the treatment of refractory neuropathic pain following cesarean delivery

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Introduction: Nerve injury and the development of neuropathic pain are known complications of cesarean delivery, and the management of these painful conditions can be challenging in the postpartum setting. We present a case of intractable left lower abdominal pain following cesarean delivery, and discuss the use of ilioinguinal/iliohypogastric nerve blocks to provide immediate and sustained relief.

Case: 30year old G4P2 with obesity (BMI=45), chronic diabetes mellitus on insulin, and two prior cesarean deliveries presented in spontaneous labor. Following combined spinal-epidural anesthesia, patient underwent unremarkable repeat cesarean delivery via low-transverse Pfannenstiel incision. The epidural catheter was removed at the end of the surgery; however, shortly after arriving in the PACU patient began to complain of severe electric, shooting pain at the left margin of her surgical incision and upper left thigh. Despite receiving IV fentanyl and bilateral transversus abdominis plane (TAP) block, the patient continued to have excruciating pain. Ultimately, a new epidural catheter was placed to provide post-operative analgesia, and our patient remained comfortable overnight. However, upon briefly discontinuing her epidural infusion on post-operative day (POD) #1, she again developed severe neuropathic pain, and the epidural infusion was restarted. Symptoms were most consistent with iliohypogastric nerve entrapment. Gabapentin or pregabalin were recommended for her neuropathic pain, but the patient refused these medications as she desired to breastfeed the infant. The patient continued to require continuous epidural infusion for adequate analgesia. On POD #2, she underwent ultrasound-guided ilioinguinal and iliohypogastric nerve blocks (10cc of 0.25% bupivacaine + 4mg dexamethasone + 1:300,000 epinephrine) with immediate relief of her left abdominal and upper thigh pain. The epidural infusion was discontinued and patient was discharged home on oral analgesics on POD #4.

Discussion: Previous reports discussing the management of iliohypogastric nerve entrapment have focused largely on surgical approaches (i.e. either release or resection of the entrapped nerve) (1) or radiofrequency ablation, although case reports of single-shot ilioinguinal and iliohypogastric nerve blocks have been described following abdominal herniorrhaphy and other abdominal surgeries (2). This quick and technically-straightforward approach is attractive in parturients with suspected iliohypogastric or ilioinguinal nerve entrapment, particularly since many pharmacologic agents for the management of neuropathic pain are contraindicated in the post-partum setting.

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Abstract #:S-42

Labor Analgesia for Parturient with Arthrogryposis Multiplex Congenita

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Introduction: Arthrogryposis Congenita Multiplex (ACM) is a syndrome characterized by rigid, contracted joints and malformed extremities with different neurogenic, myopathic and even environmental causes (1). Pregnancies in patients with ACM are rare given genitourinary abnormalities such vaginal and uterine agenesis. This case demonstrates the successful use of labor neuroaxial analgesia in a patient with ACM.

Case: 26 y.o. G1P0 at 35 wks. presented with rupture of membranes. Patient is wheelchair bound and suffers from ACM. On physical exam there was a Class I airway, marked scoliosis, a normal size thorax, but short and underdeveloped extremities. Cardiovascular and pulmonary examinations were unremarkable. Given the lack of hip joint abnormalities and the presence of an adequate pelvic inlet, the patient was deemed a candidate for a vaginal delivery.

An early CSE was performed with a 17G Touhey needle and a 26G Gertie Marx spinal needle in the right lateral decubitus position. The epidural space was easily identified with a single attempt, 8 cm from the skin. The spinal was dosed with 20mcg of Fentanyl and 100mcg of PF Morphine. After the catheter was secured at the skin and aspiration was confirmed as negative, a test dose of 3ml of 1.5% Lidocaine (45mg) with epinephrine was administered. No signs of intravascular or intrathecal injection were noted, but the blood pressure decreased, requiring correction with IV fluids and pressors. A continuous infusion of 0.0625% Bupivacaine with Fentanyl was started at 8ml/hr.

6 hours later, the patient requested a top-up. Aspiration was reconfirmed as negative and a similar dose was administered, 60mg of 2% Lidocaine (3ml). Once again, the patient became hypotensive with symptoms of lightheadedness and diaphoresis. 200mcg of Phenylephrine and 15mg of Ephedrine were needed to restore the blood pressure. Over the remaining course of her 24 hours of labor, the patient required 3 additional boluses. Bupivacaine 0.125% was utilized as not to interfere with her expulsive strength. None of these boluses were greater than 3ml and the patient reported excellent, bilateral analgesia. The patient delivered a male infant via an unassisted vaginal delivery.

Discussion: The identification of the epidural space in patients with ACM is challenging due to vertebral abnormalities such as scoliosis and narrow foramina. When the epidural space is identified there could be enhanced spread with subsequent marked hemodynamic fluctuations, as demonstrated in this case, or abnormal spread leading to one sided or patchy blocks (2). Continuous spinal catheters have been used in the past when epidural placement has proven difficult (3). Caution should be also exercised with the dosing of spinal catheters as there is known differences with the production and resorption of CSF in patients with ACM.

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Abstract #:S-43

Management of a super morbidly obese parturient with heart failure and COPD for Cesarean Delivery secondary to preeclampsia with severe features and uncontrollable hypertension

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Background: Obesity in the pregnant woman is associated with a broad spectrum of problems, including dramatically increased risk for cesarean delivery, hypertension and pre-eclampsia. (1, 2) We describe the peripartum anesthetic management of a super obese parturient for emergent repeat cesearean delivery in the setting of pre eclampsia with severe features.

Clinical Features: A 33-year-old multiparous woman with BMI of 70 presented at 29 weeks for management of systolic blood pressures in the severe range. Her past medical history was significant for an in-situ tracheostomy, placed 4 years prior for respiratory failure secondary to BMI > 100; as well as chronic hypertension, CHF with EF of 30-40% and COPD. An arterial line, and peripheral intravenous access were placed by anesthesia at bedside. Due to severe range blood pressures refractory to medical management, emergent repeat C/D was called. Following ENT consult for exchange to cuffed tracheostomy in the OR, peripheral intravenous access failed. Ultrasound guided central intravenous access was obtained via the right internal jugular, and ultrasound was utilized to obtain midline for placement of an intentional intrathecal catheter. A sensory level to T4 was obtained with 1cc of local anesthetic with narcotic, and delivery proceeded uneventfully. The patient was transferred to PACU on 4L trach collar, and observed overnight. The patient was then transferred to the postpartum floor, and discharged home on POD #4.

Conclusions: The rate of obesity in the general population is increasing dramatically particularly among females of childbearing age (2). Morbid obesity in this population, is associated with multiple problems (1). Asides from the increased prevalence of DM, HTN and poor neonatal outcomes, morbid obese patients present challenges for the anesthesiologist including airway management, intravenous access and neuraxial procedures. Ultrasound facilitates line placement and neuraxial anesthesia (3) ; particularly in the setting of severe preeclampsia, where blood pressure stabilization precludes repeated attempts at invasive procedures. Intrathecal catheter provides a reliable, rapidly titratable and hemostable anesthetic technique for the super obese preeclamptic undergoing repeat cesarean delivery (4).

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Abstract #:S-44

Epidural Post Platelet Transfusion – Good Analgesia or Taking a Risk?

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A 17 y/o primigravida was admitted for IOL at 38 weeks secondary to preeclampsia. She had a lifelong qualitative platelet disorder. Hematology workup defined this as an unnamed genetic qualitative platelet disorder, with normal counts, but mostly dysfunctional platelets. This case questions whether an epidural in a patient requiring platelet transfusion as part of her delivery plan is safe. Little literature exists to make recommendations and ASRA guidelines only discuss patients on anti-platelet medications, not with inherent dysfunction (1).

Hematology recommended 5 units platelets prior to delivery for adequate hemostasis. The patient desired a labor epidural and we felt that it could be safely performed because she would be receiving a platelet transfusion. Risks of transfusion would already be incurred as part of the delivery, and the platelet function should be adequate for an epidural.

At the onset of active labor the anesthesia team felt that an additional 5 units of platelets (total 10 units) were warranted given her preeclampsia. An epidural was placed at 8 cm cervical dilation and successful vaginal delivery of a baby boy (APGARS 8/9) followed (300mL EBL). She received 600 mcg PR of mesoprostol during delivery for hemostasis. Post-partum she had no fever, heavy bleeding, or neurologic signs of epidural hematoma. Her Hgb was 10.1 and although the platelet count was not documented, it may have been irrelevant given her qualitative disorder.

Discussion: Epidural hematoma is a rare and devastating complication of neuraxial anesthesia. The risk of epidural hematoma is difficult to assess and has been mainly based on case reports. Most report a risk of around 1 in 200,000 in parturients (2,3). With such a low incidence it is difficult to determine the relationship between epidural hematoma, regional anesthesia, and coagulopathy. Understanding the risk of hematoma, as it relates to platelets, also requires understanding of the coagulation system and how it changes during pregnancy. The hypercoagulable state further confounds this picture.

Predisposing risk factors for hematoma in parturients include gestational thrombocytopenia, pre-eclampsia with HELLP syndrome, thromboprophylaxis in pregnancy, and patients with preexisting coagulopathies. Thrombocytopenia is the most common hematologic disorder in pregnancy. Gestational platelet counts decrease until 26 to 32 weeks, but there is a compensatory increase in mean platelet volume (4,5). This suggests an increase in platelet consumption and reactivity. Typically, platelets return to normal 3-5 days postpartum. There is a risk of thrombocytopenia in subsequent pregnancies, as well (6).

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Abstract #:S-45

High ratio between the duration of membrane rupture to the total duration of labor is associated with increased morbidity in term neonates

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Objective: The duration of ruptured membranes (ROM) is an important risk factor for neonatal sepsis. However ROM duration is influenced by the duration of labor, yet studies investigating the influence of this relationship on neonatal outcomes are lacking. Our study hypothesis was that the ratio between duration of ROM-to-duration of labor may better identify patients at risk of neonatal morbidity compared to ROM duration alone.

Methods: We performed a secondary analysis using MFMU data from the Factor V Leiden Mutation Study. We identified women with singleton pregnancies who underwent vaginal delivery ≥37 weeks' gestation. Women whose babies had congenital malformations or SGA <10th percentile were excluded. Our primary outcome – neonatal morbidity- was defined by the presence of at least one of the following conditions: stillbirth, respiratory distress syndrome, transient tachypnea of the newborn, sepsis, seizures, NICU admission or a 5 min APGAR ≤3. The ratio of ROM duration-to-labor duration was categorized into quartiles: (<0.24; 0.24 – 0.513; 0.514 – 0.99; ≥1.0). We performed bivariate analyses to assess the relationship between the ratio and other demographic, obstetric and intrapartum factors with neonatal morbidity. Variables associated with neonatal morbidity (P<0.1) were included in a multivariate logistic regression model. The AUROC was compared with a model containing ROM duration.

Results: Our cohort comprised 2826 women, of which 181 (6.4%) women had neonatal morbidity. Compared to women in the lowest quartile, women in the higher quartiles were at increased risk of neonatal morbidity (Table 1). Other factors independently associated with neonatal morbidity were: African-American race, Hispanic ethnicity, obesity and pre-eclampsia, HELLP or eclampsia. The AUROC for the model including the ratio (AUROC=0.66) was similar to the AUROC for a model with ROM duration (AUROC=0.65; P=0.43).

Conclusion: In this exploratory study, high ratios of ROM duration-to-labor duration were associated with an increased risk of neonatal morbidity. However the ratio and ROM duration may have similar predictive values for neonatal morbidity among term women undergoing vaginal delivery. Among term women with vaginal deliveries, ROM duration appears to be as predictive as ROM to labor duration ratio for identifying adverse neonatal outcomes.

Abstract #:S-45

	Adjusted OR[a]	95% CI
Ratio of ROM duration-to- labor duration (quartiles)		
<0.24	Reference group	
0.24 – 0.513	1.51	0.91 – 2.52
0.514 – 0.999	2.50	1.55 – 4.03
≥1.0	1.97	1.20 – 3.23
Race / Ethnicity:		
Caucasian	Reference group	
African-American	1.87	1.12 – 2.93
Hispanic	2.47	1.62 – 3.77
Other	1.49	0.51 – 4.36
Pre-pregnancy BMI:		
BMI <25	Reference group	
BMI 25-29.9	1.14	0.77 – 1.70
BMI ≥30	1.63	1.06 – 2.50
Preeclampsia, HELLP syndrome or eclampsia		
No	Reference group	
Yes	3.53	1.54 – 8.13

[a] Adjusting for maternal age, gestational age at delivery, gestational diabetes. BMI = body mass index; ROM = rupture of membranes

Abstract #:S-46

Validation study to assess whether time of delivery influences the risk of neonatal morbidity

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Objective: Based on data from a previous single center study, time of delivery may not influence the risk of neonatal morbidity. However, validation studies are needed to confirm or refute these findings. Using data from a multicenter study, we examined whether time of delivery influences the likelihood of neonatal morbidity within a cohort of women with singleton pregnancies delivering at 13 different obstetric centers.

Methods: We performed a secondary analysis of data from the MFMU Factor V Leiden Mutation study. Women with congenital malformations, babies with SGA, stillbirths, miscarriages and who received terminations were excluded. We categorized time of delivery into 3 intervals: 07:00-16:59 (day); 16:59-23:59 (evening); and midnight-06:59 (overnight). Our primary outcome -neonatal morbidity- was defined by the presence of at least one of the following: respiratory distress syndrome, transient tachypnea of the newborn, sepsis, seizures, NICU admission or a 5 min APGAR ≤7. To examine the influence of time of delivery on neonatal outcomes, we performed multivariate logistic regression to account for potential confounders.

Results: Our cohort comprised 4087 women; of which 1917 (46.9%) delivered during the day, 1140 (27.9%) delivered in the evening, and 1030 (25.2%) delivered overnight. We observed no differences in the rates of neonatal morbidity according to the delivery time period (day: 12.3%; evening: 12.8%; overnight: 12.6%; P=0.9). After adjustment for confounding, we observed no differences in the risk of morbidity according to time of delivery (Table). Similar findings were observed when stratifying by mode of delivery.

Conclusion: This secondary analysis provides data that supports prior work suggesting that time of delivery is not associated with an increased risk of neonatal morbidity. Future studies are needed to assess whether physician-level and hospital-level factors influence the risk of neonatal morbidity according to time of delivery.

Table. Time of Day and Risk of Neonatal Morbidity

	Evening aOR (95% CI)	Overnight aOR (95% CI)
Neonatal morbidity – all deliveries[a]	0.99 (0.75 – 1.31)	0.98 (0.75 – 1.30)
Neonatal morbidity – all vaginal deliveries[b]	0.99 (0.71 – 1.37)	0.98 (0.71 – 1.35)
Neonatal morbidity – all cesarean deliveries[b]	0.95 (0.55 – 1.64)	0.95 (0.55 – 1.62)

Reference group = Day for time of delivery

[a] Adjusting for maternal age; years of schooling; race/ethnicity; obesity; parity; gestational age at delivery; gestational diabetes; duration of labor; preeclampsia, HELLP or eclampsia; placental abruption and mode of delivery.

[b] Adjusting for maternal age; years of schooling; race/ethnicity; obesity; parity; gestational age at delivery; gestational diabetes; duration of labor; preeclampsia, HELLP or eclampsia; placental abruption.

Abstract #:S-47

A Rare Neurological case in pregnancy

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A 25 year-old primipara with a long-standing history of Migraine, headache, aphasia and numbness of the left arm two years ago with no history of trauma or infection. Initial CT Scan of the Brain had revealed cerebellar tonsillar herniation through foramen magnum. MRI Scan of the brain confirmed Arnold Chiari Type 1 malformation with tonsillar descent by 4 mm with no hydrocephalus and syringomyelia. Tertiary Hospital referral with Neurological review and repeat CT scan had been done. Final diagnosis was low-lying cerebellar Tonsils. She was discharged from Neurological follow up.

She was now admitted to labour ward with spontaneous rupture of membrane without prior anaesthetic review in pregnancy. Patient was asymptomatic during labour. Labour epidural was requested as patient was induced for prolong rupture of membrane. Epidural catheter had to be re-sited after the first placement, due to analgesic solution leaking from the site of insertion. Maternal and fetal hemodynamics was stable with effective analgesia. The patient had an uneventful normal vaginal delivery.

Discussion: Low-lying cerebellar tonsils has some association with Arnold Chiari malformation. Arnold Chiari Type 0 malformation is characterized by an alteration in Cerebro Spinal Fluid (CSF) hydrodynamics at the level of the Foramen Magnum. Patients with this subtype have syringomyelia either without tonsil herniation or with only mild tonsil herniation-associated findings (1). Neuroaxial anaesthesia is contraindicated in presence of raised intracranial pressure in view of herniation of cerebellar tonsils compressing lower brainstem and upper spinal cord causing life-threatening consequences more so with inadvertent dural puncture. Risk of intracranial haemmorrhage is also high. Spinal anesthesia can present with similar manifestation but the magnitude of the effect and incidence is less compared to epidural induced dural puncture (2). Our decision to perform the epidural was based on the patient having no history or signs of new/severe onset of neurological symptoms in which case we can safely say that regional technique would be contra-indicated. There are no firm guidelines to suggest GA over regional technique as similar risks exist. There are 2 cases of cerebellar tonsils herniation in the UK registry of high-risk obstetric cases. Both cases had Elective LSCS under general anaesthesia (3). Neurological disease does not preclude regional anaesthesia, however multidisciplinary approach and individualized care plan must be made.

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Abstract #:S-48

The Feasibility of Teaching Transthoracic Echocardiography to Anesthetists and Intensivists in a Low Resource Country

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Background: Despite significant improvement worldwide since 1990, rates of maternal mortality remain exceedingly high. Ninety-nine percent of maternal deaths occur in developing countries, and over half of these deaths occur in sub-Saharan Africa. Many of these deaths, however, are preventable. Complications of hemorrhage and pregnancy-induced hypertension are the leading causes of maternal mortality. Intravascular volume assessment and fluid replacement remain challenging in these situations. A noninvasive means of assessing intravascular volume status and myocardial function may improve patient management. Transthoracic echocardiography (TTE) is being used successfully for acute patient care in the emergency department and in the surgical and medical intensive care units. Critically ill obstetric patients are an additional group who may benefit from bedside TTE. We sought to determine the feasibility of teaching basic bedside TTE to both anesthetists and intensivists in Ghana, Africa.

