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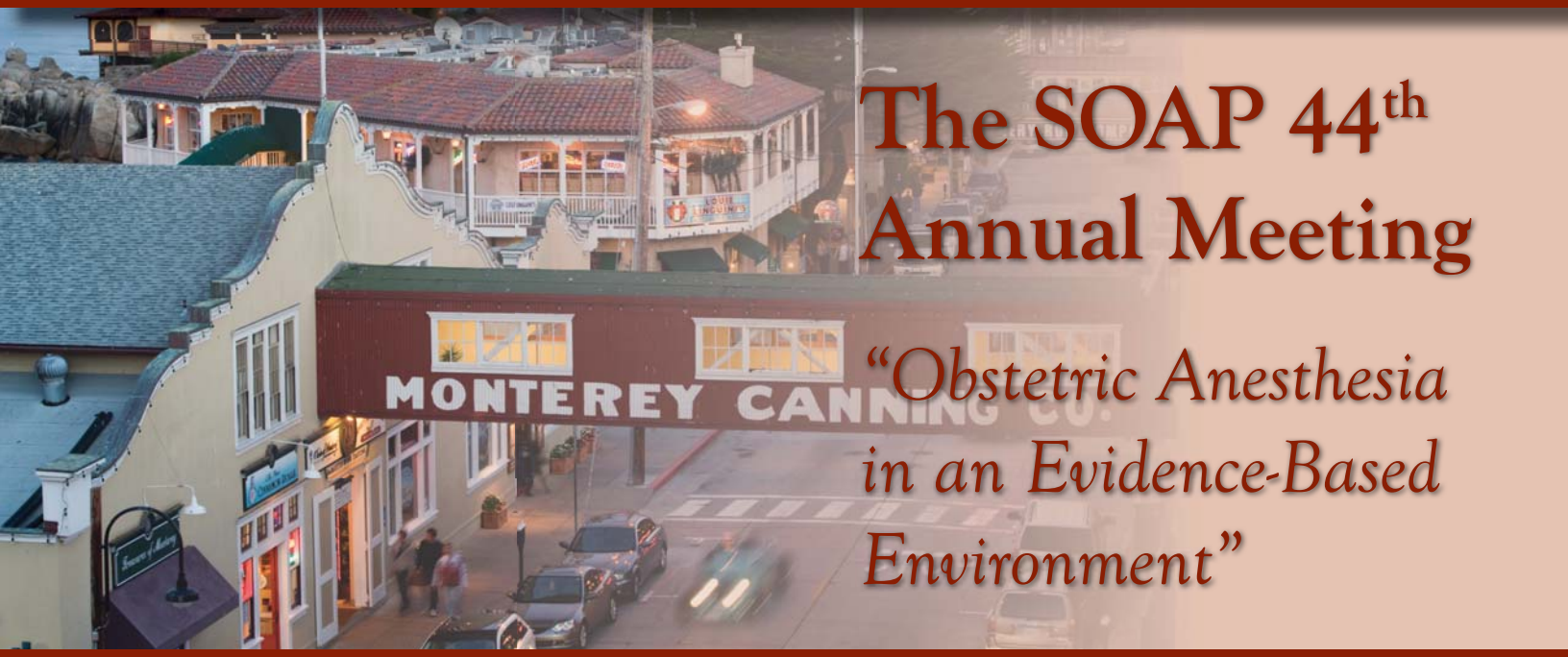
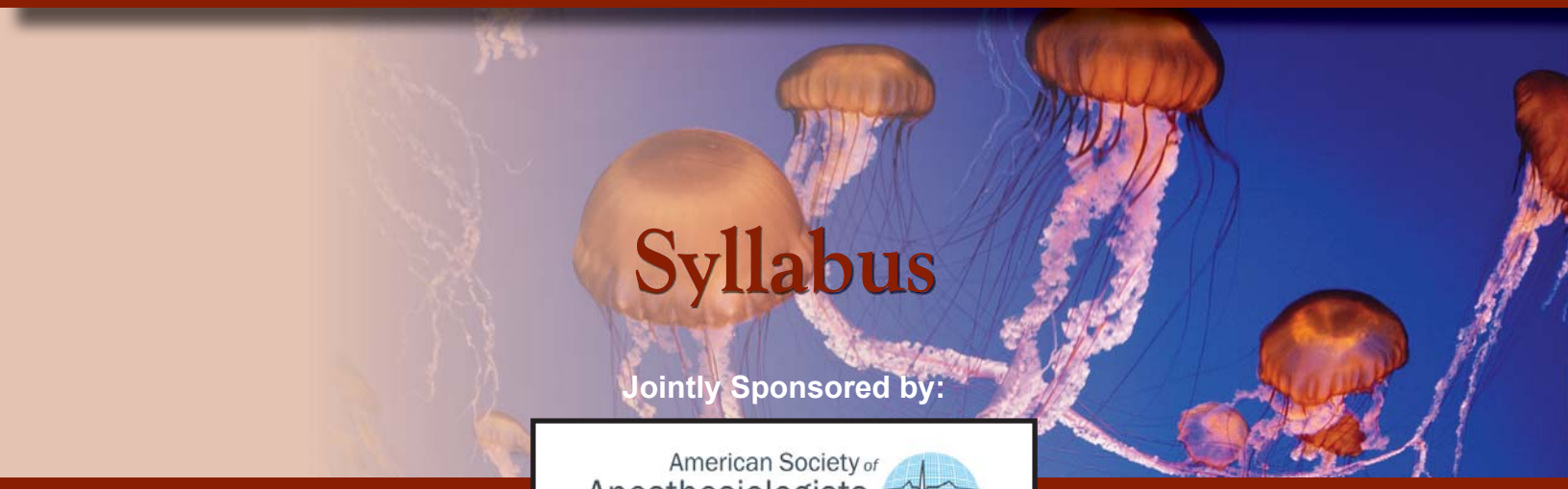


The SOAP 44th Annual Meeting

"Obstetric Anesthesia in an Evidence-Based Environment"

May 2-5, 2012 • Hyatt Regency Monterey Resort and Spa • Monterey, California



Syllabus

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The Society for Obstetric Anesthesia and Perinatology presents

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SOAP
Society for Obstetric Anesthesia and Perinatology

520 N. Northwest Highway, Park Ridge, IL 60068
Phone: 847-825-6472 ♦ Fax: 847-825-5658
E-mail: soap@soap.org ♦ Website: www.soap.org

Program Committee

McCallum R. Hoyt, M.D., M.B.A.
President-Elect and Program Chair
Brigham and Women's Hospital
Harvard Medical School
Boston, MA

Dennis C. Shay, M.D.
2012 Meeting Host
Anesthesia Service Medical Group
San Diego, CA

Pamela J. Angle, M.D., FRCPC, M.Sc.
University of Toronto
Toronto, ON

Katherine W. Arendt, M.D.
Mayo Clinic
Rochester, MN

William R. Camann, M.D.
Brigham and Women's Hospital
Harvard Medical School
Boston, MA

Brendan Carvalho, MBBCh, FRCA, MDCH
Stanford University
Stanford, CA

Jill M. Mhyre, M.D.
University of Michigan Health System
Ann Arbor, MI

Vilma E. Ortiz, M.D.
Massachusetts General Hospital
Boston, MA

Quisqueya "Kiki" Palacios, M.D.
Baylor College of Medicine
Houston, TX

Craig Palmer, M.D.
University of Arizona
Health and Science Center
Tucson, AZ

Barbara M. Scavone, M.D.
University of Chicago
Chicago, IL

Richard M. Smiley, M.D., Ph.D.
Columbia University
New York, NY

John Sullivan, M.D., M.B.A.
Northwestern University
Feinberg School of Medicine
Chicago, IL

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

Manuel C. Vallejo, Jr., M.D., D.M.D.
Magee-Womens Hospital of UPMC
Pittsburgh, PA

Come to the Annual Meeting in Monterey, California!

Dear Friends,

Welcome to Monterey! On behalf of the SOAP Program Committee, we are pleased to have you here. This year's meeting is a mixture of old favorites and new offerings, and all will combine to make this an informative and exciting conference giving maximal value for your time. We are truly thrilled about this program and believe you will agree with us that this is the best meeting presented to date.

Continuing the tradition of pre-meeting workshop offerings, two workshops are planned for Wednesday, May 2. The two workshops are the Ultrasound Workshop so ably coordinated by Jose Carvalho in past years and a High-Risk Obstetric Crisis Simulation Workshop offered by Gillian Hilton with her team from Stanford. Each workshop is offered twice on Wednesday; once in the morning and once in the afternoon to allow for attendance at both. A new session called Clinical Concepts is also introduced. This symposium is designed to present a concentrated, evidence-based discussion of a key clinical topic. The inaugural topic is "Coagulopathy: Nuts and Bolts to Cutting Edge" and is moderated by Phil Hess. This is offered on Wednesday afternoon. All sessions involve innovative technology as part of the instruction so please enjoy these offerings.

The theme for this year's Annual Meeting is "Obstetric Anesthesia in an Evidence-Based Environment". Several sessions incorporate the EBM theme starting with the special GM/FAER lecture given by Dr. Gordon Guyatt on Thursday morning. Dr Guyatt is one of the innovative founders of the concept of "Evidence-Based Medicine" and will discuss why it is relevant to the practice of obstetric anesthesia. Other theme-based sessions are a pro-con debate titled "Patient Outcomes are Better with Protocol-Driven Care" featuring Robin Russell and Scott Segal, and a breakfast session demonstrating the use of evidence-based medicine principles to clinical scenarios with Pam Angle, an experienced instructor in the practical application of evidence-based concepts. Additionally, a clinical forum will focus on evidence-based management concepts and specialty-specific concerns surrounding postpartum hemorrhage from three experts. Maurice Druzin will present the obstetrician's viewpoint, Tim Goodnough, the hematologist and blood bank director's position, and Andrea Fuller, the anesthesiologist's perspective. Favorite SOAP sessions also include the Gertie Marx competition, poster and oral research presentations, a session covering the best cases of the year, and the OB research seminar. The "What's New" lectures and Fred Hehre presentation will be given by the following distinguished speakers; Ray Powrie (What's New in Obstetric Medicine; Update 2012), Julian "Bill" Parer (What's New in Obstetrics; Evolving Consensus on Standardization of FHR Pattern Management), Gordon Lyons (Fred Hehre Lecture: A Critical Examination of Regional Technique), and Alexander Butwick (Gerard W. Ostheimer Lecture). We are introducing an optional poster walk-around session during our Thursday afternoon break with Richard Smiley, and are very honored to present the Distinguished Service Award to Dr. Gerald Bassell.

The meeting also includes an exciting social program featuring the Welcome Reception, a sunrise yoga session, the annual celebratory banquet at the renowned Monterey Bay Aquarium, a sensational series of tours (whale watching, wine tasting, and Big Sur Coastline tour) for those coming with you, and the ever-popular free afternoon for sight seeing, shopping, exercising, relaxing, or a round of golf on one of those famed Pebble Beach courses. Two more new introductions to the meeting format include having the annual business meeting during the lunch session on Thursday and the award presentations on Saturday during the general session. The meeting concludes on Saturday afternoon and is followed by an on-site wine tasting for those not needing to rush off on Saturday evening.

We love having you here with us in gorgeous Monterey, California! Enjoy!

McCallum R. Hoyt, M.D., M.B.A.
SOAP President-Elect and Program Committee Chair

Dennis C. Shay, M.D.
SOAP 2012 Meeting Host

Program Faculty

* Annual Meeting Faculty - Lecturers, Panelists
# Moderators/Introductions
+ High Risk Obstetric Crisis Simulation Workshop Faculty
~ Judges
^ Use of Ultrasound in Obstetric Anesthesia: Spinals and Epidurals, Vascular Access, and TAP Blocks Workshop
= Clinical Concepts Symposium

Pamela J. Angle, M.D., FRCPC, M.Sc.*
University of Toronto
Toronto, ON

Julie Arafeh, R.N., M.S.N+
Lucile Packard Children's Hospital
at Stanford
Palo Alto, CA

Katherine W. Arendt, M.D.#
Mayo Clinic
Rochester, MN

Cristian Arzola, M.D., M.Sc.^
Mount Sinai Hospital
University of Toronto
Toronto, ON

Leyla Baghirzada, M.D., M.P.H., FRCPC^
Mount Sinai Hospital
University of Toronto
Toronto, ON

Mrinalini Balki, M.D.^
Mount Sinai Hospital
University of Toronto
Toronto, ON

Brian T. Bateman, M.D.#
Massachusetts General Hospital
Harvard Medical School
Boston, MA

David J. Birnbach, M.D., M.P.H.#~
University of Miami, Jackson Memorial
Miami, FL

David Bogod, MB, BS, FRCA, LLM~
Nottingham University Hospitals
Nottingham, UK

Brenda A. Bucklin, M.D.#=
University of Colorado Denver
Denver, CO

Alexander Butwick, MBBS, FRCA, MS*
Stanford University
Stanford, CA

William R. Camann, M.D.#
Brigham and Women's Hospital
Harvard Medical School
Boston, MA

Brendan Carvalho, MBBCh, FRCA, MDCH#
Stanford University
Stanford, CA

Jose C.A. Carvalho, M.D., Ph.D., FANZCA, FRCPC^
Mount Sinai Hospital
University of Toronto
Toronto, ON

Jeremy Collins M.D.+
Stanford University
Stanford, CA

Javier Cubillos, M.D.^
Mount Sinai Hospital
University of Toronto
Toronto, ON

Robert D'Angelo, M.D.~
Wake Forest University School
of Medicine
Winston-Salem, NC

Kay Daniels M.D.+
Stanford University
Stanford, CA

Maurice Druzin, M.D.*+
Stanford University
Stanford, CA

Roshan Fernando, FRCA* ~
University College London Hospitals
London, UK

Pamela Flood, M.D.#~ *
University California San Francisco
School of Medicine
San Francisco, CA

Michael A. Froelich, M.D., M.S.# =
University of Alabama at Birmingham
Birmingham, AL

Andrea J. Fuller, M.D.*
University of Colorado Health
Sciences Center
Fort Collins, CO

Yehuda C. Ginosar, M.D.~
Hadassah Hebrew University
Medical Center
Jerusalem, Israel

Eric Goldszmidt, M.D., FRCPC^
Mount Sinai Hospital
University of Toronto
Toronto, ON

Lawrence "Tim" Goodnough, M.D.*
Stanford University
Stanford, CA

Maria Cristina Gutierrez, M.D.+
UC Davis Medical Center
Sacramento, CA

Gordon Guyatt, M.D., B.Sc., FRCPC, M.Sc.*
McMaster University
Toronto, ON

Kim Harney, M.D.+
Stanford University
Stanford, CA

Joy L. Hawkins, M.D.~
University of Colorado School
of Medicine
Aurora, CO

Philip E. Hess, M.D.= ~
Beth Israel Deaconess Medical Center
Boston, MA

Gillian Hilton, MBChB, FRCA+
Stanford University
Stanford, CA

McCallum R. Hoyt, M.D., M.B.A.*#
Brigham and Women's Hospital
Harvard Medical School
Boston, MA

Bhavani Shankar Kodali, M.D.#
Brigham and Women's Hospital
Harvard Medical School
Boston, MA

Ruth Landau, M.D.*
University of Washington
Seattle, WA

Jennifer M. Lucero, M.D., M.A.#
University California San Francisco
San Francisco, CA

Gordon Lyons, M.D.*
St. James' University Hospital
England, UK

Clarita Margarido, M.D., Ph.D.^
University of Toronto
Toronto, ON

Jill M. Mhyre, M.D.* =
University of Michigan Health System
Ann Arbor, MI

Albert Moore, M.D., FRCPC^
McGill University, Royal Victoria Hospital
Montreal, QC

Ana Morales-Clark, BSN, OB, CCTS+
Lucile Packard Children's Hospital
at Stanford
Palo Alto, CA

Kenneth E. Nelson, M.D.#
Wake Forest University Health Sciences
Winston Salem, NC

Yayoi Ohashi, M.D., Ph.D. ^
Mount Sinai Hospital
University of Toronto
Toronto, ON

Vilma E. Ortiz, M.D.#
Massachusetts General Hospital
Boston, MA

Arvind Palanisamy, M.D., FRCA*
Brigham and Women's Hospital
Harvard Medical School
Boston, MA

Moeen Panni, M.D., Ph.D.#
University of Florida, College of
Medicine
Jacksonville, FL

Julian Parer, M.D., Ph.D.*
University California San Francisco
San Francisco, CA

Raymond Powrie, M.D.*
Brown University - Women and Infants'
Hospital
Providence, RI

Stephen Pratt, M.D.*
Beth Israel Deaconess Hospital
Harvard Medical School
Boston, MA

Andrea Lorraine Puck, RN, MS+
Lucile Packard Children's Hospital
at Stanford
Palo Alto, CA

Edward T. Riley, M.D.+
Stanford University
Stanford, CA

Robin Russell, M.D., FRCA*
John Radcliffe Hospital
Oxford, UK

Alan C. Santos, M.D., M.P.H.#
St Luke's Roosevelt Hospital Center
New York, NY

Barbara M. Scavone, M.D.#
University of Chicago
Chicago, IL

Scott Segal, M.D., MHCM*
Tufts Medical Center
Boston, MA

Dennis C. Shay, M.D.#
Anesthesia Service Medical Group
San Diego, CA

Naveed T. Siddiqui, M.D., M.Sc.^
Mount Sinai Hospital
University of Toronto
Toronto, ON

Richard M. Smiley, M.D., Ph.D.#
Columbia University
New York, NY

Maya S. Suresh, M.D.#~
Baylor College of Medicine
Houston, TX

Paloma Toledo, M.D., M.P.H.#
Northwestern University Feinberg School
of Medicine
Chicago, IL

Ashley M. Tonidandel, M.D., M.S.#
Wake Forest University Health Sciences
Winston Salem, NC

Lawrence C. Tsen, M.D.~
Brigham & Women's Hospital
Harvard Medical School
Boston, MA

Manuel C. Vallejo, Jr., M.D., D.M.D.^ ~
Magee-Womens Hospital of UPMC
Pittsburgh, PA

Anasuya Vasudevan, MBBS, M.D.#=
Beth Israel Deaconess Medical Center
Boston, MA

Paul M. Wieczorek, M.D., FRCPC^
McGill University, SMBD-Jewish
General Hospital
Montreal, QC

Cynthia A. Wong, M.D.#
Northwestern University
Chicago, IL

Faculty Disclosures

Each presenter is required to disclose the existence of any financial interest and/or other relationship(s) (e.g. employee, consultant, grant recipient/research support he/she might have with a) the manufacturer(s) of any commercial product(s) to be discussed during his/her presentation and/or b) the commercial contributor(s) of the activity.

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Planner/Faculty Disclosures

The following planning committee members and/or faculty have indicated that they have relationships with industry to disclose:

Robin Russell, M.D., FRCA
8 - Elsevier

The following planning committee members and/or faculty have indicated that they have no relationships with industry to disclose relative to the content of this CME activity:

Pamela J. Angle, M.D., FRCPC, M.Sc.
Julie Arafeh, R.N., M.S.N
Katherine W. Arendt, M.D.
Cristian Arzola, M.D., M.Sc.
Leyla Baghirzada, M.D., M.P.H., FRCPC
Mrinalini Balki, M.D.
Brian T. Bateman, M.D.
David J. Birnbach, M.D., M.P.H.
David Bogod, MB, BS, FRCA, LLM
Brenda A. Bucklin, M.D.
Alexander Butwick, MBBS, FRCA, MS
William R. Camann, M.D.
Brendan Carvalho, MBBCh, FRCA, MDCH
Jose C.A. Carvalho, M.D., Ph.D., FANZCA, FRCPC
Jeremy Collins M.D.
Javier Cubillos, M.D.
Robert D'Angelo, M.D.
Kay Daniels M.D.
Maurice Druzin, M.D.
Roshan Fernando, FRCA
Pamela Flood, M.D.
Michael A. Froelich, M.D., M.S.
Andrea J. Fuller, M.D.
Yehuda C. Ginosar, M.D.
Eric Goldszmidt, M.D., FRCPC
Lawrence "Tim" Goodnough, M.D.
Maria Cristina Gutierrez, M.D.
Gordon Guyatt, M.D., B.Sc., FRCPC, M.Sc.
Kim Harney, M.D.
Joy L. Hawkins, M.D.
Philip E. Hess, M.D.
Gillian Hilton, MBChB, FRCA
McCallum R. Hoyt, M.D., M.B.A.
Bhavani Shankar Kodali, M.D.
Ruth Landau, M.D.
Jennifer M. Lucero, M.D., M.A.
Gordon Lyons, M.D.
Clarita Margarido, M.D., Ph.D.
Jill M. Mhyre, M.D.
Albert Moore, M.D., FRCPC
Ana Morales-Clark, BSN, OB, CCTS
Kenneth E. Nelson, M.D.
Yayoi Ohashi, M.D., Ph.D.
Vilma E. Ortiz, M.D.
Arvind Palanisamy, M.D., FRCA
Moeen Panni, M.D., Ph.D.
Julian Parer, M.D., Ph.D.
Raymond Powrie, M.D.
Stephen Pratt, M.D.
Andrea Lorraine Puck, RN, MS
Edward T. Riley, M.D.
Alan C. Santos, M.D., M.P.H.
Barbara M. Scavone, M.D.
Scott Segal, M.D., MHCM
Dennis C. Shay, M.D.
Naveed T. Siddiqui, M.D., M.Sc.
Richard M. Smiley, M.D., Ph.D.
Maya S. Suresh, M.D.
Paloma Toledo, M.D., M.P.H.
Ashley M. Tonidandel, M.D., M.S.
Lawrence C. Tsen, M.D.
Manuel C. Vallejo, Jr., M.D., D.M.D.
Anasuya Vasudevan, MBBS, M.D.
Paul M. Wieczorek, M.D., FRCPC
Cynthia A. Wong, M.D.

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4 Equity Position
5 Stock Options
6 Funded Research
7 Consulting Fees
8 Honoraria
9 Other Material Support

Abstract Author Disclosures

The following abstract authors have indicated that they have relationships with industry to disclose:

Alexander J. Butwick, MBBS, FRCA, MS
3 - Masimo Corp.
9 - Haemonetics Corp

Harvey M. Carp, Ph.D., M.D.
4 - Obstetric Solutions and Interventions, LLC, Phoenix Arizona

Brendan Carvalho, MBBCh, FRCA
6 - Pacira

Robert Garfield, Ph.D.
4 - Obstetric Solutions and Interventions, Phoenix, Arizona

Ashraf S. Habib, MBBCh, M.Sc., MHS, FRCA
7 - Masimo

William Maner, B.Sc., B.A.
6 - Obstetric Solutionss and Interventions, Phoenix, Arizona

The following abstract authors have indicated that they have no relationships with industry to disclose relative to the content of this CME activity:

Etedal Aamri, M.D.
Niekoo Abbasian, M.D.
Alaa A. Abd-Elsayed, M.D., MPH
Mohammed Abdel-Rahim, M.D.
Amir Abdelmalak, M.D.
Ramon Abola, M.D.
Rinat Abramovich, Ph.D.
Mohammed Abu-Lil, RN
Jacob K. Adam, M.D.
Niesen D. Adam, M.D.
M. Christopher Adams, M.D.
Clayton Adams, M.D.
Amit Alam, BS
Meredith Albrecht, M.D.
Pedram Aleshi, M.D.
Terrence K. Allen, M.D., MBBS, FRCA
Suresh Anandakrishnan, M.D., MBBS, FRCA
Murphy Anderson, CRNA
Pamela Angle, B.Sc., M.Sc., M.D., FRCPC
Martin Angst, M.D.
Saravanan Ankichetty, M.D
Fenny Anthikad, M.D., MBBS
Andreas V. Antoniou, M.D., M.Sc., FRCPC
Julie Arafeh, MSN
Thomas L. Archer, M.D., MBA
Katherine W. Arendt, M.D.
Kristopher Arheart, Ed.D.
Valerie Arkoosh, M.D., MPH
Cristian Arzola, M.D.
Mihaela Astilean, M.D.
Ami Attali, DO
Taylor G. Austin, M.D.
Avijit Basak, MS
Susmita Bhattacharya, M.D.
Leyla Baghirzada, M.D., FRCPC, MPH
Sonia Bahlani, M.D.
Emily Baird, Ph.D., M.D.
Chritopher Baker, M.D.
Mrinalini Balki, MBBS, M.D.
Jerasimos Ballas, M.D., MPH
Catiffany Banks, BS
Philip Barclay, FRCA
Andrew B. Barker, M.D.
Juliet Barker, BM
Sabri Barsoum, M.D.
Thomas E. Bate, MBChB, FRCA
Brian T. Bateman, M.D.
Jeannette R. Bauchat, M.D.
Melissa E. B. Bauer, DO
Victor Baum, M.D.
Curtis L. Baysinger, M.D. MPH
Michelle Beam, DO
Nicole C. Beatty, M.D.
Kevin T. Beers, M.D.
Maria X. Beltran, Resident III
Scott E. Benzuly, M.D.
Miles Berger, M.D., Ph.D.
Paul Berstein, M.D.
David J. Birnbach, M.D., MPH
Michael Block, M.D.
Terry D. Bogard, M.D.
Oksana Bogatyryova, M.D.
Robert Bolash, M.D.
Diana P. Bolaños Arboleda, M.D.
Laurent Bollag, M.D.
Jessica L. Booth, M.D.
Satrajit Bose, M.D., M.H.S.
Mayer Brezis, M.D.
Allison Bryant, M.D.
Brenda A. Bucklin, M.D.
Jason M. Buehler, M.D.
Brian Burrough, M.D.
Dan R. Bustamante, M.D.
William Camann, M.D.
Christopher R. Cambic, M.D.
Nicole Camp, M.D.
Qinying Cao, M.D., MS
Eric Cappiello, M.D.
Mark Carlson, DO
Dominic Carollo, M.D.
Stephen R. Carr, M.D.
Jose CA Carvalho, M.D., Ph.D.
Molly Cason, M.D.
Laurie Chalifoux, M.D.
Thomas M. Chalifoux, M.D.
Alan Chaput, M.D., FRCPC
Kallol Chaudhuri, M.D., Ph.D.
Yushio Cheing, MBBS
Li-Kuei Chen, M.D., Ph.D.
Christopher Chen, M.D.
Richard Cherry, M.D., FRCPC
Pramod Chetty, M.D.
Franklin Chiao, M.D.
Joon H. Choi, BA, M.D.
Brenda J. Christopher, M.D.
Christopher Ciliberto, M.D.
Allison G. Clark, M.D.
Claudia Clavijo, M.D.
Jefferson Clivatti, M.D.
John Coffman, M.D.
Sheila E. Cohen, MBChB
Jennifer Cohn, M.D.
Brad R. Cohn, M.D.
Naida Cole, M.D.
Lee Coleman, M.D.
Valerie D. Collins, M.D.
Malachy Columb, FRCA
Karenrose R. Contreras, M.D.
Nathalie Corchia, B.Sc.
Christina Cordiero, B.S.
Genevieve Cote, M.D., M.Sc., FRCPC
Caley Coulson, BS

Abstract Author Disclosures

The following abstract authors have indicated that they have no relationships with industry to disclose relative to the content of this CME activity:

Roseann H. Covatto, M.D.
Angelette Covin, M.D.
Margaret G. Craig, M.D.
Ioana Crisan, RN
Seth M. Crislip, M.D.
Chantal Crochetiere, M.D., FRCPC
Javier E. Cubillos, M.D.
Virginia M. Cuce, R.N.C., MSN
Michael D'Ambra, M.D.
Abelina D'Costa, M.D.
Justin DaGraca, M.D.
Patricia L. Dalby, M.D.
Torijaun D. Dallas, M.D.
Mudar Dalloul, M.D.
Carmen R. Dargis, M.D.
Marianne David, M.D.
Jo Davies, MBBS, FRCA
Erika Davis, M.D.
Lyndsey Day, M.D.
De Oliveira De Oliveira.Jr., M.D.
Bruno V. DeCaria, M.D.
Cheryl DeSimone, M.D.
Caroline AH Dean, MBBS, MRCP, FRCA
Jeremy Deer, M.D.
Caroline N. Dejean, M.D.
Jerod S. Denton, Ph.D.
Neha Deshpande, BA
Lisa Deutsch, Ph.D.
Reena Dhingra, M.D.
Dennis Dice, BSEE
Kassapidis Dimitrios, DO
Galina Dimitrova, M.D.
Emily M. Dinges, M.D.
Jasmine Djordjevic, B.Sc.
James A. Dolak, M.D., Ph.D.
Joanne Douglas, M.D., FRCPC
Kristi Downey, M.Sc.
John W. Downing, M.D.
Elizabeth Drake, BM
Natalie Drake, M.D.
Richard Driver, M.D.
David Drover, M.D.
Adrienne T. Duffield, M.D.
Susan D. Dumas, M.D.
Nicole M. Durko, DO
Vincent P. Duron, M.D.
Juan Dávila-Velázquez, M.D.
Jesse M. Ehrenfeld, M.D. MPH
Jean F. Ehrenworth, R.N.C, M.S.N.
Luminita Eid, M.D.
Leonid A. Eidelman, M.D.
Sharon Einav, M.D.
Yasser Y. El-Sayed, M.D.
Nadir El-sharawi, MBBS, FRCA
Uriel Elachalal, M.D.
Elia Elia, M.D.
Robert Ellis, MBChB, FRCA
Jeremy Elliston, B.Sc., MBBS
Lola Emanuel-Kole, B.Sc., MBBS, FRCA
Kingsley Enohumah, MBBS, M.Sc., FCARCSI
Jonathan Epstein, M.D.
Wittwer D. Erica, M.D., Ph.D.
Magda Erik Soussi, M.Sc.
Amy Evers, M.D.
Yossef Ezra, M.D.
Anthony Fabio, Ph.D.
Carolona Fadon, M.D.
Shou-Zen Fan, M.D., Ph.D.
Michaela K. Farber, M.D.
Dan Farine, M.D.
Ali Sabri Faris, MBChB, FIBMS
Jason R. Farrer, M.D.
Joe Feinglass, Ph.D.
Liping Feng, M.D.
Helene Fiengold, M.D.
Andrew Fine, M.D.
Steven T. Fogel, M.D.
Nelson J. Fonseca Ruiz, M.Sc.
Ivy F. Forkner, M.D.
Carmen Frias, FFARCSI
Zeev Friedman, M.D
Alexander Friend, BA
Thomas Frisell, M.Sc.
Michael Froelich, M.D., M.S.
Andrea Fuller, M.D.
Sharmila Ghosh, M.D.
Catherine Gallant, M.D., FRCPC
Edward J. García Peñuela
Lindsay Gennari, M.D.
Ronald B. George, M.D. FRCPC
Lyle P. Gerety, M.D.
Liane Germond, M.D.
Raphael Y. Gershon, M.D., MBA
Roxana Ghashghaei, BA
Shayanti Meela Ghosh, MBBS, B.Sc., FRCA
Sarah Gibb, MBChB, FRCA
Lesley Gilbertson, M.D.
Yehuda Ginosar, B.Sc., MBBS
Marie-Andree Girard, M.D., FRCPC
Raymond Glassenberg, M.D.
Akash Goel, B.Sc.
Susan Goheen, M.D., FRCPC
Tally S. Goldfarb, M.D.
Stephanie R. Goodman, M.D.
Yaakov Gozal, M.D.
Michal Granot, Ph.D.
Michael F. Greene, M.D
Nathaniel Greene, M.D.
Mary Lou Greenfield, MPH
Domenick C. Grieshaber, M.D.
Sorina Grisaru-Granovsky, M.D.
William A. Grobman, M.D., MBA
Lydia Grondin, M.D.
Mara A. Grossman, M.D.
Amos Grunebaum, M.D.
Laarni Guerina, M.D
Susan Guest, RN
Deepak Gupta, M.D.
Avni Gupta, M.D.
Deepak Gupta, M.D.
Ling Qun HU, M.D.
Adeniran A. Haastrup, M.D.
Ashraf S. Habib, MBBCh, FRCA
John Haddad, M.D.
Andrea M Hages D.O.
Mona Halim, M.D.
Stephen Halpern, M.D., M.Sc., FRCPC
Catherine Halstead, M.D., FRCPC
Daniel Hanono, M.D.
Elsje Harker, M.D.
Simon Haroutinian, Ph.D.
Priscilla G. Harrell, M.D.
Lynne Harris, BSN
Stuart Hart, M.D.
Jan Hart, MSPH
Stuart Hart, M.D.
Scott Harter, M.D.
Romana Hasnain-Wynia, Ph.D.
D. Matt Hatch, M.D.
Joy L. Hawkins, M.D.
Niamh Hayes, FCARCSI
Michael J. Hays, M.D.
Sonia Hernandez-Diaz, M.D., Sc.D.
Philip E. Hess, M.D.
Gillian Hilton, MBChB, FRCA
Kim Hinshaw, MBBS, FRCOG
Bryan C. Hoelzer, M.D.
Shawn L. Hoffman, M.D., FRCPC
Guilherme Holck, M.D.
Jeffrey J. Honer, BS, M.D.
John A. Hossack, Ph.D.
H. Jane Huffnagle, DO
Suzanne Huffnagle, DO
Genevieve Hunkele, DO
Igor Ianov, M.D.
Alexander Ioscovich, M.D.
Unyime Ituk, MBBS, FCARCSI
Celina R. Jacobi, BS
Carolyn N. James, M.D.
Chandrasekar Janarthanan, MBBS, DA, FRCA
Vanthana Jayaraj, MBBS
Bauchat R. Jeanette, M.D.
Suyogi Jigajinni, MBBS, FRCA
Myhre M. Jill, M.D.
Raymond F. Johnson, BS
Cheryl Jones, M.D., DVM
Philip Jones, M.D., FRCPC
Marenco Julio, M.D.
Rachel M. Kacmar, M.D.
Sarah E. Kadhim, M.D.
Robin Kalish, M.D
Sari J. Kaminsky, M.D.
Laine Kassler
Arendt W. Katherine, M.D.
Kouhei Kawashima, M.D.
Jason D. Keller, DO
Kim S. Khaw, MBBS, FRCA, FHKCA, FHKAM
John Kingdom, M.D.
Klaus Kjaer, M.D.
Allan Klapper, M.D.
Bhavani Shankar Kodali, M.D.
Patricia Kolesnichenko, M.D.
Isabelle Korn-Lubetzki, M.D.
Joanna Kountanis, M.D.
Vesela P. Kovacheva, M.D., Ph.D.
Olajide O. Kowe, MBBS
Elizabeth Krenz, M.D.
Melissa Kreso, M.D.
Timo Krings, M.D., Ph.D., FRCPC
Bobby Krishnachetty, MBBS FRCA
Kamal Kumar, M.D.
Jinesh Lachmansingh, M.D.
Mark W. Lambert, B.Sc., MBBS, FRCA
Ruth Landau, M.D.
Aoife Lane, M.D.
Elizabeth M. Lange, M.D.
Jaqueline Laundre, M.D.
Olga Lazar, M.D.
Allison Lee, M.D.
Lin Lee, M.D.
Shara WY Lee, M.Sc., Ph.D.
Lisa R. Leffert, M.D.
Christian Lehmann, M.D., Ph.D.
Fawn A. Leigh, M.D.
Barbara L. Leighton, M.D.
Harry Lemmens, M.D.
Agnieszka Lesicka, M.D.
Maggie R. Lesley, M.D.