Methods: Nine anesthetists of various levels of experience and one intensivist volunteered to participate in a 2-hour TTE workshop which included a PowerPoint lecture followed by hands-on training using a portable Sonosite MicroMaxx Ultrasound System. Only one anesthetist had any prior exposure to TTE. A 31-question written pre-test was administered prior to attending the workshop; the same test was administered again after workshop completion. A skills test was also administered after completion of the workshop which involved each participant obtaining 5 basic transthoracic echocardiographic views on a volunteer subject. The views were assessed based on accuracy and quality of the images obtained.

Results: All participants improved their written test score after completion of the workshop except for the participant with prior TTE exposure whose score remained unchanged. The ability of participants to obtain accurate TTE views after completion of the workshop was inconsistent as was the quality of images obtained.

Conclusions: After 2 hours of basic TTE training, all workshop participants with no prior TTE exposure improved their written post-test score. These results show that in a short period of time, basic knowledge of TTE can be obtained. However, the ability of participants to obtain accurate TTE images was inconsistent and did not correlate with written test score improvement. These results show that the application of the information learned during the TTE workshop did not translate into obtaining useful, practical images. We conclude that teaching the concepts of basic transthoracic echocardiography to anesthetists and intensivists in low resource countries is quite feasible. However, more instruction and hands-on teaching and experience are required before this new tool can be incorporated into daily use for obstetric patient care.

Abstract #:S-49

Systematic Capture of Regional Anesthesia Quality Metrics for Labor Analgesia

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Background: Neuraxial anesthesia and analgesia is used frequently in obstetrics(1) with varying rates of complications across institutions(2,3). Previous large scale studies have investigated adverse events including dural puncture, venous puncture, paresthesias, and epidural failure and replacement rates(2). However, in order to compare rates of complications and adverse outcomes to national norms the data must be complete and accurate. We initiated a quality improvement (QI) project that compared our current medical record system with an automated electronic medical record (EMR) system to evaluate core regional anesthesia quality measures.

Methods: Medical records were reviewed for completeness and documentation of quality measures including inadvertent dural puncture, aspiration of blood into the epidural catheter, paresthesia during epidural placement, epidural failure requiring replacement or use of a second anesthetic, failure to document bilateral sensory level at least once and patient satisfaction. Data was collected for 10 days before and 10 days after the EMR was changed to mandate completion of all six quality measures before the case could be signed and closed.

Results: Records for 79 patients were reviewed; 36 patients pre-interventions and 43 patients post-intervention. Pre-intervention, gaps in documentation for the quality measures were significant, with missing or unknown responses as follows: parasthesias 14%, blood in catheter 8%, dural puncture 11%, epidural replacement 97%, bilateral sensory levels 31%, and patient satisfaction 64%. The rate decreased to zero for all six quality measures once the mandatory EMR system was instituted. Rates of adverse outcomes could not be compared because data collected before the mandatory reporting change was incomplete.

Discussion: This QI intervention eliminated documentation deficiencies. Adapting the EMR has allowed us to track quality markers related to neuraxial anesthesia. As a result of this study, we are notified of each patient who is dissatisfied with her epidural and investigate each failure prior to discharge. Limitations include using some quality measures that may or may not be important for optimal patient care.

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Abstract #:S-50

The effect of ondansetron on acute opioid tolerance in patients receiving intrathecal opioids prior to cesarean delivery

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Background: Opioids are commonly added to local anesthetic solution in spinal anesthesia for cesarean delivery. The addition of intrathecal (IT) fentanyl improves intraoperative analgesia but may induce acute tolerance to opioids resulting in increased postoperative pain and analgesic requirements (1,2). The 5-hydroxytryptamine type 3 receptor has been identified as a novel target for treating opioid dependence, and ondansetron (a well known antiemetic) has been shown to prevent and reverse opioid-induced hyperalgesia and tolerance in mice (3,4). No study to date has investigated whether or not these results can be generalized to a human population. The purpose of this study is to investigate whether administration of intravenous (IV) ondansetron prior to spinal anesthesia will have an attenuating effect on IT fentanyl-induced acute opioid tolerance and decrease pain scores and postoperative analgesic requirements. Our null hypothesis is that the addition of IV ondansetron prior to spinal anesthesia, including IT fentanyl, will not change postoperative pain scores or analgesic use.

Methods: Eighty-six patients undergoing elective cesarean delivery were recruited and randomly allocated to receive either 8 mg IV ondansetron (n=44) or placebo (n=42) in a prospective, double-blind design. All patients received the same study protocol regimen for spinal anesthesia consisting of 15 mg bupivacaine, 20 micrograms of IT fentanyl, and 100 micrograms of preservative free morphine. This is a secondary analysis, using linear mixed-effects models to assess the difference in pain and opioid consumption in the first 24 hours after surgery between the groups.

Results: No differences between the two groups were found in age, ASA scores, duration of surgery, or sensory and motor block characteristics. There was no difference between the groups in postoperative pain scores (p=0.920) or opioid consumption (p=0.539).

Discussion: In patients undergoing cesarean section under spinal anesthesia, including IT fentanyl, the addition of IV ondansetron prior to spinal anesthesia did not significantly affect post-operative pain scores or opioid consumption. The administration of ondansetron did not have an effect on acute opioid tolerance in this sample.

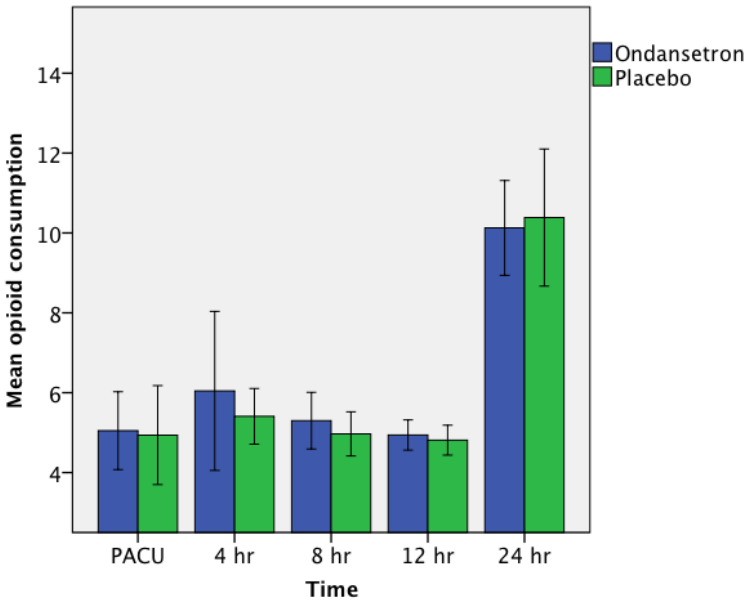

Figure 1. Mean and standard error of postoperative opioid consumption in the first 24 hours

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Abstract #:S-51

Anesthetic Management of Large Volume Cervical Varix in the Second Trimester

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Background: Cervical varices are an extremely rare, potentially life-threatening complication associated with pregnancy. The incidence of cervical varices in pregnancy is difficult to determine, as there are fewer than 10 documented cases1. They are often associated with significant secondary hemorrhage1, resulting in both maternal and fetal morbidity and mortality. It is critical that the anesthesiologist be knowledgeable of the potential management concerns; timing and mode of interventions such as embolization, as well as the potential for emergent delivery. Among the obstetric community, there is limited evidence in the management of these cases which further complicates decision making, and requires close communication between the patient, anesthesia, and obstetric teams. We present our management of a patient with uncontrolled hemorrhage secondary to cervical variceal bleeding in second trimester.

Case: A 22 year old primigravida, at 16 weeks gestation, presented to the ED with one week of intermittent heavy vaginal bleeding. She reported a recent admission at an outside hospital requiring 2 units PRBCs, at which time she was told her bleeding was due to uterine fibroids. Upon workup she was found to have a hemoglobin of 6.0, placenta previa with a small placental abruption, and a large vascular mass in the anterior portion of her cervix suspected to be an AVM or varix. Following transfusion, the patient stabilized and her bleeding temporarily resolved. After extensive counseling, the patient opted for a uterine artery embolization with subsequent dilatation and evacuation of the fetus, should she continue to have significant bleeding. However, prior to her scheduled embolization, the patient developed sudden massive hemorrhage. Emergent embolization in IR was unsuccessful, requiring urgent surgical intervention. Unfortunately, for this patient, the circumstances warranted an emergent hysterectomy, under general anesthesia. Although in this case, the complication of a cervical varix lead to termination of the pregnancy and emergent hysterectomy, careful management by obstetric and anesthesia teams limited morbidity to the patient and her post-operative course was uneventful.

Discussion: We present a rare case, acute hemorrhage in a gravid, second trimester female. In such patients, an adequate plan is key and communication between providers is critical. Anesthesiologists are trained in managing hemodynamically unstable patients secondary to massive hemorrhage. However, special consideration needs to be directed towards the gravid parturient.

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Abstract #:S-52

Does nitrous oxide labor analgesia influence the pattern of neuraxial analgesia usage? An impact study from an academic medical center

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Introduction: Several options are available for pain relief during labor and delivery. Although commonly used in other countries, nitrous oxide (N2O) has only recently undergone resurgence in popularity in the United States. It may be used as a bridge to other methods of analgesia, or for patients who are undecided about epidural analgesia(1). N2O became available at our institution in August 2014. We sought to examine how this would influence the pattern of neuraxial labor analgesia at our institution.

Methods: Data were obtained from a nursing database of N2O usage and from anesthesia billing codes 01967 and 01968: neuraxial analgesia for labor and vaginal delivery, and neuraxial analgesia for labor resulting in cesarean delivery, respectively. We compared 5 months before and 5 months after the introduction of N2O. Availability of N2O was 24 hrs/day, 7 days/week, consistent with neuraxial analgesia availability. N2O was self-administered by patients via a Pro-Nox™ delivery system (N2O:O2 50:50) and monitored by the L&D nursing team.

Results: Total number of births over the study period was 5408: 2660 pre-N2O and 2748 post-N2O. The rate of epidural usage pre-N2O was 76%, and after was 73% (p=NS, Chi-square). A total of 582 patients used N2O. Monthly analysis showed no change in pattern of neuraxial analgesia use in the pre- and post-N2O periods. (Figure). No change in cesarean rate was observed over the study period. Detailed chart review to evaluate the number of patients who utilized both N2O and epidural analgesia during labor is ongoing.

Conclusion: The introduction of N2O for labor analgesia was not associated with any significant change in our epidural rate. Further data analysis will reveal whether these results represent that N2O use was predominantly among women who were committed to non-neuraxial pain relief techniques or natural childbirth, or was used by women as an adjunct to epidural pain relief. Under the conditions of our study, these results suggest that N2O does not discourage neuraxial use for labor pain relief.

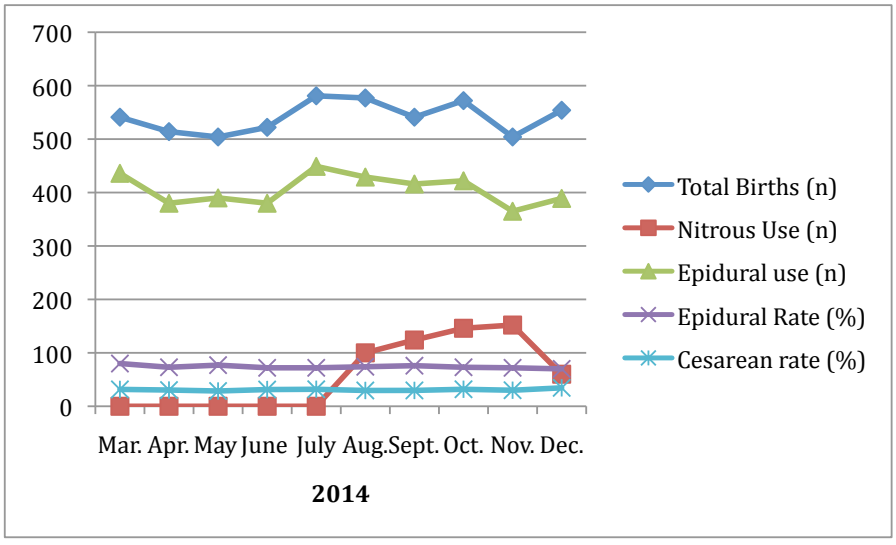

Figure 1. Delivery Trends and Pattern of Analgesia

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Abstract #:S-53

An Impact Study of Cell Salvage Blood Transfusion Practice in a Community Maternal Hospital in China

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Introduction: Postpartum hemorrhage (PPH) is the leading cause of maternal death in China and the world. Allogeneic blood transfusion (RBCT) is an important component of the treatment of PPH. The use of autologous blood obtained via cell salvage blood transfusion (CSBT) has been controversial in obstetric practice because of limited safety data. The current study is designed to investigate the impact of CSBT on safety and blood transfusion (BT) practice in cesarean delivery (CD) parturients (Pts) at high risk for PPH.

Methods: The data was obtained from the database of the blood bank, the billing case log of CSBT, and the electronic medical records in all the Pts who underwent CD and BT in Ningbo Women and Children's Hospital in China during a 48–month period (10/01/2010 – 09/30/2014). There were three phases in the study, baseline (10/01/2010-05/31/2011), implementing (06/01/2011-07/31/2012), and practice (08/01/2012 – 09/30/2014) based on CSBT usage (0.01%, < 45%, >45%, respectively). Transfusion triggers were 8 g/dL and 10 g/dL, for RBCT and CSBT, respectively. The primary outcomes were saved RBCT units/CD, adverse reactions to BT, and hospital discharge Hgb levels in transfused Pts. The secondary outcomes were parameters related to transfusion rates of other blood products, postpartum coagulation profiles, infection issues, ICU stay, and hospitalizations. All rates related to transfusion of CSBT were adjusted by RBCT rate in the baseline phase. All ordinal and continuous data are assessed with Kolmogorov-Smirnov test for normality, and analyzed with $\chi 2$, Student t-Test, or Mann-Whitney U test. $P < 0.01$ was considered significant.

Results: A total of 794 Pts out of 23,462 CD receiving either RBCT (346) or CSBT (448) were included in the study. The proportion of RBCT and CSBT during the study period is illustrated on Fig 1a. Basic characteristics among Pts were comparable in the three phases. On Fig 1b, three units (medium) of allogeneic RBC/CD were saved and the rate of adverse reactions was lower (RR 0.16, 95%CI: 0.07-0.34) with 0% in all CSBT Pts, and lower postoperative BT rate (RR 0.63, 95%CI: 0.44-0.90) . Other outcomes appear on Table 1. Wasted cell salvage collection rates, however, were 25% in Implementing Phase and 50% in Practice Phase.

Conclusions: CSBT saved allogeneic RBCT with a lower transfusion-related adverse reaction rates and higher individual postoperative Hgb level without compromising outcomes but 50% risk of financial costs.

Abstract #:S-53

Table 1: Impacts on Clinical Outcomes Among Parturients in Three Phases

CLINICAL OUTCOMES	BASELINE	IMPLEMENTING	PRACTICE	RR#(95%CI)
Transfusion Rates				
CSBT Rate	0.02%†	0.16%	3.58%^	144 (20-1025)
RBCT Rate	1.77%†	1.90%	1.12%^	0.63 (0.47-0.84)
Postpartum transfusion rates	1.8%†	2.1%	4.7%^	2.6 (3.1-3.4)
Postoperative RBCT rates of PPH partuirients	30.6%	37.0%	23.3%^	0.63(0.44, 0.90) ↟
CSBT beneficial rate	1.39%†	7.95%	76.18%^	54.9 (7.6-396)
Adjusted CSBT beneficial rates	1.39%†	6.83%	29.19%^	21.1 (2.9-153)
Complete RBCT avoidance rate	1.39%†	5.30%	60.77%^	43.8 (6.1-316)
Adjusted complete RBCT avoidance rate	1.39%†	4.56%	23.14%^	16.8 (2.3-122)
Transfused PRBC and Hemoglobin Levels (Hgb)				
Units of RBC transfusion per cesarean delivery	3 (1-21)†	3 (0-17)	0 (0-23)^	
Pretransfusion Hgb (g/dL)	6.9 (3.6-9.9)†	6.9 (4.0-10）	7.9 (3.2-10.9)^	
First postoperative Hgb (g/dL)	8.4 (6.1-12.1)†	8.5 (5.5-12.5)	9.3 (5.6-13.2) ^	
Hospital discharge Hgb (g/dL)	8.9 (6.6-12.4)†	8.9 (6.5-13.5)	9.6 (6.3-13.6)^	
Adverse Reactions				
Transfusion reaction rate	18.1%†	16.6%	7.53%^	0.42(0.21-0.81)
Adjusted transfusion reaction rate	18.1%†	14.2%	2.88%^	0.16(0.07-0.34)
Adverse reaction to CSBT rate	0.0	0.0	0.0	
Coagulation Effects				
FFP transfusion rate	33.3%	47.0%	32.4%^	
Platelet transfusion rate	0.0%	0.0%	3.0%	
Cryoprecipitate transfusion rate	0.0%	1.3%	4.6%	
First postoperative INR	1.01 (0.83-1.39)*†	1.10(0.92-1.47)	1.05 (0.87-2.09)^	
Postoperative day one INR	0.99 (0.8-1.12)*†	1.09 (0.92-1.42)	1.04 (0.79-1.32)^	
First postoperative platelet count	161 (33-363)	160 (40-462)	159 (25-362)	
Postoperative day one platelet count	172 (36-354)	170 (55-384)	174 (46-527)	
Postoperative day one fibrinogen(mg/dL)	254 (94-607)†	265 (88-538）	299 (45-540)^	
Hospital discharge fibrinogen (mg/dL)	322 (171-564)	313 (115-587)	336 (103-597)	
Infections				
Antibiotics use rate	81%†	84%	62%^	
Antibiotics use day	5（3-11）†	4（2-11）	4 (2-11)^	
Efficiency				
Postpartum hospital days	7 (4-15)	7 (4-19)	7 (4-40)	
Total hospital days	11 (5-79)	10 (5-82)	10 (5-90)	
ICU days	3 (0-5)	3 (0-5)	3 (0-8)	
ICU rates	74%	73%	72%	

NOTE: *Comparing data between Baseline and Implementing Phases, P<0.01; †Comparing data between Baseline and Practice Phases, P<0.01; ^Comparing data between Implementing and Practice Phases, P <0.01; #Risk ratio of rate in Practice Phase compared with Baseline Phase. ↟ Over the rate in Implementing Phase.

Abstract #:S-53

Fig 1a.Impact of Cell Salvage Blood Transfusion on PPH Blood Transfusion Practice

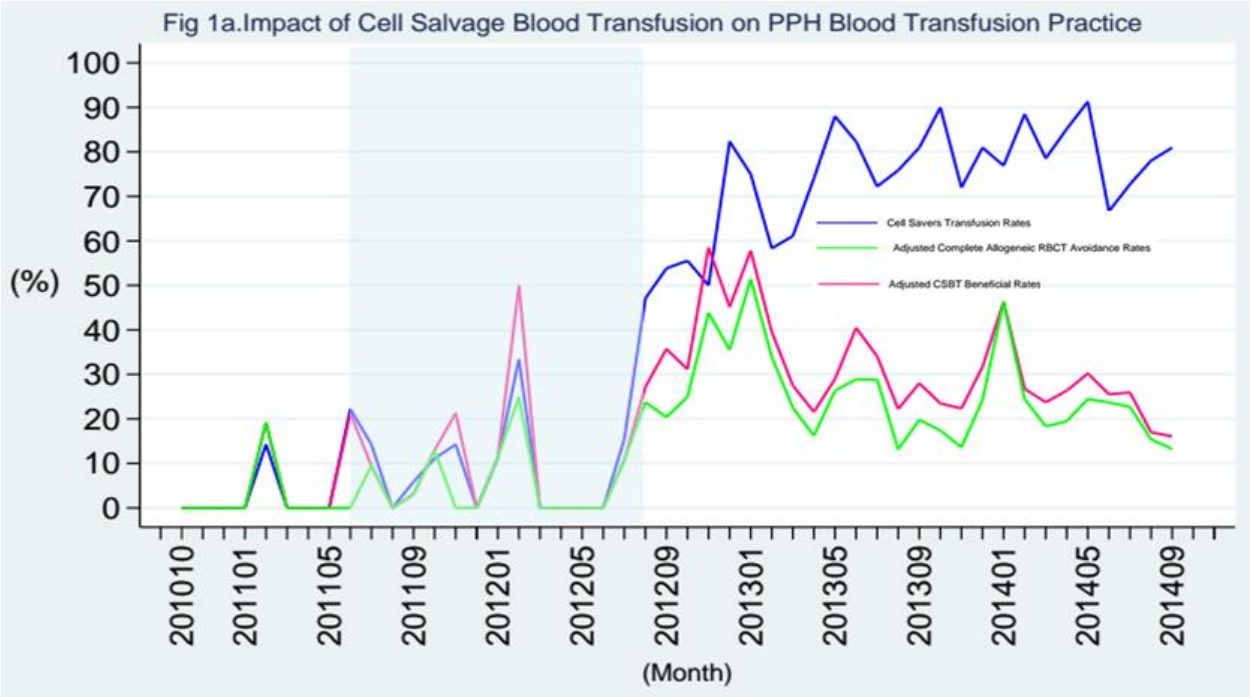
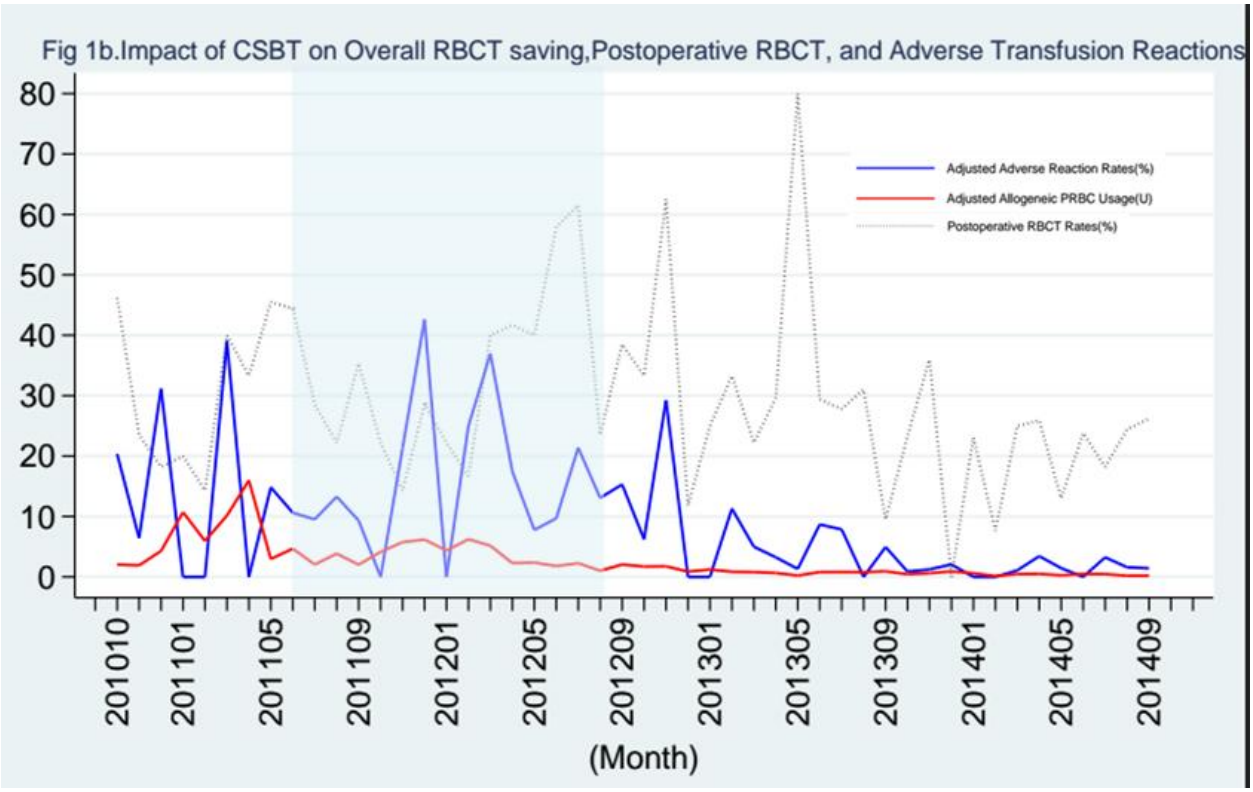


Fig 1b.Impact of CSBT on Overall RBCT saving,Postoperative RBCT, and Adverse Transfusion Reactions



Abstract #:S-54

Anesthesia for Fetal Cardiac Interventions

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Presenting Author's Institution: Brigham and Women's Hospital - Boston, MA
Co-Author: Zhou Jie M.D., M.S., M.B.A. - Brigham and Women's Hospital - Boston, MA

Introduction: Fetal interventions for congenital heart diseases such as aortic or pulmonary stenosis with evolving hypoplastic left heart syndrome (HLHS) have been performed with different types of anesthetic techniques over the past 15 years (1). Mode of anesthesia for fetal surgery at our institution has evolved over time from general anesthesia to neuraxial due to enhanced multi-disciplinary care. The paucity of published data on the maternal and fetal perioperative outcomes under different anesthesia modalities led us to perform a retrospective study.

Methods: We evaluated fetal cardiac surgeries performed at our institution between February 24, 2004 and October 9, 2014. Mode of anesthesia, perioperative maternal and fetal outcomes, length of surgery (LOS), intravenous fluids, opioid usage, incidence of perioperative nausea, vomiting, pruritus (N/V/P), and recovery time were analyzed.

Results: To date, 66 of 130 records were reviewed: 58 percutaneous aortic valvuloplasty for evolving HLHS and 8 percutaneous atrial septostomy for HLHS. Three anesthetics were utilized: 1) GA with spinal with preservative free morphine for postoperative pain (GAWS, n=19), 2) GA alone (GAA, n=20), and 3) Combined spinal epidural or epidural (CSE/E Group, n=27). Maternal complications, anesthetic details, fetal outcomes, and recovery course are listed in the table. The neuraxial technique is linked to less N/V/P, shorter surgical time, less intraoperative fluid and IV opioid use and less maternal airway complications.

Discussion: Our preliminary data show that as the anesthetic method for fetal cardiac interventions transitioned from GA with long acting spinal opioids to neuraxial, fewer side effects such as N/V/P were experienced postoperatively. In the CSE/E group, the shorter surgical time was accompanied by a longer recovery, which is the opposite in the GAWS and GAA groups. Importantly, neuraxial anesthesia afforded the flexibility to pause and resume surgery in cases of fetal malposition, facilitating successful fetal outcomes. Overall, the neuraxial approach avoided maternal airway complications that occurred in some cases of GA, which could result in better maternal safety and satisfaction. Further data collection and analysis will determine if these trends are statistically significant.

References:

1. Freud LR, Circulation 2014

Abstract #:S-54

Mode of Anesthesia		GAWS N = 19	GAA N = 20	CSE/E* N = 27
Case Details	Length of Surgery (min)	155± 38	145±35	112±34
Maternal Anesthetic Details	Intravenous crystalloid (L)	2.3±0.53	2.1±0.78	1.2 ±0.55
	Intravenous fentanyl (mcg)	108 ± 91	150 ± 91	58 ± 51
Complications	Laryngospasm	0	1	0
	Bronchospasm	0	1	0
	Arrhythmia	1	2	0
	Pulmonary edema	1	0	0
	Fetal bradycardia	1	5	6
	Case aborted: fetal malposition**	2	4	0
Postoperative Details	Length of Recovery (min)	110 ± 34	136 ± 56	167 ± 48
	N/V needing treatment	11(57%)	2(10%)	0
	Pruritis needing treatment	7(36%)	0	0

Table - Maternal complications, intraoperative anesthetic details, fetal outcomes, and post operative recovery and side effects reported by anesthesia modes. (GAWS: GA with spinal with preservative free morphine GAA: GA alone CSE/E: Combined spinal and epidural or epidural)

*CSE/E contained no long acting opioids.

**2 cases of fetal malposition in the CSE/E groups were halted for a few hours and resumed successfully.

Abstract #:S-55

Safety of IV tPA in Pregnancy-Related Stroke: Findings from a Large US Stroke Registry

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Background: Tissue plasminogen activator (tPA) is an efficacious therapy for acute ischemic stroke. Pregnancy and recent delivery are thought to pose unacceptable risks of bleeding complications after IV tPA. Pregnant or recently postpartum women with ischemic stroke have been excluded from trials of IV tPA and therefore are rarely treated. We sought to determine the frequency of IV tPA use and short term outcomes among pregnant/recently postpartum vs. non-pregnant women with ischemic stroke entered in Get with the Guidelines® (GWTG) stroke, the largest contemporary U.S. stroke registry.

Methods: GWTG stroke is a national, voluntary quality improvement program sponsored by the American Heart Association with more than 1,700 participating hospitals and over 3 million patients. There were 1928 women aged 18-44 with ischemic stroke who were treated from 2008-2013 with IV tPA (without intra-arterial therapy) who were pregnant or recently postpartum (<6 weeks) (n=15) vs. non-pregnant (n=1913), identified based on medical history or ICD-9 codes. Patient and hospital categorical variables were compared by Chi-square; continuous variables by Wilcoxon Rank-Sum.

Results: Pregnant patients were less likely to receive IV tPA in the 0-3 hr treatment window vs. non-pregnant patients (4.4% vs. 7.9%, p = 0.03) due to pregnancy itself (58% vs. 0%), recent surgery (47% vs. 12%), mild stroke symptoms (16% vs. 31%) or rapidly improving of symptoms (13% vs. 32%). There were no significant differences in major bleeding complications and discharge outcomes were comparable. Overall rates of in-hospital mortality were low (0-2%) and rates of home discharge were high (60-72%). Length of stay was greater among pregnant patients (Table).

Conclusions: Although ischemic stroke in women of childbearing age is uncommon, it can be devastating. Pregnant women with ischemic stroke rarely receive IV tPA, due to the FDA labelled warnings regarding pregnancy. However, in this the largest contemporary series of tPA in pregnancy, the short term outcomes and complication rates compare favorably with non-pregnant women of similar ages. As the data are underpowered to show true differences between the groups, larger prospective studies are warranted to assess the efficacy and safety of thrombolysis during or immediately after pregnancy.

Abstract #:S-55

Table. Patient Characteristics, Treatments and Outcomes after IV tPA Therapy in Pregnant and Non-Pregnant Women with Ischemic Stroke				
Variable	***Overall (N=1928)***	***Pregnant (N=15)***	***Not Pregnant (N=1913)***	***P value***
Age, median (IQR)	39 (34-42)	30 (26-36)	39 (34-42)	**<0.0001**
Race/Ethnicity				0.76
White, n (%)	966 (50.2)	7 (46.7)	959 (50.2)	
Black, n (%)	606 (31.5)	5 (33.3)	601 (31.5)	
Hispanic (any race), n (%)	228 (11.8)	3 (20.0)	225 (11.8)	
Asian, n (%)	32 (1.7)	0 (0.0)	32 (1.7)	
Other, n (%)	94 (4.9)	0 (0.0)	94 (4.9)	
Health Insurance				0.15
Medicaid, n (%)	353 (20.1)	5 (38.5)	348 (19.9)	
Private/Champus/VA/Other, n (%)	991 (56.4)	8 (61.5)	983 (56.3)	
Self pay/None, n (%)	328 (18.7)	0 (0.0)	328 (18.8)	
Symptom Onset Location				0.53
Another acute care facility, n (%)	16 (0.83)	0 (0.0)	16 (0.84)	
While in-patient at hospital, n (%)	67 (3.5)	0 (0.0)	67 (3.5)	
Care Delivery				
Brain imaging completed, n (%)	1885 (97.9)	15 (100.0)	1870 (97.9)	0.85
Onset to treatment time (min), median (IQR)	150 (116-182)	170 (130-208)	150 (116-181)	0.15
Care Measures				
Defect-free care, n (%)	1571 (84.6)	12 (80.0)	1559 (84.6)	0.62
Door to needle ≤ 60 min, n (%)	496 (30.6)	4 (33.3)	492 (30.6)	0.84
Complications				
Symptomatic ICH, n (%)	25 (1.3)	1 (6.7)	24 (1.3)	0.07
Serious/Life-threatening hemorrhage, n (%)	8 (0.4)	0 (0.0)	8 (0.4)	0.80
Other complications, n (%)	40 (2.1)	0 (0.0)	40 (2.1)	0.57
Patient Discharge Outcomes				
In-Hospital mortality, n (%)	39 (2.0)	0 (0.0)	39 (2.0)	0.58
Discharged to home, n (%)	1387 (71.9)	9 (60.0)	1378 (72.0)	0.30
Independent ambulation at discharge, n (%)	1195 (72.1)	7 (53.9)	1188 (72.2)	0.14
Length of stay (days), median (IQR)	4 (2-6)	5 (4-8)	4 (2-6)	**0.05**
Length of stay > 4 days, n (%)	658 (36.7)	10 (66.7)	648 (36.5)	**0.02**
ICH = Intracerebral Hemorrhage; IV tPA = Intravenous Tissue Plasminogen Activator; IQR = Interquartile Range; VA = Veterans Administration				

Abstract #:S-56

Novel Use of Nylon Epidural Catheter for Airway Topicalization During Video Laryngoscopy in a Critically Ill Post-Partum Patient

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Co-Author: Jacqueline M. Galvan M.D. - University of Illinois at Chicago - Chicago, Illinois

Introduction: Intubation for postpartum patients can be challenging. In the immediate post-partum period there is a significant increase in Mallampati score compared to the pre-labor airway. Decrease in pharyngeal area and edema may be contributing factors. These changes D.O. not seem to reverse in the immediate post-partum period and can precipitate difficult or lost airway. When awake intubation is indicated, techniques for anesthetizing the airway may include transtracheal block or topicalized lidocaine. This invasive technique may not be suitable for all patients or providers. Use of a nylon epidural catheter through a fiberoptic bronchoscope for airway topicalization is described, but relies on patient cooperation. We report the novel use of a nylon epidural catheter for airway topicalization during video laryngoscopy in a critically ill post-partum patient.

Case: Patient is a 26 yo G3P2 at 40 weeks gestation who presented with profound dyspnea and repeated fetal decelerations. After emergent cesarean delivery under general anesthesia she was admitted to the ICU due to hemodynamic instability and pulmonary edema. She developed spontaneous pneumothorax, pneumonia, sepsis and renal failure. Post-operative day 2 the patient self-extubated and quickly deteriorated to respiratory distress. Cursory exam noted a morbidly obese woman in extremis, altered mentation, Mallampati 4, short TM.D.. Given immediate post-partum period, pneumothorax, tenuous hemodynamics, difficult airway and inability to cooperate with awake fiberoptic intubation, decision was made to topicalize the airway and intubate while maintaining spontaneous ventilation. 2% lidocaine was transorally applied to the oropharynx via a nylon epidural catheter, which was advanced until cough reflex was elicited. 50 mg of Ketamine was given as an amnestic agent. Patient was intubated quickly and atraumatically using a GlideScope under good conditions with minimal hemodynamic changes.

Discussion: The post-partum airway is challenging to anesthesia providers, particularly since the time to resolution of pregnancy changes are ill defined. Awake fiberoptic intubation is the gold standard in anticipated difficult airway, but may not be feasible in uncooperative patients or when time constraints exist. It is also suggested that awake fiberoptic intubation may have no benefit over awake video laryngoscopy when adequate topicalization is used. Use of epidural catheter with a bronchoscope to anesthetize the airway has been described, but not during video laryngoscopy in a spontaneously ventilating patient. This case describes the novel, efficacious and safe use of a nylon epidural catheter to facilitate airway topicalization during intubation in a post-partum patient in respiratory distress.

References:

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2. Kodail et al. Anesth 108.3 (2008): 357-62
3. Pilkington, S., et al. Br J Anaesth 74.6 (1995)

Abstract #:S-57

A case of acute fatty liver of pregnancy: obstetric and anesthetic implications.