Abstract Author Disclosures

The following abstract authors have indicated that they have no relationships with industry to disclose relative to the content of this CME activity:

Philip Levin, M.D.
Yunping Li, M.D.
Grace Lim, M.D.
Xue-Mei Lin, M.D.
Stephanie N. Lin, M.D., S.M.
Steven Lipman, M.D.
Hui Liu, M.D.
Joyce Lo, M.D.
Robert M. Lobel, M.D.
Vivek Loomba, M.D.
Todd Lovgren, M.D.
Francois I. Luks, M.D.
Anne M. Lynch, M.D., MSPH
Grant C. Lynde, M.D.
Marissa Lyttle, M.D.
Niklas Långström, M.D., Ph.D.
Rahul Dev Mandal, MS
Andrew MIller M.D.
Yu-Shan Ma, M.D.
Alison Macarthur, M.D., FRCPC, M.Sc.
Christina N. Mack, M.D.
Bryan P. Mahoney, M.D.
Purva Makani, FRCA
Vivek Malladi, M.D.
Shuba Mallaiah, FRCA
Natesan Manimekalai, M.D.
Kristin Mantell, M.D.
Nicholas Marcanthony, M.D.
Clarita Margarido, M.D., Ph.D.
Kristine Marmai, M.D., FRCPC
Rachel Martin, M.D.
Frank William Mauldin, Jr., Ph.D.
Bryan G. Maxwell, M.D., MPH
Ryan P. Maxwell, D.O.
Cory D. Maxwell M.D.
Robert J. McCarthy, Ph.D.
Conan McCaul, FCARCSI
Patrick O. McConville, M.D.
Thomas McElrath, M.D., Ph.D.
Alison McGeer, M.D., FRCPC
Alan P. McGlennan, MBBS, FRCA
Heather R.. McKenzie, M.D.
Dennis T. McWeeney, DO
Giorgio Medranda, BS
Sachin H. Mehta, M.D.
Michele Mele, M.D.
Abigail Melnick, M.D.
Jill M. Mhyre M.D.
Daniella Miele, D.O.
Elena Mirochnitchenko, M.D.
Hooman Mirzakhani, M.D.
Basem Mishriky, M.D.
Upma Misra, MBBS, M.D., FRCA, MBA
Robert Mittendorf, M.D., Ph.D.
Daria Moaveni, M.D.
Germán A. Monsalve Mejía
Christy L. Morgan, M.D.
Kathleen G. Morgan, Ph.D.
Benjamin Morley, M.D.
Elicia J. Morris, BSN
Raina Moyer, BA
Allana Munro, M.D.
Christopher S. Muratore, M.D.
Caitriona Murphy, MBBCh, BAO, FCARCSI
Jamie D. Murphy, M.D.
Caitriona Murphy, MBBCh, BAO, FCARCSI
Danielle Murray, BA
Amy P Murtha M.D.
Katsutoshi Nakahata M.D.
Sara C Nelson M.D.
Edward C Nemergut M.D.
Paul Newell BSC (Hons), MSc
Floria F Ng RN, BASc
N'joki Ng'ang'a M.Sc.,R.N.C.
Warwick D. Ngan Kee, MBChB, M.D., FANZCA, FHKCA, FHKAM
John C. Nguyen, M.D.
Albert P. Nguyen, M.D.
Koichi Nishikawa, M.D., Ph.D.
Heather C. Nixon, M.D.
Anna S. Oberg, M.D., Ph.D.
Yayoi Ohashi, M.D.
Emmanuel A. Ojo, MPH
Kowe Olajide, M.D.
Onyi C. Onuoha, M.D., MPH
Sharon Orbach-Zinger, M.D.
Clemens Ortner, M.D., M.Sc.
Walter Osorio
Kevin Owen, M.Sc.
Corrina Oxford, M.D.
Meredith Pace, M.D.
Kristin Palmsten, MS
Joshua Pan
Ho-Yu Pan, RN, MBA
Peter H. Pan, M.D.
Moeen K. Panni, M.D., Ph.D.
Joana Panni, Ph.D.
Constandinos H. Papageorgiou, MBChB, FRCA
Christine S. Park, M.D.
Sra Paruchuri, M.D.
Shetal H. Patel, MBBS
Paras Patel, M.D.
Nisa Patel, MBBS
Shetal H. Patel, MBBS
Linor Peer
Donald H. Penning, M.D., MS, FRCP
Feyce Peralta, M.D.
Anahi Perlas, M.D.
Amy L. Phelps, Ph.D.
May C. Pian-Smith, M.D.
David J. Portch, MBChB
Alison S. Powell, M.D., BS
Manju Prasad, M.D.
Stephen Pratt, M.D.
Debanjali Ray, M.D.
Sivam Ramanathan, M.D.
Jayanthie S. Ranasinghe, M.D.
Morgan Rawl, BA
Adrienne P. Ray, M.D.
Imre Redai, M.D.
Rebecca Reeves, M.D.
Jonathon Reiss, B.A.
MaryJo Ricci, M.Sc.
Michael G. Richardson, M.D.
Philippe Richebé, M.D., Ph.D.
Edward Riley, M.D.
Laura E. Riley, M.D.
Samuel T. Rodriguez, M.D.
David Rosen, M.D.
Lauren Ross, M.D.
Brian Rothman, M.D.
James Rothschild, M.D.
Cortessa Russell, M.D.
Melissa Russo, M.D.
Saher S. Sabri, M.D.
Neeti Sadana, M.D.
James Sadler, M.D.
Herney Saldarriaga
Islam Saleh Abdo, M.D.
Devereux N. Saller, M.D.
Migdalia Saloum, M.D.
Michael R. Sanchez, M.D.
Jaime A. Sanders, M.D.
Kim A. Sanford, M.D.
Divina Santos, M.D.
Tracie A. Saunders, M.D.
Barbara Scavone, M.D.
Joy Schabel, M.D.
Mark D. Schlesinger, M.D.
Eugene Scioscia, M.D.
Gareth Seaward, M.D.
Margaret M. Sedensky, M.D.
Olusegun Senbore, M.D.
Tamas Seres, M.D.
Ofra Seri, B.Sc.
Luis C. Serna
Darshinder Singh Sethi, MBBS, FRCA
J. Bryan Sexton, Ph.D.
Saurin Shah, M.D.
Vihang D. Shah, M.D.
Pranav Shah, M.D.
Waleed Shah, M.D.
Nirav K. Shah, M.D.
Meir Shalit, M.D.
Amy Shanks, M.S.
Joel Shapiro, M.D.
Melissa Shaw, RN
Ilya Shekhter, MBA
Manjunath M. Shetty, M.D., M.P.H.
Alexander G Shilkrut M.D.
Monica Siaulys M.D., PhD
Naveed Siddiqui M.D, MSc
Christopher Sikorski M.D.
Anthony Silipo, DO, PGY-4
Marcos Silva, M.D
Suganthi Singaravelu, MBBS, FRCA
Sudha Singh, M.D., FRCPC
Daniel C. Sizemore, M.D.
Kathleen A. Smith, M.D.
Denis Snegovskikh, M.D.
Nury I. Socha García
Mieke Soens, M.D.
Karina Somohano
Vitaly Soskin, M.D., Ph.D.
Joan Spiegel, M.D.
Una Srejic, M.D.
Arvind Srirajakalidindi, M.D.
Kelsey Steensland, M.D.
Deborah Stein, M.D.
Bettina Steiner-Birmanns, M.D.
Ashley Storey, M.D.
Jhananiee Subendran, B.Sc.
Pervez Sultan, MBChB, FRCA
Hans P. Sviggum, M.D.
Ryan Swain, Ph.D., M.D.
Richard Swartz, H.B.Sc., M.D., Ph.D., FRCPC
Bibiana L. Tabima
Joshua Tan, MS
Christian Taylor, BS
Angukumar Thangamuthu, MBBS, FCARCSI
Robert H. Thiele, M.D.
Steve P. Thomas, MBChB, FRCA
Joseph Thornhill, M.D.
Michael C. Tielborg, M.D., M.Sc.
Vicky Ting, M.D.
Mohamed Tiouririne, M.D.
Paloma Toledo, M.D., MPH
Andrea Torri, M.D.
Lawrence C. Tsen, M.D

Abstract Author Disclosures

The following abstract authors have indicated that they have no relationships with industry to disclose relative to the content of this CME activity:

Felix Tsivislavsky, M.D.
Kalpana Tyagaraj, M.D.
Manuel C. Vallejo, M.D., D.M.D.
Kristen L. Vanderhoef, M.D.
Swarup Varaday, MBBS
Gurinder M. Vasdev, M.D.
Marzanna Vasington, M.D.
Ivan Velickovic, M.D.
Giselle Villar, M.D., FRCPA
Christopher M. Viscomi, M.D.
Sheethal N. Vishwanath, BS, M.D.
Christiane Vogt-Harenkamp, M.D., Ph.D.
Phillip Wang, BS
Christine M. Warrick, BA
Kristin Washburn, M.D.
Izabella Wasiluk M.D.
Jonathan Waters M.D.
Michael E. Watson Jr. M.D., PhD
Debra Watson-Smith RN
Carolyn F Weiniger MBChB
Louise Wen BA
Matthew K Whalin M.D., PhD
William D White MPH
Benjamin C. Whitehill, MS II
Renata Wilczek, M.D.
Carol Wild, MBChB
Marvin Williams, DO
Hilary Wilson, Ph.D.
Bernard Wittels, M.D., Ph.D.
Douglas Woelkers, M.D.
Assefu Woldestadik, M.D.
Cynthia A. Wong, M.D.
Jocelyn Wong, B.A
Cristina Wood, M.D., MS
Sarah Wyhs, M.D.
Stephanie Yacoubian, M.D.
Ted Yaghmour, M.D.
Yu-Hsuan Yang, M.D.
Shiraz Yazdani, M.D.
John Yeh, M.D.
Akari Yoshida, M.D.
Paul Youngs, BM
Fatima Zahir, M.D., MBBS
Lauren Zakarin, BS, M.D.
Mark I. Zakowski, M.D.
Valerie Zaphiratos, M.D., M.Sc.
Zhong Zhang, M.D.
Jin Zhang, M.D., MS
Ming Zhang, M.D., Ph.D.
Jie Zhou, M.D., MS, MBA
Ying Zhu, M.D.
Zuo Zihyi, M.D.
Duncan G. de Souza, M.D.

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The Society for Obstetric Anesthesia and Perinatology adheres to ACCME Essential Areas, Standards, and Policies regarding industry support of continuing medical education. In accordance with the ACCME Standards for Commercial Support of CME, SOAP implemented mechanisms, prior to the planning and implementation of this CME activity, to identify and resolve conflicts of interest for all persons in a position to control content of this CME activity. All presenters are required to make a verbal disclosure prior to their presentation.

Program Information

Program Overview
The purpose of the Society is to provide a forum for discussion of medical problems unique to the peripartum period and to promote excellence in medical care, research and education in anesthesia, obstetrics, obstetric medicine and neonatology.

Accreditation and Designation
This activity has been planned and implemented in accordance with the Essential Areas and policies of the Accreditation Council for Continuing Medical Education through the joint sponsorship 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 AMA Credit Statement
The American Society of Anesthesiologists and the Society for Obstetric Anesthesia and Perinatology designates this live activity for a maximum of 17.75 AMA PRA Category 1 Credit(s)™. Physicians should only claim credit commensurate with the extent of their participation in the activity.

Target Audience
The SOAP 44th 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 44th 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.

Use of Ultrasound in Obstetric Anesthesia: Spinals and Epidurals, Vascular Access and TAP Blocks Workshop
The American Society of Anesthesiologists and the Society for Obstetric Anesthesia and Perinatology designates this live activity for a maximum of 4 AMA PRA Category 1 Credit(s)™. Physicians should only claim credit commensurate with the extent of their participation in the activity.

High Risk Obstetric Crisis Simulation Workshop
The American Society of Anesthesiologists and the Society for Obstetric Anesthesia and Perinatology designates this live activity for a maximum of 4 AMA PRA Category 1 Credit(s)™. Physicians should only claim credit commensurate with the extent of their participation in the activity.

Clinical Concepts - "Nuts and Bolts to Cutting Edge: A Seminar on Coagulopathy"
The American Society of Anesthesiologists and the Society for Obstetric Anesthesia and Perinatology designates this live activity for a maximum of 3.5 AMA PRA Category 1 Credit(s)™. Physicians should only claim credit commensurate with the extent of their participation in the activity.

Evidence Based Practice Breakfast
The American Society of Anesthesiologists and the Society for Obstetric Anesthesia and Perinatology designates this live activity for a maximum of 1.5 AMA PRA Category 1 Credit(s)™. Physicians should only claim credit commensurate with the extent of their participation in the activity.

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

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 complies 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 (847) 825-6472 and/or submit a description of your needs in writing to soap@asahq.org.

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Program Objectives

Use of Ultrasound in Obstetric Anesthesia: Spinals and Epidurals, Vascular Access, and TAP Blocks Workshop

At the end of this session, participants will be able to:

- Describe the physics and basic application of ultrasound.
- Utilize ultrasound to assist placement of neuraxial blocks.
- Acquire techniques to facilitate the placement of central line intravascular and arterial line.
- Practice and visualize the placement of blocks through hands-on demonstrations.

High Risk Obstetric Crisis Simulation Workshop

At the end of this session, participants will be able to:

- Be familiar with several modes of obstetric simulation.
- Be able to discuss the rationale for interventions utilized in stat General Endotracheal Anesthesia for emergency cesarean.
- Be able to describe current approaches for Airway Management in the parturient in high risk situations.
- Be able to list causes of and interventions for Maternal Arrest (Cognitive, Technical, Behavioral).

Clinical Concepts: "Nuts and Bolts to Cutting Edge: A Seminar on Coagulopathy"

At the end of this session, participants will be able to:

- Describe the changes in coagulation that occur during pregnancy and identify the common abnormalities
- Describe the cause of obstetric hemorrhage and the treatments of coagulopathy during hemorrhage
- Interpret tests of coagulation and apply the results to clinical scenarios
- State the recommendations and guidelines of major national and international organizations
- Discuss the current research in the topic of coagulopathy in pregnancy

Fred Hehre Lecture: "A Critical Examination of Regional Technique"

At the end of this session, participants will be able to:

- Understand that opportunities for errors with regional blockade abound.
- Consider that failure to adopt comprehensive asepsis may carry a penalty.
- Understand that a code is needed to identify clear solutions on a tray.
- Understand that avoidable drug errors can have catastrophic effects.
- Consider safer approaches to practical techniques.

Gertie Marx Research Competition

At the end of the session, participants will:

- Recognize the most recent and best peer reviewed obstetric anesthesia research abstracts from around the world (presentation in this session will be by fellows). This is a judged competition.

Gertie Marx/FAER Education Lecture: "Why Bother with Evidence-Based Obstetrical Anesthesia"

At the end of this session, participants will be able to:

- Understand the fundamental principles of evidence-based medicine.
- Consider how these principles might be applied in obstetrical anesthesia.

Clinical Forum: "Post-Partum Hemorrhage Management – Perspectives from Three Disciplines"

At the end of this session, participants will be able to:

- Understand the principles of ordering blood products for parturients.
- Demonstrate the usefulness of massive transfusion protocols during PPH.
- Better understand and evaluate the obstetrical issues contributing to a PPH.
- Outline the surgical techniques employed to manage PPH.
- Discuss the anesthesiologist's role in planning for and managing obstetrical hemorrhage.
- Review the risk of human error in blood transfusion practice.

What's New in Obstetrics: "Evolving Consensus on Standardization of FHR Pattern Management"

At the end of this session, participants will be able to:

- Understand current concensus on FHR nomenclature and interpretation.
- Explore why there remain differences in recommendations for FHR pattern management.
- Present evidence for effectiveness for various published approaches to FHR management.

What's New in Obstetric Medicine: "Update in Obstetric Anesthesia Medicine in 2012"

At the end of these sessions, participants will be able to:

- Understand the challenges in diagnosis and treatment of Sepsis in pregnancy.
- Explore a broad perspective on present thinking about the use of antidepressants in pregnancy.
- Be able to comment on the present recommendations (and their pitfalls) related to Thromboprophylaxis in pregnancy.

Pro-Con Debate: "Patient Outcomes Are Better with Protocol-Driven Care"

At the end of the session, participants will:

- Understand the importance of evidence-based medicine.
- Recognize the value and limitations of protocols and guidelines.
- Question if all protocols and guidelines are evidence-based.
- Appreciate the importance of physician experience and clinical acumen.
- Be aware of the heterogeneity of the obstetric population.
- Appreciate that protocols and guidelines may not be appropriate in certain cases and clinical situations.
- Differentiate protocol-driven care from the absence of clinician decision-making.
- Understand the benefits of protocol-driven care in diverse medical settings.
- Describe optimal areas of benefits from protocol driven care in obstetric anesthesia.

Evidence-Based Practice Breakfast

After attending this problem based learning session, participants will be able to:

- Understand what an "Evidence Cycle" is and illustrate its use in answering a clinical question.
- Describe what a "PICOTT" is.
- Describe and use the concepts of "Relative Risk", "Relative Risk Reduction", and "Number Needed to Treat" as they apply to estimates of treatment effect.

Program Objectives

Gerald W. Ostheimer Lecture

At the end of this session, participants will be able to:

- Evaluate the level of evidence for new preventa-tive and therapeutic strategies in the vast field of obstetric anesthesia, maternal fetal medicine, perinatology, obstetric medicine, pediatrics, epidemiology and affiliated specialties.
- Describe and apply state of the art obstetric analgesia and anesthesia.
- Identify novel concepts in areas of research relevant to understanding and management of pregnancy related disorders, neonatal outcomes, and obstetric anesthesia.

Obstetric Anesthesiology Research: "What's the Future"

At the end of the session, participants will:

- Summarize recent data on the mechanisms of labor pain, chronic pain after childbirth, spinal anesthesia-induced hypotension, and simulation in obstetrics.
- Formulate ideas for future research in mechanisms of labor pain, chronic pain after childbirth, spinal anesthesia-induced hypotension, and simulation in obstetrics.

Best Case Reports Session

At the end of this session, participants will be able to:

- Organize anesthetic plans to treat a variety of complex and rare diseases and obstetric anesthetic complications.

Poster Reviews

At the end of these sessions, participants will be able to:

- Identify recent advances in obstetrics, obstetric anesthesia, and obstetric medicine research.

Best Paper Presentations

At the end of this session, participants will be able to:

- Identify the most recent and best peer reviewed research in obstetrics, obstetric anesthesia, and perinatology. (Presentations in this session will be by attending anesthesiologists). This is a judged competition.

Oral Presentation Sessions

At the end of these sessions, participants will be able to:

- Identify the most recent peer reviewed research in obstetrics, obstetric anesthesia, and perinatology presented by the researchers.

The Society for Obstetric Anesthesia and Perinatology would like to thank the following supporters of the SOAP 44th Annual Meeting:

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Program Schedule

Wednesday, May 2, 2012

Regency Ballroom Foyer	**7:00 a.m. - 6:30 p.m.**	**Registration Hours**
Oaktree Room	**7:00 a.m. - 12:00 p.m.**	**SOAP Board of Director's Meeting**
Pebble Room	**8:00 a.m. - 12:00 p.m.**	**Use of Ultrasound in Obstetric Anesthesia: Spinals and Epidurals, Vascular Access, and TAP Blocks Workshop** Course Director: Jose C.A. Carvalho, M.D., Ph.D., FANZCA, FRCPC
Beach Room		**High Risk Obstetric Crisis Simulation Workshop** Course Director: Gillian Hilton, MBChB, FRCA
	12:00 p.m. - 1:00 p.m.	**Lunch on own**
Pebble Room	**1:00 p.m. - 5:00 p.m.**	**Use of Ultrasound in Obstetric Anesthesia: Spinals and Epidurals, Vascular Access, and TAP Blocks Workshop** Course Director: Jose C.A. Carvalho, M.D., Ph.D., FANZCA, FRCPC
Beach Room		**High Risk Obstetric Crisis Simulation Workshop** Course Director: Gillian Hilton, MBChB, FRCA
Pacific Room	**1:00 p.m. - 4:30 p.m.**	**Clinical Concepts: "Nuts and Bolts to Cutting Edge: A Seminar on Coagulopathy"** Course Director: Philip E. Hess, M.D.
Spyglass Promenade	**6:00 p.m. - 8:00 p.m.**	**Welcome Reception with Wine Tasting and Light Food Pairings**

Thursday, May 3, 2012

Regency Ballroom Foyer	**6:00 a.m. - 6:00 p.m.**	**Registration Hours**
Big Sur/Cypress/Spyglass Windjammer Room	**6:30 a.m. - 7:30 a.m.**	**Continental Breakfast, Exhibits, and Poster Viewing**
Regency Ballroom	**7:30 a.m. - 7:45 a.m.**	**Welcome to the 44th Annual Meeting**
Regency Ballroom	**7:45 a.m. - 9:15 a.m.**	**Gertie Marx Research Competition** Moderator: Alan C. Santos, M.D., M.P.H. Judges: David Bogod, MB, BS, FRCA, LLM; William R. Camann, M.D.; Joy L. Hawkins, M.D.; Maya S. Suresh, M.D.; Robert D'Angelo, M.D.; Manuel C. Vallejo, Jr., M.D., D.M.D.; Philip E. Hess, M.D.
Regency Ballroom	**9:15 a.m. - 9:30 a.m.**	**Distinguished Service Award** Presenter: David J. Birnbach, M.D., M.P.H. Recipient: Gerard M. Bassell, M.D.
Big Sur/Cypress/Spyglass Windjammer Room	**9:30 a.m. - 10:15 a.m.**	**Coffee Break, Exhibits, and Poster Viewing**
Regency Ballroom	**10:15 a.m. - 11:15 a.m.**	**Gertie Marx/FAER Education Lecture: "Why Bother with Evidence-Based Obstetrical Anesthsia"** Speaker: Gordon Guyatt, M.D., B.Sc., M.Sc., FRCPC Introduced by: McCallum R. Hoyt, M.D., M.B.A.
Regency Ballroom	**11:15 a.m. - 12:15 p.m.**	**Poster Session 1** Moderators: Brenda A. Bucklin, M.D. and Katherine W. Arendt, M.D.
Regency Ballroom	**12:15 p.m. - 2:00 p.m.**	**SOAP Business Meeting & Election; Box Lunch**
	12:30 p.m. - 4:30 p.m.	**Monterey Bay Whale Watching Cruise** *Departs from the Hyatt Regency Lobby at 12:30 p.m. ($100 fee)*
Regency Ballroom	**2:00 p.m. - 3:30 p.m.**	**Oral Presentations 1** Moderator: Vilma E. Ortiz, M.D.
Big Sur/Cypress/Spyglass Windjammer Room	**3:30 p.m. - 4:15 p.m.**	**Coffee Break**
Windjammer/Spyglass Room		**Special Poster Session Walk-Around** *(Optional)* Moderator: Richard M. Smiley, M.D., Ph.D.
Regency Ballroom	**4:15 p.m. - 5:30 p.m.**	**Obstetric Anesthesiology Research: "What's the Future?"** Moderator: Cynthia A. Wong, M.D. Judges: Pamela Flood, M.D.; Roshan Fernando, FRCA; Lawrence C. Tsen, M.D.; Yehuda C. Ginosar, M.D.; David J. Birnbach, M.D., M.P.H.; David Bogod, MB, BS, FRCA, LLM
Monterey Ballroom/Terrace	**6:00 p.m. - 7:00 p.m.**	**Fellows Reception** *(By Invitation)*
Regency Room 4	**6:00 p.m. - 9:00 p.m.**	**Resident Dinner**
Regency Room 1-3, 5, 6 Oaktree Room		**Breakout Sessions** *(By Invitation)* Program Director: Paloma Toledo, M.D., M.P.H. Program Speaker: Arvind Palanisamy, M.D., FRCA

Program Schedule

Friday, May 4, 2012

Regency Ballroom Foyer	**6:00 a.m. - 1:00 p.m.**	**Registration Hours**
Pebble Room	**6:00 a.m. - 7:30 a.m.**	**Evidence-Based Practice Breakfast** Course Director: Pamela J. Angle, M.D., FRCPC, M.Sc.
Big Sur/Cypress/Spyglass Windjammer Room	**6:30 a.m. - 7:30 a.m.**	**Breakfast, Exhibits, and Poster Viewing**
Regency Ballroom	**7:30 a.m. - 8:30 a.m.**	**Pro-Con Debate: "Patient Outcomes Are Better with Protocol-Driven Care"** Moderator: Barbara M. Scavone, M.D. Pro: Scott Segal, M.D., MHCM - Protocol Driven Con: Robin Russell, M.D., FRCA - Autonomy
Regency Ballroom	**8:30 a.m. - 9:30 a.m.**	**What's New in Obstetric Medicine: "Update in Obstetric Medicine 2012"** Speaker: Raymond Powrie, M.D. Introduced by: William R. Camann, M.D.
Big Sur/Cypress/Spyglass Windjammer Room	**9:30 a.m. – 10:15 a.m.**	**Coffee Break, Exhibits, and Poster Viewing**
	10:00 a.m. - 2:00 p.m.	**Carmel Valley/Monterey County Wine Tour** *Departs from the Hyatt Regency Lobby at 10:00 a.m. ($125 fee)*
Regency Ballroom	**10:15 a.m. - 11:45 a.m.**	**Best Paper** Moderator: Kenneth E. Nelson, M.D.
Regency Ballroom	**11:45 a.m. - 12:45 p.m.**	**Fred Hehre Lecture** **"A Critical Examination of Regional Technique"** Speaker: Gordon Lyons, M.D. Introduced by: Maya S. Suresh, M.D.
	12:00 p.m.	**Exhibit Hall Teardown**
	12:45 p.m.	**Open Afternoon**
	6:30 p.m. - 10:30 p.m.	**SOAP Banquet at the Monterey Bay Aquarium** *6:30 p.m. - Depart from the Hyatt Regency Lobby by motor coach to the Monterey Bay Aquarium* *10:00 p.m. - Depart from the Monterey Bay Aquarium by motor coach to return to the Hyatt Regency* ***Catering by Cindy Pawlcyn from Top Chef Masters Season 1 on the Bravo channel*** *Cindy Pawlcyn is widely recognized as a pioneer of wine country cooking and one of the first proponents of the farm to table philosophy. She is the executive chef and owner of the Napa Valley restaurants – Cindy's Backstreet Kitchen, Go Fish, Mustards Grill, and the new Brassica Mediterranean Kitchen & Wine Bar.*

Saturday, May 5, 2012

Regency Ballroom Foyer	**6:00 a.m. - 6:00 p.m.**	**Registration Hours**
Tennis Court	**6:00 a.m. - 7:00 a.m.**	**Hatha Yoga Session**
Big Sur/Cypress Room	**6:30 a.m. - 7:30 a.m.**	**Continental Breakfast**
Regency Ballroom	**7:30 a.m. - 9:00 a.m.**	**Clinical Forum: "Post-Partum Hemorrhage Management – Perspectives from Three Disciplines"** Moderator: Brendan Carvalho, MBBCh, FRCA, MDCH Lawrence T. Goodnough, M.D. - Hematologist Maurice Druzin, M.D. - Obstetrician Andrea J. Fuller, M.D. - Anesthesiologist
Regency Ballroom	**9:00 a.m. - 10:00 a.m.**	**Poster Session #2** Moderators: Ashley M. Tonidandel, M.D., M.S. and Pamela Flood, M.D.
	9:00 a.m. - 1:30 p.m.	**Big Sur Coastline Tour** *Departs from the Hyatt Regency Lobby at 9:00 a.m.*
Regency Ballroom	**10:00 a.m. - 10:15 a.m.**	**Awards Presentation**
Big Sur/Spyglass Windjammer Room	**10:15 a.m. -10:45 a.m.**	**Coffee Break, Exhibits, and Poster Viewing**
Regency Ballroom	**10:45 a.m. - 11:45 a.m.**	**Gerard W. Ostheimer Lecture** Speaker: Alexander Butwick, MBBS, FRCA, MS Introduced by: Paloma Toledo, M.D., M.P.H.
Regency Ballroom	**11:45 a.m. - 12:45 p.m.**	**What's New in Obstetrics: "Evolving Consensus on Standardization of FHR Pattern Management"** Speaker: Julian Parer, M.D., Ph.D. Introduced by: Jennifer M. Lucero, M.D., M.A.

Program Schedule

Saturday, May 5, 2012

Monterey Ballroom	**12:45 p.m. - 2:30 p.m.**	**Lunch**
Regency Ballroom	**2:30 p.m. - 3:30 p.m.**	**Oral Presentations 2** Moderator: Dennis C. Shay, M.D.
Regency Ballroom	**3:30 p.m. - 4:45 p.m.**	**Best Case Reports: What Can We Learn From This?** Moderators: Bhavani Shankar Kodali, M.D. and Moeen Panni, M.D., Ph.D.
	4:45 p.m.	**Closing Remarks and Adjournment**
Oaktree Terrace	**5:00 p.m. - 7:00 p.m.**	**Farewell Wine Tasting and Cheese Reception** *Optional Social Event with Cash Bar*

Thursday Educational Session Materials

Gertie Marx Research Competition
Moderator: Alan C. Santos, M.D., M.P.H.

Gertie Marx/FAER Education Lecture
"Why Bother with Evidence-Based Obstetrical Anesthsia"
Speaker: Gordon Guyatt, M.D., B.Sc., M.Sc., FRCPC
Introduced by: McCallum R. Hoyt, M.D., M.B.A.

Oral Presentations 1
Moderator: Vilma E. Ortiz, M.D.

Obstetric Anesthesiology Research: "What's the Future?"
Moderator: Cynthia A. Wong, M.D.