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A 23 year old parturient, gravida 3, para 1, abortus 1, presented at 36 weeks' gestation with nausea, vomiting, pruritus and green discoloration of urine. Her past medical history included asthma, a recently treated urinary tract infection and newly diagnosed gestational diabetes. Her partner was known to be Hepatitis C positive. Her initial lab work revealed elevated transaminases beyond 1000 U/l, impaired coagulation (fibrinogen 124 mg/dl, INR 1.6) and liver function (albumin 2.7 gm/dl, total bilirubin 3.4 mg/dl) but a she had a normal platelet and white blood cell count. Renal function was impaired (creatinine 1.0 mg/dl) and her blood glucose level was trending between 60 and 100 despite the diagnosis of gestational diabetes. Ultrasound of the right upper quadrant showed evidence of hepatic steatosis but no signs of cholecystitis or cholelithiasis. Hepatitis serology was sent but came back negative. Urine samples showed no proteinuria and her blood pressure was not elevated. At this point the diagnosis of acute fatty liver of pregnancy (AFLP) was made and the plan was to deliver within the next 24 hours.

After stripping of membranes the patient was induced with misoprostol. Despite transfusing nine units of FFP and one unit of cryoprecipitate, her coagulopathy could not be corrected and therefore the patient did not receive neuraxial anesthesia. Pain control was accomplished using intravenous narcotics. The next morning the patient had a vaginal delivery of a healthy baby girl.

The patient subsequently complained of shortness of breath, possibly due to transfusion related volume overload. However a chest radiograph did not show clear evidence of volume overload. For further observation the patient was transferred to the intensive care unit and treated with intravenous diuresis. Later on the patient developed a fever as well as uterine tenderness and was started on empiric antibiotic therapy for endometritis. Despite acute liver failure, the patient did not show any signs of cerebral edema.

The next day her symptoms improved, transaminases fell below 200 U/l and she was transferred to the postpartum unit. Fever resolved and urine output improved over the next 24 hours. Antibiotics were discontinued the following day and after one more night of observation she was discharged home.

On a follow up appointment four days later, blood work revealed transaminases below 100 U/l, improved coagulation (fibrinogen 164 mg/dl), recovered liver (INR 1.1) and kidney function (creatinine 0.6 mg/dl).

This patient had AFLP but made a rapid recovery with no complications. We ruled out preeclampsia, which can sometimes co-exist with AFLP. Most patients present late in the disease process and in those circumstances there is a significant increase in maternal and neonatal morbidity and mortality. The differential diagnosis, prognosis, treatment, intensive care management and anesthetic implications of AFLP will be presented at the poster session.

Abstract #:S-58

Labor and assisted-vaginal delivery in the setting of left ventricular noncompaction cardiomyopathy

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Co-Author: Christopher James M.D. - University of Florida College of Medicine Jacksonville - jacksonville, Florida

Introduction: Left ventricular noncompaction cardiomyopathy (LVNC) is a relatively rare primary genetic cardiomyopathy believed to be caused by the arrest of the normal embryogenesis of the endocardium and myocardium. LVNC shows variability in its genetic pattern, pathophysiology and clinical presentations, ranging from asymptomatic patients to those who develop ventricular arrhythmias, thromboembolism, heart failure and sudden cardiac death. Pregnancy outcomes in LVNC are currently not well described. We present a rare case of LVNC in a preterm patient induced for preeclampsia, and the first reported case of an epidural anesthetic for labor and instrumented-vaginal delivery.

Case Report: A 29 year-old (G3P1011) at 36+4 weeks gestation with a past medical history of congenital LVNC on Cavedilol presented with severe headache, high blood pressures, and new onset facial swelling. Pre-labor transthoracic echocardiography was significant for moderate left atrial and ventricular enlargement, marked apical trabeculation, global hypokinesis and an ejection fraction of 30-35%. Fluid restriction at 50ml/hr and magnesium sulfate was started on induction of labor for preeclampsia. An epidural was placed at L4-5 interspace with a bolus of 3ml of 1.5% lidocaine and a subsequent infusion of 0.1% bupivacaine and 2 mcg/ml of fentanyl at 10 ml per hour. After an uneventful labor course, during the second stage of labor, the epidural was dosed over 90 minutes with lidocaine 2% with epinephrine and fentanyl 100 mcg in small aliquots of 3 to 5 ml. On complete cervical dilation and fetal presentation at +3 station, the block resulted in a T6 dermatome level. Despite this high sensory level, there were no significant hemodynamic changes resulting in a successful, painless outlet forceps vaginal delivery. Repeat post-delivery echo was unchanged and she was discharged on post-partum day 3 without any sequelae.

Discussion: LVNC or "spongy myocardium" is characterized by a compact epicardial layer and a non-compacted endocardial layer with prominent trabeculations. It is an uncommon condition with a genetic pre-disposition that can occur in isolation or in association with other cardiac anomalies. Management is directed at clinical manifestations: heart failure, arrhythmias, and systemic embolic events. With respect to the few case reports in the literature, initial presentation/ prognosis varies, with parturients presenting asymptomatic to fulminant heart failure requiring transplantation. Pregnancy and childbirth can usually be managed successfully in patients with LVNC, as in other cardiac conditions, if the diagnosis is made early and appropriate interventions are performed as occurred in this case, depicting the first reported case with an epidural anesthetic for labor and vaginal delivery.

References:

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Abstract #:S-59

Postpartum DIC with an epidural in situ and bleeding at the site

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Introduction: Epidural hematoma is a common fear but uncommon occurrence in obstetric anesthesia. Disseminated intravascular coagulation (DIC) and epidural-site bleeding present a high-stakes dilemma for diagnosis and management.

Case: A 31 year old G1P0 presented for induction of labor at 40+ weeks. Approximately 5 hours after an uneventful epidural placement, emergency cesarean was done due to non-reassuring fetal heart tones. The block was inadequate, and general anesthesia was induced. Delivery of the fetus was uncomplicated, but severe hypotension developed after placenta removal, requiring epinephrine to resolve. The working diagnosis was amniotic fluid embolism (AFE), so a DIC panel was drawn. The remainder of the cesarean was uneventful. Estimated blood loss (EBL) was 600cc.

When the drapes were removed, significant vaginal bleeding and a pool of blood under the patient were noted. Bleeding could not be controlled with a Bakri balloon and vaginal packing, so the abdomen was re-opened. 500cc of blood without clot, and bleeding from the hysterotomy site and peritoneal edges were found. The DIC panel resulted, showing D-dimer>34, fibrinogen<35, INR>10, PTT>200, and 126,000 platelets. With AFE the likely etiology, supportive care was considered the best approach. O'Leary sutures and Floseal were used for hemostasis. The abdomen was packed and fascia closed. 8 units PRBCs, 9 units FFP, 3 units cryoprecipitate, 2 platelet six-packs, 500cc albumin, and 5 L crystalloid were given. EBL was 6 L.

On transfer of the patient to her bed, significant oozing from the epidural site was noted. Due to sedation, neurologic assessment could not be done. Neurosurgery was consulted and recommended a CT scan to determine the need for urgent surgical intervention for epidural hematoma. A suspicious area was noted on the non-contrast CT, and confirmatory MRI was recommended by radiology. The risk of heat-induced tissue injury with an in-situ lumbar catheter and a 1.5-Tesla MRI were insufficiently known to recommend the MRI with the catheter-in situ. The patient's most recent platelet count was 19,000.

Epidural hematoma is a known risk of catheter removal in coagulopathic patients, so the care team weighed the risks of waiting for normalized coagulation v. proceeding with imaging. The potential tissue injury of MRI with the catheter in situ, and the delay for serial lab tests and transfusions were considered unacceptable. 2 six-packs of platelets were transfused and the catheter removed. MRI showed a hematoma at L3-L4, and the patient was managed expectantly. She was discharged to home on postpartum day 10 neurologically intact.

Discussion: The MRI compatibility of epidural catheters in vivo is essentially unknown. There is a paucity of data regarding them quantity of heat generation with MRI coils other than the transmit/receive RF head coil.

References:

http://mrisafety.com/SafetyInfov.asp?SafetyInfoID=292

Reg Anesth & Pain Med 2014; 39

Abstract #:S-60

Obstetric Anesthesia Clinics: A survey of Academic Centers in the United States

Presenting Author: Mohamed Tiouririne M.D.
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Co-Author: Alexander J. Butwick M.B.B.S., FRCA, M.S. - Stanford University - Stanford, CA

Introduction: The anesthetic management of high-risk obstetric patients is often challenging. Knowledge of patients' pre-existing morbidities and functional status is important in tailoring anesthetic and interdisciplinary plans for labor and delivery. An obstetric anesthesia clinic (OAC) can provide an ideal venue for facilitating anesthetic pre-delivery planning, (1) however, the adoption of OACs in contemporary anesthetic practice is uncertain. Our study aim was to examine the use and characteristics of OACs in US academic hospitals.

Methods: We identified US academic hospitals with ACGME accredited anesthesia residency programs (www.acgme.org). For each hospital, the obstetric anesthesia director was contacted by email and invited to complete an online survey. In the survey specific questions were asked about the operational characteristics of the OAC, if present, within each institution. Data are presented as median [IQR], n(%). Categorical data were analyzed using Fisher's test: $P<0.05$ as statistically significant.

Results: 113 obstetric anesthesia directors were contacted and 65 directors completed the survey (response rate=58%). L&D units were categorized into three groups (tertiles) according to delivery volume: low, medium and high volume = 1800 [1500-2000], 3000 [2500-3500], and 4500 [3950-7000] deliveries per year respectively (Table). Overall, only 38% hospitals had an OAC. The proportion of hospitals with an OAC and the operational hours of the OACs did not vary by delivery volume. OACs were generally staffed by anesthesiologists, with residents involved in over half the OACs. Disappointedly, the directors reported that obstetricians did not always refer high-risk patients to the OAC; the frequency of OAC referral by obstetricians was inconsistent. None of the directors indicated that obstetricians 'always' referred patients to the OAC, with 44% directors reporting that obstetricians 'never' referred patients.

Conclusion: In this survey, less than half of all academic hospitals had an OAC. Although organizational characteristics of an OAC were inconsistent, these were not influenced by hospital delivery volume. Future studies are needed to determine whether implementation of an OAC improves the anesthetic management and peripartum outcomes of high-risk patients..

References:

1. SOAP Summer Newsletter 2014

Abstract #:S-60

Table: Characteristics of the system-wide processes for the referral of high-risk women to obstetric anesthesiologists

	All hospitals (n=65)	Low volume hospitals (n=25)	Medium volume hospitals (n=20)	High volume hospitals (n=20)	P value
Number of deliveries / year	2700 [2000-3800]	1800 [1500-2000]	3000 [2500-3500]	4500 [3950-7000]	
OAC					0.68
Yes	25 (38%)	11 (44%)	8 (40%)	6 (30%)	
No	37 (57%)	13 (52%)	12 (60%)	12 (60%)	
Unknown	3 (5%)	1 (4%)	0	2 (10%)	
For Hospitals with an OAC					
Operational frequency of the OAC					0.06
> 1 clinic/wk.	10 (40%)	8 (73%)	2 (25%)	0	
1 clinic /wk.	5 (20%)	1 (9%)	2 (25%)	2 (33%)	
1-clinic/2 wks.	3 (12%)	1 (9%)	1 (12%)	1 (17%)	
1-clinic/4 wks.	1 (4%)	0	0	1 (17%)	
Other	6 (24%)	1 (9%)	3 (38%)	2 (33%)	
Staffing of OAC*					
Attending	20 (30%)	9 (82%)	5 (63%)	6 (100%)	0.22
Resident	13 (52%)	6 (55%)	4 (50%)	3 (50%)	1.0
Fellow	5 (20%)	1 (9%)	2 (25%)	2 (33%)	0.55
Other	3 (12%)	1 (9%)	2 (25%)	0	0.43
How often does the obstetrician refer to the OAC?					0.92
Always	0	0	0	0	
Sometimes	3 (12%)	1 (9%)	2 (25%)	0	
Rarely	6 (24%)	3 (27%)	2 (25%)	1 (17%)	
Never	11 (44%)	5 (46%)	3 (37%)	3 (50%)	
Unknown	5 (20%)	2 (18%)	1 (13%)	2 (33%)	

Data presented as median [IQR] and n(%).
OAC = obstetric anesthesia clinic
* Percentages may be >100% as more than one person may staff the clinic

Abstract #:S-61

Long term sequelae following post dural puncture headache- an unreported problem?

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Co-Author: Shashi Timalpur M.D., FRCA - Glasgow Royal Infirmary - Glasgow, Lanarkshire
Hanlie Du Plessis M.D., FRCA - Glasgow Royal Infirmary - Glasgow, Lanarkshire
Kerry Litchfield M.D., FRCA - Glasgow Royal Infirmary - Glasgow, Lanarkshire

Background: Post dural puncture headache (PDPH) is a well-recognised short term complication following central neuraxial blockade for labour analgesia and delivery (1).However, the long term sequelae following PDPH or epidural blood patch(EBP) is less well described.There was a belief in our department that there was a cohort of women who had long term symptoms from a PDPH who had not been identified and received no follow up. As a result of this we introduced a new service for women who had experienced a PDPH or received an EBP. They were identified by our routine post-natal follow up and if they were still experiencing symptoms related to their PDPH/EBP they were offered a clinic appointment.

Method: Over a 2 year period,our department identified 53 women who were suffering from a PDPH. This gave an incidence of PDPH following an Epidural of 1.17% and spinal of 0.4%.EBP was performed in 34/53 (64%) and of these a repeat EBP was performed in 6/34(17%).

Cases: during the follow up period we identified 6 patients who were experiencing long term symptoms:4 with headaches and 2 with back pain. Of the 4 patients with chronic headaches 3 sustained an accidental dural puncture with an 18G Touhy needle and 1 a spinal anaesthetic with a 25G Sprotte. 3 patients received an EBP. Imaging was only performed in 1 patient with a normal MRI brain/spine with no evidence of intra-cranial hypotension, 'sagging brain'.

Both of the patients complaining of chronic lower back pain sustained an ADP with an 18G Touhy. Both received an EBP and 1 required a repeat EBP after a normal CT head. Neither patient reported back pain prior to pregnancy.

Discussion: Here we describe 6 women over a 2 year period at our institution that experienced chronic pain most likely resulting from a PDPH or EBP. Our figures show that if a patient suffered a PDPH at our institution they have a 7.5% (4/53) risk of a chronic headache. Risk of chronic back pain following EBP was 5.8% (2/34). Long term sequelae related to EBP is of particular relevance currently due to the recent publication advocating prophylactic EBP via in-situ Epidural catheter that was sited after an ADP(2).

The patients experiencing chronic headaches reported headaches consistent with classical PDPH symptoms and also of a completely different nature. This raises the possibility of a PDPH resulting in the initiation of pain pathway unrelated to the initial injury ie CSF leak.

Conclusion: We postulate that chronic pain following PDPH is an under reported long term sequelae. However, for this to be properly elucidated a far larger number patients would require to be investigated across many centres.

References:

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2. Stein MH,Cohen S,Mohiuddin M.A. et al.Prophylactic vs therapeutic blood patch for obstetric patients with accidental dural puncture-a randomised controlled trial. Anaesthesia.2014 Apr;69(4):320-326

Abstract #:S-62

Management of a patient Goldenhar syndrome,difficult airway, placenta accreta and intra-operative hypotesion secondary to cell salvage blood

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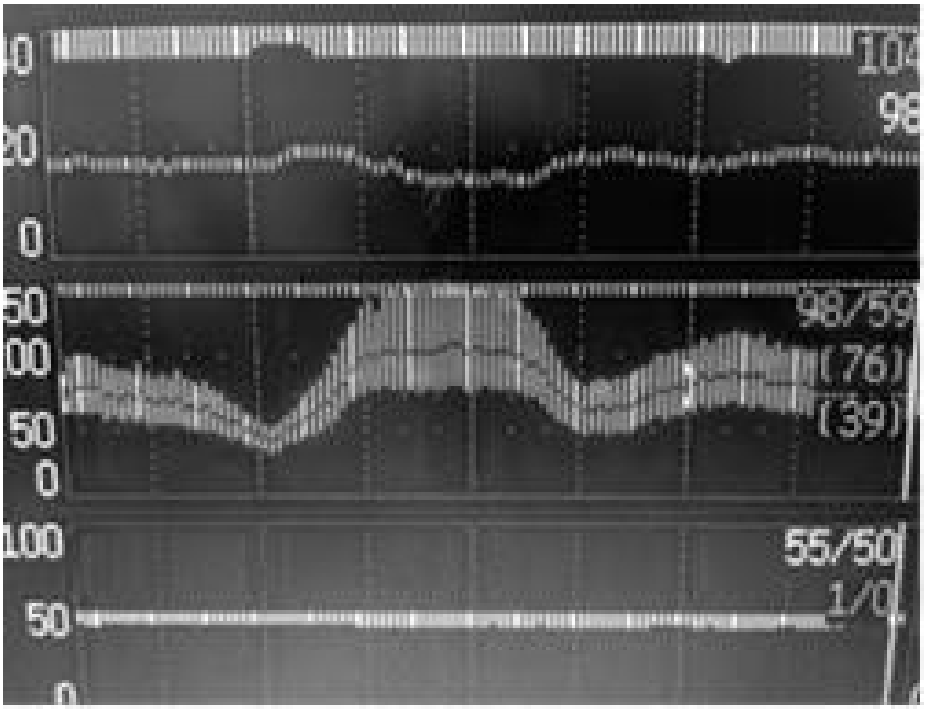
Background: Goldenhar syndrome,also known as oculoauricular vertebral dysplasia,first described in 1952,is a rare congenital abnormaility characterised by unilateral incomplete development of the ear, nose, soft palate and mandible. When these occur with spinal abnormalities it is known as Goldenhar syndrome.Treatment is usually confined to surgical interventions to help the child develop. Case:28 year old para 2+0,2 previous caesarean sections(CS) under spinal anaesthesia,with Goldenhar syndrome was diagnosed with probable placenta accreta on ultrasound.She was unable to have an MRI due to the presence of extensive spinal metalwork.Airway examination revealed marked facial asymmetry,mallampati grade2,receding jaw and limited neck extension.The decision was made to perform an elective CS at 35 weeks under a general anaesthetic.Her blood tests were unremarkable. Interventional radiology inserted bilateral iliac balloons under local anaesthetic prior to incision.Her airway was secured with an awake fibreoptic intubation and then she was induced with propofol 200mg.A radial arterial line was inserted and cell salvage was available. Visual inspection of the uterus revealed placental invasion through the uterine wall but not into any adjacent structures.A live baby boy was delivered through a vertical uterine incision. Due to the fixation of the placenta it was decided to perform a hysterectomy. Blood loss was 1500ml in total and we returned 600ml via cell salvage.Twice during this the patient experienced profound hypotension which resolved with phenylephrine and stopping the infusion.See pic 1. This has been reported previously in the literature(1) and is thought to be due to the use of a leucocyte depletion filter. We performed bilateral TAP blocks prior to emergence and provided a morphine PCA.Post-operatively the patient went to the obstetric HDU and made a good recovery.