Abstract #:GM-1

Comparison of Epidural Blood Patches Performed with Blind Loss of Resistance Technique versus Fluoroscopic Guidance for Postdural Puncture Headache in Parturients

Hans P. Sviggum, M.D.[1]; Bryan P. Mahoney, M.D.[2]; Katherine W. Arendt, M.D.[1]; Bryan C. Hoelzer, M.D.[1]; Jie Zhou, M.D.[2]
Mayo Clinic - Rochester, Minnesota[1]; Brigham and Women's Hospital - Boston, MA[2]

Introduction: Epidural blood patch (EBP) is an effective therapeutic treatment for postdural puncture headache (PDPH). Traditionally, EBP has been performed using a blind loss of resistance (BLOR) technique. However, fluoroscopy has become increasingly utilized in the last decade for EBP placement. The objective of this retrospective study was to compare the efficacy and safety profiles of EBP performed using a BLOR technique and those using a fluoroscopic-guided (FLUORO) technique.

Methods: All patients, age ≥ 18 years, who underwent a BLOR EBP at Brigham and Women's Hospital from January 1, 2009 to August 30, 2011 or a FLUORO EBP at Mayo Clinic from January 1, 2005 to December 1, 2011 for postpartum PDPH treatment, were retrospectively identified. Only the patients' first EBP was analyzed. Procedural details and outcome data including patient demographics, date and time of neuraxial placement, date and time of EBP, volume of blood injected, continued or recurrence of PDPH, need for repeat EBP, and complications were collected.

Results: A total of 89 patients underwent BLOR EPB and 68 patients underwent FLUORO EBP were reviewed. Body Mass Index (BMI) was lower in the BLOR group (30.6 ± 5.7 vs 33.0 ± 7.1; p=0.018). The mean number of hours from neuraxial placement to EBP was similar between the BLOR and FLUORO groups (65.5 ± 33.8 vs 71.8 ± 42.4; p=0.338). A higher volume of blood was injected in the BLOR group (22 ± 7 vs 18 ± 4 ml; p<0.001). Continued or recurrent headache occurred in 42 (47.2%) patients in the BLOR group compared to 12 (17.6%) in the FLUORO group (OR=4.2; 95% CI 2.0 to 8.8; p<0.001). Twenty-four (27.0%) patients in the BLOR group underwent a repeat EBP compared to 6 (8.8%) in the FLUORO group (OR=3.8; 95% CI 1.5 to 10.0; p=0.006). There was one EBP-related complication in each group. Both complications were minor and achieved complete resolution.

Discussion: This is a pilot retrospective study comparing EBP performance using BLOR technique to FLUORO technique. The number of patients experiencing continued headache or a recurrence of headache after initial relief was higher in the BLOR group compared to the FLUORO group. This result could be from the BMI difference between the groups. We are planning on future paired sample analysis to control for this confounding factor upon additional sample data collection. Repeat EBP rate was higher in the BLOR group, which could be attributed to practice style differences between institutions such as willingness to perform repeat EBP, or possible scheduling or cost obstacles for EBP performance. There was no difference in complications rates or severity. A carefully designed prospective study may better illustrate the differences between these techniques.

References:

1. Saffa-Tisseront, et al. Anesthesiology 2001;95:334.
2. Kawaguchi, et al. J Anesth 2011;25:450.

Abstract #:GM-2

Endogenous Pain Inhibition Does Not Appear to be the Mechanism Responsible for Pregnancy-Induced Analgesia

Pervez Sultan, MBChB, FRCA[1]; Brendan Carvalho, M.D.[2]; Hilary D. Wilson, Ph.D.[3]; Michal Granot, Ph.D.[4]; Ruth Landau, M.D.[3]
University College London Hospital[1]; Stanford University - Stanford, CA[2]; University of Washington - Seattle, WA[3]; University of Haifa - Haifa, Israel[4]

Background: Pregnancy-induced analgesia (PIA) is a well-described pain modulation phenomenon occurring during pregnancy. It is postulated that PIA occurs due to enhanced endogenous noxious inhibition and helps women tolerate the intense pain of labor. The aim of this study was to assess the hypothesis that endogenous noxious inhibition, as tested by diffuse noxious inhibitory controls (DNIC), would increase over the course of pregnancy, and that pregnant women would show greater inhibition compared to non-pregnant women.

Methods: A total of 31 pregnant (P) and 30 non-pregnant women (NP) were enrolled in this prospective, multicenter study. P women were assessed once each trimester (8-12wks, 18-22wks, at 36wks) and at 6-12wks postpartum. NP were assessed during 4 menstrual cycles (average score pre/post-ovulation) and compared with the P women visit scores. DNIC was performed as previously described (1). A 4x2 mixed design ANOVA was conducted to assess differences within and across subjects, with time (1-4) and group (P vs. NP) as independent variables, and DNIC as dependent variable. Intra-class correlation coefficients (ICC) were also calculated within each group to explore stability across time.

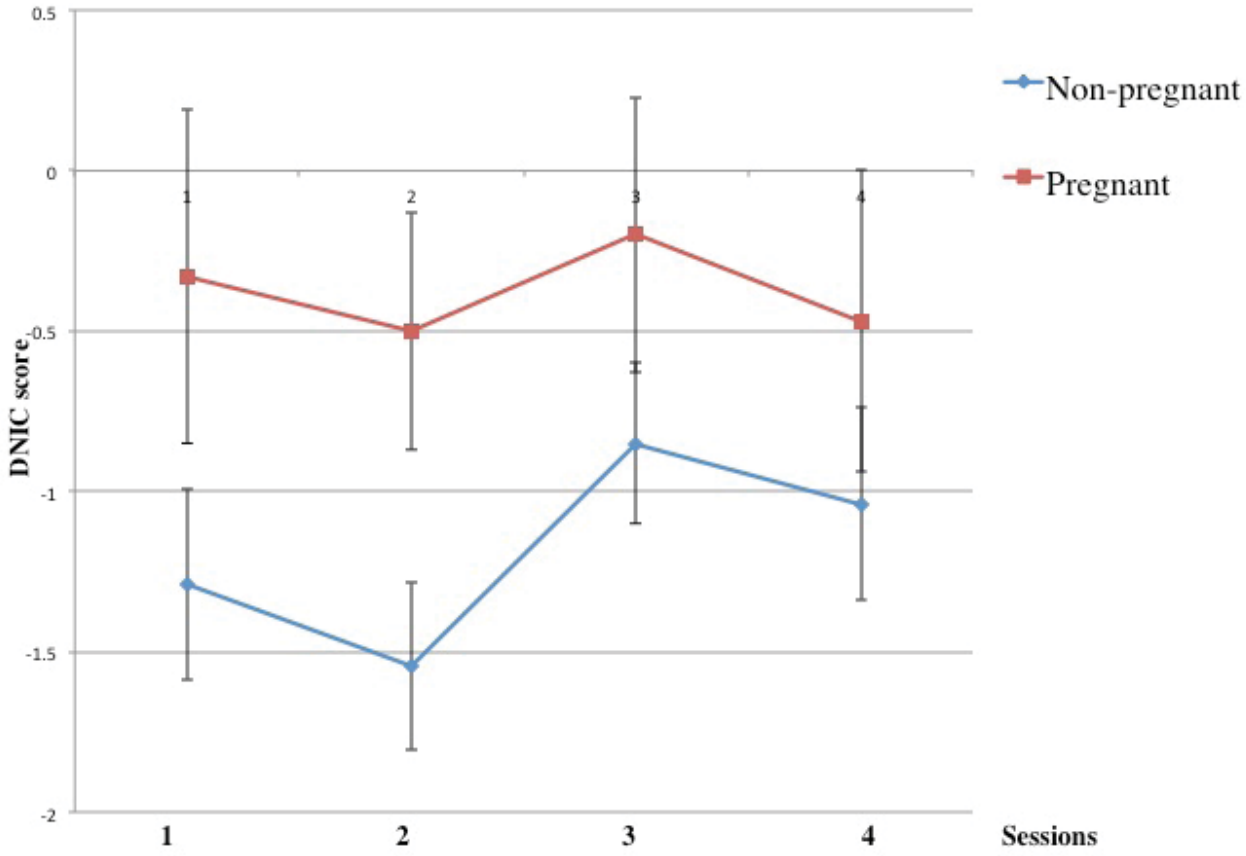
Results: Overall, P women had less efficient DNIC compared to NP controls ($F_{1,35}$ =5.23, p< .05; Fig). DNIC scores did not change significantly over time ($F_{3, 35}$ =.84, p=.48), and there was no significant group by time interaction ($F_{3,35}$ =0.53, p=.47). ICC for DNIC were significant for NP women (ICC=.60, p<.001), but not for P women (ICC=.03, p=.36), and there was greater variation in DNIC during pregnancy compared to controls.

Discussion: This is the first study to assess DNIC changes in pregnancy. Contrary to our hypothesis, DNIC was less efficient in pregnant compared to non-pregnant women, and there were no significant changes in DNIC over time. There was less stability in DNIC among the pregnant group as compared to controls, suggesting that pregnancy may have some impact on DNIC. This variability also suggests sub-groups may exist that experience differential DNIC response throughout pregnancy. These negative findings may reflect that PIA is not driven by enhanced endogenous noxious inhibition, however we cannot exclude the possibility that it may play a role in combination with other effects that were not tested.

1. J Vis Exp. 2010 Jan 27;(35)

Additional Files:

Figure. DNIC score over time in non-pregnant and pregnant women



A negative DNIC score indicates greater endogenous noxious inhibition
Data is presented as mean ± standard errors

Abstract #:GM-3

Carbetocin Vs. Oxytocin: In-Vitro Human Myometrial Contractions After Oxytocin Pre-Treatment

Naida Cole, M.D.; Magda Erik Soussi, M.Sc.; Jose CA Carvalho, M.D., Ph.D.; John Kingdom, M.D.; Mrinalini Balki, M.D.
Mount Sinai Hospital - Toronto, ON

Introduction: Postpartum hemorrhage (PPH) is the main cause of maternal mortality globally. Oxytocin is the 1st-line agent for prevention of uterine atony and PPH, but myometrial exposure to oxytocin in-vivo (during oxytocin augmented labor) or in-vitro may lead to its receptor desensitization, reducing the efficacy of subsequent oxytocin administration [1]. Carbetocin, a new oxytocin analog, is recommended by the Society of Obstetricians and Gynecologists of Canada instead of oxytocin in elective cesarean deliveries (CD)[2], yet the supporting evidence is scarce. Our study evaluated the relative efficacy of carbetocin vs. oxytocin in-vitro in oxytocin-pretreated human myometrium.

Methods: Myometrial samples of non-laboring women undergoing elective CD were pretreated in-vitro with physiological salt solution (PSS) (control) or 10-5M oxytocin for 2h, then subjected to increasing concentrations of oxytocin or carbetocin (from 10-10 to 10-5M) in organ bath chambers at 1g tension. The amplitude and frequency of contractions during the dose-response were recorded, and area under the curve (AUC) calculated and compared between groups.

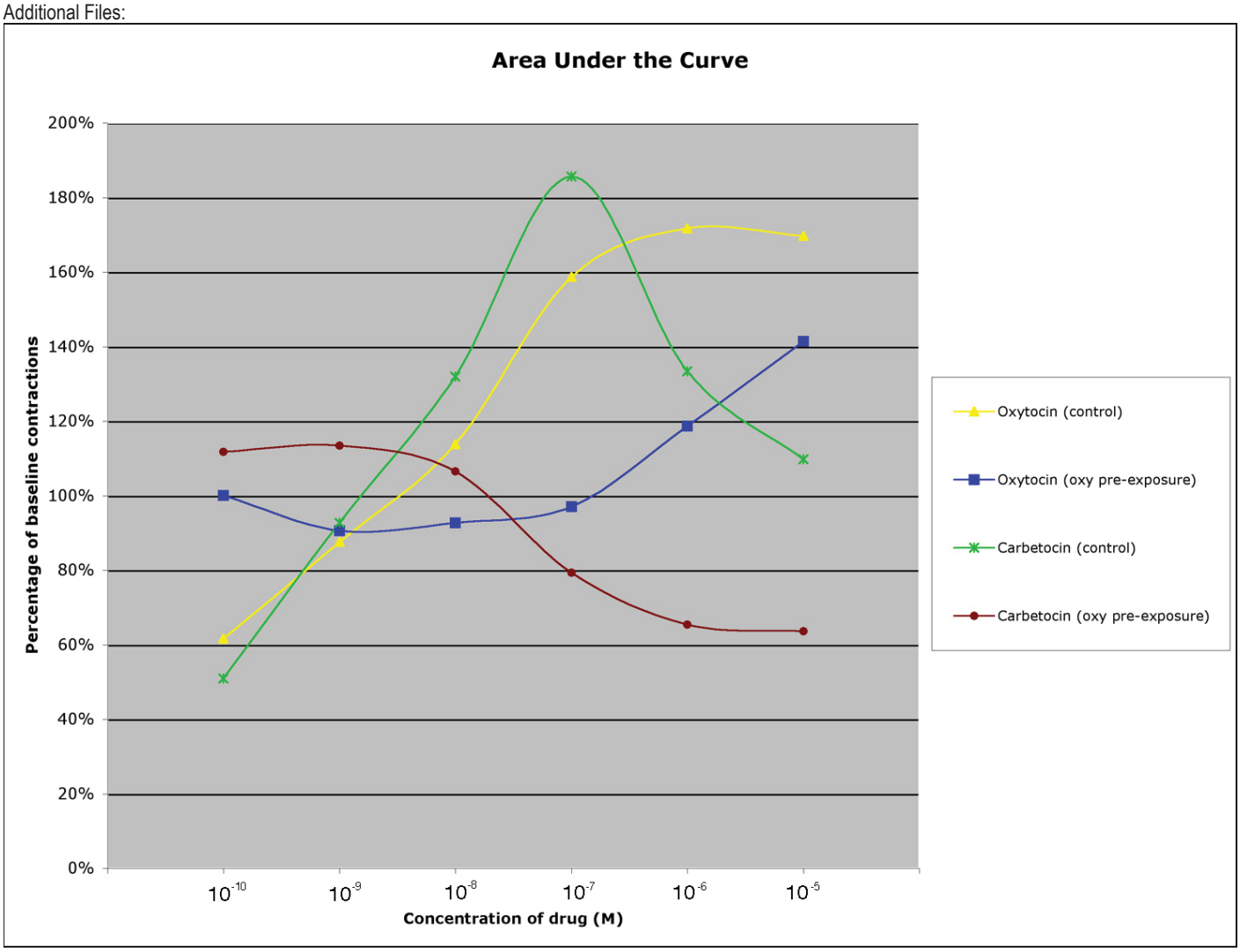
Results: Myometrial samples of 9 women were obtained and 25 experiments performed (oxytocin n=14; carbetocin n=11). The AUC of the contractions increased with increasing drug concentration, but the dose-response curves of the 2 drugs had different slopes (Fig 1). Overall, the mean AUC during the dose-response was higher in control vs. oxytocin pretreated groups, both for oxytocin (Δ17%) and carbetocin (Δ27%). At the peak of the carbetocin dose-response curve (10-7M), there was a significant difference between control vs. oxytocin pretreated groups of carbetocin (p=0.03) and near significant difference between oxytocin groups (p=0.06).

Discussion: Unlike previous studies[3], we found a higher maximal contractile effect of carbetocin than oxytocin in control groups. Similar to oxytocin[4], myometrial contractions were inhibited in oxytocin pretreated samples after carbetocin administration, suggesting oxytocin desensitization decreases carbetocin's efficacy. Carbetocin may be preferred over oxytocin for PPH

prophylaxis after elective CD, but may be a poor choice for laboring parturients pre-exposed to oxytocin. Clinical studies are warranted to confirm these findings.

References:
1.Am J Obstet Gynecol 2003;188:497–502
2.J Obstet Gynaecol Can 2009;31:980-93
3.Eur J Pharmacol 1998;355:203-10
4.Reprod Sci 2009;16:501-8

Additional Files:



Abstract #:GM-4

Temporal Trends and Predictors of Severe Maternal Sepsis and Mortality During Hospitalization for Delivery

Melissa E. B. Bauer, DO[1]; Brian Bateman, M.D.[2]; Amy Shanks, M.S.[1]; Jill Mhyre, M.D.[1]
University of Michigan - Ann Arbor , MI[1]; Massachusetts General Hospital - Belmont, MA[2]

Introduction: Sepsis emerged as the leading cause of direct maternal death in the most recent Saving Mothers' Lives report from the UK, and is reported to complicate 1:7654 to 1:8338 deliveries.(1,2,3) The population-level incidence and temporal trends are unknown in the US. The purpose of this study is to determine incidence, risk factors and outcomes for severe maternal sepsis during hospitalization for delivery using the largest administrative dataset of admissions available in the US, the Nationwide Inpatient Sample (NIS).

Methods: Admissions for delivery in women aged 12-55 were identified by the associated ICD-9CM codes for delivery and were extracted from the database during 1998-2008. Sepsis, severe sepsis (defined as sepsis and organ dysfunction) and death were identified by the presence of diagnosis codes indicating these conditions. Logistic regression analyses clustered by hospital were undertaken to determine temporal trends and independent predictors of severe sepsis, controlling for maternal demographics, obstetric complications, and hospital characteristics.

Results: Our cohort consisted of 9,245,079 admissions for delivery. Sepsis complicated 2758 deliveries (1:3351), including 855 cases of severe sepsis (23.7% of sepsis cases) and 87 deaths (3.2% of sepsis cases). While the overall incidence of sepsis does not appear to have changed over time, the rate of severe sepsis increased from 17.1% in 1998-2000 to 30.3% in 2007-2008, P=<0.001. The death rate among patients with sepsis increased during the same period from 2.2% to 4.9%, P=0.03. Factors independently associated with severe sepsis during hospitalization for delivery are: chronic renal insufficiency (aOR 21.4, 95%CI 8.8,52.0), chronic liver disease (aOR 27.6, 95%CI 10.2, 74.5), stillbirth (aOR 7.3, 95%CI 5.1,10.4) retained products of conception (aOR 6.8, 95%CI 3.8,12.2), cesarean delivery (aOR 5.2, 95%CI 4.4,6.2), hypertensive diseases of pregnancy (aOR 4.4, 95%CI 3.1,5.5), chronic heart failure (aOR 4.4, 95%CI 3.0,6.3), cerclage during pregnancy (aOR 2.5, 95%CI 1.4,4.7), and preterm delivery <37 weeks (aOR 2.0, 95%CI 1.6,2.5).

Conclusion: In this study, the rate of delivery-related sepsis was higher than previous estimates, and the rate of death and severe sepsis among parturients with sepsis increased markedly between 1998 and 2008. These trends mirror those demonstrated in the UK, and may be due to increasing virulence, or due to increasing numbers of high-risk conditions that increase susceptibility among childbearing women. Chronic renal insufficiency, chronic liver disease, stillbirth, retained products of pregnancy and cesarean delivery were among the strongest predictors of severe sepsis during hospitalization for delivery. Further research is needed to more clearly define the basis for the rise in severe sepsis during pregnancy and to develop interventions to decrease it.

1) AJOG 1988;159:410-6
2) ObstetGyncol 1997;90:553-61
3) BJOG 2011;118(S1)

Abstract #:GM-5

As Compared to Continuous Labor Epidural Analgesia, Dural Puncture Epidural Analgesia Only Reduces the Incidence of Immediate Failures of Epidural Analgesia

Deepak Gupta, M.D.; Arvind Srirajakalidindi, M.D.; Vitaly Soskin, M.D., Ph.D.
Wayne State University/Detroit Medical Center - Detroit, Michigan

Introduction: Dural puncture epidural (DPE) technique with 25G Pencan needle through 17G Tuohy needle without administering intrathecal analgesics allows additional confirmation of epidural space (cerebrospinal fluid flow from Pencan confirms that Tuohy is in epidural space), testing for early epidural catheter failure (Combined Spinal Epidurals prevent testing of epidural catheters due to masking effects of intrathecal analgesics), and enhancement of labor analgesia by intrathecal transfer of epidural analgesics across the dural puncture. Hypothesis: DPE technique would provide superior labor analgesia as compared to continuous labor epidural (CLE) technique without increasing incidence of adverse effects. Visual evidence of intrathecal transfer of epidural analgesics would be appreciable on ultrasound.

Methods: The study was a prospective randomized study. After written informed consent, Group A patients received CLE and Group B patients received DPE. A screening lumbar ultrasound examination was done to assess depth of epidural space in transverse plane; and at the end of epidural placement, attempt was made to appreciate if any medication flow could be visualized across the posterior ligament complex in both groups.

Results: 131 patients consented for study: 2 patients were excluded as they delivered within 30 minutes after consenting for study; 2 preterm patients were excluded as they were discharged home after failed progression of initial cervical dilatation; and 15 patients in Group B were excluded as dural punctures were not successful. Henceforth, on comparing data of Group A (n=63) with Group B (n= 49) (see Table 1), DPE technique had lower incidence of immediate failures of labor analgesia (P=0.0436) and less time was required to perform DPE (P=0.0321) as difficult unsuccessful dural punctures got excluded (n=15). Among the adverse effects, there was higher incidence of paresthesias while doing dural punctures (P<0.0001). Due to novelty of ultrasound assessment for medication flow, only two visualizations of epidural medications' flow were appreciated among the first 20 cases wherein it was attempted. Finally, epidural depth assessment (n=112) with ultrasound correlated with loss of resistance technique (r=0.88; P<0.0001).

Conclusion: As compared to CLE technique, DPE technique did not enhance labor analgesia except for fewer immediate failures in labor analgesia. Lumbar ultrasound imaging did not appreciate intrathecal transfer of analgesics.

Abstract #:GM-6

Non-Invasive Placental and Fetal Organ Hemodynamic Monitoring Using BOLD fMRI in Pregnant Mice: Comparing the Effects of Maternal Ephedrine and Phenylephrine Administration

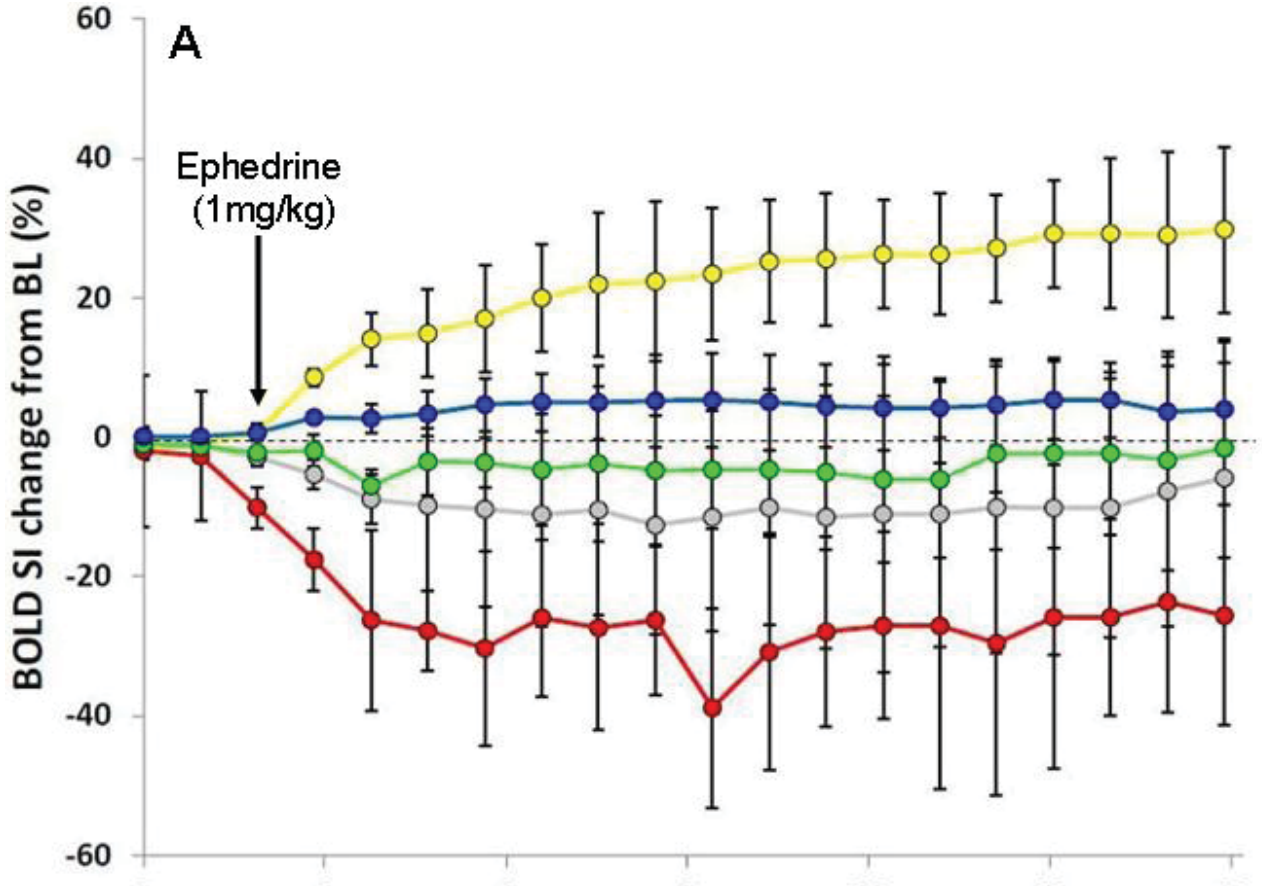
Joel Shapiro, M.D.; Rinat Abramovich, Ph.D.; Nathalie Corchia, B.Sc.;
Uriel Elachalal, M.D.; Yehuda Ginosar, B.Sc., MBBS
Hadassah Hebrew University Medical Center - Jerusalem

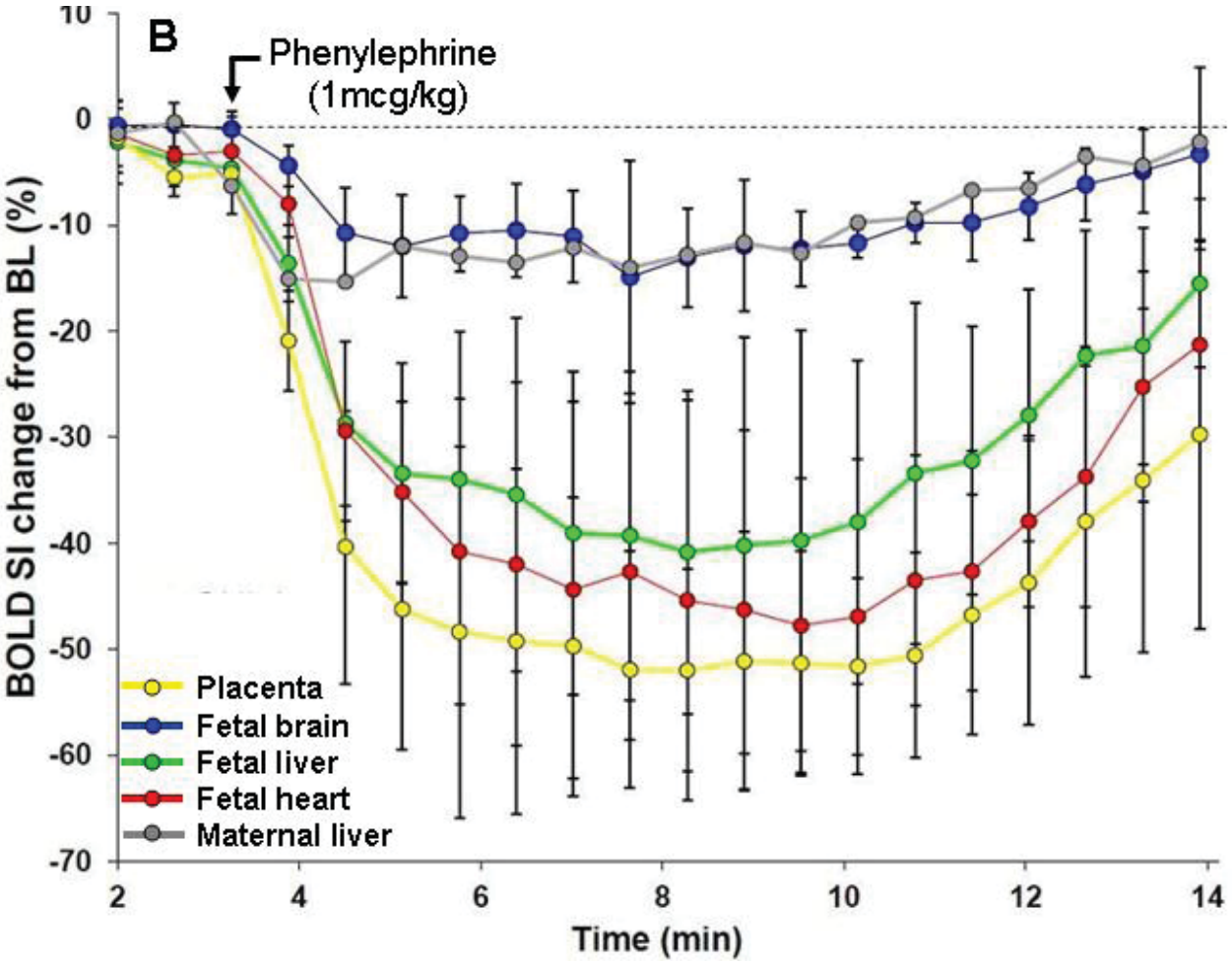
Introduction: We previously reported the use of blood oxygen level dependant functional MRI (BOLD-fMRI) for monitoring hemodynamic changes in placenta and fetal organs in mice. Here we describe the use of BOLD-fMRI to compare ephedrine and phenylephrine for effects on placental and fetal organ perfusion.

Methods: Pregnant ICR mice (n=16; E17.5) were anesthetized with pentobarbital (30mg/kg i.p.) and placed supine in a 4.7-T Bruker Biospec MRI spectrometer. Following baseline images, ephedrine (1mg/kg) or phenylephrine (1 mcg/kg) were administered intravenously. Equipotential doses were selected from a pilot study in anesthetized pregnant Wistar rats with femoral artery pressure transduction. Changes in placental and fetal perfusion following ephedrine or phenylephrine administration were analyzed from T2*-weighted gradient echo MR images (TR/TE=147/10 ms). Different regions of interest (placenta, fetal heart, fetal liver and fetal brain) were identified on True-FISP images using home written IDL software. Percentage change of MR signal intensity (%ΔSI) following the administration of equipotential doses of either ephedrine or phenylephrine were calculated and presented by time curves.

Results: We observed that the effects of ephedrine and phenylephrine were markedly different. Phenylephrine caused a marked reduction in placental and fetal heart and fetal liver signal intensity, but fetal brain SI was unchanged. The time course of fetal cerebral perfusion following phenylephrine (Fig B) was statistically different from that of the placenta and all other fetal organs ($p<0.001$). Additionally, the fetal brain: fetal liver %ΔSI ratio was markedly increased with respect to baseline ($p<0.001$). The time course of fetal cerebral perfusion following ephedrine (Fig A) was only statistically different from that of the fetal heart ($p<0.001$). Fetal heart SI was markedly reduced with respect to baseline ($p<0.001$).

Discussion: Ephedrine increased maternal liver and placental SI and decreased fetal heart SI; this was apparently related to increased maternal cardiac output with increased fetal myocardial oxygen demand. Phenylephrine markedly reduced placental and fetal organ SI, except for fetal brain SI which was minimally changed; this was apparently indicative of acute placental and fetal asphyxia with fetal brain sparing. BOLD fMRI has potential as a tool for non-invasive hemodynamic and pharmacodynamic monitoring of the placental and fetal circulation.




B
Phenylephrine
(1mcg/kg)
BOLD SI change from BL (%)
10
0
-10
-20
-30
-40
-50
-60
-70
2
4
6
8
10
12
14
Time (min)
Placenta
Fetal brain
Fetal liver
Fetal heart
Maternal liver

Gertie Marx/FAER Education Lecture
"Why Bother with Evidence-Based Obstetrical Anesthsia"

Gordon Guyatt, M.D., B.Sc., M.Sc., FRCPC

Objective: To become familiar with the three key principles of evidence-based medicine

Summary: Evidence-based medicine is based on three principles. The first is that there some types of evidence are more trustworthy than other types. There are many examples where observational studies and biological rationale have led us astray. They include antioxidant vitamins for cancer and cardiovascular disease prevention, anti-arrhythmic drugs for prevention of sudden death, and beta blockers for reducing mortality in heart failure. Such examples have led to a hierarchy of evidence for questions of therapy in which randomized trials are at the top of the hierarchy followed by observational studies looking at patient-important outcomes, physiological studies, and uncontrolled clinical observations. In obstetrical anaesthesia, whether one should withhold epidural early in labor to prevent delay in labor illustrates the principle.