Discussion: This patient provided a number of anaesthetic and obstetric challenges. Her care mandated the involvement of a multi-disciplinary team, which resulted in a good outcome for both mother and child.This case highlights the benefits of effective multi-disciplinary care.Furthermore, it also illustrated the potential hypotensive response to cell salvage auto-transfusion via a leucocyte depletion filter.



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Abstract #:S-63

Management of a pre-eclamptic parturient with a Liver transplant, chronic rejection and thrombocytopenia

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Background: Pregnancy in women who are recipients of liver transplants is generally associated with a good outcome. However, they carry high risk to the patient, fetus and allograft. A meta-analysis of studies from the UK, USA, Italy and Poland showed higher rates of pre -eclampsia, pre-term births,caesarean section rates and lower birth weight(1).

Case: 20 year old primigravid women at 27 weeks.She had previously received a liver transplant 3 years ago for auto-immune hepatitis with one episode of acute rejection due to poor compliance with her medication.This had continued and she had evidence of chronic rejection.Furthermore, she had chronic thrombocytopenia with platelet counts of 80-100x10/L. Her immunosuppressant therapy was prednisolone and tacrolimus. During routine obstetric review she was found to be pre-eclamptic which necessitated transfer to a tertiary centre.She was commenced on oral Labetalol and a magnesium infusion to reduce the risk of fetal cerebral palsy. The national liver unit was contacted who recommended increasing her prednisolone. Fetal ultrasound demonstrated absent end diastolic flow and therefore caesarean section(CS) was required. Blood results - Hb132g/l, WCC 6.4 x 10 /l, platelets 76x10 /l, bilirubin 10,ALT82,AST 90, urate 0.66, urea 9.6 and creatinine 64, coagulation screen normal. The decision was taken to perform a general anaesthetic due to her thrombocytopenia.A rapid seuquence induction was performed with alfentanil 1mg, thiopentone 375mg and suxamethonium 100mg and her airway was secured uneventfully.CS was uncomplicated and a live boy was delivered weighing 810g. Formal apgars were not recorded. Blood loss was 300ml. For analgesia she received 15mg morphine and ultrasound guided TAP blocks prior to extubation. Insertion of a nasal temperature probe resulted in an epistaxis which settled. Her post -operative recovery was complicated by a wound infection, which was treated successfully with co amoxiclav.

Discussion: This case highlights the importance of an effective multi-disciplinary approach to complex patients. Transfer to a tertiary centre and telephone advice from a national centre contributed to good outcomes for mother and baby. With rising transplant rates it is likely that more patients who have received an organ will become pregnant and require mulit-disciplinary input during their pregnancy. A platelet count of 80x10 /l is used as a surrogate safety marker for regional anaesthesia in the obstetric population. However, there is no specific evidence base to support this and some anaesthetists may have opted for a regional technique for the caesarean section, particularly with the normal coagulation screen.

References:

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Abstract #:S-64 & MA-04

Local anesthetic wound infiltration for post-cesarean analgesia: a systematic review and meta-analysis

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Introduction: Inadequate postoperative analgesia is one of the most common causes of poor patient satisfaction following cesarean delivery (CD). Wound infiltration with local anesthesia has been investigated as a potentially useful method for providing analgesia after CD. We performed this systemic review and meta-analysis to assess the efficacy of local anesthetic wound infiltration for postoperative analgesia following CD.

Methods: We searched MEDLINE, EMBASE, CENTRAL and CINAHL for studies that assessed the efficacy of continuous or single injection wound infiltration with a local anesthetic for post cesarean analgesia. Only randomized controlled trials that compared local anesthetic wound infiltration versus control and reported post-cesarean pain scores and/or opioid consumption were included in the review. Studies were combined according to their use or non-use of intrathecal morphine (ITM). Studies that involved continuous wound infusion were analyzed separately from single injection. We assessed pain scores and opioid consumption at 6, 24 and 48 hrs after surgery, as well as opioid related side effects. We analyzed data using random effects model.

Results: A total of 17 studies were included in this review (8 studies with continuous infusion and 9 studies with single injection). In 13 studies the CD was performed under spinal anesthesia, 1 study used epidural anesthesia, and 3 studies used general anesthesia. Results are summarized in the table. In patients who did not receive ITM, continuous wound infusion with a local anesthetic significantly reduced pain scores at rest at 6 hours, during movement at 24 and 48 hours, as well as opioid consumption at 6, 24, and 48 hours. There was a decrease in nausea in patients with continuous local anesthetic infusion who did not receive ITM. Single injection infiltration with a local anesthetic significantly reduced opioid consumption at 24 hours in patients who did not receive ITM and decreased pain scores at rest at 24 hours in patients who received ITM.

Conclusion: Local anesthetic wound infiltration might be an effective modality for improving post CD analgesia. However, there is a lack of data on the efficacy of this technique in patients who receive neuraxial morphine.

Outcome	Continuous Infusion		Single Injection	
	Without ITM	With ITM	Without ITM	With ITM
Pain scores at 6h (at rest)	-1.48 (-2.44, -0.52) {3}	NA	-0.84 (-1.93, 0.24) {6}	NA
Pain scores at 6h (with movement)	-1.77 (-3.58, 0.05) {3}	NA	-1.33 (-3.91, 1.25) {2}	NA
Pain scores at 24 h (at rest)	-0.52 (-1.03, -0.00) {6}	NA	0.01 (-0.21, 0.24) {6}	-0.09 (-0.15, -0.03) {2}
Pain scores at 24h (with movement)	-1.03 (-2.03, -0.02) {4}	NA	-0.38 (-1.13, 0.36) {2}	0.60 (-0.8, 2.03) {1}
Pain scores at 48 h (at rest)	-0.10 (-0.53, 0.33) {4}	NA	0.00 (-0.29, 0.29) {2}	0.20 (-0.63, 1.03) {2}
Pain scores at 48h (with movement)	-0.88 (-1.59, -0.18) {2}	NA	NA	NA
Morphine consumption at 6h	-8.12 (-10.38, -5.87) {2}	NA	NA	NA
Morphine consumption at 24 h	-14.68 (-25.72, -3.64) {5}	1.25 (-4.02, 6.52) {1}	-9.32 (-15.05, -3.60) {4}	NA
Morphine consumption at 48 h	-17.67(-26.84, -8.50) {5}	3.12 (-3.37, 9.62) {1}	NA	NA
Opioid related side effects				
Nausea	0.52 (0.33, 0.82) {4}	NA	0.70 (0.40, 1.21) {3}	0.43 (0.05, 3.54), {2}
Vomiting	0.58 (0.25, 1.32) {2}	NA	0.73 (0.44, 1.20) {4}	2.37 (0.10, 56.76) {1}
Pruritis	0.84 (0.52, 1.35) {2}	NA	0.49 (0.23 , 1.04) {2}	0.56 (0.23 , 1.37) {1}

Table 1- Data is expressed as mean difference or relative risk (95% CI) {number of studies included in the analysis}; NA, not applicable

Abstract #:S-65

Vaginal Delivery in a Mother with Pulmonic Atresia

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Introduction: Pregnant women with complex congenital heart disease are becoming increasingly more common due to better pediatric care. Our patient was a 29 year old woman with a history of pulmonary atresia with an intact ventricular septum (PAIVS) and atrial septal defect (ASD) who presented in labor.

Case: Patient had presented with cyanosis soon after birth, followed by pulmonary valvectomy at 2 days , and left modified Blalock-Taussig shunt (BTS) at 6 days. She developed a left pulmonary artery (LPA) stenosis at 3 months which required BTS take down. ASD closure was done at age 6 followed by LPA angioplasty and stenting at age 9, and she developed pulmonary valve insufficiency. Residual LPA stenosis on VQ scan in 2012 (L lung perfusion 28%, R lung 71%) required another angioplasty and LPA stent. Supraventicular and ventricular arrhythmias on a Holter monitor required metoprolol therapy . Cardiac MRI 1 year prior to pregnancy showed severe pulmonary insufficiency, regurgitant fraction 40%. Fetal echocardiogram was normal. Illustrations included in poster.

This patient had been followed closely by the Adult Congenital Heart Disease Clinic during her pregnancy, and vaginal delivery planned. She (G2P0010) presented to L&D at 38w5d with contractions and with our urging was admitted to a maternal high risk telemetry unit. No invasive maternal monitors were planned. Elevated blood pressures existed so preeclampsia evaluation was pursued and found negative. She received a combined spinal epidural technique with 0.2 mg of intrathecal morphine with 20 mcg of fentanyl which kept her comfortable for 4 hours, at which time the epidural catheter was activated with 6 cc of 0.08% bupivacaine with 2 mcg fentanyl per ml, and a PCEA pump started at 6 cc/hr with an 8 min lock out and maximum of 21 cc/hr. She did not require use of her PCEA button. The infusion was decreased due to numbness for a trial of maternal pushing (TOMP). TOMP was abandoned shortly due to maternal fatigue and shortness of breath. A forceps assisted delivery was accomplished without epidural reactivation. A male child was born with Apgar scores 8 &9. Mother developed symptomatic tachycardia after delivery with oxytocin administration, and lower extremity swelling for one week postpartum.

Discussion: PAIVS is characterized by either complete obstruction of the right ventricular outflow tract, or an absence of a passage between the ventricular mass and PAs with an intact ventricular septum. Repair strategies depend on anatomy. Infants rely on continued patency of the arterial duct as an alternative source of pulmonary blood flow in extrauterine life until intervention. Adult survivors have a high incidence of arrhythmias and reintervention. Multidisciplinary medical coordination and communication is essential for these patient's lifetime, but with careful management women with this disorder can reproduce and live quality lives.

Reference:

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Abstract #:S-66 & MA-06

A meta-analysis assessing the effect of active warming on maternal and neonatal outcomes

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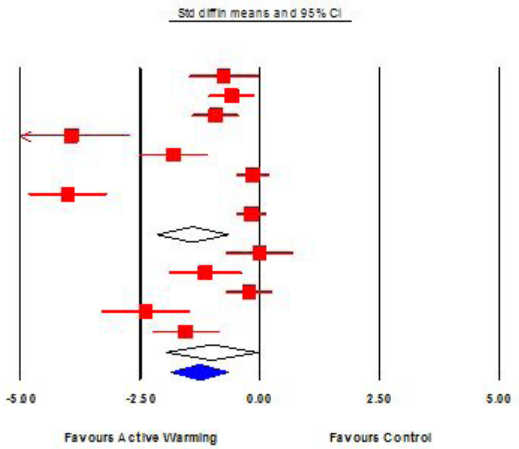
Introduction: Active warming is recommended to maintain normothermia for surgical procedures under anesthesia. The role of perioperative warming for cesarean delivery is uncertain and currently not considered standard of care. This meta-analysis aimed to determine the efficacy of active warming on maternal and neonatal outcomes following elective cesarean delivery.

Methods: We searched databases (PUBMED, EMBASE, SCOPUS, MEDLINE, CINAHL) and the Cochrane Central Register of Controlled Trials using MeSH terms and text words "temperature OR warming" AND "caesarean." We included randomized controlled trials utilizing forced air warming or warmed fluid that commenced warming within 30 minutes of neuraxial anesthesia placement. Study quality was graded using the Jadad 5 point scale. The primary outcome was maximum change in core temperature. Secondary outcomes included maternal (temperature at the end of surgery, shivering, thermal comfort, hypothermia, vomiting, vasopressor use) and neonatal (temperature, umbilical cord pH and Apgar scores at 1 and 5 minutes) outcomes. Standardized mean difference / mean difference / risk ratio (SM.D./M.D./RR) and 95% confidence interval (CI) were calculated using random effects modeling (CMA, version 2, 2005).

Results: 13 studies (median Jadad score 3; range 0-5) met our criteria. 789 patients (416 warmed and 373 controls) were analysed for the primary outcome. Warming significantly reduced core temperature change (SM.D. -1.27 [- 1.86, -0.69]; p=0.00002), and resulted in higher temperatures at the end of surgery (M.D. 0.43 [0.27, 0.59]; p<0.00001). Warming was associated with significantly less shivering (RR 0.58 [0.43, 0.79]; p=0.0004), improved thermal comfort (SM.D. 0.98 [0.24, 1.72]; p=0.01), and a lower incidence of hypothermia (RR 0.66 [0.50, 0.87]; p=0.003). The incidence of vomiting and vasopressor use did not vary significantly between groups. Neonatal outcomes did not vary between groups except for umbilical artery pH, which was higher in the warmed group (M.D. 0.02 [0, 0.05]; p=0.04).

Conclusion: Active warming for elective cesarean delivery decreases core temperature reduction, and decreases the incidence of hypothermia and shivering. Findings from this meta-analysis suggest that forced air warming or warmed fluid should be utilised for elective cesarean delivery.

Group by Subgroup within study	Study name	Std diff in means	Warming Method	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value	Sample size Warming	Sample size Control
Fluid	Chung	-0.750	Fluid	0.378	0.143	-1.490	-0.010	-1.985	0.04711	15	15
Fluid	Goyal	-0.587	Fluid	0.255	0.065	-1.087	-0.086	-2.297	0.02159	32	32
Fluid	Woolnough	-0.919	Fluid	0.256	0.066	-1.421	-0.417	-3.587	0.00033	50	25
Fluid	Yokoyama	-3.922	Fluid	0.624	0.390	-5.146	-2.699	-6.283	0.00000	15	15
Fluid	Chan	-1.806	Fluid	0.376	0.141	-2.542	-1.070	-4.809	0.00000	21	19
Fluid	Jorgensen	-0.142	Fluid	0.188	0.035	-0.511	0.228	-0.752	0.45227	57	56
Fluid	Smith	-4.000	Fluid	0.423	0.179	-4.830	-3.170	-9.448	0.00000	35	32
Fluid	Paris	-0.170	Fluid	0.164	0.027	-0.491	0.152	-1.033	0.30161	73	76
Fluid		-1.428		0.381	0.145	-2.175	-0.682	-3.751	0.00018		
Forced Air	Butwik	0.000	Forced Air	0.365	0.133	-0.716	0.716	0.000	1.00000	15	15
Forced Air	Chung	-1.131	Forced Air	0.393	0.155	-1.902	-0.361	-2.877	0.00402	15	15
Forced Air	Fallis	-0.222	Forced Air	0.255	0.065	-0.721	0.278	-0.870	0.38451	32	30
Forced Air	Horn 2002	-2.374	Forced Air	0.477	0.227	-3.309	-1.440	-4.980	0.00000	15	15
Forced Air	Horn 2014	-1.537	Forced Air	0.360	0.130	-2.243	-0.831	-4.267	0.00002	19	21
Forced Air		-1.023		0.485	0.236	-1.974	-0.071	-2.107	0.03514		
Overall		-1.274		0.300	0.090	-1.861	-0.687	-4.251	0.00002		



Abstract #:S-67

How Well D.O. We Teach Obstetric Anesthesia To Our Residents? An Analysis of ABA ITE Results

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Introduction: All academic obstetric anesthesiologists have established teaching curricula for residents and fellows. However, while similar topics are likely covered, specific curricula vary depending on institution. We currently lack feedback on how well we prepare trainees for the American Board of Anesthesiologists (ABA) certification examinations as no specialty-specific performance metrics are reported to residency programs. Using the annual In-Training Examination (ITE) results from 2013-2015, we tested the hypothesis that U.S. residency programs provide satisfactory teaching in the area of obstetric anesthesia, as demonstrated by strong performance on the ABA ITE.

Methods: When the ITE scores are released to residency programs each year, they are accompanied by a "Program Summary of Residents' Item Performance" that shows national results on each question item, as well as the program's individual results by CA level (i.e., CB, CA-1, CA-2 and CA-3). We examined 3 years of ITE item performance results from 2013-2015, within the subspecialty category of obstetric anesthesia as well as items we judged to be obstetric anesthesia-related from other categories such as Pharmacology and Anatomy. Items were ranked by the percent of CA-3's nationally who answered the question correctly. A score > 70% was considered adequate performance on that question.

Results: U.S. residents had adequate performance (i.e., >70% answered correctly) on 70% of the obstetric anesthesia-related questions. See Table 1 for specific question items and the percent correct for each of these items on the ITE. Obstetric anesthesia topics are well-represented on the exams as compared to other subspecialty areas. The number of ITE questions designated as "obstetric anesthesia" compared to other subspecialty areas are shown in Table 2.

Conclusions: This is a first attempt to elucidate the areas in obstetric anesthesia that are tested on national certification examinations. It appears that U.S. anesthesiology residency programs prepare residents well for correctly answering questions related to obstetric anesthesia. Obstetric anesthesiologists who practice in an academic setting and teach residents and fellows should approach the Anesthesiology Core Program Director for the results specific to their residency program, and tailor their teaching efforts to areas where their residents performed below the national average.

Table 1. 2013-2015 In-Training Examination question items related to obstetric anesthesia and percent of CA-3 residents nationally who answered the question correctly. * Indicates items that were listed under the "obstetric anesthesia" category by the ABA.

ITE question key phrase topic	CA-3 % correct
ACLS in pregnancy*	98
Succinylcholine side effects	98
Metformin: perioperative management	98
Diagnosis of preeclampsia*	97
Management of the difficult airway: obesity	97
Metformin: complications	97
Fetal heart rate patterns: dx*	96
Uptake and distribution: pregnancy*	95
Morbid obesity and atelectasis	95
Pulmonary embolism pathophysiology	95
SBE prophylaxis indications	94
Pregnancy: DIC*	92
Spread of epidural anesthetics*	91
Pain: somatic versus visceral	91
Long QT syndrome: medications	90
Neonatal resuscitation: meconium*	89
LMWH assessment*	88
Cryoprecipitate: fibrinogen content	87
Preeclampsia complications*	87
Preeclampsia: lab abnormalities*	87
Spinal anesthesia anatomy: paramedian*	87
Local anesthetic concentration calculation*	86
Pregnancy: normal ABG*	85
Pregnancy: hematologic, electrolyte changes*	84
Maternal physiology: blood volume*	84
E cylinder: N2O content	84
Torsades de Pointes: treatment	83
Obesity: PFT changes	82
Primary pulmonary HTN and pregnancy*	81
Fetal heart rate tones: variable decelerations*	80
Hyper-magnesemia Rx*	80
Fetal heart tones: causes of late decels*	80
Herbal medications: anti-coagulation effects	78

FRC definition	77
Local anesthetic onset: factors influencing*	76
Placenta accreta: risk factors*	76
H2 blockers: onset time	74
Neonatal resuscitation medications*	73
Post-spinal backache*	73
Anesthesia for cerclage*	72
Pregnancy: asthma + uterine atony*	70
Predictor difficult intubation	70
TEG: decreased MA diagnosis and rx	67
Preterm labor and surgery*	66
Oxytocic drugs: indications*	66
Succinylcholine: normal K increase	66
Labor pain: regional blocks*	65
Placental ion exchange*	64
Antiphospholipid syndrome: mgt in labor*	63
Lumbar spine: radiologic anatomy*	61
Morbid obesity: drug dosing	60
Ondansetron: side effect	60
Epidural local anesthetics: GI effect*	59
Pregnancy: hemostasis*	46
Dural sac anatomy*	46
Spinal micro-catheters*	45
Coagulations changes in pregnancy*	45
Pregnancy: hemodynamic changes*	42
ASRA guidelines: epidural catheter removal*	24
Gastric volume: PO liquid effect*	13

Table 2: Number of questions per subspecialty category on the ABA In-Training Examination in 2013 and 2014.

# Of Questions	OB	Pain	Pediatric	Critical Care	Regional
2013	13	6	11	15	4
2014	13	11	16	11	0
2015[§]					

[§]*Results to be added following 2015 ITE.*

Abstract #:S-68

Chewing Gum in the Hypopharynx during Rapid Sequence Induction in a Cesearean section: A Case Report

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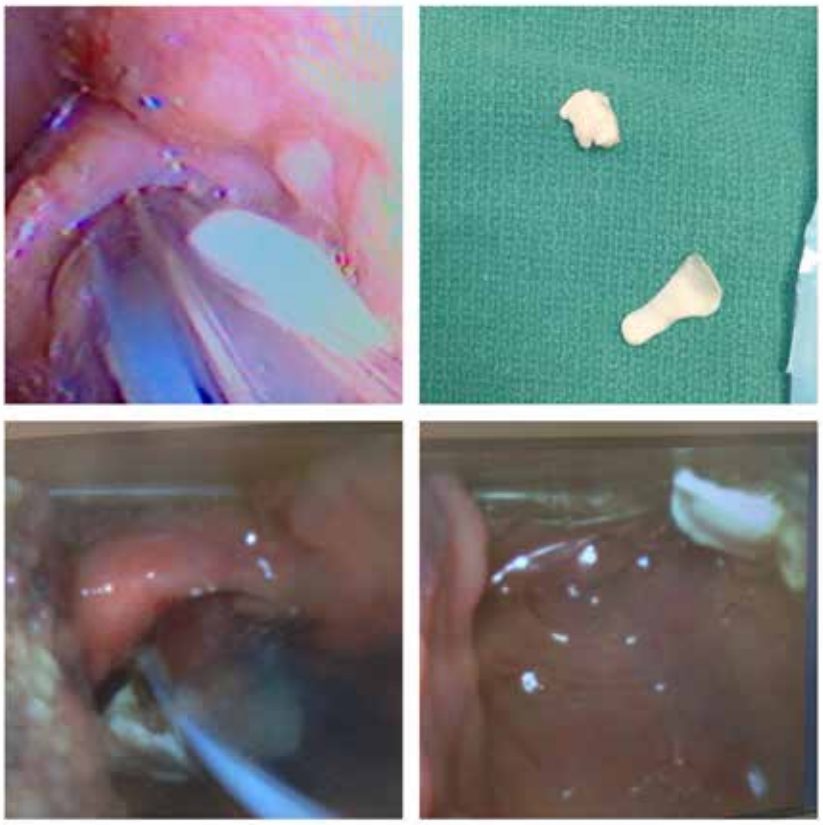
Introduction: Guidelines on preoperative fasting from the American Society of Anesthesiologists D.O. not explicitly address gum chewing. Due to concern for increased aspiration risk from increased gastric volume and decreased pH in gastric content, preoperative gum chewing has resulted in many delayed and cancelled procedures. A recent publication[1] addressing gastric volume and pH in patients undergoing endoscopy showed that chewing gum can result in an increase in gastric volume without change in gastric pH. Parturients have a greater risk of aspiration when undergoing general anesthesia than non-parturients and special care must be taken to minimize that risk during induction. The authors present a case of chewing gum found in the hypopharynx during rapid sequence induction for a cesarean section on a patient whose NPO status had been assessed and who had failed to disclose the use of gum.

Case Presentation: We report a 26-year-old female who presented for scheduled cesarean section. After failed sub-arachnoid block, the anesthetic was converted to general anesthesia. During rapid sequence induction, chewing gum was identified in the hypopharynx during laryngoscopy. The gum did not obstruct the glottic opening and the endotracheal tube was carefully placed to avoid pushing the gum into the trachea. After securing the airway, attempts to remove the gum with Magill forceps were made. However, the gum was adhered to the endotracheal tube and could not be removed during the case. Bronchoscopy was performed prior to emergence to confirm the absence of gum in the patients trachea and bronchi. The patient was extubated and observed for signs of airway obstruction postoperatively.

Conclusion: Prior studies have shown an increased gastric volume in fasting patients after chewing gum[1,2]. However, there appears to be little research into aspiration risk for patients already at an elevated risk for aspiration, such as the parturient. In obstetric patients, NPO status guidelines have been challenged and some have suggested that chewing gum is safe. This case highlights an additional risk to chewing gum in the preoperative period and during labor.



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Abstract #:S-69

Carbetocin at Elective Cesarean Delivery: A Non-Inferiority Study between 20 and 100 mcg

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Introduction: Carbetocin is recommended by the Society of Obstetricians and Gynaecologists of Canada as the uterotonic of choice to prevent postpartum hemorrhage (PPH) post elective cesarean delivery (1). The recommended intravenous dose by the manufacturer is 100 mcg; however, 3 previous studies have shown that smaller doses may be as effective (2,3,4), and that the ED 90 could be as low as 14.8mcg (95%CI 13.7 to 15.8) (4). The purpose of this study was to compare the efficacy of 20mcg and 100mcg of carbetocin.

Methods: With institutional REB approval and informed consent of each participant, this study was conducted as a randomized double-blind, non- inferiority study. We included women undergoing elective cesarean delivery under spinal anesthesia, who had no condition predisposing to PPH. They were randomized into two groups to receive either 20 mcg or 100 mcg of carbetocin intravenously upon delivery of the anterior shoulder of the baby. Uterine tone was assessed by the obstetrician at 2 and 5 minutes after carbetocin administration, according to a numerical verbal scale 0 to 10, where 0=atonic uterus and 10=firm uterus. If uterine tone was considered unsatisfactory by the obstetrician and additional uterotonic was deemed necessary, this was promptly administered according to usual practice at our hospital (oxytocin and/or ergot and/or carboprost). The primary outcome was the uterine tone (scale 0-10) at 2 minutes after carbetocin administration. Sample size was calculated at 102 subjects.

Results: Recruitment is underway and 40 cases have been completed until the preparation of this abstract. Overall, the uterine tone (mean±SD) was 7.6±1.7 and 8.0±1.2 at 2 and 5 minutes, respectively. Five women required the use of additional uterotonics within the first 24 hours. In all these 5 cases additional uterotonic was administered intra-operatively; the uterine tone at 2 and 5 minutes in these cases was 6.5/6.5, 10/8, 7/8.5, 8/6 and 3/4, and the time of request was 4, 11, 7,15 and 5 minutes after administration of carbetocin. The overall calculated blood loss (mean±SD) was 770±407 mL and the overall incidence of hypotension post carbetocin administration was 30%. At a recruitment rate of 24 cases/month, we plan to recruit the last patient by April 2015.

Discussion: The overall mean uterine tone seems to be adequate in most patients, however, 23 and 15% of patients had uterine tone <7 at 2 and 5 minutes, which in theory could prompt the request for additional uterotonics. It seems however, that the decision of requesting additional uterotonic is not based entirely on the assessment of tone, as only 3 of the 5 women receiving additional treatment exhibited tone <7. Final discussion and conclusion will be presented at the meeting.

References:

1. J Obstet Gynaecol Can 2009; 31: 980-93;
2. Can J Anesth 2012; 59: 751-7;
3. Can J Anesth 2013 ;60:1054-60;
4. Can J Anesth 2014; 61:242-8.

Abstract #:S-70

An unusual case of restrictive lung disease in the parturient: aggressive tubercular disease

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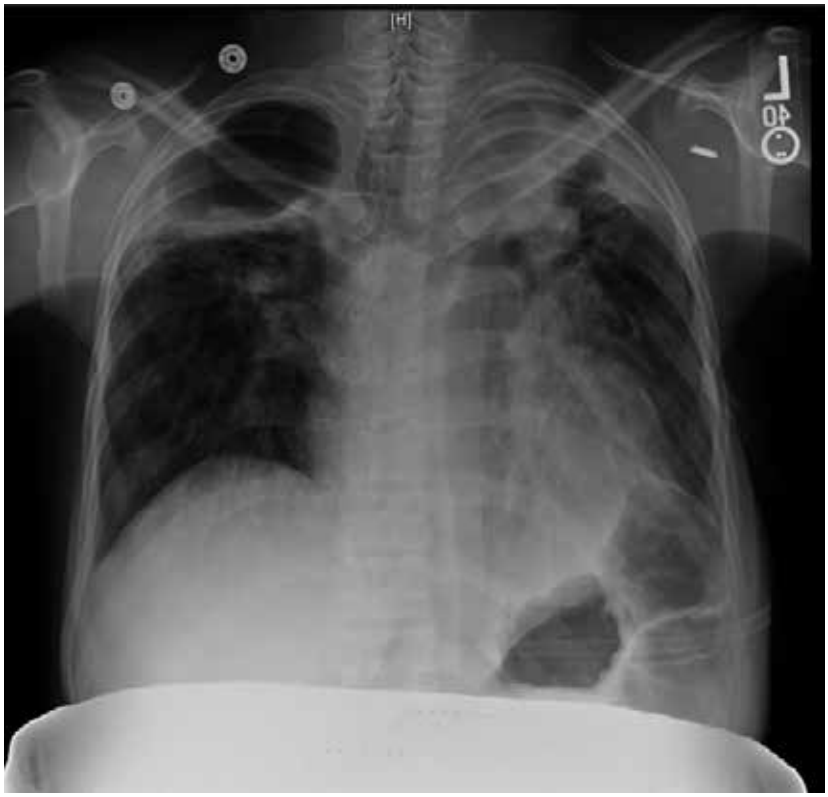
Introduction: Restrictive lung disease in the parturient is rare.(1) Restrictive lung disease may be due to musculoskeletal abnormalities, interstitial lung diseases, or post-infectious complications from tuberculosis. In developed nations, many post-infectious respiratory sequelae are rarely encountered due to aggressive public health efforts that have reduced primary infection of tuberculosis. We present the management of a cesarean delivery in a woman with advanced tuberculosis destruction of her lungs causing clinically significant respiratory distress.

Case: Our patient is a 33 year old G2P1 at 34 5/7 weeks gestation presented to our institution with progressive dyspnea at rest and orthopnea. Medical history included asthma and remote TB infection with multidrug treatment. Pulmonary function test revealed severe restrictive lung disease with an FVC of 1L (5% predicted) and FEV1 of 0.75L (4% predicted). ABG demonstrated hypercarbia, hypoxemia, and anemia. Chest x-Ray (Figure 1) showed bilateral apical scaring, bronchiectasis, and right upper lobe cystic mass. TTE demonstrated normal cardiac function with possible pulmonary hypertension. MFM, anesthesiology, neonatology, cardiology and ICU services met for multidisciplinary planning. Due to deterioration of pulmonary status, the decision was made to proceed with primary cesarean delivery under general anesthesia. The patient demonstrated significant intraoperative hemodynamic instability requiring aggressive management including transfusion and pressors. Cardiac assessment via TEE guided medication administration and transfusion therapy. Both mother and baby required admission to the intensive care unit for ventilator weaning and were discharged home on postoperative day #6.

Discussion: Severe restrictive lung disease with pulmonary hypertension is a relative contraindication to pregnancy. (2) Fortunately, many of the causes of restrictive lung disease D.O. not typically affect patients of childbearing age. Post-infectious sequelae from tuberculosis are rarely seen in industrialized countries, especially in immunocompetent patients. This case demonstrates the necessity of multidisciplinary management of rare disease states to maximize perioperative safety and to ensure good outcomes for both mother and baby.



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2. Van de Velde M, et al. Maternal Critical Care: A Multidisciplinary Approach. Cambridge UP, 2013.

Abstract #:S-71

Retrospective study to examine hospital coding and clinical features of maternal sepsis-related morbidity

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Introduction: The quality of hospital coding for maternal sepsis, severe sepsis and septic shock is not well described. In addition, Systemic Inflammatory Response Syndrome criteria can overlap with normal physiologic parameters of pregnancy, therefore the clinical diagnosis of maternal sepsis can prove challenging. (1, 2) The aims of the study were (i) to determine the positive predictive value (PPV)s of ICD-9 billing codes for maternal sepsis, severe sepsis and septic shock, and (ii) to examine key clinical features, laboratory indices and outcomes for these morbidities.

Methods and Materials: In this IRB-approved retrospective study we examined medical records of hospitalized women identified using ICD-9 codes for maternal sepsis, severe sepsis and septic shock between 2007–2013 in a single tertiary obstetric center. The diagnoses of sepsis, severe sepsis and septic shock were confirmed using criteria defined by the International Sepsis Definitions Conference. (2) We recorded vital signs and laboratory data at the time of hospital admission and at the time of diagnosis of each septic condition.

Results: We initially identified 190 women with ICD-9 codes for the septic morbidities. After examining medical records, only 35 (18%) women met criteria for a clinical diagnosis of sepsis, severe sepsis or septic shock. The PPVs of billing coding were low: sepsis = 15%; severe sepsis = 10%; and septic shock = 24%. Maternal vital signs and laboratory data documented at admission and at clinical diagnosis are presented in the Table. The mean (SD) times from admission to diagnosis were: sepsis = 108 (192) hours; severe sepsis = 212 (345) hours; septic shock = 64 (51) hours. No women died of sepsis during the study period.

Discussion: At the time of admission and clinical diagnosis, we observed considerable heterogeneity in the maternal vital signs and laboratory indices of women who met current criteria for sepsis, severe sepsis or septic shock. Using current sepsis criteria, the low PPVs in our study suggest that ICD-9 coding errors for these conditions are highly prevalent. Population-wide studies are needed to establish specific diagnostic and early detection criteria for sepsis in the obstetric setting, and to validate the accuracy of ICD-9 codes for maternal sepsis.

References:

Crit Care Med 2003;31:1250-1256

Anesth Analg 2013;117:944-50

Table: Physiologic and biomarker results

	Sepsis (n=22)	Severe Sepsis (n=6)	Septic Shock (n=7)
Temp - admission	36.7 [36.6–37.1] n=21	36.6 [36.2–37.3]	36.8 [36.6-39.2] n=6
Temp - diagnosis	38.5 [38.1–39.3]n=21	38.1 [38.1–38.2]	38.1 [37.6-40] n=6
HR - admission	100 (22)	99 (20)	98 (14)
HR - diagnosis	116 (15) n=21	116 (19)	122 (6) n=5
RR - admission	18 [18-18] n=21	18 [18-20]	19 [17-20] n=4
RR - diagnosis	20 [18-22] n=21	28 [25-31]	24 [23-25] n=5
SBP - admission	113 [106-124]	121 [111-125]	119 [99-125]
SBP - diagnosis	109 [96-123]	101 [90-125]	99 [92-113] n=4
WBC - admission	10.1 [8.1-12.6] n=13	10.2 [9.7-23.2] n=5	11.8 [11.1-15.7] n=5
WBC - diagnosis	13.2 [9.7-17.7]	17.1 [14-17.8]	15.4 [9.6-21.3]
% Neutrophils - admission	81 [69.3-87] n=12	77.1 [71.8-93.3] n=3	83.6 [66-90.2] n=3
% Neutrophils - diagnosis	90.5 [79.6-91.4] n=15	86.8 [70.5-88.1] n=5	92.5 [85.5-93] n=5
pH - diagnosis	7.4 [7.34-7.43] n=4	7.34 n=1	7.37 n=1
Lactate (mmol/L) - diagnosis	1.7 [1.4-2.2] n=4	None	1.9 [1.8-2.3] n=4
Hospital LOS	7 [4-10]	7 [4-21]	14 [13-16]
ICU admission (yes)	3 (14%)	5 (83%)	7 (100%)
ICU LOS	3 [2-34]	2 [2-2]	9 [2-14]

Temp = temperature (Celsius); HR = heart rate (per minute); RR = respiratory rate (per minute); SBP = systolic blood pressure (mm Hg); WBC = white blood cell (K/µL); LOS = length of stay (days); ICU = intensive care unit

Data presented as: number (%), mean (standard deviation), median [interquartile range]

Abstract #:S-72

Intrapartum Fever and Epidural Insertion: A UK National Survey

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Introduction: As sepsis remains a leading cause of maternal mortality (1), temperature monitoring during the intrapartum period is essential (2). Clinicians must be vigilant in recognizing and managing intrapartum fever (IPF) to optimize neonatal and maternal management.

Methods: Following approval from The Obstetric Anaesthetist's Association Audit subcommittee (Survey 150), all UK members were invited to complete an electronic survey. Questions examined knowledge about monitoring intrapartum temperature and explored whether the presence of maternal fever affected their anesthetic management. Chi-square test was used to compare categorical data; $p<0.05$ was regarded statistically significant.

Results: From the 1668 UK members, 571 responded (34% response rate), and 74% were attending grade. Only 29% and 13% correctly knew the UK nationally recommended frequency of temperature monitoring during the 1st and 2nd stages of labor respectively. Only 12% knew the definition of IPF as per NICE guidelines (2 readings >37.5ºC 1 hour apart, or 1 reading >38ºC). Management involving blood cultures, acetaminophen and antibiotics would be initiated by 36% once IPF is diagnosed. Senior anesthesiologists are more inclined to monitor temperature after epidural insertion compared with residents (8% vs 0.7%, p=0.01). Figure 1 shows how the presence of IPF would influence labor epidural management amongst our respondents. 22% felt epidural insertion in the presence of IPF warrants an individualised patient plan, comprising of multidisciplinary team (M.D.T) discussion, clinical assessment, investigation and treatment for sepsis including acetaminophen.