The second key principle of EBM is that systematic summaries of the all the best available evidence are necessary for optimal decision making. The third key principle is that evidence never tells you what to do, it is always evidence in the context of values and preferences. Decisions regarding home birth, or whether to receive an epidural, illustrate the application of values and preferences to clinical decision-making.

Key Points:

- For questions of therapy, randomized trials yield more credible evidence than observational studies, physiological experiments, or uncontrolled clinical observations
- Optimal decision-making requires systematic summaries of the best available evidence
- Evidence alone is never sufficient for clinical decision-making; application of value and preference judgments is required

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Abstract #:OP1-1

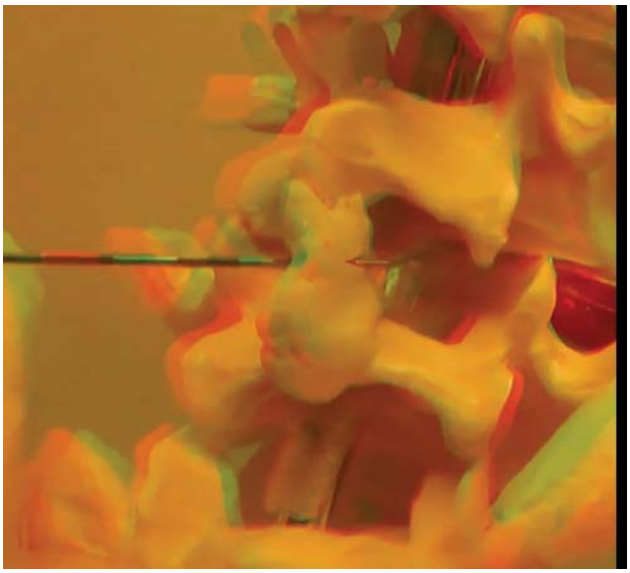
Teaching and Learning Obstetric Epidurals Using 3D Technology on YouTube

Bhavani Shankar Kodali, M.D.; Stephanie Yacoubian, M.D.;
Michael D'Ambra, M.D.
Brigham and Women's Hospital - Boston, MA

The key factor for successful epidural catheter placement is the proper orientation of the needle. Epidural placement can be challenging in the obstetric population due to exaggerated lumbar lordosis and increased body weight, both of which can obscure landmarks. Epidural placements can be particularly difficult in patients with scoliosis given the rotational component associated with spine curvature. The concepts of needle direction in these situations can be difficult to appreciate. Demonstrations using osseous or plastic spine models can be helpful but not always practical at the bedside. Two–dimensional (2D) images of the spine lack depth perception and are not useful for demonstrating needle trajectory. Three-dimensional (3D) technology is best for this purpose. Earlier we used 3D technology to produce 3D videos and conducted a 6-question survey. 92% of trainees felt the 3D videos improved their understanding of epidural anatomy. The average score on the survey improved from 52% before watching the videos to 85% following the videos. The greatest improvement was in CA-1 trainees with minimal epidural placement experience, with an average of 42% improvement.. Unfortunately, the equipment used was very expensive and methodology was very complex. Here, we demonstrate a simple technique to produce 3D scenarios using a conventional 3D digital camera that may have wider teaching implications.

Methods: We used a Fuji 3D HD W3 camera that has two camera channels. The 3D videos produced by this camera can be observed on its 3D screen. They can be also viewed on a 3D-HD screen with polarizing eyewear. Most importantly, we created anaglyph 3D videos that can be seen on conventional iphones, ipads, personal computers (PCs) using inexpensive paper red-cyan filters. We also converted these 3D files into 3D-YouTube formats so that they can be accessed worldwide. The following scenarios on a spine model were recorded in 3D: normal epidural and CSE needle placement, unilateral catheter migration through intervertebral foramina, failed CSE, and epidural placement in lordotic and scoliotic spines. The 3D videos accompanied by commentary are uploaded on YouTube. The videos can be accessed, viewed and downloaded for teaching using devices such as ipads, iphones, and smartphones.

Access: These 3D videos can be accessed and downloaded from YouTube using search criteria; "Failed epidural" in YouTube, or "Failed epidural YouTube" in google.



Abstract #:OP1-2

Transport from the Labor Room to the Operating Room Significantly Decreases the Quality of CPR During Simulated Maternal Cardiac Arrest

Jocelyn Wong, BA[1]; Steven Lipman, M.D.[2]; Sheila E. Cohen, MBChB[2]; Julie Arafeh, MSN[2]; Brendan Carvalho, MBBCh[2]
Dartmouth Medical School[1]; Stanford University Medical Center - Stanford, CA[2]

Introduction: This simulation study compared cardiopulmonary resuscitation (CPR) rendered during transport to the operating room (OR) versus that rendered while stationary in the labor room (LR). We hypothesized that transport would decrease the quality of CPR, an outcome that would impact patient transport to the OR for perimortem cesarean delivery (1).

Methods: This randomized, prospective study was conducted at Lucile Packard Children's Hospital, Stanford, California. Twenty-six teams composed of two staff persons (obstetricians, nurses, anesthesiologists) were randomized to perform CPR on the Laerdal Skills Reporter mannequin during transport or while stationary. Each drill was comprised of three continuous phases: 4 min while stationary, 2 min randomized to either remaining stationary or to transport, and 4 min while stationary. During transport, two individuals not participating as study subjects moved the gurney from the LR to the OR while the study team performed CPR. The primary outcome was the percentage of correctly delivered compressions based on rate>100, sternal hand placement, depth > 1.5 inches and release. Secondary outcomes included ventilation tidal volume, interruptions in compressions, and position of staff relative to the mannequin during the transport phase.

Results: The percentage of correct compressions was 32% in the transport group and 93% in the stationary group (Figure; $P < 0.001$). The median (IQR) compression rates were 124 (110-140) per minute in the transport group and 123 (115-132) in the stationary group ($P = 0.703$). The percent of compressions of insufficient depth was 21% in the transport group and <1% in the stationary group ($P < 0.001$). Interruptions in CPR were observed in 92% of transport and

8% of stationary drills (P<0.001). Median (IQR) tidal volume was 270 (166-430) mL in the transport group and 390 (232-513) mL in the stationary group (P=0.031). During transport, 2 staff straddled the mannequin, 18 kneeled next to the mannequin, and 4 ran alongside the gurney.

Conclusion: Our data demonstrates that transport negatively impacts the overall quality of resuscitation on a mannequin during simulated maternal arrests. These findings, together with previously published simulation data on patient transport-related delays in delivery via perimortem cesarean delivery (2), further strengthen recommendations that perimortem cesareans should be performed at the site of arrest.

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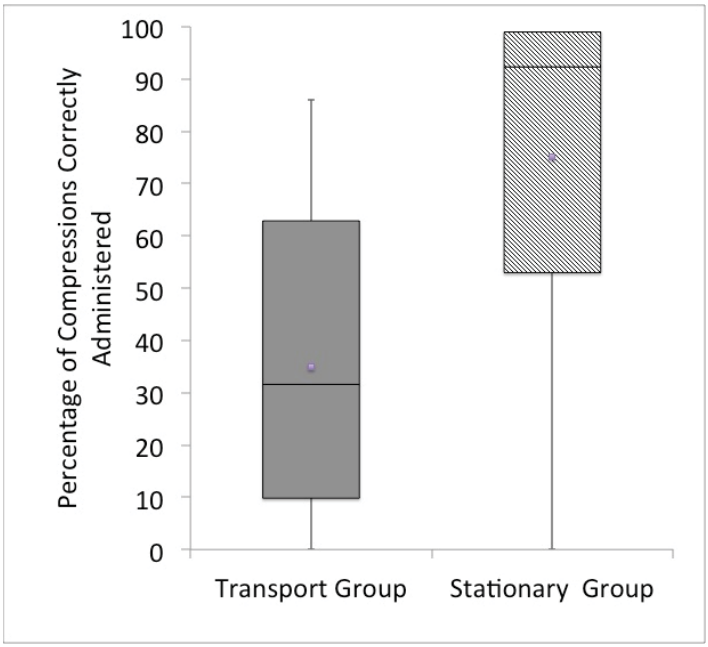

Abstract #:OP1-3

In-Vitro Rat Myometrial Contractions After Oxytocin Pretreatment at Different Trimesters

Mrinalini Balki, MBBS, M.D.; Magda Erik Soussi, M.Sc.; Jose Carvalho, M.D., Ph.D.; John Kingdom, M.D.
Mount Sinai Hospital - Toronto, ON

Introduction: Oxytocin receptors in both human and rat myometrial cells are desensitized by exposure to oxytocin, reducing the ability of cells to respond to subsequent administration of oxytocin (1). This desensitization effect reduces oxytocin-induced contractility of the isolated term pregnant rat uterus after pre-treatment with 10-8M concentration of oxytocin for 1h (2). Rat uterine contractility in response to oxytocin has been shown to increase with increased gestational age, both in cell culture and in tissue (3, 4), but the inhibition of contractility after oxytocin pretreatment has heretofore only been explored in the term pregnant rat uterus. The objective of this study was to investigate pregnant rat myometrial contractility in response to oxytocin administration after pretreatment with oxytocin at early gestation (Day 7), mid gestation (Day 14), and term gestation (Day 21-22).

Methods: After approval by the Animal Care Committee, this in-vitro study was conducted in pregnant Wistar rats. Four longitudinal myometrial strips were isolated from each animal and after equilibration, were pre-treated with either oxytocin 10-8M or PSS (control) for 1h, then subjected to a dose-response study with oxytocin in a pattern of one log molar increase every 10 min from 10-10M to 10-5M. The amplitude and frequency of contractions were recorded, and the area under the curve (AUC) was calculated and compared between groups.

Results: Myometrial samples were obtained from 27 rats and a total of 67 experiments were performed (oxytocin pre-exposure, n=33; control, n=34). The AUC during the dose-response increased with increasing gestational age (Fig 1). The AUC was significantly higher in the control group vs. oxytocin pre-treated group at term gestation (Δ 70.25%, p = 0.036), but the difference was not significant at early and mid gestation.

Discussion: These findings agree with our earlier work in term pregnant rat uterus (2). As the desensitization phenomenon does not affect oxytocin-induced myometrial contractility at early and mid gestation, oxytocin can be effectively used as an uterotonic for 1st and 2nd trimester abortions, even after prior oxytocin exposure. Studies in human myometrium are warranted to confirm these findings.

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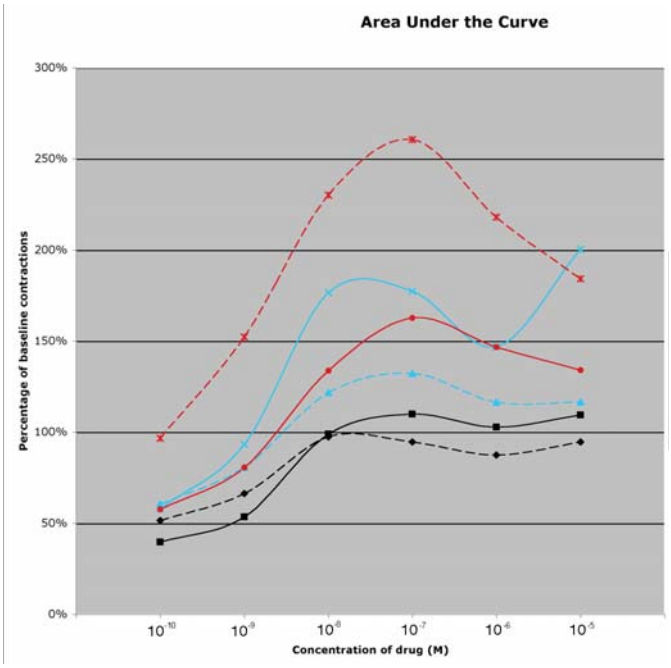

Abstract #:OP1-4

Predictive Modeling for Placenta Accreta Diagnosis Among Pre-Operatively Suspected Cases

Carolyn F. Weiniger, MBChB[1]; Luminita Eid, M.D.[1]; Yehuda Ginosar, M.D.[1]; Lisa Deutsch, Ph.D.[2]; Yossef Ezra, M.D.[1]; Sharon Einav, M.D.[3]
Hadassah Hebrew University Medical Center - Jerusalem, Israel[1]; Biotstats - Modiin, Israel[2]; Shaare Zedek Medical Center - Jersualem, Israel[3]

Background: Diagnosis of placenta accreta prior to surgery is tentative, limiting anesthesia planning. Predictive modeling techniques were employed to improve the assessment of likelihood of the real risk of placenta accreta.

Methods: Consecutively over a 9 year period, women with predictors for placenta accreta were categorized prior to cesarean delivery into high or low susipcion. Predictors included ultrasound signs, placenta previa, previous cesarean delivery. The uncertainty with this categorization meant that women without accreta diagnosed at surgery were undergoing preparations such as general anesthesia and large intravenous access unnecessarily. A more accurate model with higher discriminatory power was sought. A new model, determined by area under the curve of the receiver operating characteristic curve was chosen. The new risk score was derived from the model, optimal cut-points were chosen to classify subjects into high/low risk for accreta, hysterectomy and massive transfusion.

Results: Of ninety-two women with suspected placenta accreta, 52 (56.5%) had accreta diagnosis confirmed at surgery. Classification to low, 25 (29.3%) and high, 65 (70.1%) suspicion predicted definite accreta among high suspicion cases with sensitivity 90% and specificity 55%. General anesthesia was performed for 50/52 (96.2%) patients with accreta diagnosed at surgery and 29/40 (72.5%) without, p=0.001. The new model with highest discriminatory power to differentiate between women found to have/not have accreta at surgery used ultrasound signs of accreta, previous cesarean delivery and placenta previa, with odds ratios (95%CI); 7.8 (2.66-22.68), p=0.0002; 1.77 (1.15-2.71), p=0.0091; 3.9 (1.08-13.98), p=0.0381, respectively. The risk score for accreta derived from the model has an area under curve of 0.84. Using an optimal cut-off value on the risk score, a sensitivity of 94% and specificity of 52% was obtained for predicting the likelihood of accreta, figure 1. Sensitivity and specificity for prediction of massive blood transfusion was 96% and 63% respectively.

Conclusion: A risk score derived from a prospectively assessed cohort of parturients using pre-delivery predictors of placenta previa, ultrasound signs and previous multiple cesarean deliveries can improve accuracy of predicting placenta accreta. This enables preparation for the likelihood of massive transfusion among patients likely to have accreta.

Abstract #:OP1-5

Three-Dimensional Ultrasound Bone Imaging for Spinal and Epidural Placement

Mohamed Tiouririne, M.D.; Frank William Mauldin, Jr., Ph.D.; Kevin Owen, M.Sc.; John A. Hossack, Ph.D.
University of Virginia - Charlottesville, Virginia

Introduction: Ultrasound guidance of neuraxial anesthesia has gained recent popularity among anesthesiologists. However, conventional 2D ultrasound imaging has proven to be limited in the obese and morbidly obese population [1] due to numerous factors including: user skill required to interpret ultrasound images, limited imaging depths, and artifacts (i.e. false appearance of tissue structures in the image) generated from spinal bone reflections [2].

Methods: To circumvent the limitations of conventional ultrasound, a handheld ultrasound device was developed with 3D bone imaging capabilities. Fully automated segmentation of spinal bone surfaces was achieved using a new active shape model based signal processing algorithm. In this technique, a statistical model of spine surface shapes was developed using a "training set" comprising 6,120 spine surface profiles produced from a computed aided design (CAD) model. Additionally, specialized ultrasound transducers were implemented to reduce bone-derived artifact signal compared with conventional ultrasound. Feasibility of the proposed device was demonstrated using an excised deer spine and in vitro phantom model. Bone imaging artifact signal was quantified in terms of image contrast for both conventional ultrasound and the proposed imaging system. Error from 3D bone surface renderings with and without the active shape model approach was quantified using a CAD spine model embedded in a tissue-mimicking gelatin phantom (example images in Fig below).

Results: The proposed device demonstrated both 2D (Fig A) and 3D (Fig B) bone imaging capabilities. Custom transducers yielded reduced artifact bone imaging with average contrast improvement of approximately 6 decibels (dB). The active shape model based segmentation approach (Fig A; red line denotes the segmented spine surface) yielded 3D reconstructions (Fig B) that exhibited root mean squared (RMS) error of 1.8 mm compared to 2.2 mm without the active shape model.

Conclusions: The proposed handheld ultrasound device enabled intuitive imaging of bone anatomy with inherently safe ultrasound. Using the proposed techniques, ultrasound-based image artifacts were reduced compared to standard ultrasound. In addition, highly accurate 3D spinal bone renderings were demonstrated (Fig B) at imaging depths up to 10 cm.

[1] Chin et al, Anesth 2011
[2] Grau et al, Can J Anesth 2003

Abstract #:OP1-6

Oxytocin and Arginine Vasopressin Do Not Alter Vascular Resistance in the Fetoplacental Circulation of the Dual-Perfused Human Placenta

Curtis L. Baysinger, M.D.; Raymond F. Johnson, BS; John W. Downing, M.D.; Jerod S. Denton, Ph.D.
Vanderbilt University School of Medicine - Nashville, TN

Introduction: In non-pregnant animals, high dose vasopressin constricts uterine resistance vessels more than oxytocin!. Physiologic oxytocin concentrations have no effect on pregnant and non-pregnant rat uterine vessels2. In contrast, the effects of these drugs on the fetoplacental circulation have not been well studied. Oxytocin has little effect on umbilical artery Doppler velocity3 and while vasopressin has no effect on overall myometrial blood flow in pregnant animals4, its fetoplacental circulatory effects are unreported.

Methods: With IRB approval and informed written patient consent, placentae from healthy women at term delivered by elective cesarean section were rapidly transported to our laboratory. A fetal chorionic artery and vein serving a discrete cotyledon were quickly cannulated, needles were inserted on the maternal side of the cotyledon, and Krebs Ringers buffer (KRB) was infused at constant pH(7.4) and temperature(37^{o}C). The open (non-recirculating) model was employed and fetal perfusion rates were held constant. Flow rate (Q) was assumed proportional to FAP and inversely related to arteriolar vascular resistance (FVR). Fetal perfusion pressures (FAP) were recorded every 5 minutes and the FAP recordings made just before every step interval were used for data analysis. Each cotyledon was perfused for a control period of 1 hour to allow pressures to stabilize. Arginine vasopressin was added to the fetal reservoir in increasing concentrations [10-11 to 10-6M in 5(10-N+1)] increments (n=5). Similarly, oxytocin was studied over a range of concentrations (10-9 to 10-6M) (n=6). After each study, 5-hydroxytryptamine (5HT) was infused. Wilcoxon rank sum test compared percentage changes from baseline for each concentration.

Results: Two placentas were discarded since 5-HT failed to increase FAP. FAP did not change in response to any concentration of either vasopressin (n=4) or oxytocin (n=5). (Table 1)

Discussion: Our results support umbilical artery Doppler findings showing that oxytocin has minimal effect on FAP3and thus fetal vascular resistance. Although fetal concentrations of vasopressin have been noted to rise substantially during labor4, this would be expected to have little effect on fetal circulation.

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Obstetric Anesthesiology Research: "What's the Future?"

Cynthia A. Wong, MD

Discussants:

1. Labor Pain Mechanisms: Pamela Flood
2. Chronic Pain After Childbirth: Ruth Landau
3. Spinal Anesthesia-Induced Hypotension: Roshan Fernando
4. Simulation: Steve Pratt

Objectives:

By the end of the Research Hour, participants should be able to

1. Summarize recent data on the mechanisms of labor pain, chronic pain after childbirth, spinal anesthesia-induced hypotension, and simulation in obstetrics.
2. Formulate ideas for future research in mechanisms of labor pain, chronic pain after childbirth, spinal anesthesia-induced hypotension, and simulation in obstetrics.

Pro-Con Debate: "Patient Outcomes Are Better with Protocol-Driven Care"
Pro: Scott Segal, M.D., MHCM - Protocol Driven
Con: Robin Russell, M.D., FRCA - Autonomy

What's New in Obstetric Medicine: "Update in Obstetric Medicine 2012"
Speaker: Raymond Oliver Powrie, M.D.

Best Paper
Moderator: Kenneth E. Nelson, M.D.

Fred Hehre Lecture: "A Critical Examination of Regional Technique"
Speaker: Gordon Lyons, M.D.

Pro-Con Debate: "Patient Outcomes Are Better with Protocol-Driven Care"

Pro

Scott Segal, M.D., MHCM

Objectives: This debate will examine whether protocol-driven medical care improves patient outcomes, or is just another fad in this era of health care improvement efforts. At the conclusion of this presentation, the participant will understand the origins and rationale for protocols in medicine and the data supporting their benefits.

Summary: Medicine is "complex." It involves the coordination of dozens, even hundreds of individual tasks, and the selection and order of those tasks isn't the same for each patient. This makes caring for patients not merely "complicated"—made up of lots of individual steps and requiring specialization and flexibility—but also fraught with the natural variations in disease and patient condition. And yet as physicians we often do not even get the basic steps right, much less the sequencing and communication between experts required for the truly complex problems. Protocols help us do just that. By making sure that we don't miss a step or fail to follow those elements comprising best practices, they can improve patient outcomes.

Like some other innovations in medicine, "protocols" are borrowed from the successes of other industries. Aviation is perhaps the most widely known, and the checklists all pilots use every flight grew out of the realization that modern aircraft were too complex to fly safely when relying solely on the expertise and experience of even the best pilots.(1) Aviation (including space travel) has gone on to include protocols for all sorts of untoward events, including emergencies as rare as the recent famous water landing of US Air 1549 in the Hudson River.(2)

In medicine, there have been protocols for many years, including notably in anesthesiology. You use them every day (ASA standards of monitoring, FDA machine checkout) and in emergencies (ACLS protocols, MH protocol). More recently, attention has been paid to more robust efforts to ensure best practices have been followed, with notable success. Pronovost devised the central line protocol and checklist, which is credited with driving CVP infection rates to near zero across multiple hospitals that have adopted it.(3) Protocols for ventilator weaning shorten the time and increase the success, compared to clinician judgment alone.(4) The World Health Organization Safe Surgery Checklist was trialed across a diverse group of hospitals around the world and reduced 30-day postoperative mortality from 1.5% to 0.8% and major complications from 11% to 7%.(5) Similar results were seen in an implementation across Western advanced care hospitals with below average complication rates prior to the intervention.(6) The more compliant care givers are with the protocols, the greater the effect seen.(7) Importantly, professionals' attitude and culture about safety and quality improves after implementation of surgical safety protocols (8), and the quality improvement is at least in part due to such attitudinal changes, and not just to the protocols themselves.(9) Most recently, protocols for OR emergencies have been developed and reduce errors in simulated cases.(10) There is every reason to continue to develop more protocols in perioperative care, and anesthesiologists should take a leading role in such efforts.

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Pro-Con Debate: "Patient Outcomes Are Better with Protocol-Driven Care"

Con

Robin Russell, M.D., FRCA

Objectives: The debate will examine whether protocol-driven care improves patient outcomes. Delegates should understand the limitations as well as the value of protocol-driven care and question if all guidelines are evidence based and whether this is more reliable than the clinical acumen of the experienced physician.

Summary: The last 20 years has seen widespread enthusiasm for evidence-based medicine. This is most welcome in obstetric anesthesia, a specialty in which personal anecdote and bias has for many years negatively influenced patient care. Previous widely held beliefs have been shown to be incorrect in a series of systematic reviews and meta-analyses.[1] But while this has obviously been beneficial, there is now an increasing risk of over reliance on studies whose conclusions are of questionable validity.

Each maternity now has an increasing number of protocols and guidelines. In the UK such guidelines are now a necessary part of clinical governance without which hospitals face financial penalties.[2] But are all guidelines evidence based?[3] If they are, which is highly unlikely, why is there so much variation between units?[4] Is it simply that in order to meet the criteria for passing external review, various protocols are included in unit guidelines? Worse, recommendations regarding care can be misguided increasing risk to patients.[5]

There is little doubt that protocols ensure that the majority of patients receive what is considered the optimum treatment. However, the obstetric population is not homogenous and what is best for one woman need not necessarily be appropriate for another. Only the clinical judgment of the experienced physician can decide on best management in certain cases.[6]

So a combination of evidenced-based medicine and clinical acumen are required to ensure optimum management.[7] Over reliance on protocols, which might or might not be truly evidence based, without input from experienced physicians, at worst ultimately leads to the disappearance of the clinical acumen of skilled doctors but inevitably encourages mediocrity amongst the medical staff of the future.

Key Points

- Evidence based medicine is an extremely useful tool but it does have limitations
- Protocols and guidelines are important to ensure appropriate care is delivered by those with limited experience
- Not all protocols and guidelines are evidence based
- The experienced clinician may be able to better assess an individuals needs which may, on occasion not be in keeping with protocols and guidelines

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Abstract #:BP-1

Serotonin Receptors Increase During Pregnancy and Activate Human Myometrial Smooth Muscle in a Src Independent Manner

Yunping Li, M.D.[1]; Zhong Zhang, M.D.[2]; Philip E. Hess, M.D.[1]; John Yeh , M.D.[3]; Kathleen G. Morgan, Ph.D.[4]
Beth Israel Deaconess Medical Center[1], Massachusetts General Hospital[3], Harvard Medical School, Boston, MA; Xiangya Hospital, Central South University - Changsha, Hunan[2]; Boston University, Sargent College - Boston, MA[4]

Introduction: Serotonin (5-hydroxytryptamine, 5-HT) is a neurotransmitter, neuromodulator, and neurohormone. It modulates many behavioral processes through the at least 14 subclasses of the 5-HT receptors. Serotonin receptor-2a (SR-2a) is the only receptor among these receptor subclasses with an effect on contractility. Serotonin is also known to modulate contractions of the uterus; however, the involved signaling pathways have not been studied in detail. Src kinase is a major regulator of focal adhesion turnover and contractility in myometrial muscle (Li et al). The hypothesis of the current study is to determine if Src mediates serotonin-induced contractions and whether serotonin activates the focal adhesion signaling pathway.

Methods: After informed written consent, human uterine samples were collected from patients undergoing cesarean sections. Rat myometrium samples were also collected for comparison. Isometric tension measurements were used to determine the effect of serotonin and the effect of a Src inhibitor on strips of human myometrium.

Results: By using Western immunoblotting, here we demonstrate that the protein levels of the serotonin receptor 2a increase significantly during pregnancy, both in rat and human uterine smooth muscle. We studied ex vivo the contractile effect of serotonin in isometrically contracting human term uterine smooth muscle in a myobath. 10-6M serotonin markedly augments spontaneous contraction and significantly increases the contractility (area under curve AUC of 5 minutes) (baseline 232±66 vs. 1202±324, p=0.02). Stretch of smooth muscle to 1.5x of resting length can also induce contraction to a similar extent as serotonin (AUC 5' 1801±477). Interestingly, PP2, a Src inhibitor, differentially inhibits stretch induced contraction (AUC 5' 451±89 vs.1801±477, p=0.03), but not serotonin-induced contraction (AUC 5' 812±369 vs. 1202±324, p=0.22), indicating that serotonin activates uterine smooth muscle dominantly via Src independent pathways.

Conclusion: In the present study, we used a selective Src inhibitor to determine that the effect of serotonin on isolated strips of myometrium is Src independent. Serotonin is a potent uterotonic agent that may play a key role in the prevention of uterine atony and consequent postpartum hemorrhage.

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Li Y, Reznichenko M, Tribe RM, Hess PE, Taggart M, Kim HR, DeGnore JP, Gangopadhyay S and Morgan KG. Stretch Activates Human Myometrium via ERK, Caldesmon and Focal Adhesion Signaling. PLoS ONE 2009; 4(10): e7489.

Abstract #:BP-2

PGRMC1 as a Mediator of the Protective Effect of Progestins on Cytokine Induced MMP 9 Activity

Terrence K. Allen MBBS, FRCA; Liping Feng, M.D.; Amy P. Murtha , M.D.
Duke University Medical Center - Durham, NC

Introduction: Elevated levels of TNFα and proteolytic enymes such as matrix metalloproteinase 9 (MMP 9) have been identified in the amniotic fluid of women who develop preterm premature rupture of membranes (PPROM). Cytokine induced MMP 9 activity in the chorion can be partially attenuated by progestin analogues such as medroxyprogesterone acetate (MPA). The mechanism of this protective effect still remains unclear. We hypothesize that this effect may be mediated through a novel membrane associated progesterone receptor: progesterone membrane receptor 1 (PGRMC1). Our objective was to determine if the protective effect of MPA was attenuated when PGRMC1 expression was depleted with PGRMC1 small interfering rnA (sirnA) in a human cytotrophoblast cell line (HTR8/SVneo) known to express the PGRMC1 receptor but not the classical nuclear progesterone receptor.

Methods: HTR8/SVneo cells were transfected with pre-validated scramble control sirnA or PGRMC1 specific sirnA (10 nM final concentration) using Lipofectamine rnAiMAX for 72 h. Cells were then pre-treated with MPA (1μM) or Ethanol (vehicle) for 6 h followed by treatments with and without TNFα 10 ng/ml for an additional 24h. Culture media were harvested for MMP 9 activity assessed using gelatin zymography. In parallel, cell lysates were harvested to confirm PGRMC1 knockdown by western blotting. Image J software was used for densitometry analysis. Experiments were replicated on 3 separate occasions. Data were pooled and expressed as mean ± standard error. The different treatment groups were compared with ANOVA with post hoc Tukey's test for pairwise comparisons.

Results: Western blot analysis confirmed knockdown of PGRMC1 expression. MPA pretreatment reduced the relative MMP 9 activity in both the control and PGRMC1 sirnA groups in response to TNFα stimulation (figure 1). However in cells depleted of PGRMC1 there was significantly less protection (greater mean relative MMP 9 activity) from MPA pretreatment followed by TNFα compared to controls treated with MPA followed by TNFα (74% vs 40%, p<0.001) (figure 1).

Conclusion: Our results demonstrate that the reduction of cytokine induced MMP 9 activity by progestins may partially be mediated through PGRMC1 and provides some insight into possible therapeutic mechanisms for preventing PPROM.

Additional Files:

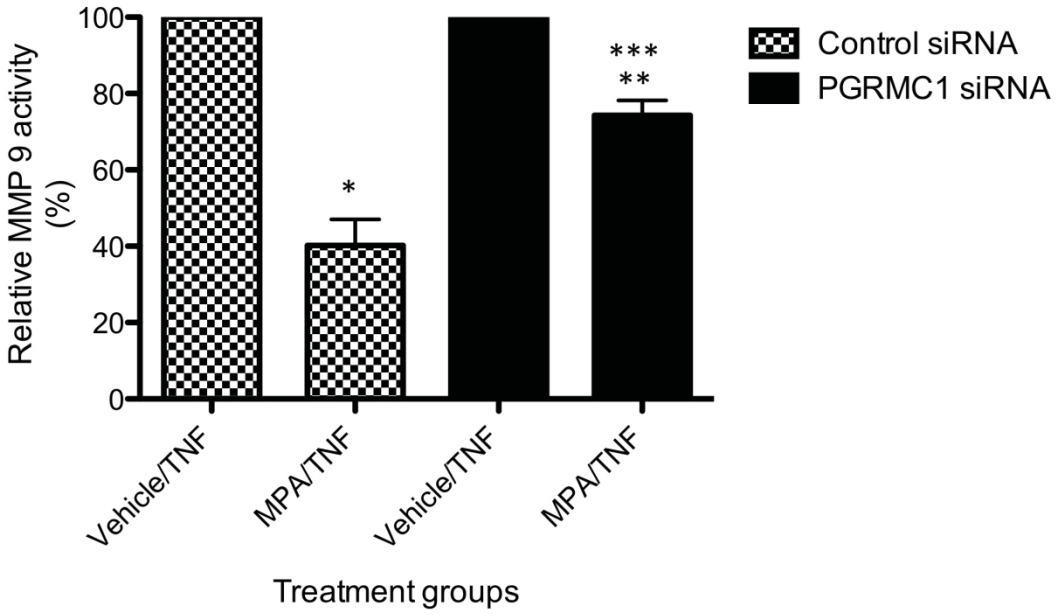


Figure 1. Effect of MPA on TNF induced MMP 9 activity with and without PGRMC1 siRNA. MMP 9 activity is relative to the vehicle/TNF group for each experimental arm.* P< 0.001 vs TNF/vehicle group (control siRNA), ** P< 0.01 vs TNF/vehicle group (PGRMC1 siRNA), *** p<0.001 MPA/TNF (control siRNA) vs MPA/TNF (PGRMC1 siRNA). Data are mean ± SEM

Abstract #:BP-3

Chronic Pain following C-Section Evaluated with the Short-Form McGill Pain Questionnaire 2 (SF-MPQ-2)

Clemens Ortner, M.D., M.Sc.[1]; Hilary Wilson Ph.D.[1]; Philippe Richebé, M.D., Ph.D.[1]; Laurent Bollag , M.D.[1]; Monica Siaulys, M.D., Ph.D.[2]; Ruth Landau, M.D.[1]
University of Washington - Seattle, WA[1]; Hospital e Maternidade Santa Joana - Sao Paulo, Sao Paulo[2];

Introduction: Estimates of the incidence of chronic pain after CS vary widely ranging from 3-18%^1,2. One factor that may contribute to this variability is the lack of standardized and comprehensive approach to evaluate chronic pain in this population. The aim of this study was to utilize the brief pain inventory (BPI)^3 and revised SF-MPQ2^4, a novel comprehensive measure of pain quality, to characterize pain experience in women after CS.

Methodology: 360 women with no history of chronic pain undergoing an elective CS were enrolled. Spinal anesthesia was standardized (bupivacaine 12mg, fentanyl 25µg, morphine 100µg). Post-op pain at rest (R), while sitting (S) and uterine cramping (U) was recorded at 48h. Pain at 8 weeks and 6 months was scored with BPI (3 pain severity questions); pain quality was assessed with SF-MPQ2 (22-items including 6 descriptors each for continuous, intermittent and neuropathic pain, and 4 for affective pain) rated on an 11-point numeric rating scale (NRS). Data are presented as median NRS [quartiles].

Results: Average maternal age was 31±5, with a majority of Caucasians (78%), and primary CS (70%). Pain at 48h was overall mild (NRS-R=2 [0;3]; NRS-S=2 [0;4]; NRS-U=1 [0;3]). At 8 weeks, 334 women (93%) responded, and 34 (10%) complained of pain >0 in the last week (BPI 2 [2;4]); only 8 (2.4%) met the widely accepted criteria of chronic pain of ≥ 4/10 in the last week. At 6 months, 327 women (90%) responded, and 11 (3.4%) still reported some pain (BPI 3 [2;4]). Using SF-MPQ2, neuropathic symptoms were present in 238 women (71%) at 8 weeks, and 138 (42%) at 6 months (Figure). Numbness was the most common neuropathic symptom. The range for other reported pain descriptors was between 0.6-4%. 13 descriptors were never reported at 6 months.

Conclusion: In this prospective longitudinal study, the incidence of chronic pain at 6 months was close to 4%. Using for the 1st time SF-MPQ2 to characterize chronic pain after CS, the most prevalent descriptor was numbness, which was present in 38% of women at 6 months. Other descriptors occurred with a low incidence and included throbbing, tender, cramping, stabbing or piercing pain. As previously described, we found that chronic pain after CS is rare and that characteristics of pain, if present, are mostly neuropathic^5, validating SF-MPQ2 as a useful tool to assess long term pain after CS.

1 Sia, Anesthesiol 2008
2 Kainu, IJOA 2009
3 Cleeland, Pain 1996
4 Dworkin, Pain 2009
5 Loos, Obstet Gyn 2008

Additional Files:

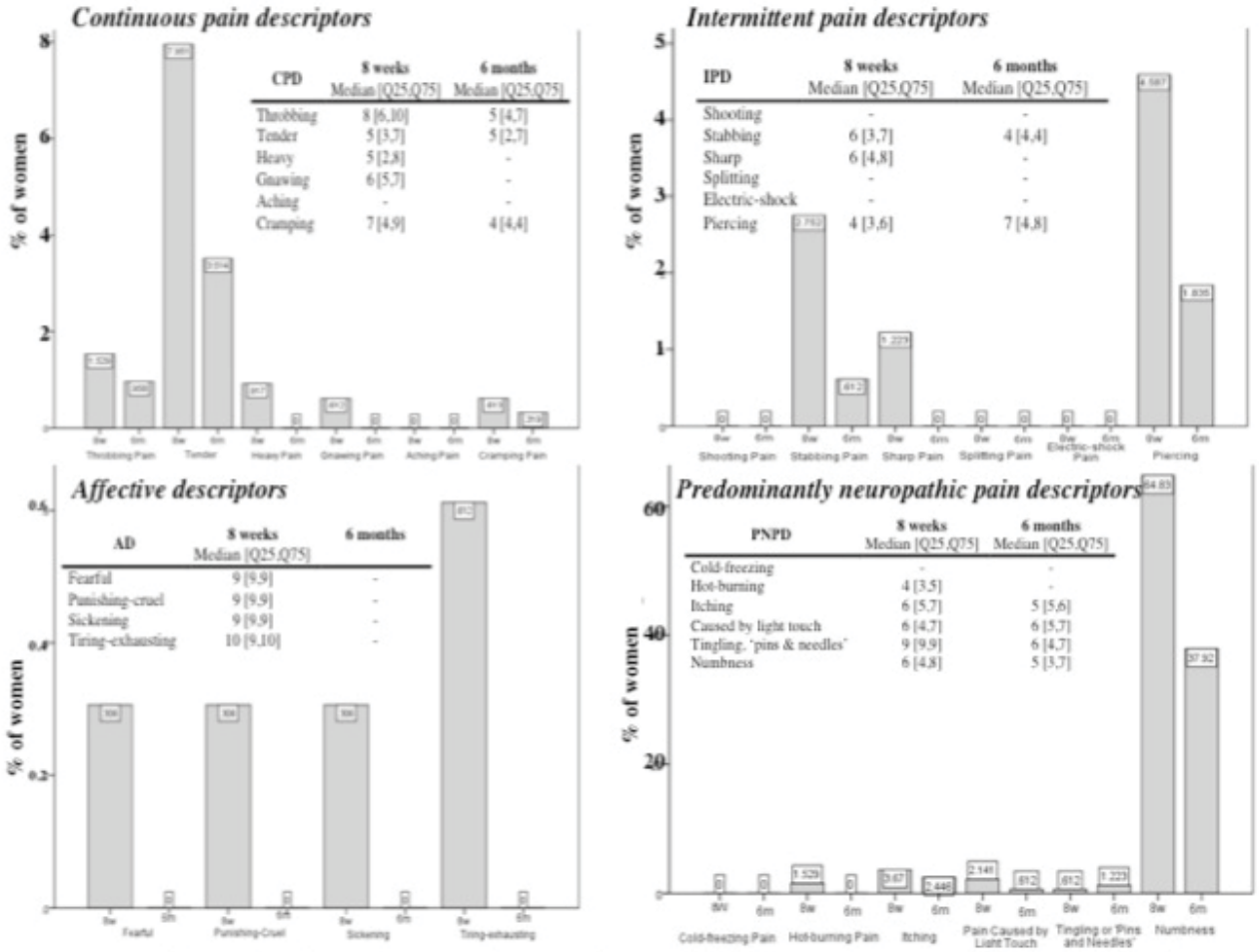


Figure: SF-MPQ-2 (Short-form McGill Pain Questionnaire-2) at 8 weeks and 6 months post-CS

Y axis is the proportion od women reporting pain (NRS > 0). X axis reports the pain descriptors at 8 weeks and 6 months. Median pain score and quartiles for each pain descriptor are presented within each Table.

Abstract #:BP-4

Postoperative Subcutaneous Instillation of Ketorolac but not Hydromorphone Reduces Pain, Analgesic Use and Wound Exudate Concentrations of Interleukin-6 and Interleukin-10 Following Cesarean Delivery

Brendan Carvalho, MBBCh, FRCA[1]; Harry Lemmens, M.D.[1]; Vicky Ting, M.D.[2]; Martin Angst, M.D.[1]
Stanford University - Palo Alto, CA[1]; Santa Clara Valley Hospital - San Jose, CA[2]

Background: Low doses of drugs delivered locally into surgical wounds may provide effective anti-inflammatory effects, while evoking minimal systemic side effects.(1,2) The primary objective of this study was to test the effects of ketorolac and hydromorphone added to continuous local anesthetic wound instillation on the release of key inflammatory mediators following cesarean delivery.

Methods: Sixty healthy women undergoing cesarean delivery with spinal anesthesia were enrolled in this randomized, double-blinded study. Patients were randomized to receive a subcutaneous surgical wound instillation of either plain bupivacaine 0.5% at 10 mg/h (Active control; Group B) or bupivacaine 0.5% with hydromorphone 0.04 mg/h (Group H) or bupivacaine 0.5% with ketorolac 0.6 mg/h (Group K) for 48 hours post-cesarean delivery. Wound exudate was sampled at 4, 24, and 48 h post-cesarean delivery using a subcutaneously implanted catheter and assayed for interleukin (IL) 1, IL-2, IL-6, IL-8, IL-10, IL-12, tumor necrosis factor (TNF), interferon (INF), and granulocyte-macrophage colony stimulating factor (GM-CSF).

Results: Analytes were detectable at variable rates (47-100%) and all changed significantly over the 48-hour study period. The addition of ketorolac to bupivacaine significantly decreased IL-6 (P=0.0121) and IL-10 (P=0.0046) compared to plain bupivacaine. Postoperative subcutaneous instillation of ketorolac but not hydromorphone was associated with a decrease in pain (P=0.018) and analgesic use (P=0.02) following cesarean delivery (Figure). The anti-inflammatory and nociceptive effects of peripherally administered hydromorphone were less apparent.

Conclusions: In addition to a reducing post-cesarean delivery pain and analgesic use, a low daily dose of peripherally administered ketorolac exerted significant anti-inflammatory effects in postoperative cesarean wounds. These results suggest a significant benefit to adding a low dose of ketorolac into surgical wounds. These anti-inflammatory and nociceptive benefits demonstrated at very low daily doses offer potential side effect advantages over higher systemic doses used routinely post-cesarean delivery.

Abstract #:BP-5

An Impact Study of Availability of Epidural Labor Analgesia on the Rate of Cesarean Delivery – A Report from the Chinese No Pain Labor N' Delivery Experience

Ling Qun HU, M.D.[1]; Jin Zhang, M.D., MS[2]; Cynthia A. Wong, M.D.[1]; Qinying Cao, M.D., MS[2]; Robert McCarthy, Ph.D., M.D.[1]
Northwestern University Feinberg School of Medicine - Chicago, IL[1]; Shijiazhuang Obstetrics and Gynecology Hospital - Shijiazhuang, Hebei[2]

Introduction: Although randomized clinical trials suggest that neuraxial labor analgesia (NA) does not increase the risk of cesarean delivery (CD), its impact on operative vaginal delivery (OVD) and other safety outcomes are still controversial. In 2008,the No Pain Labor N' Delivery (NPLnD) program was launched in China to teach safe and effective NA. The current NA rate is <1% and the CD rate is > 50%. The aim of this study was to evaluate the impact of the introduction of NA on mode of delivery in a single Chinese hospital.

Methods: Data were collected retrospectively from preexisting databases from the Shijiazhuang Obstetrics and Gynecology Hospital(08/2009-08/2011). Variables included the total number of deliveries and mode of delivery, indications for CD, overall clinic visits and hospital admissions, 5-min Apgar score ≤ 3, infant death ≤ 7 days, postpartum hemorrhage(PPH), and maternal death. The obstetric anesthesia service was started on 01/11/10(M-F,0800-1730), became 24/7 on 07/17/10, and become part of a fee-for-service incentive stimulation package on 11/12/10. A one-day education event was provided to pregnant women, obstetric health care providers and hospital administrators by the primary author from Northwestern University(NU) on 08/28/10. The modified NPLnD Protocol derived from the current practice in NU was used (epidural 0.075-0.1% ropivacaine + sufentanil 0.1-0.2μg/mL, infused after bolus doses). Data were compared among 3 periods: 08-12/09(baseline; NA rate 0%), 01-08/10(phase-in; NA rate from 4.6% to 40.3%), and 09/10–08/11(final phase; NA rate > 45%) using X2.

Results: There were 19,938 deliveries in the 25-month study period. The NA rate increased from 0% to 59% and monthly delivery rate increased from 757 to 1056. The mean (±SD) of the clinic visits/delivery (47.6±6.6) and the hospital admissions/delivery(2.2±0.3) did not change. The mode of delivery data are shown in Figure 1. Figure 2 illustrates the incidences of maternal and perinatal death, PPH, and Apgar ≤ 3. There was a significant difference in the CD rate between the baseline and phase-in epochs (-2.3%, 95%CI -0.3%,-4.3%, p=0.03) and the phase-in and final epochs(-4.5%, 95%CI -0.3%,-6.0%, p=0.0002). The OVD rate did not change. The Apgar ≤ 3 rate decreased from 1.4% to 1.1%, to 0.9% (p<0.001).

Discussion: The important finding is that the introduction of NA was associated with a significant decrease in the CD rate and the number of neonates with Apgar ≤ 3. No safety indicators worsened. We suggest that the introduction of NA to Chinese women may be one method to improve labor and delivery outcomes.

Additional Files:

Figure 1. Impacts of Epidural Labor Analgesia on Mode of Delivery

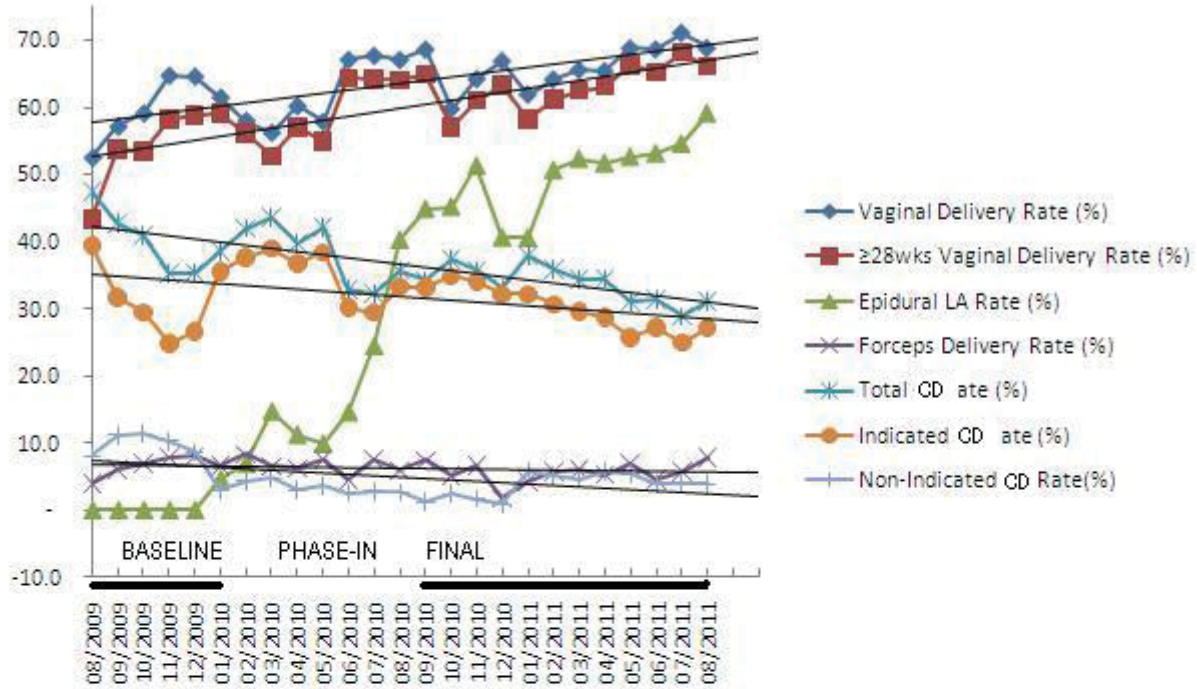
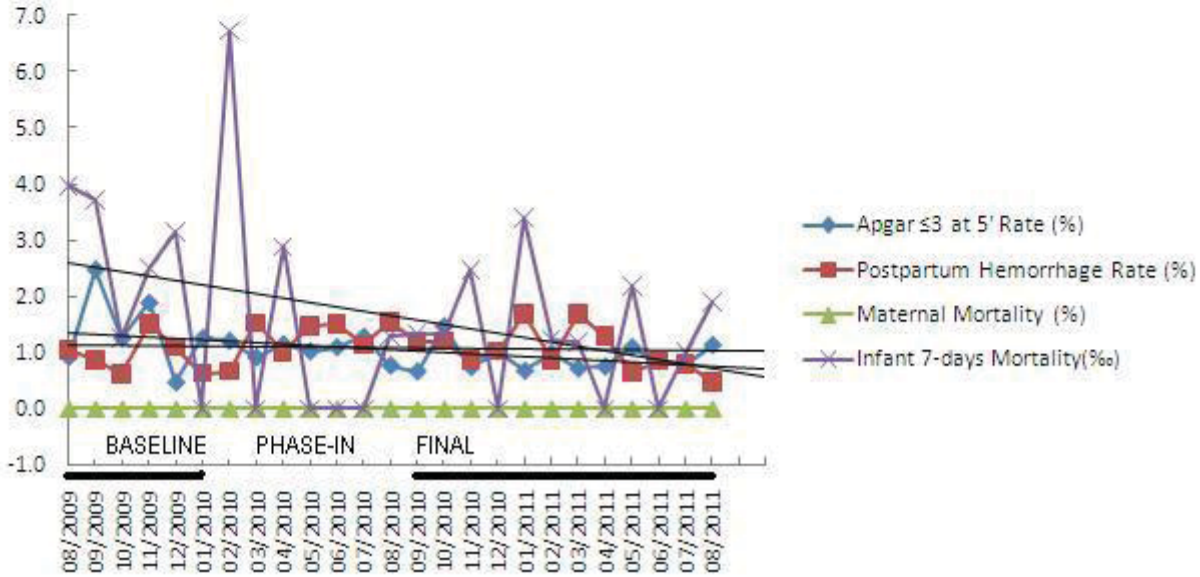


Figure 2. Impacts of Epidural Labor Analgesia on Patient Safety



Abstract #:BP-6

Recurrence of Postpartum Hemorrhage - The Swedish Medical Birth Register

Brian T. Bateman, M.D.[1]; Anna S. Oberg, M.D., Ph.D.[2]; Kristin Palmsten, MS[2]; Thomas Frisell, M.Sc.[3]; Niklas Långström, M.D., Ph.D.[3]; Sonia Hernandez-Diaz, M.D., Sc.D.[2]
Massachusetts General Hospital, Harvard Medical School[1], Harvard School of Public Health[2] - Boston, MA; Karolinska Institutet – Stockholm[3]

Introduction: Postpartum hemorrhage (PPH) is a major cause of maternal morbidity and the incidence of PPH has been increasing in developed countries. While a history of PPH is a recognized risk factor for PPH in subsequent pregnancies, little is known about how the risk accumulates after multiple affected pregnancies, how this is modulated by the severity of prior PPHs, and how recurrence risk varies by PPH subtype. We report risks of PPH according to women's PPH history in the Swedish population.

Methods: The cohort consisted of 538,244 primiparous women included in the Medical Birth Register between 1997-2009. PPH was defined using diagnostic codes based on >1 liter of estimated blood loss. It was further classified as severe if the parturient received a blood transfusion. We estimated relative risks (RR) and 95% confidence intervals (CI) for PPH comparing women with and without a history of PPH.
Results: Risk of PPH was 5.5% in first pregnancies, and 4% in later pregnancies. Compared to women without any previous PPH, women with PPH in their first pregnancy had a greatly increased risk of PPH in subsequent pregnancies (Figure 1). PPH risk was 12.9 % in the second pregnancy among women with PPH in their first pregnancy compared to 3.8% among women without PPH in their first pregnancy (RR 3.3; CI 3.2-3.5). In women with severe PPH in their first pregnancy, this RR was 4.2 (CI: 3.9-4.6). For third pregnancies, the risk was 24.2% when both prior pregnancies were affected, compared to 3.4% among women without PPH in their first two pregnancies (RR 7.2; CI: 5.9-8.8).

Similar patterns of recurrence risk were observed in subanalyses of PPH due to uterine atony and PPH due to other causes. Excluding women with stable risk factors for PPH expected to be present across all pregnancies (including coagulopathy, fibroids, diabetes) did not substantially change patterns of recurrence, nor did accounting for mode of delivery.

Conclusions: PPH risk is highest among women with >1 consecutive affected deliveries and in those with a previous severe PPH. These women should be delivered in hospitals with the anesthesia, obstetric, and blood bank resources to readily respond to a PPH; the care team should anticipate an increased likelihood of bleeding. The presence of recurrence risk across all PPH subtypes may point to a sub-clinical coagulopathy as the mechanism of recurrent PPH.

Fred Hehre Lecture: "A Critical Examination of Regional Technique"

Gordon Lyons, M.D.

On completion of this presentation participants should:

- Understand that opportunities for error are widespread.
- Understand that failure to critically assess practice may carry a penalty.
- Consider how to build safety into their processes.

Synopsis: Professor James Reason[1] developed his Swiss cheese model of human error for the nuclear industry, but its application is widespread. The purpose of this lecture is to examine the practice of regional blockade in an attempt to identify some of the holes in the cheese. Not all aspects of practice have a sound evidence basis, but the tenets of good practice should appeal directly to common sense. Another approach to practices that lack a sound evidential basis is the risk versus benefit analysis. Case histories will be used where possible to give perspective to the points under consideration, and these will have significance beyond obstetric anaesthesia.

The lecture is not intended to be comprehensive, but will examine a variety of everyday practices that include aseptic technique[2], the discipline of the sterile tray, identifying the space[3], and wrong route errors[4]. The consequences of failing to adopt a safe approach can be devastating.

A 34 yr old mother of two ruptured her Achilles tendon during a handball match. She was given an epidural injection for the repair. The operator had both local anaesthetic and colourless chlorhexidine in pots on the tray. Following the procedure, she developed a tetraplegia, and needed constant attention until she died three years later.[5]

Published cases represent the more extreme examples in clinical practice. Even rare mishaps will not be reported unless they tell us something new. Histories provide no information on the incidences of the problems under discussion, and consequently leave us in difficulty as to how to weigh evidence of this nature. They do, however, allow us to identify poor technique, and this in turn gives us the opportunity to reduce errors and complications.

Key Points

- Drugs and needles need protecting from airborne contamination
- Chlorhexidine is an effective bactericidal agent and a potent neurotoxin
- A consistent choice of space is necessary to avoid conus injection

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4. Jones R, Swales H, Lyons G. A national survey of safe practice with epidural analgesia in obstetric units. Anaesthesia 2008; 63: 516-9
5. Anon. Miss n' mix. Tetraplegia following an erroneous epidural injection. Acta Anaesthesiologica Belgica 2001; 52: 205-6

Clinical Forum: "Post-Partum Hemorrhage Management – Perspectives from Three Disciplines"
Moderator: Brendan Carvalho, MBBCh, FRCA, MDCH
Lawrence T. Goodnough, M.D. - Hematologist
Maurice Druzin, M.D. - Obstetrician
Andrea J. Fuller, M.D. - Anesthesiologist

Gerard W. Ostheimer Lecture
Speaker: Alexander Butwick, MBBS, FRCA, MS
Introduced by: Paloma Toledo, M.D., M.P.H.

What's New in Obstetrics: "Evolving Consensus on Standardization of FHR Pattern Management"
Speaker: Julian Parer, M.D., Ph.D.
Introduced by: Jennifer M. Lucero, M.D., M.A.

Oral Presentations 2
Moderator: Dennis C. Shay, M.D.

Clinical Forum: "Post-Partum Hemorrhage Management – Perspectives from Three Disciplines"

Lawrence Tim Goodnough, M.D.

We previously reported the use of a standardized massive transfusion protocol (MTP) for the successful management of unexpected and massive PPH.[1] Our MTP is available for any woman who has an emergent need for blood transfusion, independent of the presence or absence of a pre-existing specimen for type and screen/crossmatch. The MTP importantly provides for patients whose antibody screen evaluation was positive or unknown upon admission. It is not always feasible to provide antigen phenotype negative, fully Coomb's crossmatched RBC in the initial resuscitative phase for massively hemorrhaging obstetric patients (irrespective of antibody status).

Our MTP established formal processes for communicating requests along with early release and rapid transit times for emergency release from the TS to the labor and delivery unit. For obstetric patients, six O negative uncrossmatched blood units, four units of AB plasma, and one apheresis platelet unit are issued. A verbal order (written and electronic are not permitted) is required in order to facilitate the issue MTP blood products to a courier within 5-10 minutes of receiving the verbal order. A written order with patient identifiers is delivered to the TS by the transport person from our labor and delivery unit. At the same time, a transport cooler containing MTP blood components (6 units packed red blood cells; 4 units fresh frozen plasma/liquid plasma; 1 apheresis unit platelets) is issued by the TS.

We assessed the activity of our MTP program for our labor and delivery unit, along with an analysis of its impact on our blood component inventory.[2] Orders for MTP for the management of obstetric hemorrhage were received for 9, 11 and 11 patients in 2008, 2009, and during the first 8 months of 2010, respectively. The proportion of patients requiring the MTP protocol was 0.25% (based on a total of 12945 deliveries during this 32 month period). Obstetric hemorrhage accounted for 31 (11%) of 286 total MTP cases for all clinical units received by the TS during this 32 month interval. The proportions of issued RBC, plasma, and platelets from the MTP that were transfused for obstetric hemorrhage were 60%, 71% and 67% respectively. Nontransfused blood components (167 RBC, 76 plasma, and 22 platelets) were returned to the TS; of these returned components, only 3 (1.8%) of 167 RBC, 41 (54%) of 76 plasma, and 2 (9%) of 22 platelets could not be re-inventoried because of time spent out of controlled, defined conditions in transport containers. The discarded components represented 0.7%, 16%, and 3% of the total number of RBC, plasma, and platelet products ordered and issued for these MTP patients. Twenty four percent of all issued RBC (421 units) and 20% of all transfused RBC (254 units) for these MTP protocol patients, were O negative, uncrossmatched units. Similarly, 27% of all issued plasma (263 units) and 23% of all transfused plasma (187 units), were AB units.

The proportion of O negative RBC outdated was extremely low (0.17%), in the range for all RBC units (0.45%). A higher proportion of liquid AB plasma from the MTP was outdated (5.1%) compared to frozen AB plasma units (1.1%) and to all plasma units (0.17%). The 14 wasted liquid AB plasma units occurred over a 2.5 year interval, and was deemed acceptable in the context of 10 units that are estimated to outdate in TS inventory per annum.

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2. Goodnough LT, Daniels K, Wong AE, Viele M, Fontaine MF, Butwick AJ. How we treat: transfusion medicine support of obstetric services. Transfusion 2011;51:2540-8.

Clinical Forum: "Post-Partum Hemorrhage Management – Perspectives from Three Disciplines"

Maurice Druzin, M.D. - Obstetrician

Clinical Forum: "Post-Partum Hemorrhage Management – Perspectives from Three Disciplines"

Obstetric Hemorrhage: The Anesthesiologist's Perspective

Andrea J. Fuller, M.D.

Objectives:

1. To discuss the anesthesiologists role in assessment of an obstetrical hemorrhage and preparation of the operating room for a hemorrhaging patient
2. To weigh the risks and benefits of general vs. regional anesthesia for the management of obstetrical hemorrhage
3. To discuss optimal transfusion practices, including the administration of clotting factors, in the obstetrical patient

Key Points:

1. Obstetrical hemorrhage is a serious emergency which must be rapidly assessed and treated.
2. The decision to perform regional or general anesthesia must be made on a case by case basis bearing in mind that the incidence of difficult airway may increase if large volume resuscitation is necessary.
3. Retrospecitive studies from the trauma literature suggest that earlier administration of clotting factors and platelets improves outcome in the trauma population but it is unclear if this evidence is applicable to the obstetrical population.

Summary: Postpartum hemorrhage is the leading cause of postpartum intensive care admission and a leading cause of maternal death in the United States. Uterine blood flow comprises 10% of maternal cardiac output at term. Any condition resulting in obstetrical hemorrhage (e.g. placenta accreta, uterine rupture, etc.) can rapidly lead to massive hemorrhage. The anesthesiologist must be vigilant in this situation as under-resuscitation can easily occur. The consequences of obstetrical hemorrhage are considerable, including evidence that patients experience myocardial ischemia due to decreased tissue oxygen delivery.

Blood loss is often underestimated in obstetrics. It is the duty of the anesthesiologist to obtain an accurate assessment of the clinical scenario, estimate the blood loss, and understand the acuity of the situation. Communication with the obstetrical team and the blood bank is absolutely critical.

Preparation of the operating room for an obstetrical hemorrhage includes equipment for rapid infusion, invasive hemodynamic and core temperature monitoring, airway instrumentation, and large-bore intravenous access. Laboratory studies to be obtained include complete blood count, coagulation studies, fibrinogen level, and type and cross. A massive transfusion protocol is extremely helpful in obstetrical hemorrhage as it can make blood product delivery to the obstetrical unit simpler and more predictable. The decision of whether to use general or regional anesthesia should be made on a case by case basis. However, general anesthesia is recommended in cases of extreme hemodynamic instability or emergencies. If regional anesthesia is used, consideration for conversion to general anesthesia should be made prior to large volume resuscitation as airway changes may occur and the possibility of encountering a difficult airway is increased.

Current recommendations from the American Society of Anestheisologists are to transfuse red blood cells for hemoglobin levels < 6 g/dl and to use clinical judgment for hemoglobin levels between 6 g/dl and 10 g/dl. Transfusion of fresh frozen plasma is recommended with INR > 2.0 or for microvascular bleeding due to clotting factor deficiency. Recent literature from the trauma setting suggests improved outcomes such as decreased length of ICU stay and mortality with earlier clotting factor and platelet transfusion. Studies in the obstetrical setting are lacking and it remains to be seen if there is benefit to earlier administration of clotting factors and platelets.

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Anesth Analg 2007;105:1736-1740
Anesthesiology 2006;105:198-208
Curr Opin Anesthesiol 2012; epub ahead of print
J Trauma (71) 2 Suppl 3 S318-328

What's New in Obstetric Anesthesia - 2011?

Alexander Butwick M.B.B.S., F.R.C.A., M.S. (Epi)

Objectives: The primary objective of this review is to highlight key papers published from January 2011 to December 2011 which have major scientific and clinical relevance to practicing obstetric anesthesiologists. Relevant topics in this review originate from published research in the fields of obstetric anesthesia, obstetrical medicine, perinatology, pediatrics, epidemiology, maternal health, health policy and affiliated clinical specialties (internal medicine, surgery, pathology).

Methods: 74 journals and newsletters published in the English language were hand-searched from January 2011 to December 2011 for the purposes of sourcing articles for this review. The journals were chosen based on a number of factors: scientific/clinical relevance to the fields of obstetric anesthesia, obstetrics and perinatology; prior Ostheimer journal lists; journal impact factor; and the quality of published work. In addition, other electronic and media sources were used to supplement the primary search including: Pubmed, SciVerse Scopus, Obstetric Anesthesia Digest, MDLinx, Obstetric and Gynecologic Survey, Journal of Women's Health, Journal Watch Women's Health Alerts (http://womens-health.jwatch.org/); electronic RSS feeds including: http://tinyurl.com/ob-anes-feed.

A systematic approach incorporating checklists was used as a method for assessing the scientific quality for four types of research: systematic reviews; randomized controlled trials, observational studies (including studies with nonexperimental/quasi-experimental designs with or without control or comparison groups), and investigations of diagnostic tests/monitoring devices. Each study was evaluated using criteria previously described by the Research Triangle Institute, University of North Carolina for the US Agency for Healthcare Research and Quality (AHRQ) [West S, King V, Carey TS, et al. Systems to Rate the Strength of Scientific Evidence. Evidence Report/Technology Assessment No. 47 (AHRQ Publication No. 02-E016. Rockville, MD: April 2002); URL: http://www.thecre.com/pdf/ahrq-system-strength.pdf]. Specific domains were used in the criteria for evaluating four types of system to grade the quality of individual studies (Table).

Level of evidence for each article was also estimated using the most recent guidelines from the Oxford Centre for Evidence-Based Medicine (Howick J et al; Centre for Evidence Based Medicine, Oxford, UK: URL: http://www.cebm.net/index.aspx?o=5653).

Each article selected for the final syllabus was categorized into a specific topic area (see Table of Contents). The categories for the Table of Contents for the 2012 Ostheimer lecture were based on key areas of clinical and scientific interest. Categories were also determined based on important topics of interest which offer new or advanced clinical and research perspectives, challenge current practice paradigms or describe novel / new techniques or scientific approaches for advancing clinical care.