Discussion: Despite ongoing efforts to increase awareness of maternal sepsis, high proportions of UK obstetric anesthesiologists have inadequate knowledge about monitoring intrapartum temperature and IPF. M.D.T education and local audit should be encouraged to improve knowledge and management of IPF. Divided opinions on epidural insertion in the presence of IPF reflect the lack of UK consensus on this subject. Until national guidelines are available, local departments should provide anesthesiologists with clear recommendations on epidural insertion in the presence of maternal fever.

References:

1. MBRRACE-UK: Mothers and Babies: Reducing Risk through Audits and Confidential Enquiries across the UK, 2014 www.npeu.ox.ac.uk/mbrrace-uk
2. National Institute of Health and Care Excellence (2014) [Intrapartum Care: Care of Healthy Women and their Babies during Childbirth]. [CG190]. London. National Institute of Health and Care Excellence. www.nice.org.uk/guidance/cg190

Abstract #:S-72

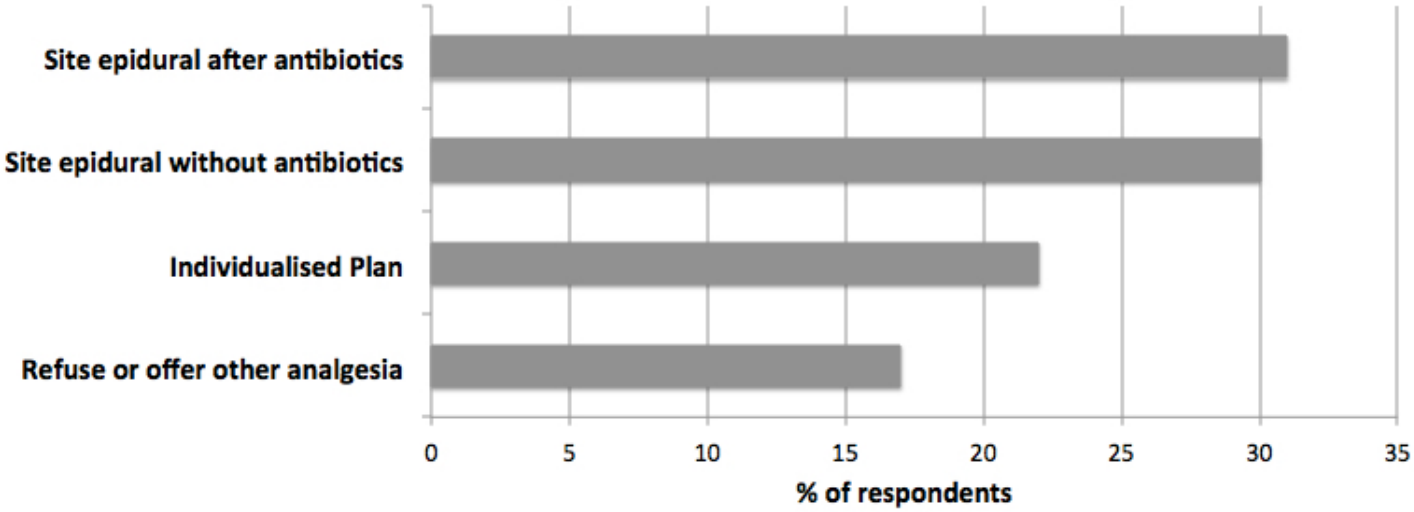

Figure 1: Showing how respondents would manage labor epidurals in the presence of IPF

Abstract #:S-73

Anesthesia For Cesarean Section in a Patient with a Hemorrhagic Cerebral Cavernous Malformation

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Case Report: A 14 y.o. P1G0 presented at 30 wks. gestation with generalized weakness. MRI revealed a right pontine hemorrhage from a cerebral cavernous malformation(CCM). She was discharged after serial MRI's showed no worsening of the bleed but was re-admitted at 32 wks. with left-sided weakness, inability to walk and left facial droop. MRI showed increased hemorrhage with mass effect on the fourth ventricle. The decision was made to perform cesarean delivery due to worsening neurologic status. Epidural anesthesia was conducted with slow incremental titration of lidocaine 2% with epinephrine to achieve a T4 level. Cesarean delivery of a healthy infant was uneventful. Neurologic symptoms worsened on POD1 with MRI evidence of extension of the bleed and hydrocephalus. A ventriculostomy was done to relieve the pressure, but after further expansion of the hemorrhage,a craniotomy for resection of the CCM was required.

Discussion: CCM's are berry-like,tiny clusters of abnormal,sinusoidal-type blood vessels found in the brain or spinal cord. The walls of the capillaries are thin, less elastic than normal, and prone to leaking. CCM is present in 0.1-0.5% of the population and account for 8-15% of all CNS vascular malformations. Most of these remain asymptomatic and are incidental radiologic findings.

Unlike AV malformations, CCM's have no large feeding arteries and are low-flow lesions. They can occur sporadically or have a familial component. Symptomatic CCM may manifest with seizures, neurologic impairment, hydrocephalus or raised ICP. Because they are low-flow, it is uncommon to have sudden catastrophic neurologic injury, but repeated bouts of hemorrhage can be severely disabling.

It is controversial whether the risk of hemorrhage increases during pregnancy. Some are of the opinion that the hemodynamic changes of pregnancy (increased blood volume, cardiac output) and hormonal changes(relaxin,progesterone) which affect connective tissue and the vasculature may predispose to hemorrhage. However, large case studies suggest the risk of CCM rupture(3%/pregnancy) is no greater in pregnant patients with CCM than non-pregnant. Furthermore vaginal delivery was not contraindicated in patients with CCM.

Our patient fell into the rare category of severe CCM hemorrhage in pregnancy. Early delivery was chosen to avoid additional risk to the fetus and mother should neurosurgical intervention be required. Our anesthetic goals were extrapolated from the management of ruptured AVM- avoidance of wide swings in hemodynamics and ICP. We chose to avoid GA and the stresses of laryngoscopy, intubation and extubation. Regional also allowed monitoring the neurologic status during the procedure. A slow, titrated epidural was preferred to avoid the sudden hypotension seen with spinal anesthesia. Re-bleeding is more common with ruptured AVM in pregnancy and our patient worsened post-op despite a stable intra-op course.

References:

J Neurosurg 118:50-55,2013

Abstract #:S-74

Development of carotid and vertebral artery dissections in a postpartum woman with HELLP syndrome: a case report

Presenting Author: Sophia C. Yi M.D.
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Co-Author: Christopher R. Cambic M.D. - Northwestern Memorial Hospital - Chicago, IL

Headaches develop in the first postpartum week in 12-39% of patients.1 We present a patient with HELLP syndrome and inadvertent dural puncture during epidural catheter placement, who was found to have a right internal carotid artery (ICA) and bilateral cervical vertebral artery dissections after complaining of a postpartum headache.

39 yo nulliparous patient presented with 48 h history of elevated blood pressure, 8 lb. weight gain, and headache. Laboratory tests on admission revealed platelet count of 144,000, transaminitis, elevated creatinine, and a urine protein/creatinine ratio of 0.9. Suspecting HELLP syndrome, OB team decided to proceed with cesarean delivery. While awaiting NPO requirement, an epidural catheter was placed due to potential for decreasing platelet count. First attempt at placement resulted in inadvertent dural puncture with 17 Ga Tuohy needle. Second attempt was done a level higher, and an epidural catheter was placed without issue. The rest of the operation and postoperative course proceeded uneventfully, until postoperative day (POD) 4 when she began complaining of right neck stiffness, which was treated with oral analgesics. On POD 5 she also developed a 10/10 positional headache, without any focal neurologic signs. She received an epidural blood patch later that day, which resulted in improvement in her symptoms. That night, her neck stiffness returned, and her headache returned the following morning. She underwent a second blood patch on POD 6, and again had relief of her symptoms. However, on POD 7, her headache and neck stiffness recurred, but were more severe in nature, and her headache was non-positional; all other neurologic findings were negative. A MRI/MRA was ordered, which showed a right cervical ICA dissection with pseudoaneurysm. She was admitted to the ICU and underwent CT angiogram, which confirmed the MRA findings, and also showed bilateral cervical vertebral artery dissections at the V2 segment. The rest of her workup was normal. She was started on a heparin infusion and transitioned to warfarin. Her symptoms resolved, and she was discharged home on warfarin with no permanent neurologic sequellae. Follow-up imaging 3 months later showed resolution of the dissections, but persistent right ICA pseudoaneurysm.

The differential for postpartum headache is broad, encompassing both benign and life threatening conditions. This patient's symptoms were initially consistent with postdural puncture headache, but changes in the severity of the neck stiffness and positional nature of the headache prompted further evaluation. Although most carotid and vertebral dissections occur spontaneously or after trauma, there are reports of carotid or vertebral dissection in a preeclamptic patients. 2-4 No known association exists between intracranial hypotension and development of arterial dissection.

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1. N Engl J of Med, Vol 344, No. 12, 898-906
2. Intl J of Ob Anes (2004) 13, 44-46
3. J Stroke Cerebrovasc Dis. 2010:16

Abstract #:S-75

Clinical significance of audible air leakage during labor epidural analgesia: A prospective observational study

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Background: Air leakage sounds are sometimes heard during labor epidural analgesia because the epidural space of pregnant women is under sustained positive pressure. We investigated whether audible air leakage is related to successful labor epidural analgesia using loss of resistance to air technique.

Methods: We observed the occurrence of audible air leakage after removing the air syringe or after the Tuohy needle was rotated 90º during labor epidural analgesia in 1,200 parturients. Patients were allocated to the sound (Group S) or no sound group (Group N) according to the occurrence of audible air leakage. Overall failure rate, failure of catheter insertion, unintentional dural puncture, intravenous catheter, paresthesia, inadequate analgesia, catheter migration, and labor pain were investigated.

Results: The incidence of audible air leakage in our sample was 35.9%. Rates of overall epidural failure, unintentional dural puncture, and intravenous catheter were significantly lower and median scores on the numerical rating scale of labor pain were significantly higher in Group S than in Group N. No differences were observed in the incidence of the failure of catheter insertion, temporary paresthesia, replacement due to paresthesia, inadequate epidural analgesia or catheter migration between groups. The presence of air leakage sounds had a positive predictive value of 98.6%, a specificity of 76.2%, and a sensitivity of 38.4% for successful labor analgesia without catheter replacement.

Conclusions: The occurrence of audible air leakage sound after removing the air syringe or after 90º rotation of the Tuohy needle was associated with successful needle placement in the epidural space.

Abstract #:S-76

Acute Normovolemic Hemodilution for a Jehovah's Witness with Polyhydramnios Presenting for Urgent Cesarean Delivery

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Introduction: Most Jehovah's Witnesses (JW) D.O. not accept transfusion of blood products. Anesthesiologists can employ acute normovolemic hemodilution (ANH) to decrease red blood cells lost during surgery while providing autologous blood, kept in continuity with the patient, for reinfusion as needed.1

Case: A 32 year-old G1P0 at 31 weeks with a twin gestation complicated by polyhydramnios presented for an urgent cesarean delivery (CD) for suspected sudden amnio-chorion separation. The patient is a JW and refused blood products. Physical exam was notable for a gravid uterus out of proportion to dates and 3+ pitting edema of the left lower extremity. A combined spinal epidural (spinal: bupivacaine 5mg, fentanyl 15mcg, morphine 0.15mg) was performed. An arterial line (AL) and a central venous catheter (CVL) were placed. The procedures were well tolerated and she remained hemodynamically stable.

Starting hematocrit (Hct) was 34. 2L of blood was removed via the AL into 6 citrate-phosphate-dextrose-adenine (CPDA) units kept in continuity with the patient. Serial Hct and hemodynamics were used to guide fluid replacement (6L of lactated ringers total). Prior to surgery Hct was 28. Epidural catheter was dosed with 2% lidocaine 15ml and fentanyl 50mcg. Twins were delivered uneventfully. Uterine tone was achieved with oxytocin, methylergonovine and misoprostol. Blood loss was 800mL and ending Hct was 24. Due to hypotension, the autologous blood was reinfused. Blood was reinfused via the CVL, which was in continuity with the CPDA units and the patient at all times. After transfusion of all 6 units, furosemide 10mg IV was given prophylactically. Despite this, she developed pulmonary edema that responded to further diuresis. Final Hct was 26.

Discussion: Due to this patient's increased risk of post partum hemorrhage (PPH), the benefits of ANH outweighed the risks. The decision to reinfuse blood is challenging and ideally reinfusion should be done once hemostasis has been achieved or when hemodynamic derangements resulting from hypovolemia and anemia can no longer be supported by vasopressors and crystalloids. Since the risk of uterine atony and PPH persists post-operatively, all 6 units were reinfused as the autologous units expire after 4 hours. It is essential to provide adequate diuresis during the reinfusion process.

Reference:

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Abstract #:S-77

Association between ionized Mg, total Mg, and perinatal outcomes in infants with maternal preclampsia

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OBJECTIVE: Magnesium sulfate(MgSO4) is a commonly used drug for women with preeclampsia because of its effect that it reduces progression to eclampsia. This study was aimed to evaluate the association between total magnesium (tMg) and ionized Mg (iMg) and gestational age in preterm babies and secondly to access the association between hypermagnesemia and adverse outcomes.

METHODS: A prospective study was performed in inborn preterm infants who were admitted to neonatal intensive care units. TMg, iMg, pH, total calcium Ca (tCa), ionized Ca (iCa) were collected immediately after delivery or within 3 hours of age. Incidence of respiratory distress syndrome (RDS), bronchopulmonary dysplasia (BPD), retinopathy of prematurity (ROP), intraventricular hemorrhage (IVH) were compared between hypermagnesemia, defined as more than 2.9 mg/ dL, and normal group.

RESULTS: One hundred twenty nine neonates were eligible for this study. IMg was significantly correlated with tMg ($r = 0.367$, $p < 0.001$). However, there were no correlation between iMg and gestational age, tCa, pH, iCa, Apgar score at 1 min, and Apgar score at 5 min. Among adverse outcomes, only the incidence of IVH was higher in hypermagnesemia than normal group (23.8% vs 7.5%, $p = 0.04$).

CONCLUSIONS: In preterm babies less than 37 weeks of age, the level of iMg was similar regardless of gestational age and preterm babies with high magnesium level without additional magnesium exposure should be screened for IVH.

Abstract #:S-78

Multi-disciplinary Approach To Neuraxial Anesthesia In A Patient With A Congenital Nevus

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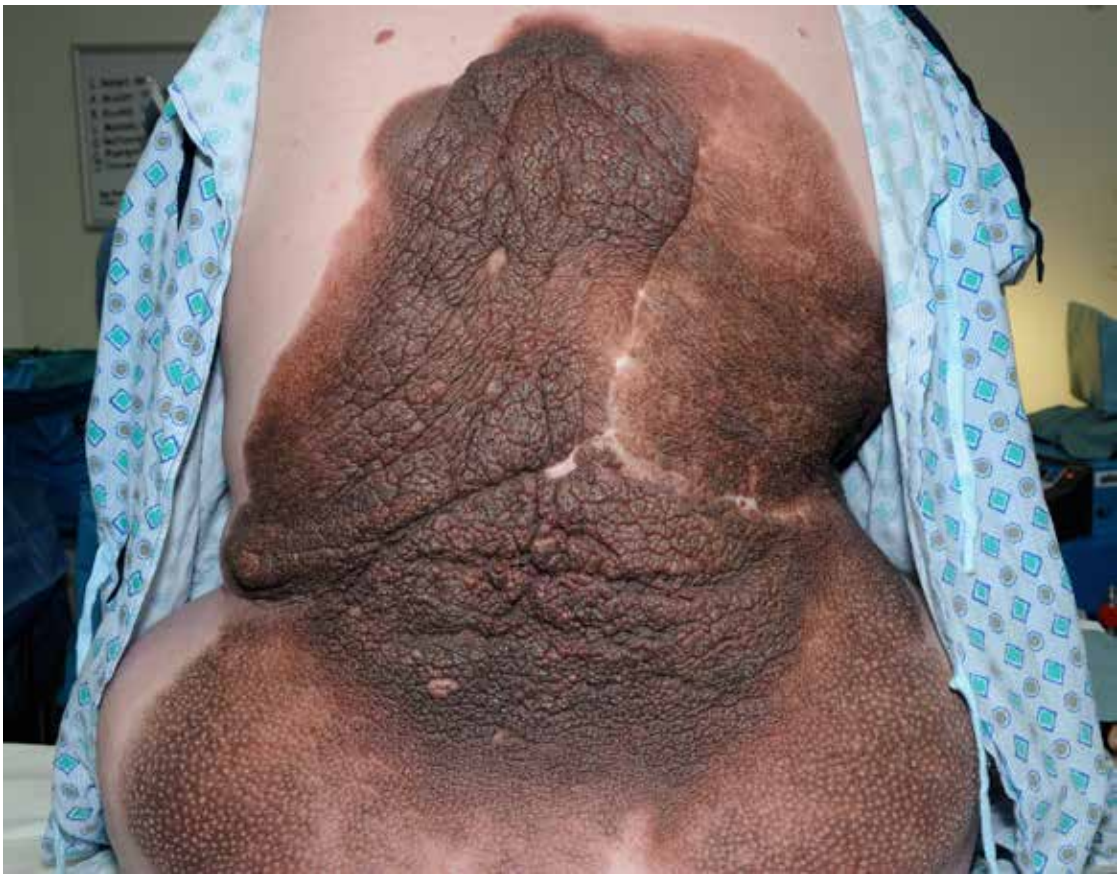
A 34 year old G2P1 parturient at 36 weeks with a large congenital nevus presented for consultation for regional anesthesia for her repeat cesarean section. Her prior cesarean section was performed under general anesthesia due to the complexity and location of her lesion and uncertainty of the safety of regional anesthesia. Significant history included a surgical resection of approximately one third of this lesion in early childhood with resultant regrowth and scar formation. Her previous cesarean section was complicated by severe PONV, difficulty with neonatal bonding, and dissatisfaction with her experience. Her medical history was otherwise unremarkable. Her physical examination was notable for the extensive distribution of her nevus extending from her buttocks to her scapulae, and the marked engorgement of this tissue. The patient stated that the nevus was extremely friable and was prone to bleeding with minimal manipulation. Our patient desired to be awake for this cesarean section to avoid PONV and to allow for earlier neonatal bonding. Two separate dermatologists were consulted and both opinions supported that spinal anesthesia was safe and that there was no significant risk of introducing melanin cells (which could then become malignant) into the CSF. A spinal anesthetic was agreed upon. Prepping for the spinal was extremely challenging given the thick, vascular, torturous nature of the nevus. We utilized several sizes of cotton applicators and a created applicator comprised of a 20 cc syringe and an 18g angio-catheter. A total of 40 cc of betadine was applied. The spinal was successful after only one reposition of the introducer, in a small area of scar at approximately L2-L3. A T4 anesthetic level was achieved and the patient underwent a successful cesarean section under regional anesthesia. No PONV was noted and she proceeded to breast feed and bond with her neonate almost immediately. The advanced multidisciplinary approach to her care improved her overall satisfaction and allowed for an improved mother-baby environment.