The syllabus primarily aims to include systematic reviews, randomized controlled trials, observational studies, diagnostic/device studies, and a limited number of case series that are of genuine scientific interest. Relevant correspondence associated with each article, such as editorials, letters to the editor, commentary articles, were considered for the final syllabus. In addition, a select number of high caliber journal articles (such as review articles, commentary or opinion-based articles), and important peer and non-peer reviewed publications from established regional, national or international organizations related to maternal health (such as Centre for Maternal and Child Enquiries - United Kingdom) have also been included in the syllabus. Due to the limitations on the number of articles in the syllabus, the following articles were not included: case reports, unaccompanied letters of correspondence, articles from non-index linked journals, journals not published using English language.

The lecturer wishes to apologize to investigators whose articles were not selected in the final syllabus. As a disclaimer, the syllabus aims to provide a broad overview of key papers from scientific disciplines that are indirectly or directly relevant to obstetric anesthesiologists. Selecting papers for the final syllabus proved challenging due to the high number of quality articles published in 2011. This lecturer acknowledges that **all** clinicians and investigators should be congratulated for their efforts in publishing work which advances the knowledge and practice of obstetric anesthesiology.

Table. *Domains evaluated in each study type to assess scientific quality for the syllabus for the Ostheimer lecture.*

Systemic Reviews	Randomized Controlled trials	Observational studies	Diagnostic tests/ Device studies
Study question	Study question	Study question	Study population
Search strategy	Study population	Study population	Adequate description of test/device
Inclusion and exclusion criteria	Randomization	Compatibility of subjects	Appropriate reference standard
Interventions	Blinding	Exposure or intervention	Blinded comparison of test or standard
Outcomes	Interventions	Outcome measures	Avoidance of verification bias
Data extraction	Outcomes	Statistical analyses	
Study quality and validity	Statistical Analyses	Results	
Data synthesis and analysis	Results	Discussion	
Results	Discussion	Funding or sponsorship	
Discussion	Funding or sponsorship		
Funding or sponsorship			

Source = West SL et al. *Systems to Rate the Strength of Scientific Evidence.* AHRQ, 2002.

LIST OF JOURNALS:

Anesthesia, Intensive Care, Pain Journals:

Acta Anaesthesiologica Scandinavica
Anaesthesia
Anesthesiology
Anesthesia & Analgesia
Anesthesia and Intensive Care
Anesthesiology Clinics of North America
ASA Newsletter
British Journal of Anaesthesia
Canadian Journal of Anaesthesia
Critical Care medicine
European Journal of Anaesthesiology
European Journal of Pain
International Anesthesiology Clinics
International Journal of Obstetric Anesthesia
Journal of Clinical Anesthesia
Journal of Critical Care
Journal of Pain
Pain
Regional Anesthesia and Pain Medicine

Perinatology and Pediatric Journals

American Journal of Perinatology
BMC Pediatrics
Early Human Development
Journal of Paediatrics and Child Health
Journal of Pediatrics
Journal of Perinatology
Pediatrics

Obstetric Journals

Acta Obstetricia et Gynecologica Scandinavica
American Journal of Maternal/Child Nursing
American Journal of Obstetrics and Gynecology
The Australian and New Zealand Journal of Obstetrics and Gynaecology
Birth
British Journal of Obstetrics and Gynecology (BJOG)
Clinical Obstetrics and Gynecology
Current Opinion in Obstetrics and Gynecology
European Journal of Obstetrics & Gynecology & Reproductive biology
Fertility and Sterility
Gynecologic and Obstetric Investigation
International Journal of Gynecology and Obstetrics
Journal of Maternal-Fetal and Neonatal medicine
Journal of Midwifery and Women's Health
Journal of Women's Health
Obstetrical and Gynecological Survey
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What's New in Obstetrics
(Articles published in 2011)

1. Mhyre JM: What's new in obstetric anesthesia? Int J Obstet Anesth 2011; 20: 149-59.

2. Toledo P: What's new in obstetric anesthesia? The 2011 Gerard W. Ostheimer Lecture. Anesth Analg 2011; 113: 1450-58.

Co-existing/Acquired Disease and Maternal Health

Cardiac Disease

3. Hidano G, Uezono S, Terui K: A retrospective survey of adverse maternal and neonatal outcomes for parturients with congenital heart disease. Int J Obstet Anesth 2011; 20: 229-35.

Retrospective review of maternal and neonatal outcomes in women with congenital cardiac disease (n=151) at a single obstetric center over a 7 yr period. Of note, a high proportion of parturients had favorable baseline functional status (NHYA class I/II=91%). No maternal deaths and low neonatal mortality (1 patient) were observed. Maternal cardiac events occurred in 1% of vaginal deliveries and 15% of Cesarean deliveries; however patients with greater co-morbidity underwent Cesarean delivery (CD).

4. Lui GK, Silversides CK, Khairy P, Fernandes SM, Valente AM, Nickolaus MJ, Earing MG, Aboulhosn JA, Rosenbaum MS, Cook S et al: Heart rate response during exercise and pregnancy outcome in women with congenital heart disease. Circulation 2011;123: 242-48.

In this retrospective analysis of obstetric patients with congenital heart disease, investigators used pre- or antenatal cardiopulmonary exercise testing parameters to predict adverse pregnancy outcomes (n=89 pregnancies). Increases in heart rate (HR) response reduced the risk of major maternal and neonatal cardiac events; a 10 bpm increase in maternal HR reduced the risk of a maternal and neonatal event (OR=0.71; 95% CI=0.53-0.94 and OR=0.75; 95% CI=0.58-0.98, respectively). However, the multivariate logistic regression models used in this study suffered from 'overfitting'.

5. Kuklina E, Callaghan W: Chronic heart disease and severe obstetric morbidity among hospitalisations for pregnancy in the USA: 1995-2006. BJOG 2011; 118: 345-52.

Massive, population-wide, retrospective study of chronic heart disease among obstetric-related hospitalizations using US administrative data between 1995 to 2006 (n=approx. 48 million). One of the main findings was a tripling in the rate of postpartum hospitalizations for chronic heart disease over the study period (4.8 to 14.4 per 10,000 deliveries; P<0.01). Rates of major co-morbid conditions (especially cardiac arrest/VF) associated with chronic heart disease among delivery hospitalizations also substantially increased from 1995-7 to 2004-6.

6. Karamlou T, Diggs BS, McCrindle BW, Welke KF: A growing problem: maternal death and peripartum complications are higher in women with grown-up congenital heart disease. Ann Thorac Surg 2011; 92: 2193-98; discussion 2198-99.

Using data from the Nationwide Inpatient Sample between 1998-2007 (total births=39.9 million), this observational study assessed the prevalance of adult congenital heart disease (CHD) among pregnant women. A 43% increase in deliveries to CHD patients occurred over the study period, and the rate of maternal mortality was 18-fold higher in CHD versus non-CHD women. As observed in other mortality reviews, obstetricians and anesthesiologists should adequately prepare for an increasing number of women with CHD at high risk of severe maternal and perinatal morbidity and mortality.

7. Regitz-Zagrosek V, Blomstrom Lundqvist C, Borghi C, Cifkova R, Ferreira R, Foidart JM, Gibbs JS, Gohlke-Baerwolf C, Gorenek B, Iung B et al: ESC Guidelines on the management of cardiovascular diseases during pregnancy: the Task Force on the Management of Cardiovascular Diseases during Pregnancy of the European Society of Cardiology (ESC). Eur Heart J 2011; 32: 3147-97.

This must-read document by an expert taskforce within the European Society of Cardiology encompasses guidelines for the screening, work-up, optimization and management of obstetric patients with acquired and congenital heart disease.

8. Arendt KW, Fernandes SM, Khairy P, Warnes CA, Rose CH, Landzberg MJ, Craigo PA, Hebl JR: A case series of the anesthetic management of parturients with surgically repaired tetralogy of Fallot. Anesth Analg 2011; 113: 307-17.

Restrospective study analyzing anesthetic, obstetric and cardiac outcomes over a 14 yr period in pregnant patients with surgically corrected Tetralogy of Fallot (n=27 deliveries). All patients underwent neuraxial blockade for labor or delivery. Cardiac outcomes were generally favorable, with no episdoes of new or sudden-onset peripartum congestive heart failure and only one episode of non-sustained ventricular tachycardia.

Respiratory Disease

9. Higgins N, Leong E, Park CS, Facco FL, McCarthy RJ, Wong CA: The Berlin Questionnaire for assessment of sleep disordered breathing risk in parturients and non-pregnant women. Int J Obstet Anesth 2011; 20: 22-25.

Exploratory prospective study comparing the rate of self-reported sleep disordered breathing (using a Berlin questionnaire) in pregnant (n=4074) and non-pregnant women (n=490). A significantly higher proportion of pregnant women had a positive Berlin questionnaire (33% vs 20%; OR=2.0, 95% CI=1.6-2.5) However, more research is needed to validate this screening tool for correctly identifying sleep disordered breathing in the pregnant population.

Infectious Disease

Influenza and Pregnancy

10. Influenza vaccination coverage among pregnant women, United States, 2010-11 influenza season. MMWR Morb Mortal Wkly Rep 2011; 60: 1078-82.

This Internet panel survey assessed influenza vaccination uptake during the 2010-11 influenza season (n=1457); 49% of respondents who were pregnant between Oct 2010 - Jan 2011 received vaccination, with increased uptake among those who had contact with a health-care provider. This report emphasizes that health-care providers are integral for promoting the safety and effectiveness of influenza vaccination for pregnant patients.

H1N1: Obstetrical and Perinatal Outcomes

11. Pierce M, Kurinczuk JJ, Spark P, Brocklehurst P, Knight M: Perinatal outcomes after maternal 2009/H1N1 infection: national cohort study. BMJ 2011; 342: d3214.

High-quality, national cohort study (UK) reporting maternal and perinatal outcomes in women identified with H1N1 infection in 2009 (n=256). Infected women (in-patients) were at higher risk of preterm delivery (adj OR=4; 95% CI=2.7-5.9) and CD (adj OR=2.3; 95% CI=1.7-3.2) compared to historical non-infected controls. A high proportion of infected women who underwent preterm delivery required ICU admission versus women delivering at term (54% vs 12%; P<0.001), with a worryingly low rate of immunization (5%) among all women infected before 37 weeks. This data has important public health ramifications in advance of future viral pandemics.

Accompanying editorial: Joseph KS, Liston RM: H1N1 influenza in pregnant women. BMJ 2011; 342: d3237.

12. Varner MW, Rice MM, Anderson B, Tolosa JE, Sheffield J, Spong CY, Saade G, Peaceman AM, Louis JM, Wapner RJ et al: Influenza-like illness in hospitalized pregnant and postpartum women during the 2009-2010 H1N1 pandemic. Obstet Gynecol 2011; 118: 593-600.

In this study, maternal outcomes were assessed in 356 in-patients with influenza-like illness at 28 US hospitals in the MFMU network during the H1N1 pandemic. ICU admission occurred in 9.8% patients and CD was needed in 44% patients. Risk factors for ICU admission were cigarette smoking (OR=2.8; 95% CI=1.2-6.5) and chronic hypertension (OR=6.9; 95% CI=2.2-21.5). Patients receiving early antiviral treatment had a lower risk of ICU admission (OR=0.4; 95% CI=0.2-0.8).

13. Creanga AA, Kamimoto L, Newsome K, D'Mello T, Jamieson DJ, Zotti ME, Arnold KE, Baumbach J, Bennett NM, Farley MM et al: Seasonal and 2009 pandemic influenza A (H1N1) virus infection during pregnancy: a population-based study of hospitalized cases. Am J Obstet Gynecol 2011; 204: S38-45.

In response to the 2009 H1N1 pandemic, the CDC convened a meeting in August 2010 to provide recommendations, described in this consensus document, for the provision of care to pregnant women, newborns and health care providers in the event of an influenza pandemic. The importance of vaccinating pregnant women, a high-risk group for severe influenza, is emphasized. Early antiviral treatment is recommended for pregnant women or women <2 weeks postpartum with suspected influenza.

14. Mosby LG, Rasmussen SA, Jamieson DJ: 2009 pandemic influenza A (H1N1) in pregnancy: a systematic review of the literature. Am J Obstet Gynecol 2011; 205: 10-18.

Recent systematic review of 120 publications describing cases of 2009 H1N1 influenza during pregnancy. Maternal hypoxia or maternal decompensation were frequently described as indications for urgent or emergency CD, which highlight the adverse impact of H1N1 influenza on pregnant women and perinatal care.

15. Maternal and infant outcomes among severely ill pregnant and postpartum women with 2009 pandemic influenza A (H1N1)-- United States, April 2009-August 2010. MMWR Morb Mortal Wkly Rep 2011; 60: 1193-96.

In this CDC report of H1N1 influenza between April 2009 and August 2010, 247 severely ill pregnant women were admitted to ICU and 75 maternal deaths occurred due to H1N1. Maternal survival was significantly improved with early treatment with antiviral therapy within 2 days of illness onset. High rates of preterm birth (64%) were also found for liveborn singleton infants born during the hospitalization.

H1N1: Maternal Critical Illness

16. Nair P, Davies AR, Beca J, Bellomo R, Ellwood D, Forrest P, Jackson A, Pye R, Seppelt I, Sullivan E et al: Extracorporeal membrane oxygenation for severe ARDS in pregnant and postpartum women during the 2009 H1N1 pandemic. Intensive Care Med 2011; 37: 648-54.

In this case series, the use of ECMO is described for 12 pregnant/postpartum patients with severe ARDS due to H1N1 influenza. Circuit-related problems were rare; however 67% of patients had major bleeding requiring transfusion. The maternal and infant survival rates were 66% and 71% respectively; all surviving mothers were ambulant at discharge.

17. Maravi-Poma E, Martin-Loeches I, Regidor E, Laplaza C, Cambra K, Aldunate S, Guerrero JE, Loza-Vazquez A, Arnau E, Almirall J et al: Severe 2009 A/H1N1v influenza in pregnant women in Spain. Crit Care Med 2011; 39: 945-51.

In this population-wide, prospective study in 148 Spanish intensive care units, 234 women of reproductive age were admitted with A/H1N1 infection between April 2009 – Feb 2011; 50 cases (21.4%) were pregnant. In pregnant patients, 94% incurred primary viral pneumonia, 78% required mechanical ventilation and 14% died. Only a minority of patients (5/36) received antiviral treatment within 48 hr of symptom onset, adding further weight to the importance of early therapy for improving maternal outcomes.

Accompanying editorial: Joseph KS, Liston RM: H1N1 influenza in pregnant women. BMJ 2011; 342: d3237.

Obesity

18. Blomberg M: Maternal and neonatal outcomes among obese women with weight gain below the new Institute of Medicine recommendations. Obstet Gynecol 2011; 117: 1065-70.

Retrospective cohort study in Sweden (n=46,595) investigating the adverse maternal and perinatal outcomes associated with gestational weight gain in class I – III obese women. Women in obesity class III who lost weight had a decreased risk of having a large-for-gestational-age baby (OR=0.64; 95% CI=0.46-0.9). In women with no weight gain or who lost weight in pregnancy, the rates of CD were significantly reduced in obesity classes II (34%) and III (23%) women. Nonetheless, rates of CD were highest for class III women (24%-31%) in all weight-gain categories.

Latex Sensitization

19. Draisci G, Zanfini BA, Nucera E, Catarci S, Sangregorio R, Schiavino D, Mannocci A, Patriarca G: Latex sensitization: A special risk for the obstetric population? Anesthesiology 2011; 114: 565-69.

In this prospective study, the prevalence of latex sensitization was significantly higher among 294 patients undergoing CD compared to 294 non-pregnant patients undergoing gynecologic surgery (5.1% vs 1.7%; P<0.05). Higher specific immunoglobulin E serum concentration were also reported in the CD group. Improved perioperative vigilance is advised for pregnant patients with an atopic history or an itch response using rubber gloves.

Letters to the author: Weiniger CF, Pe'er L, Shalit M: Remove latex from the labor and delivery suite. Anesthesiology 2011; 115: 903; author reply 903-904.

Abouleish AE: Evidence does not show that pregnancy is a risk factor for latex allergy. Anesthesiology 2011; 115: 902-3; author reply 903-904.

Nutritional Deficiency

20. Mei Z, Cogswell ME, Looker AC, Pfeiffer CM, Cusick SE, Lacher DA, Grummer-Strawn LM: Assessment of iron status in US pregnant women from the National Health and Nutrition Examination Survey (NHANES), 1999-2006. Am J Clin Nutr 2011; 93: 1312-20.

Using data from NHANES database, investigators in this epidemiologic study aimed to investigate changing trends and disparities in rates of iron-deficiency (ID) in pregnancy. The prevalence of ID was observed to increase with advancing gestation (6.9%, 14.3%, 29.5% for 1st, 2nd, 3rd trimester respectively). Non-hispanic white parturients had a lower prevalence of ID (13.9%) than Mexican Americans (23.6%) and non-Hispanic black parturients (29.6%). Unfortunately, adverse maternal/perinatal outcomes associated with ID were not described.

Accompanying editorial: Lynch S: Improving the assessment of iron status. Am J Clin Nutr 2011; 93: 1188-89.

Obstetric Management – Antenatal Period

Preterm Labor and Preterm Birth

21. Lee HC, Lyndon A, Blumenfeld YJ, Dudley RA, Gould JB: Antenatal steroid administration for premature neonates in California. Obstet Gynecol 2011; 117: 603-609.

Retrospective cohort study (n=15343) that reported that 23% of mothers of premature infants did not receive antenatal steroids; study data were sourced from Californian hospitals with neonatal intensive care facilities between 2005-2007. Inequalites in care are partly responsible, as evidenced by Hispanic mothers, mothers <20 yr of age and those with no prenatal care being less likely to receive antenatal steroids. Insufficient time to administer steroids may explain why patients undergoing vaginal delivery or diagnosed with fetal distress - adj OR=1.3 respectively - were at higher risk of not receiving steroids.

22. Esplin MS, Merrell K, Goldenberg R, Lai Y, Iams JD, Mercer B, Spong CY, Miodovnik M, Simhan HN, van Dorsten P et al: Proteomic identification of serum peptides predicting subsequent spontaneous preterm birth. Am J Obstet Gynecol 2011; 204: 391.e1-8.

Exploratory (nested case-control) study to identify serum and proteomic markers for preterm delivery at 24 weeks and 28 weeks (n=160). A prediction model, which included serum and proteomic markers, had 86% sensitivity and 80% specificity in identifying women at risk of preterm birth. Mechanistic studies are needed to explain these findings.

23. Conde-Agudelo A, Romero R, Kusanovic JP: Nifedipine in the management of preterm labor: a systematic review and metaanalysis. Am J Obstet Gynecol 2011; 204: 134.e1-20.

Well-constructed systematic review and meta-analysis of 26 RCTs investigating the safety and efficacy of administering nifedipine for tocolysis for preterm labor (PTL). Compared to 2 agonists, nifedipine posed lower risk of delivery within 7 days of starting treatment (RR=0.82; 95% CI=0.7-0.9) and adverse maternal effects (RR=0.31; 95% CI=0.18-0.54). There were no differences between nifedipine and magnesium suphate in tocolytic effect; however fewer maternal adverse effects occurred with nifedipine (RR=0.63; 95% CI=0.48-0.82). Nifedipine maintenance tocolysis was ineffective in reducing the incidence of preterm birth compared to placebo or no treatment.

Letter to the author: Caritis SN: Metaanalysis and labor inhibition therapy. Am J Obstet Gynecol 2011; 204: 95-96.

24. Crump C, Sundquist K, Sundquist J, Winkleby MA: Gestational age at birth and mortality in young adulthood. JAMA 2011; 306: 1233-40.

High-quality cohort study investigating the association between gestational age at birth and postnatal mortality until early adulthood (n=674,820). Significant inverse associations between gestational age at birth and mortality in childhood (age 6-12 yr: adj HR 0.92; 95% CI=0.89-0.94) and young adulthood (age 18-36 yr; adj HR 0.96; 95% CI=0.94-0.97) were observed. Late preterm (34-36 weeks) birth was associated with increased mortality in young adulthood (adj HR 1.31; 95% CI=1.13-1.5). Although this study did not account for all potential confounders that impact mortality, these findings highlight an underappreciated yet important association of preterm birth on long-term health sequelae.

Letter to the author: Strunk T, Simmer K, Burgner D: Prematurity and mortality in childhood and early adulthood. JAMA 2012; 307: 32; author reply 32-33.

25. Cheng Y, Kaimal A, Bruckner T, Hallaron D, Caughey A: Perinatal morbidity associated with late preterm deliveries compared with deliveries between 37 and 40 weeks of gestation. BJOG 2011; 118: 1446-54.

Retrospective cohort study detailing differences in the risk of postnatal complications in neonates born between 34-36 weeks gestation (n=3,167,615). Using multivariate analyses, investigators found neonates born between 34-36 weeks respectively were at increased risk of perinatal complications (including low APGAR scores, neonatal seizures, ICU admission, respiratory compromise) compared to infants born between 37-40 weeks. This study is important in highlighting the adverse outcomes associated with late preterm delivery.

Preeclampsia

Predicting Preeclampsia

26. North RA, McCowan LM, Dekker GA, Poston L, Chan EH, Stewart AW, Black MA, Taylor RS, Walker JJ, Baker PN et al: Clinical risk prediction for preeclampsia in nulliparous women: development of model in international prospective cohort. BMJ 2011; 342: d1875.

High quality, international, prospective cohort study using clinical data to investigate risk factors for preeclampsia among healthy nulliparous patients (n=3529). Risk-factors identified at 14-16 weeks gestation included: age, mean arterial blood pressure, BMI, family history (FH) of preeclampsia, FH of coronary artery disease, maternal birthweight and vaginal bleeding ≥5days. The area under the ROC curve (after internal validation) was 0.71, and model performance did not improve after accounting for uterine artery Doppler indices. Using these variables, investigators found predicting preeclampsia in healthy nulliparous patients is suboptimal.

27. von Dadelszen P, Payne B, Li J, Ansermino JM, Broughton Pipkin F, Cote AM, Douglas MJ, Gruslin A, Hutcheon JA, Joseph KS et al: Prediction of adverse maternal outcomes in preeclampsia: development and validation of the fullPIERS model. Lancet 2011; 377: 219-27.

High-quality prospective multicenter study that developed and validated an adverse outcome-prediction model for preeclamptic women admitted to tertiary units (n=2023). Six predictors were included in the final model: gestational age, chest pain or dyspnea, oxygen saturations, platelet count, serum creatinine, and AST (sensitivity=0.76 and specificity=0.87). This model could be used to alter and improve approaches to patient care for preeclamptic patients.

Accompanying editorial: Teela KC, Ferguson RM, Donnay FA, Darmstadt GL: The PIERS trial: hope for averting deaths from pre-eclampsia. Lancet 2011; 377: 185-86.

Letter to the editor: Tajik P, Oude Rengerink K, Ganzevoort W, Zwinderman AH, Mol BW, Bossuyt PM: Prediction of preeclampsia complications. Lancet 2011; 377: 1313; author reply 1314.

Blood Pressure Trends

28. Gaillard R, Bakker R, Willemsen SP, Hofman A, Steegers EA, Jaddoe VW: Blood pressure tracking during pregnancy and the risk of gestational hypertensive disorders: The Generation R Study. Eur Heart J 2011; 32: 3088-97.

Prospective cohort study (n=8482) that provides evidence that blood pressure changes track differently between hypertensive versus non-hypertensive pregnancies. Second to third trimester increases in systolic, diastolic and mean blood pressures were significantly associated with a later diagnosis of preeclampsia. Unfortunately, selection bias, measurement error (from an automated cuff) and residual confounding were major study limitations.

Accompanying editorial: Cifkova R: Can blood pressure in the first trimester predict the development of gestational hypertensive disorders? Eur Heart J 2011; 32: 3067-69.

Prevention and Treatment Options

29. Rossi AC, Mullin PM: Prevention of preeclampsia with low-dose aspirin or vitamins C and E in women at high or low risk: a systematic review with metaanalysis. Eur J Obstet Gynecol Reprod Biol 2011; 158: 9-16.

In this meta-analysis of 15 studies published between 1988-2010, neither low-dose aspirin nor vitamin C and E were observed to significantly reduce the risk of preeclampsia in high-risk or low-risk women. Further work is needed to assess whether these regimens can reduce the severity of preeclampsia in low and high-risk groups.

30. Thadhani R, Kisner T, Hagmann H, Bossung V, Noack S, Schaarschmidt W, Jank A, Kribs A, Cornely OA, Kreyssig C et al: Pilot study of extracorporeal removal of soluble fms-like tyrosine kinase 1 in preeclampsia. Circulation 2011; 124: 940-50.

This interesting exploratory work shows that extracorporeal apheresis can lower circulating soluble fms-like tyrosine kinase 1 (sFlt-1) in vitro and in vivo (8 women with very preterm pre-eclampsia and elevated sFlt-1 levels). This intervention may play an important role in prolonging pregnancy and improving maternal and fetal outcomes for preterm pre-eclampsia.

Maternal/Perinatal Outcomes

31. Thangaratinam S, Koopmans CM, Iyengar S, Zamora J, Ismail KM, Mol BW, Khan KS: Accuracy of liver function tests for predicting adverse maternal and fetal outcomes in women with preeclampsia: a systematic review. Acta Obstet Gynecol Scand 2011; 90: 574-85.

This systematic review pooled 13 studies and 3497 women to assess the accuracy of liver function tests (LFTs) in predicting maternal or fetal complications in women with preeclampsia. Across all studies, the sensitivity of LFTs to predict any maternal complication varied considerably (0.04-0.95). The specificity was slightly better for predicting any maternal complication (0.17-0.79). LFTs, in isolation, are unreliable in predicting complications in women with preeclampsia.

32. Liu S, Joseph KS, Liston RM, Bartholomew S, Walker M, Leon JA, Kirby RS, Sauve R, Kramer MS: Incidence, risk factors, and associated complications of eclampsia. Obstet Gynecol 2011; 118: 987-94.

Using a population-wide administrative dataset (n=1,910,729), investigators in this Canadian study reported that the rate of eclampsia has decreased in recent years (12.4/10,000 deliveries [in 2003] to 5.9/10,000 deliveries [in 2009]). However, eclampsia was associated with maternal/fetal death as well as major maternal morbidity (including assisted ventilation, renal failure, embolism, ARDS). Further research is needed to optimize prophylactic and therapeutic regimens to reduce the rate and severity of these adverse outcomes.

Accompanying editorial: Sibai BM: Disparity in the rate of eclampsia and adverse pregnancy outcome from eclampsia: a tale of two countries. Obstet Gynecol 2011; 118: 976-77.

Accompanying editorial with a salient reminder that, despite the adverse outcomes associated with eclampsia, the absolute risks for maternal death (0.34%) and severe obstetric morbidities (0.4-0.95%) are extremely low.

Congenital Anomalies

33. Smith LK, Budd JL, Field DJ, Draper ES: Socioeconomic inequalities in outcome of pregnancy and neonatal mortality associated with congenital anomalies: population based study. BMJ 2011; 343: d4306.

Using a UK-based regional case registry for congenital anomalies (n=1579 fetuses), investigators observed socioeconomic differences in rates of termination after antenatal diagnosis of 9 major anomalies. Rates of termination were lower in the least deprived versus most deprived areas (63% vs 79%: rate ratio=0.8; 95% CI=0.65-0.97). After adjusting for maternal age, patients from the most deprived areas were 85% more likely to have a live births with an anomaly and 123% more likely to incur a neonatal death for congenital anomalies versus the least deprived areas. Differences in socioeconomic class among patients may influence the decision to terminate pregnancy after antenatal detection of these anomalies.

Inherited Thrombophilias

34. Lockwood C, Wendel G: Practice bulletin no. 124: inherited thrombophilias in pregnancy. Obstet Gynecol 2011; 118: 730-40.

The latest Practice Bulletin from ACOG regarding screening and thromboprophylaxis for obstetric patients with inherited thrombophilias. Converting subcutaneous low-molecular weight heparin (LMWH) to unfractionated heparin (UF) for patients receiving thromboprophylaxis at 36 weeks gestation is recommended to allow for neuraxial anesthesia for labor and delivery. Discontinuing subcutaneous UF or LMWH 24-36 hr prior to scheduled induction of labor or elective CD is also advised.

External Cephalic Version

35. Kabiri D, Elram T, Aboo-Dia M, Elami-Suzin M, Elchalal U, Ezra Y: Timing of delivery after external cephalic version and the risk for cesarean delivery. Obstet Gynecol 2011; 118: 209-13.

The risk of intrapartum CD after external cephalic version (ECV) has not been clearly elucidated. In this retrospective cohort study of ECV (n=502), 10% patients required intrapartum CD. The incidence of CD within 96 hr of performing ECV was 16.5%, with an increased risk for CD in primiparous and multiparous patients (OR=2.97 and 2.27 respectively). Unfortunately, the influence of analgesia for ECV on delivery outcomes was not studied.

36. Hutton EK, Hannah ME, Ross SJ, Delisle MF, Carson GD, Windrim R, Ohlsson A, Willan AR, Gafni A, Sylvestre G et al: The Early External Cephalic Version (ECV) 2 Trial: an international multicentre randomised controlled trial of timing of ECV for breech pregnancies. BJOG 2011; 118: 564-77.

High-quality multicenter RCT comparing delivery and perinatal outcomes in women undergoing ECV at 340/7 weeks versus ≥370/7 weeks. The rates of success (cephalic presentation) were higher for early ECV (41%) versus late ECV (49.1%); P=0.002. However, this did not translate into a lower rate of CD, and a non-significant increase in preterm birth occurred in the early ECV group. Patients should receive a full discussion of benefits versus risks according to the timing of ECV.

Letter to the editor: Hutton EK, Hannah ME, Ross SJ, Delisle MF, Carson GD, Windrim R, Ohlsson A, Willan AR, Gafni A, Sylvestre G et al: Early versus late external cephalic version Reply. BJOG 2011; 118: 1272-73.

37. Goetzinger KR, Harper LM, Tuuli MG, Macones GA, Colditz GA: Effect of regional anesthesia on the success rate of external cephalic version: a systematic review and meta-analysis. Obstet Gynecol 2011; 118: 1137-44.

In this meta-analysis pooling data from 6 RCTs, regional anesthesia was associated with increased ECV success compared to no regional anesthesia (57.6% vs 37.6%; RR=1.58; 95% CI=1.29-1.93). However, no statistically significant difference in the rate of CD was observed (48.4% vs 59.3%). Despite favorable improvements in ECV success with regional anesthesia, more work is needed to investigate why a concomitant reduction in CD rates did not occur.

Fertility Care

38. de Graaff AA, Land JA, Kessels AG, Evers JL: Demographic age shift toward later conception results in an increased age in the subfertile population and an increased demand for medical care. Fertil Steril 2011; 95: 61-63.

In this interesting observational study from Holland (between 1995-2008), a demographic age shift towards later conception was accompanied by an increasing demand for fertility care at an institutional level. Specifically, for each year that the mean age at first delivery increased, the mean age of patients entering a fertility clinic increased by 1.1 yr.

Small for Gestational Age

39. Mikolajczyk RT, Zhang J, Betran AP, Souza JP, Mori R, Gulmezoglu AM, Merialdi M: A global reference for fetal-weight and birthweight percentiles. Lancet 2011; 377: 1855-61.

This study comprises an innovative mathematical approach for calculating fetal weight and birthweight percentiles using current fetalweight references and adjusting for proportionality (using country-specific and obstetric co-variates). Using WHO Maternal and Perinatal data (290,610 births), investigators' classification of infants as small-for-gestational age (SGA) improved substantially after applying country or ethnic origin to the mathematical model for calculating fetal weight. Fetal growth and birthweight standards adjusted for the respective population's average birthweight can identify SGA babies who are more likely to have adverse outcomes than if no adjustment for average birthweight is made.

Accompanying editorial: Gardosi J: Fetal growth standards: individual and global perspectives. Lancet 2011; 377: 1812-14.

Gestational Diabetes Mellitus

40. Durnwald CP, Mele L, Spong CY, Ramin SM, Varner MW, Rouse DJ, Sciscione A, Catalano P, Saade G, Sorokin Y et al: Glycemic characteristics and neonatal outcomes of women treated for mild gestational diabetes. Obstet Gynecol 2011; 117: 819-27.

In this secondary analysis of a multicenter MFMU RCT of patients with gestational diabetes (GDM) (n=460), higher median fasting glucose levels in the last 2 weeks of pregnancy were observed to be significantly associated with a large-for-gestational age neonate, macrosomia and elevated C-peptide. Tight glycemic control during pregnancy is advised to optimize maternal and neonatal outcomes for patients with GDM.

41. Committee opinion no. 504: Screening and diagnosis of gestational diabetes mellitus. Obstet Gynecol 2011; 118: 751.

The latest Practice Bulletin from ACOG on diagnosing gestational diabetes. All pregnant patients should undergo screening, and a 100g, 3 hr oral glucose tolerance test is recommended for making a formal diagnosis.

42. Ryan EA: Diagnosing gestational diabetes. Diabetologia 2011; 54: 480-86.

In this excellent commentary article, the newly proposed criteria for diagnosing GDM (from the International Association of Diabetes in Pregnancy Study Groups) is questioned. The strength of association between GDM and large-for-gestational age infants, and optimal methods for population-wide screening are also reviewed.

Accompanying editorial: Long H: Diagnosing gestational diabetes: can expert opinions replace scientific evidence? Diabetologia 2011; 54: 2211-13.

Letter to the editor: Iafusco D, Galderisi A, Lombardo F, Scaramuzza A, Tartaglia E, Cocca A, Giugliano R, Giugliano B, Sena T, Napoli A et al: All classifications not built on pathogenesis become inadequate sooner or later. Diabetologia 2011; 54: 1583-84.

Peripartum Obstetric Management and Modes of Delivery

Cesarean Delivery

43. Tita AT, Lai Y, Landon MB, Spong CY, Leveno KJ, Varner MW, Caritis SN, Meis PJ, Wapner RJ, Sorokin Y et al: Timing of elective repeat cesarean delivery at term and maternal perioperative outcomes. Obstet Gynecol 2011; 117: 280-86.

Although neonatal outcomes are improved in women who undergo elective CD >39 weeks (compared to <39 weeks), the effect of timing of CD on maternal outcomes is unknown. This multicenter (NICHD-MFMU), retrospective cohort study (n=11,255) reported no reduction in composite adverse maternal outcomes in women undergoing elective CD before 39 weeks versus delivery at 39 weeks (adj OR=1.16; 95% CI=1.0-1.34). This study substantiates current practices of performing elective CD ≥39 weeks in the absence of obstetric and medical indications.

Letter to the editor: Salim R, Shalev E: Timing of elective repeat cesarean delivery at term and maternal perioperative outcomes. Obstet Gynecol 2011; 117: 1437; author reply 1437-38.

44. Fyfe EM, Anderson NH, North RA, Chan EH, Taylor RS, Dekker GA, McCowan LM: Risk of first-stage and second-stage cesarean delivery by maternal body mass index among nulliparous women in labor at term. Obstet Gynecol 2011; 117: 1315-22.

This secondary analysis using data from an established research consortium assesses the risk of CD in the 1st and 2nd stages of labor among nulliparous patients in different weight classes (n=2629). Surprisingly, only overweight and obese women were at increased risk for intrapartum CD during the 1st stage of labor (adj OR overweight=1.39, 95% CI=1.1-1.8; adj OR obese=2.9; 95% CI=2.2-3.8) but not during the 2nd stage of labor compared to women with normal BMI values. Unfortunately, neither weight gain in pregnancy nor epidural usage were accounted for in the analyses.

45. Barber EL, Lundsberg LS, Belanger K, Pettker CM, Funai EF, Illuzzi JL: Indications contributing to the increasing cesarean delivery rate. Obstet Gynecol 2011; 118: 29-38.

Single-center retrospective study assessing the changing indications for CD between 2003 and 2009 (n=32,443). The CD rate increased during the study period from 21% to 36%; 50% percent of this increase was attributable to primary CD. Non-reassuring fetal status was the main contributor (32%) to the total increase in the primary CD rate. Medical and non-medical factors are likely to be the main drivers for this change in practice.

46. Solheim KN, Esakoff TF, Little SE, Cheng YW, Sparks TN, Caughey AB: The effect of cesarean delivery rates on the future incidence of placenta previa, placenta accreta, and maternal mortality. J Matern Fetal Neonatal Med 2011; 24: 1341-46.

Investigators in this interesting study used published data and assumptions, as inputs for decision analytics, to estimate the future incidence of placenta previa, accreta and maternal death using current US birth data and assumptions on previa/accreta for multiple prior CDs. For the year 2020, the projected number of CDs is 2.2 million; the accompanying projections for obsteric-related morbidity/mortality are alarming: 730 maternal deaths, 8056 cesarean hysterectomies, and 8864 accretas.

47. ACOG Practice Bulletin No. 120: Use of prophylactic antibiotics in labor and delivery. Obstet Gynecol 2011; 117: 1472-83.

Latest practice bulletin on prophylactic antibiotics from ACOG. Within 60 min before starting a CD, a single dose of a 'targeted antibiotic' (e.g. 1st generation cephalosporin) is recommended. A higher dose of prophylactic antibiotic is recommended for obese patients. Clindamycin and an aminoglycoside are suggested for patients with a history of 'significant' penicillin or cephalosporin allergy.

48. Pearson GA, Kelly B, Russell R, Dutton S, Kurinczuk JJ, MacKenzie IZ: Target decision to delivery intervals for emergency caesarean section based on neonatal outcomes and three year follow-up. Eur J Obstet Gynecol Reprod Biol 2011; 159: 276-81.

Retrospective study from a single-center in the UK evaluating decision-to-delivery intervals (DDI) and neonatal outcomes for 591 women undergoing emergency CD [categories 1 and 2: NICE classification]. Only three surviving babies had neurologic impairment at aged 3 yr related to perinatal ischemia (DDI were 18, 36, 61 min). Interestingly, general anesthesia was used for 58% of category 1 CD, with a shorter DDI compared to regional anesthesia (21 vs 29 min; P=0.02). All category 2 CD were started under regional anesthesia, yet a surprisingly high proportion (8.4%) required conversion to general anesthesia.

49. Brennan DJ, Murphy M, Robson MS, O'Herlihy C: The singleton, cephalic, nulliparous woman after 36 weeks of gestation: contribution to overall cesarean delivery rates. Obstet Gynecol 2011; 117: 273-79.

Moderate quality, descriptive study of changing trends and indications for CD in a single obstetric center between 1974 and 2008. There were similar increases in the rates of overall CD and CD among term singleton nulliparous patients (3.8 and 3.4-fold increases respectively; correlation: r=0.93). The increase in the induction rate among singleton nulliparous patients was presumed to be a major contributor to the overall rate of CD.

Vaginal Delivery

Labor Induction

50. Rouse DJ, Weiner SJ, Bloom SL, Varner MW, Spong CY, Ramin SM, Caritis SN, Grobman WA, Sorokin Y, Sciscione A et al: Failed labor induction: toward an objective diagnosis. Obstet Gynecol 2011; 117: 267-72.

Moderate quality secondary analysis of a multicenter MFMU study assessing labor induction in 1347 nulliparous women. In this study, 60% of women in the latent phase of labor who received 12 hr of oxytocin and membrane rupture required CD. Of note, rates of chorioamnionitis and uterine atony were positively associated with latent-phase duration (adj ORs for each hr of the latent phase=1.12 and 1.13 respectively; P<0.001).

51. Kaimal AJ, Little SE, Odibo AO, Stamilio DM, Grobman WA, Long EF, Owens DK, Caughey AB: Cost-effectiveness of elective induction of labor at 41 weeks in nulliparous women. Am J Obstet Gynecol 2011; 204: 137.e1-9.

This study incorporated a decision analytic model with data sourced from the National Birth Cohort (n=200,000); the incremental cost effectiveness ratio was $10,945 for induction of labor per quality-adjusted life year gained. The results indicate that elective induction of labor at 41 weeks in nulliparous women is more cost-effective and has fewer perinatal adverse outcomes than expectant management.

52. Patterson JA, Roberts CL, Ford JB, Morris JM: Trends and outcomes of induction of labour among nullipara at term. Aust N Z J Obstet Gynaecol 2011; 51: 510-17.

In this retrospective, population-wide cohort study in New South Wales (Australia), the rate of term inductions in nulliparous women with singleton pregnancies increased from 6.8% to 12.5% from 2001 to 2007. More than 61% of all inductions occurred before 41 weeks' gestational age. More detailed examination of the decision-making processes and appropriateness of induction of labor before 41 weeks were highlighted in the discussion.

53. Jozwiak M, Rengerink KO, Benthem M, van Beek E, Dijksterhuis MGK, de Graaf IM, van Huizen ME, Oudijk MA, Papatsonis DNM, Perquin DAM et al: Foley catheter versus vaginal prostaglandin E2 gel for induction of labour at term (PROBAAT trial): an open-label, randomised controlled trial. Lancet 2011; 378: 2095-103.

High-quality multicenter RCT comparing modes of delivery and perinatal outcomes in laboring patients undergoing induction of labor (IOL) with a Foley catheter versus vaginal prostaglandin E2 gel (n=824). The use of a Foley catheter did not reduce rates of CD compared to the use of PGE2 (23% vs 20%; risk ratio=1.13; 95% CI=0.87-1.47). Fewer patients undergoing IOL with a Foley catheter had adverse perinatal/maternal outcomes (operative deliveries; intrapartum pyrexia; uterine hyperstimulation; postpartum hemorrhage); however, these between-group differences were not statistically significant.

Accompanying editorial: Norman JE, Stock S: Intracervical Foley catheter for induction of labour. Lancet 2011; 378: 2054-55.

Bishop Scores

54. Laughon SK, Zhang J, Troendle J, Sun L, Reddy UM: Using a simplified Bishop score to predict vaginal delivery. Obstet Gynecol 2011; 117: 805-11.

High-quality study to investigate the ability of a simplified Bishop score to predict vaginal delivery in uncomplicated, nulliparous pregnancies (n=5610). On the basis of multivariate logistic regression, investigators constructed a simplified score using cervical dilatation, station and effacement. The simplified score compared favorably with the original Bishop score in predicting vaginal delivery in women undergoing either spontaneous labor or indicated inductions of labor.

Letter to the editor: Tajik P, Bossuyt PM, Willem Mol B: Using a simplified bishop score to predict vaginal delivery. Obstet Gynecol 2011; 118: 360; author reply 360.

Fetal Monitoring

55. Chen HY, Chauhan SP, Ananth CV, Vintzileos AM, Abuhamad AZ: Electronic fetal heart rate monitoring and its relationship to neonatal and infant mortality in the United States. Am J Obstet Gynecol 2011; 204: 491.e1-10.

High quality retrospective cohort study that incorporated linked US birth and infant death data from 2004 (n=1,732,211 singleton live births) to assess postnatal outcomes related to the use of electronic fetal monitoring (EFM) compared to no EFM. EFM was associated with reduced early neonatal mortality (RR=0.5; 95% CI=0.44-0.57) and decreased risk of Apgar scores <4 at 5 min (RR=0.54; 95% CI=0.49-0.59). The benefits of EFM appeared to be gestational age-dependent; the number needed was lowest (1:15) for gestations between 24-27 weeks. However, EFM was also associated with an increased risk of operative vaginal delivery (RR=1.39; 95% CI=1.34-1.42) and primary CD for fetal distress (RR=1.81; 95% CI=1.74-1.88).

Letter to the editor: Klebanoff MA, Branum AM, Schoendorf KC, Lynch CD: Electronic fetal heart rate monitoring and its relationship to neonatal and infant mortality in the United States. Am J Obstet Gynecol 2012; 206: e18-e19.

Reply by the author: Chauhan SP, Chen H-Y, Ananth CV, Vintzileos AM, Abuhamad AZ: Reply. Am J Obstet Gynecol 2012; 206: e19-e20.

Labor Progress

56. Reitman E, Conell-Price J, Evansmith J, Olson L, Drosinos S, Jasper N, Randolph P, Smiley RM, Shafer S, Flood P: beta2-adrenergic receptor genotype and other variables that contribute to labor pain and progress. Anesthesiology 2011; 114: 927-39.

Investigators in this prospective observational study in 150 nulliparous patients used mixed-effects modeling to examine the association between genetic and demographic factors with labor pain and progress. Slower progress in labor was significantly associated with patients expressing CC allele at position 27 on the β_2 adrenoceptor gene (ADRB2), increased weight, black patients and neuraxial analgesia. Asian ethnicity is likely to be a proxy for ADRB2 genotype. In a separate model designed to investigate predictors for labor pain, the authors noted that patients who required instrumental delivery had significantly higher pain scores in early labor compared to patients undergoing vaginal delivery, and that cold sensitivity is a signficant predictor for labor pain. These mathematical models offer great potential in predicting labor progress and dynamic changes in labor pain for individual patients attempting vaginal delivery.

57. Miller RS, Smiley RM, Daniel D, Weng C, Emala CW, Blouin JL, Flood PD: Beta-2 adrenoceptor genotype and progress in term and late preterm active labor. Am J Obstet Gynecol 2011; 205: 137.e1-7.

Retrospective study assessing whether polymorphisms in the β_2 adrenoceptor gene (ADRB2) influence progress of active labor in term and preterm parturients (n=401). Using linear regression, investigators reported that the rate of labor progress was slower in patients with the homozygous genotype encoding for Arg/Arg 16 compared to other genotypes (0.64 cm/hr vs 0.8 cm/hr respectively). As seen in the Reitman study (referenced above), this study opens the door to further exploratory work examining the genotypic factors that influence labor progress.

Vaginal Birth After Cesarean Delivery

58. Ouzounian JG, Miller DA, Hiebert CJ, Battista LR, Lee RH: Vaginal birth after cesarean section: risk of uterine rupture with labor induction. Am J Perinatol 2011; 28: 593-96.

In this retrospective cohort study of patients undergoing trial of labor after cesarean delivery (TOLAC), investigators reported uterine rupture rates in women experiencing spontaneous onset of labor versus induced labor (1% vs 1.2% respectively; P=0.51) (n=6832). No differences in rupture were observed between oxytocin or prostaglandin E_2 induction (1.4% vs 1.0%; P=0.59). Labor induction may not increase the risk of uterine rupture in women undergoing TOLAC.

59. Sharma PS, Eden KB, Guise JM, Jimison HB, Dolan JG: Subjective risk vs. objective risk can lead to different post-cesarean birth decisions based on multiattribute modeling. J Clin Epidemiol 2011; 64: 67-78.

In this thought-provoking study of how women with a prior CD determine risk related to childbirth, absolute (objective) risks of elective CD vs vaginal birth after cesaraen were compared with patients' (subjective) interpretation of the same risks (n=96). Using decision analytic techniques, the results of risk modeling based on patient preference favored repeat CD (73% vs 18%; P<0.001), as women prioritized any risk to the infant over risks to their own health. In contrast, TOLAC was associated with lower probabilities of risk to the mother with modeling using objective measures of risk. This study highlights the challenges that clinicians and patients with a prior CD face when discussing childbirth-related risks.

Twin Delivery

60. Rossi AC, Mullin PM, Chmait RH: Neonatal outcomes of twins according to birth order, presentation and mode of delivery: a systematic review and meta-analysis. BJOG 2011; 118: 523-32.

In this meta-analysis (18 studies) of neonatal outcomes after twin delivery, investigators reported that the risk of neonatal morbidity and mortality was lower for twin A compared to twin B (OR=0.53 and 0.55 respectively). Favorable outcomes were generally noted for twins born by vaginal delivery compared to CD. A key observation was that the observed rate of neonatal morbidity was highest for twin B after a CD following a failed attempt at vaginal delivery compared to either vaginal or CD.

Postpartum Period Management

Uterotonics

61. Langesaeter E, Rosseland LA, Stubhaug A: Haemodynamic effects of oxytocin in women with severe preeclampsia. Int J Obstet Anesth 2011; 20: 26-29.

Observational study reporting important hemodynamic effects of 2.5 units oxytocin (using LiDCOplus) in 18 severe preeclamptics undergoing CD with spinal anesthesia. After oxytocin dosing, all patients exhibited tachycardia and an SVR decrease; however, the secondary effects on stroke volume and cardiac output were more unpredictable.

62. Yamaguchi ET, Cardoso MM, Torres ML, Nascimento RC, Ribeiro MC, Frerichs E, Payen D: Serum oxytocin concentrations in elective caesarean delivery: a randomized comparison of three infusion regimens. Int J Obstet Anesth 2011; 20: 224-28.

This RCT assessed the effect of three, different oxytocin infusions - Ox1=0.33 U infused over 30 min; Ox2=2.67 U infused over approx. 4 min; Ox3=2.67 U infused over 30 min - on serum oxytocin levels in patients undergoing elective CD. Serum oxytocin levels were higher at 5 and 30 mins in patients receiving Ox3 compared to Ox1 and Ox2. However formal longitudinal analysis was not performed to assess within/between group differences. Future studies are needed to determine if these increases in serum oxytocin concentration promote adequate uterine activity after delivery.

63. Sheehan SR, Montgomery AA, Carey M, McAuliffe FM, Eogan M, Gleeson R, Geary M, Murphy DJ: Oxytocin bolus versus oxytocin bolus and infusion for control of blood loss at elective caesarean section: double blind, placebo controlled, randomised trial. BMJ 2011; 343: d4661.

High quality multicenter double-blind RCT comparing oxytocin bolus (5 U) with and without an infusion (40 U in 500 mL Normal Saline over 4hr) in patients undergoing elective CD (n=2058). Similar proportions of patients in each group experienced major obstetric hemorrhage; however, women receiving oxytocin bolus plus infusion were less likely to receive an additional uterotonic agent than women in the bolus only group (12.2% vs 18.4%). These data suggest that the use of a post-bolus 'maintenance' oxytocin infusion is advantageous.

64. Moertl M, Friedrich S, Kraschl J, Wadsack C, Lang U, Schlembach D: Haemodynamic effects of carbetocin and oxytocin given as intravenous bolus on women undergoing caesarean delivery: a randomised trial. BJOG 2011; 118: 1349-56.

RCT comparing the hemodynamic effects of a bolus of 5U oxytocin versus 100 mcg carbetocin in women undergoing elective CD (n=56). Similar hemodynamic perturbance was observed in each study group (maximal increase in HR=18 bpm vs 14 bpm, and maximal decrease in systolic BP=27 vs 23 mmHg with

oxytocin vs carbetocin respectively). Peak effects were observed for both drugs at 30-40s after dosing. Further studies assessing the minimal effective dose of carbetocin based on hemodynamic and uterotonic effects are warranted.

Thromboprophylaxis

65. Boyce H, Hume-Smith H, Ng J, Columb MO, Stocks GM: Use of thromboelastography to guide thromboprophylaxis after caesarean section. Int J Obstet Anesth 2011; 20: 213-18.

Prospective observational study to quantify the anticoagulant effect of unfractionated subcutaneous heparin (7500 u subcutaneous) using thromboelastography (TEG) and laboratory analyses in 19 women undergoing elective CD. In the first 4 hr post-CD, anti-Xa levels were predominantly undetectable in all patients, and there was limited TEG evidence of a heparin effect (based on r time using native/heparinase samples). Overall, a dose of 7500 u subcutaneous heparin produced, at best, a modest hypocoagulable effect post-CD.

66. Roeters van Lennep JE, Meijer E, Klumper FJ, Middeldorp JM, Bloemenkamp KW, Middeldorp S: Prophylaxis with low-dose low-molecular-weight heparin during pregnancy and postpartum: is it effective? J Thromb Haemost 2011; 9: 473-80.

Retrospective cohort study evaluating the incidence of venous thromboembolism (VTE) in patients at intermediate or high-risk for VTE, who received prophylaxis with low-dose low-molecular weight heparin (LMWH) in 126 pregnancies. All events occurred in women considered at high risk for VTE receiving LMWH, with the vast majority receiving nadroparin 2850 anti-Xa IU during the antepartum and postpartum periods. The incidence of VTE was surprisingly high: 5.5%; 95% CI=2.4-12.3%. The efficacy of thromboprophylactic dosing with nadroparin in at-risk patient subpopulations should be questioned.

Letter to the editor: Lindqvist PG, Hellgren M: Is obstetric thromboprophylaxis with low-molecular-weight heparin effective? Yes, if administered properly. J Thromb Haemost 2011; 9: 1669-70.

Patel JP, Patel RK, Davies JG, Arya R: Prophylaxis with low-dose low molecular weight heparin during pregnancy and the puerperium: is it effective? A rebuttal. J Thromb Haemost 2011; 9: 1269-71; author reply 1272-73.

Stratta P, Canavese C, Cena T, Quaglia M, Pergolini P, Bellomo G, Magnani C: Low-molecular-weight-heparin and pregnancy, when the dose does it: a nephrologist's opinion: a rebuttal. J Thromb Haemost 2011; 9: 2127-29; author reply 2129-30.

Psychiatric Disease

67. Munk-Olsen T, Laursen TM, Pedersen CB, Lidegaard O, Mortensen PB: Induced first-trimester abortion and risk of mental disorder. N Engl J Med 2011; 364: 332-39.

High quality population-based cohort study (n=84620) to assess if first trimester abortion was associated with an increased risk of subsequent psychiatric referral. The observed incidence rate of psychiatric contact within 12 months after induced first-trimester abortion (14.6 per 1000 person-years; 95% CI=13.7-15.6) was similar to the rate during the 9 month period prior to abortion (13.7; 95% CI=14.4-16.1), which did not support the primary study hypothesis.

Maternal Mortality

68. Hawkins JL, Chang J, Palmer SK, Gibbs CP, Callaghan WM: Anesthesia-related maternal mortality in the United States: 1979-2002. Obstet Gynecol 2011; 117: 69-74.

Based on data from the CDC, a dramatic reduction (59%) in anesthetic-related maternal deaths in the USA from 1979-1990 compared to 1991-2002 (2.9 deaths vs 1.2 deaths per million live births respectively) has occurred. Improvements in anesthetic monitoring and difficult airway/failed intubation management are likely to have been instrumental in: (i) reducing the case fatality rates due to general anesthesia (GA); and (ii) promoting the reduction in the rate ratio for maternal death due to GA versus regional anesthesia. Unfortunately, familiar causes of death associated with GA remain prevalent - intubation failure/complications due to induction (23%). High spinal and epidural blocks were reported as the leading causes of death (26%) due to regional anesthesia.

69. Paxton A, Wardlaw T: Are we making progress in maternal mortality? N Engl J Med 2011; 364: 1990-93.

Commentary article on recent changes in international rates of maternal mortality. Improvements in access of health resources and obstetrical care have contributed to a 2.3% decline in the global maternal mortality ratio between 1990 and 2008 (UN interagency estimates).

70. The California Pregnancy-Associated Mortality Review. Report from the 2002 and 2003 Maternal Death Reviews. Sacramento. California Department of Public Health, Maternal Child and Adolescent Health Division. 2011. http://cdph.ca.gov/data/statistics/Documents/MO-CA-PAMR-MaternalDeathReview-2002-03.pdf.

This is must-read document comprises detailed information of maternal deaths reported in California from 2002 and 2003 (from the California Pregnancy-Associated Mortality Review); 386 women died during childbirth or within one year of a live birth or fetal death, 98 of whom died of causes directly related to pregnancy or pregnancy management. Reported disparities in outcome were based on race, income and education. On the basis of case reviews, cardiovascular disease was a leading cause (20%) of pregnancy-related death.

71. Centre for Maternal and Child Enquiries (CMACE): Saving Mothers' Lives: Reviewing maternal deaths to make motherhood safer: 2006-2008. The Eighth Report of the Confidential Enquiries into Maternal Deaths in the United Kingdom. BJOG 2011; 118 Suppl 1: 1-203.

Key report of 261 maternal deaths in the UK that occurred between 2006-2008. The maternal mortality rate for this triennium was 11.39/100,000 maternities. Rates of death from maternal causes decreased due to presumed improvements in the prevention and treatment of thromboembolism and hemorrhage. Cardiac disease remained the leading indirect cause of maternal death (2.31/100,000 maternities). The overall rate of death from sepsis also increased (1.13 deaths/100,000 maternities). Key recommendations for reducing the number of maternal deaths, especially for high-risk parturients, center on improving the quality of interdisciplinary and subspecialist maternal care and ease of patient access to experienced maternal care providers.

Editorials affilliated with the CMACE report:

Reidy J, Russell R: Cmace 2006-2008. Int J Obstet Anesth 2011; 20: 208-12.

Wong CA: Saving mothers' lives: the 2006-8 anaesthesia perspective. Br J Anaesth 2011; 107: 119-22.

Nelson-Piercy C, Mackillop L, Williams DJ, Williamson C, Swiet M, Redman C: Maternal mortality in the UK and the need for obstetric physicians. BMJ 2011; 343: d4993.

Editorial stressing importance of obstetric physicians' early recognition of co-mordid states that may be exacerbated by pregnancy and potentially lead to major maternal morbidity or mortality.

Review article related to CMACE report:

McClure JH, Cooper GM, Clutton-Brock TH: Saving Mothers' Lives: reviewing maternal deaths to make motherhood safer: 2006-8: a review. Br J Anaesth 2011; 107: 127-32.

A summary review of CMACE findings relevant to anesthesiologists and intensive care physicians caring for obstetric patients. Deaths directly or indirectly related to anesthetic interventions are reviewed and discussed.

72. MacKay AP, Berg CJ, Liu X, Duran C, Hoyert DL: Changes in pregnancy mortality ascertainment: United States, 1999-2005. Obstet Gynecol 2011; 118: 104-10.

In this study investigators assessed the effects of the 1999 transition from ICD-9 to ICD-10 coding, and check boxes related to pregnancy status on US death certificates (since 2003) on pregnancy-related deaths were assessed. Using data from the National Vital Statistics System and Pregnancy Mortality Surveillance System, investigators found the maternal mortality ratio had increased significantly from 1995-7 to 1999-2002 to 2003-2005 (11.6; 13.1, and 15.3 respectively). Unfortunately, the ICD coding changes and 2003 death certificate revisions ('check boxes') have almost certainly influenced data reporting for maternal deaths in the US, and thus negatively impacted on the interpretation of pregnancy related and maternal mortality ratios.

73. Lozano R, Wang H, Foreman KJ, Rajaratnam JK, Naghavi M, Marcus JR, Dwyer-Lindgren L, Lofgren KT, Phillips D, Atkinson C et al: Progress towards Millennium Development Goals 4 and 5 on maternal and child mortality: an updated systematic analysis. Lancet 2011; 378: 1139-65.

Based on expanded access to international data sources, this paper is a highly impressive analysis of maternal and child mortality for the world's poorest countries. Alternative population-wide modeling for maternal mortality was performed to generate estimates for maternal death in 2011. Only 13 countries, representing 19% of livebirths in developing countries, were likely to achieve MDG 5 targets by 2015. Although improvements in maternal mortality have occurred (409,100 deaths in 1990; 273,500 deaths in 2011), the pace of change has been sluggish. More international effort and action has been called for to achieve the MDG 4 and 5 targets.

Accompanying editorial: Byass P, Graham WJ: Grappling with uncertainties along the MDG trail. Lancet 2011; 378: 1119-20.

74. Bonnet M-P, Deneux-Tharaux C, Bouvier-Colle M-H: Critical care and transfusion management in maternal deaths from postpartum haemorrhage. Eur J Obstet Gynecol Reprod Biol 2011; 158: 183-88.

Retrospective study of suspected root causes for 38 maternal deaths due to postpartum hemorrhage in France. Suboptimal practices identified as having a major contributory role included: inadequate hemodynamic monitoring, lack of laboratory assessment, and delays in transfusion. Of note, 5 patients developed cardiac arrest after induction of general anesthesia, and five patients were extubated, despite active hemorrhage.

Cardiac Arrest and Resuscitation

75. Jeejeebhoy FM, Zelop CM, Windrim R, Carvalho JC, Dorian P, Morrison LJ: Management of cardiac arrest in pregnancy: a systematic review. Resuscitation 2011; 82: 801-09.

Systematic review of studies related to resuscitation of pregnant patients experiencing cardiac arrest. Unsurprisingly, there are only five studies assessing maternal outcomes and optimal modes of resuscitation. Key findings were that perimortem CD is rarely performed within five minutes of onset of maternal arrest (see reference 202), and the quality of chest compressions is lessened due to left lateral tilt. This review highlights the lack of scientific evidence on optimal resuscitative strategies for the parturient during cardiac arrest.

Accompanying editorial: King SE, Gabbott DA: Maternal cardiac arrest—Rarely occurs, rarely researched. Resuscitation 2011; 82: 795-96.

Maternal Morbidity

Venous Thromboembolism

76. Duran-Mendicuti A, Sodickson A: Imaging evaluation of the pregnant patient with suspected pulmonary embolism. Int J Obstet Anesth 2011; 20: 51-59.

Detailed review article which provides useful information on different radiologic diagnostic modalities for confirming the diagnosis of venous thromboembolic disease, including a diagnostic imaging algorithm for patients with suspected pulmonary embolism.

77. Ferres MA, Olivarez SA, Trinh V, Davidson C, Sangi-Haghpeykar H, Aagaard-Tillery KM: Rate of wound complications with enoxaparin use among women at high risk for postpartum thrombosis. Obstet Gynecol 2011; 117: 119-24.

Retrospective cohort study to identify wound complications (wound separation, hematoma) in 'at-risk' post-cesarean patients (n=1677) receiving enoxaparin thromboprophylaxis versus 'at-risk' controls (no enoxaparin; n=1024). Inconsistent effects were observed, including a higher rate of wound separation (6.8% vs 3.6%; P=0.003) in the enoxaparin group versus control group respectively, with no between-group difference in the rate of wound hematoma. The study was underpowered for assessing between-group differences in rates of VTE.

78. Practice Bulletin No. 123: Thromboembolism in Pregnancy. Obstet Gynecol 2011; 118: 718-29.

The latest practice bulletin from ACOG provides guidelines for using prophylactic and therapeutic anticoagulation regimens in the antepartum and postpartum periods. Consideration for converting LMWH to unfractionated heparin (UH) from 36 weeks gestation is advised, and ACOG recommend ASRA guidelines for timing neuraxial blockade in patients anticoagulated with LMWH and UH. Restarting UH or LMWH is advised >4-6 hr after vaginal delivery, and >6-12 hr post-CD.

79. Jackson E, Curtis KM, Gaffield ME: Risk of venous thromboembolism during the postpartum period: a systematic review. Obstet Gynecol 2011; 117: 691-703.

Excellent systematic review of risk of VTE for postpartum patients. Key findings are that incidence rates for VTE during the first six weeks postpartum are 2.5-21.5 times greater than in nonpregnant women. Of note, the incidence of VTE was highest immediately after delivery. Unfortunately no studies in this review stratified VTE rates according to known risk factors.

80. Blondon M: Thromboprophylaxis after cesarean section: decision analysis. Thromb Res 2011; 127 Suppl 3: S9-S12.

Interesting review describing a decision-analysis for justifying 7 day thromboprophylaxis with LMWH versus no prophylaxis after CD. A modest net gain of 1.5 days in quality-adjusted life expectancy per treated patient was calculated with LMWH prophylaxis, assuming a VTE incidence=0.22% in low-risk women. Using different case scenarios, LMWH had a greater impact in reducing thrombotic events than inducing major hemorrhage events in women with known risk factors for VTE: smoking, obesity, emergency CD.

81. Virkus RA, Lokkegaard EC, Bergholt T, Mogensen U, Langhoff-Roos J, Lidegaard O: Venous thromboembolism in pregnant and puerperal women in Denmark 1995-2005. A national cohort study. Thromb Haemost 2011; 106: 304-09.

Data from all Danish women of childbearing age was used in this retrospective cohort study to assess incidence rates of VTE in pregnancy and the puerperium over a 10 yr period (n=817,751). The risk of VTE increased exponentially during

pregnancy, reaching peak levels in the early postpartum period (unadj risk=60 per 10,000 pregnant years). Interestingly, risk was not affected by maternal age; however, the incidence of postpartum thromboprophylaxis was not reported.

Postpartum Hemorrhage

Associative Factors/Risk Factors for Postpartum Hemorrhage

82. Driessen M, Bouvier-Colle MH, Dupont C, Khoshnood B, Rudigoz RC, Deneux-Tharaux C: Postpartum hemorrhage resulting from uterine atony after vaginal delivery: factors associated with severity. Obstet Gynecol 2011; 117: 21-31.

High-quality retrospective cohort study assessing risk factors associated with severe postpartum hemorrhage (PPH) due to uterine atony after vaginal delivery (n=4550). Interestingly, delays in the provision of care, including: oxytocin administration, alerting an obstetrician and anesthesiologist, manual examination of the uterus and delivery in a public, non-university hospital were independently associated with severe PPH. One ofhe most interesting findings was that the use of epidural anesthesia was found to be a protective risk factor for severe PPH.