Abstract #:S-79

Does Ethnicity affect neuraxial labor analgesia drug consumption?

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Bethany C. Pan College Student - Wake Forest University - Winston Salem, NC
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Introduction: Glance1 and Toledo2 had separately reported racial disparity in odds of anticipating or receiving labor epidural analgesia. However, the question of whether consumption of neuraxial analgesic drug is differed by race is unknown and is the goal of this study.

Method: After IRB approval for consent exemption, medical records from 3/1/ to 5/30/2014 of parturients who received neuraxial labor analgesia were reviewed. Data (demographics, fetal and L/D outcomes, EPCA volume used, supplement analgesia and complications) were extracted and analyzed with SigmaStat (SPSS Inc). Patient ethnicity was divided into 4 gps: 1. Caucasian 2. African American 3. Hispanic and 4. Others. Total analgesic consumption(TAC) is the 1° outcome and is defined as the total amount of neuraxial analgesia consumed(EPCA and supplement top up) during labor divided by duration of labor analgesia (expressed as mL/hr equivalence of 1/8% bupivacaine). Descriptive statistics, multicollinearity and normality tests were performed. Influence of ethnicity on TAC was first examined with ANOVA, then multiple linear regression(MLR) model incorporating 11 potentially confounding variables was applied to determine their significance with $P<0.05$ as significant.

Results: 922 records were analyzed(Gp -557,Gp2-198,Gp3-134 and Gp4-33), with 73.4% CSE, 26.4% Epidural and 0.2% spinal catheter. There were differences in demographics and labor characteristics among the 4 ethnic gps (Table 1a). TAC and supplement need were not different among gps (P=.39, P=.06). MLR for TAC incorporating ethnicity, BMI, age, parity, EGA, ASA, pitocin use, newborn weight, cervical dilation, labor analgesia duration and epidural type (EPID/CSE) showed that ethnicity remained an insignificant factor and only epidural type, analgesic duration, cervical dilation and newborn weight were significant (Table 1b). Additional factors (incomes, education, insurance and obstetricians) will be added in the final model.

Discussion: At a large academic center where neuraxial labor analgesia is offered 24/7 equally to all patients, ethnicity did not affect the total amount of labor neuraxial analgesic drug consumed. Comparing to Caucasian, the insignificant higher incidence of inadvertent dural puncture (2.9% vs 0.9%) and lower incidence (20% vs 32%) of requesting top ups in Hispanics may be clinically important for further investigation of ethnic disparity.

Reference:

1. Anesthesiology 2007;106:19-25 2 AnesthAnalg 2012;114:172-8

Abstract #:S-79

Table 1a Maternal, Fetal and Labor Analgesia Characteristics (* P<0.05)

	All 4 Groups	**Gp 1- Caucasian**	**Gp2- African American**	**Gp3- Hispanic**	**Gp 4 - Others**	**P - value**
N (Number)	922	557	198	134	33	
RACE (% of Total)	100%	60.4%	21.5%	14.5%	3.6%	
Tot Analg Consumed-Mean(mL/hr)	18.4±7.1	18.7±6.9	18.4±8.1	17.5±6.7	17.9±6.6	0.393
Median, IQR (mL/hr)	16.8, 14-22	17.0, 14-22	16.8, 13-21	16.0, 13-21	16.8, 13-22	0.460
EPCA volume Used (mL/hr)	16.4±5.0	16.6±4.8	16.4±5.1	16.0±5.4	15.5±5.0	0.791
Median, IQR (mL/hr)	15.6, 13-19	15.8, 13-19	15.6, 13-19	15.2, 12-18	15.3, 12-17	0.199
Age (years)*	27±6	28±5	25±6	27±7	26±5	0.001
BMI (Kg/m^2)*	32±6	31±6	32±7	32±6	29±4	0.011
Gravida (Median, IQR)*	2, 1-3	2, 1-3	2, 1-4	3, 2-4	1, 1-2	0.001
Parity (Median, IQR)*	1, 0-2	1, 0-1	1, 0-2	1, 0-3	0, 0-1	0.001
Est. Gestation Age(weeks)	39±3	39±3	38±4	39±1	39±2	0.213
ASA (Median, IQR)*	2, 2-2	2, 2-2	2, 2-2	2, 2-2	2-2	0.026
Pitocin Use (Percent)	43%	46%	44%	40%	36%	0.736
Newborn Weight (gram)*	3287±609	3330±616	3105±645	3358±505	3363±434	0.002
Cervix Dilation (cm)*	4.1±1.7	4.0±1.7	4.0±1.7	4.6±1.7	4.3±1.7	0.002
Labor Neuraxial Analgesic Duration (mins)	412 ± 316	423±321	426±319	351±277	394±349	0.104
% of CSE, Epid, SAB	73, 26, <1	73, 27, <1	72, 27, <1	74, 25, <1	82, 18, 0	0.758
# (%) Wet Tap, # Spinal Cath	9(0.98%), 2	5(0.90%), 0	0 , 1	4(2.9%), 1	0 , 0	0.136
#(%) Required Supplement Top-up	268 (29%)	176 (32%)	54 (27%)	27 (20%)	11 (33%)	0.058
% needed epidural replacement	4%	5%	2%	2%	3%	0.187

Table 1b. Multiple Linear Regression Model for Total Analgesic Drug Consumption incorporating 11 cofounding variables - Ethnicity, BMI, age, parity, EGA, ASA, pitocin use, newborn weight, cervical dilation at time of neuraxial block placement, labor analgesia duration and epidural type(EPID/CSE). **(Ethnicity (not significant factor) and only factors that are statistically significant* in the model are shown in table below.)**

	Coefficient	Std Error	t	P	VIF
Constant	21.983	3.788	5.804	<0.001	
Ethnicity	-0.426	0.293	-1.453	0.147	1.045
*Newborn Wt in grams	0.000916	0.000463	1.981	0.048	1.301
*Cervix Dilation in cm	-0.378	0.158	-2.390	0.017	1.237
*Analg Duration in min	-0.00434	0.000858	-5.057	<0.001	1..210
*CSE(1), Epidural(2)	2.050	0.557	3.681	<0.001	1.023

Abstract #:S-80

Reliability of Self-Assessment in Perioperative Emergent Cesarean Delivery Simulation Based Training

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Background: Reliability of self-assessment in simulated based learning has not been well reported in the literature. The study was designed to compare self-assessment with direct and video assessment for a simulation based training exercise.

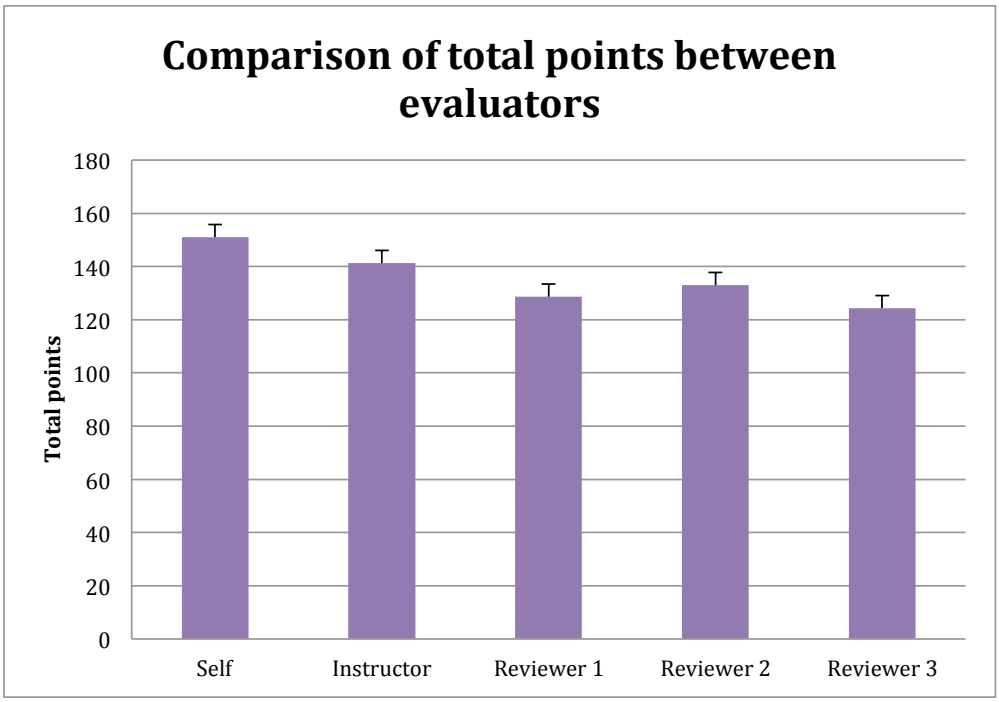
Methods: 50 anesthesia residents attended simulation-based training for an emergent cesarean section requiring general anesthesia and a validated checklist weighted scoring system (1) was used to assess performance. Checklists were completed by each resident/instructor directly following the simulation session. In addition, video recordings were viewed and scored for each resident session by 2 instructors (reviewer 1 and 2) and 1 independent reviewer (reviewer 3) who had not been involved with the simulation. The Mann Whitney test was used for all analyses.

Results: Self performance scores were significantly higher than instructor assessment scores (151 +/- 26 vs 141 +/- 29, p = 0.04). Self performance scores were also significantly higher than those for all video reviewers 1, 2 and 3 (128 +/- 25, p<0.0001, 133 +/- 32, p=0.002 and 124 +/- 25, p=0.0001). Direct observation and video assessment scores were also compared for each instructor (reviewer 1 and reviewer 2). Reviewer 2's direct observation scores were significantly higher than video (147+/-26, vs. 125+/-22, p=0.05) and no significant difference between the two for reviewer 1 (133+/-34 vs. 142+/-30 , p=0.4).

Conclusions: Self-assessment by residents may overestimate actual performance in simulation based training exercises. In addition, assessments by direct observation and video review D.O. not necessarily correlate.

Reference:

1. Int J Obstet Anesth. 2014 Nov; 23(4):341-7



Abstract #:S-81

Urgent peripartum hysterectomy @ 16 weeks for twin pregnancy with placenta previa percreta complicated by massive hemorrhage and DIC

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Background: Abnormal placentation and peripartum hysterectomy are known risk factors for peripartum hemorrhage (PMID:24373590). We present the case of an urgent peripartum hysterectomy for a 16 week nonviable twin gestation with placenta previa percreta, complicated by massive hemorrhage.

Clinical Features: A 34 yo G8P4125 presented with di-di twin pregnancy at 16 wks GA following PPROM for fetus A. Fetus A was noted to have placenta previa and accrete on ultrasound and MRI. Urgent peripartum hysterectomy was recommended by the Maternal Fetal Medicine service. Gyn-Oncology was consulted, and after review, deferred to General Gynecology; Gyn-Oncology, Trauma and Vascular Surgery were all on standby for intraoperative consultation if needed. The opinion of the obstetric and surgical teams was that the likelihood of massive hemorrhage was relatively low, due to relatively reduced vascularity of the uterus secondary to early gestational age; the plan was for hysterectomy only since the fetuses were nonviable. Nevertheless, we adhered to our abnormal placentation protocol. Large bore IV access and invasive monitoring were obtained; along with multiple units of verified blood products in the OR prior to induction and blood bank notification for possible massive transfusion. Hysterectomy proceeded uneventfully until oozing was noted from the right pelvic sidewall. The pelvis was packed and Gyn-Oncology was consulted. EBL was minimal and the patient remained stable. Upon inspection by Gyn-Oncology, placenta percreta was noted with extensive invasion into the bladder and cervix. Once the pelvic packing was removed, EBL increased dramatically. Both trauma and vascular surgery were called when further dissection resulted in ongoing rapid blood loss (EBL of 30 liters), necessitating aortic cross clamping. Massive transfusion and resuscitation maintained SBP above 80mmHg; the abdomen was packed, and the patient was stabilized for transfer to SICU. Exploratory laparotomy, cecal repair and cystorrhaphy were performed on POD#1. The patient was extubated on POD#2 and transferred to postpartum on POD#3.

Conclusions: Although reassuring obstetric factors may be present, abnormal placentation presents a risk for massive hemorrhage. Multidisciplinary consultation, blood bank notification and preparation for massive transfusion are key feature in reducing mortality and morbidity.

Abstract #:S-82

Effect of catheter size and flow rate on epidural boluses spread in an experimental model

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Introduction: Distribution of solutions in the epidural space in human cadavers is non -uniform and directed between structures according to pressures by which they were compressed. Boluses delivered at higher pressure could result in higher spread of solution associated with improved analgesia. Previous in vitro work has suggested that flow rate has little effect on the area of distribution. We hoped to demonstrate a difference in spread using three different flow rates and two different catheter sizes in an experimental epidural model.

Methods: Local research and ethics committee approval was waived. A multi-orifice unfiltered Portex© epidural catheter was secured between two perspex sheets and a plastic sheet containing air-filled hemispheres. Five millilitres of dye impregnated saline were delivered at three pre-set flow rates (250, 500 and 1000 mls/hr) via a CME Bodyguard 545© epidural pump through 18G and 20G catheters. A bolus was delivered thirteen separate times with each catheter at each flow rate with the primary outcome measured being the total height of spread of each bolus. We also measured the maximum flow rate achieved by the pump whilst delivering the bolus. The data were analysed using two-sample t-test. A p value of less than 0.05 was considered significant.

Results: The height of spread of the solution with each set of parameters is shown in the table. The results show a reduction in spread through the 18 gauge catheters as the flow rate was increased. The reduction was statistically significant between 250mls/hr and 1000mls/hr (p=0.03). In the 20 gauge catheters, spread was significantly greater in the 500mls/hr group when compared to the two other flow rates (both p=0.03), although the preset flow rate was never actually achieved.

Discussion: Our model is not a true representation of the epidural space, but is reproducible and allowed us to compare the effect of flow rate and catheter gauge on the spread of a bolus of solution. High flow rates were not achieved secondary to in -built flow rate compensation with pressures higher than 19 psi. The greatest spread seemed to be with lower flow rates and wider catheters. A possible reason for this finding may be differential flow from the three orifices in the multi orifice catheter with lower flow rates.

References:

1. Hogan Q. Reg Anaesth Pain Med 2002;2:150-6
2. Husain T. Int J Obstet Anaesth. 2014;10:S11
3. Fegley A. Anaesth Analg 2008;107:1079-81

Catheter size and flow rate	Total height of spread (mm)	Max flow rate achieved (mls/hr)
18G 250 mls/hr	89.69 (13.34)	250 (0)
18G 500 mls/h	80.92 (17.53)	495 (14.50)
18G 1000 mls/h	71.23 (10.68)	748 (47.05)
20G 250 mls/h	71.08 (10.44)	241 (7.60)
20G 500 mls/h	82.31 (15.02)	369 (13.82)
20G 1000 mls/h	70.31 (12.38)	455 (35.26)

Data are mean (SD)

Abstract #:S-83

Atypical AFE- Truly a Diagnosis of Exclusion

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Introduction: Amniotic fluid embolism (AFE) is a rare, but highly fatal, complication unique to pregnancy. It has an incidence of 1 in 8,000 to 1 in 80,000 deliveries in the United States. The proposed pathophysiology involves entry of amniotic fluid into the maternal circulation, release of endogenous mediators, such as histamine, bradykinin, leukotriene and endothelin, and ultimately an inflammatory and anaphylactoid reaction. AFE will commonly present after ROM, during C/S or within thirty minutes of delivery. Despite numerous types of presentations, it most commonly presents with cardiovascular collapse and respiratory distress initially, and then disseminated intravascular coagulopathy (DIC). Cardiovascular effects usually occur in a biphasic manner with; phase I characterized by pulmonary vasoconstriction and right heart failure and phase II by left heart failure. AFE is a challenging condition to manage and is a diagnosis of exclusion. This is a case report of a young woman who had an atypical presentation of a presumed AFE.

Case Report: An 18 year old G1P0 in active labor at 36 weeks and 1 day gestation underwent an uncomplicated C/S for breech presentation under CSE. The baby was born with fetal anomalies not compatible with life. About two hours post C/S, the patient had one episode of hypotension that was treated with ephedrine and thought to be secondary to postural change. A second IV was placed, blood tests and coagulation studies sent and oxygen administered, all as precautionary measures. The patient returned to her baseline status. Three and a half hours post C/S, the patient was found to be mildly hypotensive and with decreased saturation. In just minutes, she further declined in both saturation and mental status. She was then emergently intubated and immediately taken back to the OR. An ultrasound suggested no signs of hemorrhage though there was concern. However, the previously sent coagulation studies depicted a DIC pattern. Resuscitation was started with crystalloid and blood. Vascular access was obtained with peripheral IVs, a rapid infusion catheter and a right internal jugular central line. A radial arterial line was inserted. The patient received pRBCs, FFP, cryoprecipitate, platelets and recombinant Factor VII. A diagnostic TEE showed intracardiac volume depletion and no signs of right or left sided heart failure. The patient was hemodynamically stabilized, coagulation abnormalities corrected, diffuse bleeding from DIC controlled and then transported to the ICU where she was further treated for AFE, DIC, ARDS and AKI.

Discussion: Though unusual, AFE can have an initial presentation of DIC. As a serious peripartum complication with difficult management and high morbidity and mortality, it is of utmost importance to have an early suspicion or diagnosis of AFE. This patient's survival and limited morbidity can be attributed to the quick recognition, management and multi-disciplinary approach to her care.