Accompanying editorial: Zelop CM: Postpartum hemorrhage: becoming more evidence-based. Obstet Gynecol 2011; 117: 3-5.

83. Sosa CG, Althabe F, Belizan JM, Buekens P: Use of oxytocin during early stages of labor and its effect on active management of third stage of labor. Am J Obstet Gynecol 2011; 204: 238.e1-5.

Secondary analysis of a multicenter RCT study of vaginal deliveries in South America (n=11,323). The effect of oxytocin for induction or augmentation of labor on the incidence of PPH was assessed in women receiving active management of the third stage of labor (AMTSL). Surprisingly, there were no significant associations between induced/augmented labor and moderate PPH, severe PPH and blood transfusion among patients undergoing AMTSL. Unfortunately the temporal and dose-related effects of oxytocin in labor on the primary outcomes were not assessed.

84. Blomberg M: Maternal obesity and risk of postpartum hemorrhage. Obstet Gynecol 2011; 118: 561-68.

In this population-wide study investigators studied whether differences in prevalence of PPH exist among patients according to body mass index (BMI) class (n=1,114,071). The main finding was that the risk of atonic hemorrhage increased with increasing BMI class – adj OR for patients with BMI≥40 versus normal BMI group=2.14. The effects of anesthesia, oxytocin and other uterotonics were not accounted for in the analyses.

85. Gayat E, Resche-Rigon M, Morel O, Rossignol M, Mantz J, Nicolas-Robin A, Nathan-Denizot N, Lefrant JY, Mercier FJ, Samain E et al: Predictive factors of advanced interventional procedures in a multicentre severe postpartum haemorrhage study. Intensive Care Med 2011; 37: 1816-25.

Retrospective study investigating prediction factors for severe PPH requiring specialized treatment (uterine artery embolization or surgical intervention) following initial resuscitation. Five independent predictors for severe PPH were abnormal placental implantation, INR >1,64, fibrinogen <2g/dl, a detectable troponin I level, and maternal heart rate >115 bpm. Prediction models for severe PPH had moderate accuracy (AUROC =approx. 0.8 [2 cohorts: n=257 and 239]). Unfortunately, predictive factors were not assessed in non or poorly-resuscitated patients during the early stages of severe PPH. Variations in clinical practice, such as specialized treatment versus medical management for severe PPH. limit the clinical applicability of this model.

86. Grotegut CA, Paglia MJ, Johnson LN, Thames B, James AH: Oxytocin exposure during labor among women with postpartum hemorrhage secondary to uterine atony. Am J Obstet Gynecol 2011; 204: 56.e1-6.

Case-control study investigating the influence of oxytocin during labor on severe PPH secondary to uterine atony (n=108). Oxytocin exposure, calculated as area under the curve, was significantly higher in women with severe PPH versus control (adj. OR=1.58; 95% CI=1.05-2.57). These data add support to prior findings that oxytocin receptor desensitization and reduced contractile responsiveness occur with exogenous oxytocin administration.

87. Chang CC, Wang IT, Chen YH, Lin HC: Anesthetic management as a risk factor for postpartum hemorrhage after cesarean deliveries. Am J Obstet Gynecol 2011; 205: 462.e1-7.

Using nationwide Taiwanese datasets, investigators assessed the association between anesthetic modality for CD (general versus regional) and PPH (n=67,328). The adjusted OR for PPH with general anesthesia was 8.15 higher (95% CI=6.43-10.33) than for epidural/spinal anesthesia. Severity of PPH is likely to have confounded results in the multivariate analyses.

Placenta Accreta

88. Eller AG, Bennett MA, Sharshiner M, Masheter C, Soisson AP, Dodson M, Silver RM: Maternal morbidity in cases of placenta accreta managed by a multidisciplinary care team compared with standard obstetric care. Obstet Gynecol 2011; 117: 331-37.

Retrospective cohort study comdparing maternal outcomes in patients with placenta accreta delivering in tertiary-care obstetric centers with multidisciplinary care (n=79) versus standard care obstetric centers (n=62) in Utah. Delivery at a tertiary-care center reduced composite early maternal morbidity (OR=0.46; 95% CI=0.22-0.95). Interestingly, a higher proportion of cases initially managed with regional anesthesia were converted to general anesthesia at a standard versus tertiary-care center (36% vs 8%; P<0.01).

89. Wright JD, Pri-Paz S, Herzog TJ, Shah M, Bonanno C, Lewin SN, Simpson LL, Gaddipati S, Sun X, D'Alton ME et al: Predictors of massive blood loss in women with placenta accreta. Am J Obstet Gynecol 2011; 205: 38.e1-6.

Single-center descriptive study of transfusion outcomes in a cohort (n=77) with placenta accreta. Median blood loss was 5000 mL, and median red cell transfusion was five units. Predictors for major hemorrhage/massive transfusion could not be clearly elucidated due to the limited size of the study cohort.

90. Sadashivaiah J, Wilson R, Thein A, McLure H, Hammond CJ, Lyons G: Role of prophylactic uterine artery balloon catheters in the management of women with suspected placenta accreta. Int J Obstet Anesth 2011; 20: 282-87.

For caption – see reference 91.

91. Lilker SJ, Meyer RA, Downey KN, Macarthur AJ: Anesthetic considerations for placenta accreta. Int J Obstet Anesth 2011; 20: 288-92.

Two interesting case series detailing the anesthetic management for placenta accreta using varying neuraxial anesthetic techniques (epidural de-novo; 'two-space' combined spinal and epidural technique). Lilker et al. studied 17 patients who received neuraxial anesthesia for CD, five of whom required intraoperative conversion to general anesthesia for excessive bleeding. Sadashivaiah et al. reported two cases of fetal bradycardia following uterine artery balloon catheterization prior to CD.

Pharmacologic and Non-Pharmacologic Therapeutic Regimens

92. Kayem G, Kurinczuk JJ, Alfirevic Z, Spark P, Brocklehurst P, Knight M: Specific second-line therapies for postpartum haemorrhage: a national cohort study. BJOG 2011; 118: 856-64.

Interesting UK study describing outcomes following 2nd line therapy for PPH (n=471). Despite obvious heterogeneity amongst cases, success rates due to uterine compression sutures (75%) and interventional radiologic techniques (89%) were higher than recombinant factor VIIa (31%) and vessel ligation (36%).

93. Thon S, McLintic A, Wagner Y: Prophylactic endovascular placement of internal iliac occlusion balloon catheters in parturients with placenta accreta: a retrospective case series. Int J Obstet Anesth 2011; 20: 64-70.

Case series (n=14) highlighting important complications and unpredictable efficacy of internal iliac balloon catheterization (IIBC) performed for patients with abnormal placentation. Procedure-related vascular complications highlight the uncertain clinical value of IIBC in this setting.

Letter to the editor: Palacios-Jaraquemada JM: Proximal vascular control in cases of abnormal placentation. Int J Obstet Anesth 2011; 20: 266.

94. Logan AC, Yank V, Stafford RS: Off-label use of recombinant factor VIIa in U.S. hospitals: analysis of hospital records. Ann Intern Med 2011; 154: 516-22.

Interesting retrospective study detailing the estimated national usage of recombinant factor VIIa (rVIIa) based on data sourced from 615 US academic and non-academic hospitals. From 2000-2008, the off-label use of rVIIa increased 140-fold; 672 cases (0.9% of total) were obstetric hemorrhage who received rVIIa (15% died, 78% discharged home, 8% required further care). Despite the lack of robust evidence to justify the therapeutic efficacy of rVIIa, these data highlight the increasing off-label use of rVIIa for presumed obstetric and nonobstetric hemorrhage.

Accompanying editorial: Avorn J, Kesselheim A: A hemorrhage of off-label use. Ann Intern Med 2011; 154: 566-67.

Letters to the editor: Hayanga AJ: Off-label use of recombinant factor VIIa. Ann Intern Med 2011; 155: 337-38; author reply 338-39.

Phillips A: Off-label use of recombinant factor VIIa. Ann Intern Med 2011; 155: 337; author reply 338-39.

95. Lester F, Stenson A, Meyer C, Morris J, Vargas J, Miller S: Impact of the Non-pneumatic Antishock Garment on pelvic blood flow in healthy postpartum women. Am J Obstet Gynecol 2011; 204: 409.e1-5.

In this interesting prospective observational study, the impact of a non-pneumatic antishock garment (NASG) on the resistive index (RI) in the internal iliac artery, as a marker for approximating pelvic blood flow, was investigated in 10 postpartum patients,. With full application of the NASG (leg, pelvic and abdominal segments), the RI values (1.05) were significantly higher than baseline values with no NASG applied (RI=0.83). These data provides a physiologic basis for using NASG as a therapeutic intervention for PPH.

Cell Salvage

96. Ralph CJ, Sullivan I, Faulds J: Intraoperative cell salvaged blood as part of a blood conservation strategy in Caesarean section: is fetal red cell contamination important? Br J Anaesth 2011; 107: 404-408.

In this single-center descriptive study, cell salvage was used for 70 women undergoing CD. Volumes of salvaged blood infused were moderate (median [range]=324 mL [119-1690 mL]). No adverse maternal outcomes were reported. Fetal red blood cell volumes (FRCV) in the re-infused blood were small (median [range]=0.8 mL [0.2-12.9 mL]). The relevance of FRCV in the development of maternal alloimmunization is uncertain.

Laboratory Tests and Postpartum Hemorrhage

97. de Lloyd L, Bovington R, Kaye A, Collis RE, Rayment R, Sanders J, Rees A, Collins PW: Standard haemostatic tests following major obstetric haemorrhage. Int J Obstet Anesth 2011; 20: 135-41.

Single-center retrospective study investigating hematologic indices and transfusion data in 456 patients with severe PPH (≥1500 mL blood loss) over a 3 yr period. The most interesting finding was that fibrinogen levels had the strongest association with blood loss (r=0.4; P<0.01) unlike other parameters (PT, aPTT). These results add to prior work indicating that fibrinogen levels appear to be sensitive to early and severe changes in blood loss in severe PPH.

Protocols for Obstetric Hemorrhage Management

98. Shields LE, Smalarz K, Reffigee L, Mugg S, Burdumy TJ, Propst M: Comprehensive maternal hemorrhage protocols improve patient safety and reduce utilization of blood products. Am J Obstet Gynecol 2011; 205: 368.e1-8.

This article describes a structured protocol, designed on the basis of degree of blood loss and subjective response to intervention, for treating maternal hemorrhage. After protocol implementation at a medium sized obstetric center (<3000 deliveries/year), crude data analyses suggested a reduction in hemorrhage-related morbidity: earlier resolution of bleeding, the use of fewer blood products and reduced coagulopathy. Rates of severe bleeding (blood loss >1500 mL) were similar pre versus post protocol, suggesting that more strategic intervention may be necessary to improve outcomes in patients experiencing major hemorrhage.

Genital Tract Trauma

99. Landy HJ, Laughon SK, Bailit JL, Kominiarek MA, Gonzalez-Quintero VH, Ramirez M, Haberman S, Hibbard J, Wilkins I, Branch DW et al: Characteristics associated with severe perineal and cervical lacerations during vaginal delivery. Obstet Gynecol 2011; 117: 627-35.

Multicenter, observational study exploring risk factors for 3rd/4th degree vaginal lacerations and cervical lacerations in patients undergoing vaginal delivery (n=87,267). The strongest risk factors for 3rd/4th degree lacerations were nulliparity (7.2-fold risk), being an Asian or Pacific-Islander, increasing birth weight, episiotomy, long second stage and operative vaginal delivery. Risk factors for cervical laceration were heterogeneous among nulliparous and multiparous patient groups; however, cerclage stood out as a strong risk factor in both groups (nulliparous: OR=3.7; multiparous: 12.7). Of note, epidural analgesia was significantly associated with a reduced risk of 3rd/4th degree lacerations in nulliparous and multiparous patients (OR=0.7 and 0.5 respectively).

Stroke

100. Kuklina EV, Tong X, Bansil P, George MG, Callaghan WM: Trends in pregnancy hospitalizations that included a stroke in the United States from 1994 to 2007: reasons for concern? Stroke 2011; 42: 2564-70.

Using hospitalization data from the Nationwide Inpatient Sample, investigators in this observational study reported trends and risk factors for in-hospital pregnancy-related stroke. The rate of all-cause stroke increased between 1994-1995 and 2006-2007 for antenatal hospitalizations (0.15 to 0.22 per 1000 deliveries) and postpartum hospitalizations (0.12 to 0.22 per 1000 deliveries). Hypertensive disease and heart disease were highlighted as important risk factors associated with stroke, particularly among postpartum hospitalizations.

Cardiomyopathy

101. Gunderson EP, Croen LA, Chiang V, Yoshida CK, Walton D, Go AS: Epidemiology of peripartum cardiomyopathy: incidence, predictors, and outcomes. Obstet Gynecol 2011; 118: 583-91.

Retrospective study using data from Kaiser Northern California and state databases (between 1995-2004) to investigate the incidence and risk factors for peripartum cardiomyopathy (n=227,224). The incidence was 4.84 per 10,000 live births (95% CI=3.98-5.83), and was highest among women aged ≥40 yr. A progressive increase in the risk of cardiomyopathy with severity of hypertensive disorders was observed (independent of other risk factors). The 3 yr postdelivery mortality rate was 1.8%.

Surgical Site Infections

102. Tsai PS, Hsu CS, Fan YC, Huang CJ: General anaesthesia is associated with increased risk of surgical site infection after Caesarean delivery compared with neuraxial anaesthesia: a population-based study. Br J Anaesth 2011; 107: 757-61.

Retrospective cohort study assessing differences in surgical site infection (SSI) among Taiwanese patients undergoing neuraxial anesthesia (NA) versus general anesthesia (GA) for CD (n=303,834). Using a national dataset, investigators found the risk of SSI upto 30 days post-CD was higher among patients undergoing GA compared to NA (adjusted OR=3.73; 95% CI=3.07-4.53). Of note, prophylactic antibiotics (dosing and timing of delivery), BMI, and information validating methods of anesthesia were not accounted for in this study.

Amniotic Fluid Embolus

103. Leighton BL, Wall MH, Lockhart EM, Phillips LE, Zatta AJ: Use of recombinant factor VIIa in patients with amniotic fluid embolism: a systematic review of case reports. Anesthesiology 2011; 115: 1201-208.

In this review of case reports of amniotic fluid embolism from 2003-2009, a higher proportion (14 of 16 of patients who received recombinant factor VIIa (rVIIa) had negative outcomes - permanent disability or death - compared to 11 of 28 patients not receiving rVIIa (risk ratio=2.2 (95% CI=1.4-3.7)). Ascertaining true between-group differences in patient outcomes was limited for several reasons: the retrospective study design; probable reporting biases; a wide dosing range in the cohort receiving rVIIa; and missing data on the blood loss, clinical indications and timing of rVIIa therapy during resuscitation.

Anesthesia-related Maternal Morbidity

104. Paech MJ, Doherty DA, Christmas T, Wong CA: The volume of blood for epidural blood patch in obstetrics: a randomized, blinded clinical trial. Anesth Analg 2011; 113: 126-33.

Multicenter prospective, single-blinded randomized trial (n=121) to compare the therapeutic effects of different volumes of autologous blood (15mL, 20mL, 30mL) as an epidural blood patch for treating postdural puncture headache (PDPH). No differences between groups in the incidence of partial-complete and complete relief of PDPH were observed, however patients who received 15 mL blood experienced the highest postprocedural back pain scores. Based on this study, the optimal volume for blood injection is 20mL.

105. Paranjothy S, Griffiths JD, Broughton HK, Gyte GM, Brown HC, Thomas J: Interventions at caesarean section for reducing the risk of aspiration pneumonitis. Int J Obstet Anesth 2011; 20: 142-48.

Meta-analysis of 22 studies (n=2658) demonstrating that antacids, H2 antagonists and proton-pump inhibitors reduce the risk of intragastric pH <2.5 compared to placebo or no treatment. Combined use of antacids and H2 antagonists also reduces the risk of intragastric pH <2.5 compared to placebo or antacids alone (RR 0.02; 95% CI 0-0.2). The quality of the pooled studies was weak, and the use of surrogate markers of aspiration pneumonitis (gastric pH; gastric volume) requires formal validation.

Predicting Severe Maternal Morbidity/Mortality Among Obstetric Patients

106. Mhyre JM, Bateman BT, Leffert LR: Influence of patient comorbidities on the risk of near-miss maternal morbidity or mortality. Anesthesiology 2011; 115: 963-72.

Using a population-wide, administrative dataset, study investigators aimed to identify predictive factors associated with near-miss morbidity or mortality. Using ICD-9 codes, near miss morbidity was defined as a major medical/obstetric complication and a prolonged hospital stay or discharge to a second medical facility. Patients with pulmonary hypertension (98/1000 deliveries), malignancy (23/1000 deliveries), and systemic lupus erythematosus (21/1000 deliveries) had the highest rates of near-miss morbidity/mortality. Future clinical studies are needed to investigate the true nature of near-miss morbidity, validate relevant predictive factors and improve preventative strategies to reduce rates of near-miss morbidity and maternal death.

107. Lapinsky SE, Hallett D, Collop N, Drover J, Lavercombe P, Leeman M, Moola S, Paruk F, Bernstein M, Moodley J: Evaluation of standard and modified severity of illness scores in the obstetric patient. J Crit Care 2011; 26: 535.e1-7.

In this retrospective study, investgators tested two well-described severity of illness scoring systems, APACHE-II and SAPS-II risk prediction scores for discrimination and calibration using a multicenter, obstetric cohort (n=332). Reasonable discrimination was observed: AUROC=0.82 for APACHE-II and 0.78 for SAPS-II. Interestingly, no improvement was observed after each score was modified to account for altered physiologic changes in pregnancy.

108. Farquhar C, Sadler L, Masson V, Bohm G, Haslam A: Beyond the numbers: classifying contributory factors and potentially avoidable maternal deaths in New Zealand, 2006-2009. Am J Obstet Gynecol 2011; 205: 331.e1-8.

In this retrospective root-cause review of 49 maternal deaths in New Zealand between 2006-2009, the authors describe a new classification system for reporting contributory factors linked to these deaths. A panel of reviewers identified potential avoidability in 35% of maternal deaths. This innovative approach to 'root cause' analysis may lead to important policy changes for improving maternal quality of care at a national level.

Pregnancy Basic Science and Physiology

Implantation

109. Li Q, Kannan A, DeMayo FJ, Lydon JP, Cooke PS, Yamagishi H, Srivastava D, Bagchi MK, Bagchi IC: The antiproliferative action of progesterone in uterine epithelium is mediated by Hand2. Science 2011; 331: 912-16.

In this high-quality murine study, the intrinsic cellular mechanisms by which progesterone influences implantation are detailed. Progesterone regulates Hand2, a key transcription factor, which ultimately suppresses estrogen-mediated cell proliferation by inhibiting fibroblast growth factor expression.

Accompanying journal perspective: Hewitt SC, Korach KS: Cell biology. A hand to support the implantation window. Science 2011; 331: 863-64.

Metabolic Pathways at the Placental Level

110. Bonnin A, Goeden N, Chen K, Wilson ML, King J, Shih JC, Blakely RD, Deneris ES, Levitt P: A transient placental source of serotonin for the fetal forebrain. Nature 2011; 472: 347-50.

This high-quality murine study identified the placenta as a site of serotonin (5-HT) production. Using an innovative ex-vivo model to deliver exogenous maternal tryptophan precursor, investigators observed that metabolism of these precursors by the placenta led to subsequent 5-HT production. As 5-HT is known to be an important neurotransmitter for fetal development, impaired placental production of 5-HT may have important clinical relevance for adult psychiatric disorders associated with defective 5-HT transmission.

Accompanying journal article: McKay R: Developmental biology: Remarkable role for the placenta. Nature 2011; 472: 298-99.

Chorioamnionitis and Neurodevelopment

111. Burd I, Brown A, Gonzalez JM, Chai J, Elovitz MA: A mouse model of term chorioamnionitis: unraveling causes of adverse neurological outcomes. Reprod Sci 2011; 18: 900-907.

In this study using term mice, intrauterine inflammation was induced with lipopolysaccharide (LPS) or saline. Neuronal cell injury was observed in LPS mice, which was characterized by abnormal cytoskeletal formation and decreased neuronal arborization (with immunocytochemistry) with evidence of fetal brain inflammation. These results provide supporting mechanistic evidence to indicate how long-term fetal brain injury may develop after exposure to chorioamnionitis at term.

112. Elovitz MA, Brown AG, Breen K, Anton L, Maubert M, Burd I: Intrauterine inflammation, insufficient to induce parturition, still evokes fetal and neonatal brain injury. Int J Dev Neurosci 2011; 29: 663-71.

Accompanying murine study to Burd study (reference 111) suggesting that intrauterine inflammation (IUI) without accompanying maternal inflammation can cause neuronal injury in the fetus during the term and preterm period. Also, differences in gene expression in the fetal brain at the time of IUI may lead to heterogeneity in postnatal neurobehavioural outcomes. Worryingly, the authors speculate that IUI that does not cause preterm labor but may still evoke injury to the developing fetal brain.

Intra-Uterine Growth Retardation and Adult-onset Diabetes

113. Pinney SE, Jaeckle Santos LJ, Han Y, Stoffers DA, Simmons RA: Exendin-4 increases histone acetylase activity and reverses epigenetic modifications that silence Pdx1 in the intrauterine growth retarded rat. Diabetologia 2011; 54: 2606-14.

In this novel study, postnatal administration of exendin-4, a drug used for adults with type II diabetes, was found to have epigenetic-modifying effects on Pdx1 expression, a gene necessary for normal beta cell function, in rats induced with IUGR. This therapy may ultimately be used in the post-natal period in 'at-risk' infants to prevent adult-onset diabetes.

Anesthesia and Analgesia

Anesthesia Guidelines

114. Practice guidelines for preoperative fasting and the use of pharmacologic agents to reduce the risk of pulmonary aspiration: application to healthy patients undergoing elective procedures: an updated report by the American Society of Anesthesiologists Committee on Standards and Practice Parameters. Anesthesiology 2011; 114: 495-511.

These updated ASA guidelines serve as a useful reference for obstetric anesthesiologists wishing to update institutional policies for preoperative fasting in obstetric patients. The ASA state that its guidelines may be used or modified for pregnant patients but they are 'not intended for women in labor'. Of note, the minimum fasting period for clear fluids=2 hr and a 'light meal'=6 hr.

115. Practice advisory for the prevention of perioperative peripheral neuropathies: an updated report by the American Society of Anesthesiologists Task Force on prevention of perioperative peripheral neuropathies. Anesthesiology 2011; 114: 741-54.

This practice advisory updates guidelines for preventing perioperative peripheral neuropathies; an updated literature search was performed between 1996-2010. The recommendations include avoiding >90 degrees abduction of the upper limb, avoiding pressure on the postcondylar groove of the humerus, and a neutral or supinated arm position +/- arm padding on upper limb boards. An adequately positioned noninvasive BP cuff does not influence any risk of upper limb neuropathy.

Anesthesia for Cesarean Delivery

Neuraxial Anesthesia: Local Anesthetics

116. Carvalho B, Collins J, Drover DR, Atkinson Ralls L, Riley ET: ED(50) and ED(95) of intrathecal bupivacaine in morbidly obese patients undergoing cesarean delivery. Anesthesiology 2011; 114: 529-35.

The results of this dose-finding study are important in refuting claims that the effective dose of intrathecal (IT) bupivacaine is less in morbidly obese patients undergoing elective CD (compared to non-obese patients). Using a CSE technique, investigators reported that the derived ED50 and ED95 of IT bupivacaine for achieving successful surgical anesthesia were 9.8 mg and 15 mg respectively; these values are similar to those previously reported values in non-obese patients. IT bupivacaine <10 mg is not recommended for morbidly obese patients undergoing elective CD for single-shot spinal anesthesia. Neuraxial catheter-based techniques are prudent as greater variability in dose response in morbidly obese patients may occur compared to nonobese patients.

Accompanying editorial: Palmer CM: Let's just call it "evidence-based practice". Anesthesiology 2011; 114: 481-82.

Equivalent dosing of IT bupivacaine in morbidly obese patients (compared to nonobese patients) undergoing CD is advocated in this editorial. The editorial also questions the derived ED95 value for successful surgical anesthesia in this patient subpopulation, as wide variability in response was observed with IT bupivacaine >10 mg in this study.

Letter to the editor: Pace NL: Intrathecal dosing for cesarean delivery in obese and nonobese patients. Anesthesiology 2011; 115: 899-900; author reply 900.

117. Bouvet L, Da Col X, Chassard D, Dalry F, Ruynat L, Allaouchiche B, Dantony E, Boselli E: ED. and ED. of intrathecal levobupivacaine with opioids for Caesarean delivery. Br J Anaesth 2011; 106: 215-20.

Using a dose-finding approach, this prospective study (n=85) determined the ED50 and ED95 of IT levobupivacaine (in combination with sufentanil 2.5 mcg+morphine 100 mcg) for elective CD to be 6.2 mg (95% CI=2.6-7.6 mg) and 12.9 mg (95% CI=11.1-17.9 mg) respectively. The CIs for the ED50/ED95 suggest wide variability in dose-response among patients. A CSE technique is suggested for intrathecal doses lower than the ED95 for levobupivacaine reported in this study.

Letter to the editor: Birts W, Combeer A: Consent of subjects for general anaesthetic in Caesarean section. Br J Anaesth 2011; 107: 639-40; author reply 640.

118. Camorcia M, Capogna G, Columb MO: Effect of sex and pregnancy on the potency of intrathecal bupivacaine: determination of ED for motor block with the up-down sequential allocation method. Eur J Anaesthesiol 2011; 28: 240-44.

After assessing the degrees of motor block, investigators in this observational study (n=90) suggested that sex and pregnancy differentially influence the potency of IT bupivacaine. The ED50 for motor (NOT anesthetic) block were 6.9 mg for men, 5.2 mg for women and 3.4 mg for pregnant women.

Accompanying editorial: Benhamou D: Sex-based differences in local anaesthetic-induced motor block. Eur J Anaesthesiol 2011; 28: 235-36.

119. Zhan Q, Huang S, Geng G, Xie Y: Comparison of relative potency of intrathecal bupivacaine for motor block in pregnant versus non-pregnant women. Int J Obstet Anesth 2011; 20: 219-23.

A similar pharmacologic study to reference 119 assessing potency differences of IT bupivacaine between pregnant women (undergoing CD) and nonpregnant women (undergoing gynecologic surgery). Using an up-down sequential allocation technique, investigators calculated the relative potency ratio for motor block for pregnant (n=35) versus non-pregnant (n=35) women to be 1.14 (95% CI=1.05-1.24).

120. Arzola C, Wieczorek PM: Efficacy of low-dose bupivacaine in spinal anaesthesia for Caesarean delivery: systematic review and meta-analysis. Br J Anaesth 2011; 107: 308-18.

Meta-analysis of RCTs comparing 'low dose' IT bupivacaine (≤8 mg) to standard dose IT bupivacaine (>8 mg) for elective CD; 12 studies (n=693) were included in the final analyses. The need for analgesic supplementation was higher (RR=3.8 [95% CI=2.4-5.9] with low dose IT bupivacaine; number needed to harm=4), with no heterogeneity between studies. This analyses was limited by the arbitrary 'cutpoint' for differentiating low dose versus standard dose, and by the use of analgesic supplementation (as opposed to block assessment) for determining anesthetic efficacy.

Neuraxial Anesthesia: Opioids

121. Atkinson Ralls L, Drover DR, Clavijo CF, Carvalho B: Prior epidural lidocaine alters the pharmacokinetics and drug effects of extended-release epidural morphine (DepoDur(R)) after cesarean delivery. Anesth Analg 2011; 113: 251-58.

In this RCT (n=30), the pharmacokinetic and pharmacodynamic effects of extended-release epidural morphine 8 mg (EREM) were compared in patients undergoing CD with epidural anesthesia (using lidocaine) versus a CSE technique with no prior epidural local anesthetic; EREM was given 1 hr after CSE or ≥1hr post-epidural lidocaine. The maximum concentration of morphine was higher in the epidural lidocaine group versus CSE group (11.1 vs 8.3 ng/mL; P=0.04). Also, more patients experienced side-effects (nausea,vomiting, hypotension, oxygen use) in the epidural lidocaine group. These results suggest that epidural lidocaine may interfere with EREM pharmacokinetics. Close monitoring is advised in patients receiving EREM ≥1 hr after epidural lidocaine for CD.

Maternal Hypotension/Fetal Acidosis

122. Landau R, Liu SK, Blouin JL, Smiley RM, Ngan Kee WD: The effect of maternal and fetal beta2-adrenoceptor and nitric oxide synthase genotype on vasopressor requirement and fetal acid-base status during spinal anesthesia for cesarean delivery. Anesth Analg 2011; 112: 1432-37.

Interesting RCT in 104 Chinese women undergoing CD assessing the influence of maternal and neonatal β_2 adrenoceptor (ADRB2) genotype on post-spinal hypotension and fetal acidemia. For the treatment of maternal hypotension, neither ephedrine nor phenylephrine requirements were influenced by maternal ADRB2 genotype. Although neonatal ADRB2 p.Arg16 homozygosity attenuated the degree of ephedrine induced fetal acidemia, neonatal acid-base balance did not differ according to maternal or neonatal genotype in response to phenylephrine. Variations in genotype expression and differences in ephedrine delivery (bolus versus infusion) may explain why ephedrine requirements vary among different cesarean study populations.

123. McDonald S, Fernando R, Ashpole K, Columb M: Maternal cardiac output changes after crystalloid or colloid coload following spinal anesthesia for elective cesarean delivery: a randomized controlled trial. Anesth Analg 2011; 113: 803-10.

This RCT (n=60) is among the first to directly compare the effects on maternal cardiac indices (measured by suprasternal Doppler) of coloading with 1 L crystalloid versus 1 L colloid (6% hydroxyethylstarch) during spinal anesthesia for CD. All patients received a phenylephrine infusion. No significant differences between groups were observed in cardiac output, stroke volume, hypotension, and phenylephrine requirements. In the presence of a phenylephrine infusion, colloid coloading offers no hemodynamic advantages over a crystalloid coload in this setting.

Accompanying editorial: Mercier FJ: Fluid loading for cesarean delivery under spinal anesthesia: have we studied all the options? Anesth Analg 2011; 113: 677-80.

124. Ghabach MB, El-Khatib MF, Zreik TG, Matta MS, Mouawad JJ, Karam CJ, Ayoub CM: Effect of weight gain during pregnancy on heart rate variability and hypotension during caesarean section under spinal anaesthesia. Anaesthesia 2011; 66: 1106-11.

RCT that explores the influence of antenatal weight gain on pre- and peri-operative cardiovascular indices for 66 patients undergoing elective CD under spinal anesthesia. Patients with <11 kg weight gain had significantly higher baseline heart rate variability (entropy) and a greater incidence of postspinal hypotension than patients with either 11-16 kg or >16 kg weight gain. Further work is needed to examine the degree of influence of antenatal weight gain on peri- and post-cesarean maternal outcomes.

125. El-Hakeem E, Kaki A, Almazrooa A, Al-Mansouri N, Alhashemi J: Effects of sitting up for five minutes versus immediately lying down after spinal anesthesia for Cesarean delivery on fluid and ephedrine requirement; a randomized trial. Can J Anaesth 2011; 58: 1083-89.

RCT investigating the postspinal effects of prolonged sitting up (5 mins) or immediately lying down during elective CD (n=120). 'Sitting up' patients had significantly lower intraoperative sensory block heights (T4 vs T2), received less iv fluid (709 vs 789 mL) and had more prolonged motor block recovery (101 vs 88 min) compared with 'lying down' patients, and fewer patients required ephedrine (8% vs 47% respectively) (P<0.001). At best, modest perioperative benefits are proffered by sitting up for 5 min postspinal.

General Anesthesia

126. Park BY, Jeong CW, Jang EA, Kim SJ, Jeong ST, Shin MH, Lee J, Yoo KY: Dose-related attenuation of cardiovascular responses to tracheal intubation by intravenous remifentanil bolus in severe pre-eclamptic patients undergoing Caesarean delivery. Br J Anaesth 2011; 106: 82-87.

RCT comparing the hemodynamic effects of remifentanil 0.5 mcg/kg and 1.0 mcg/kg postinduction in patients with preeclampsia undergoing general anesthesia for CD (n=48). After tracheal intubation, maternal systolic blood pressure values did not increase above baseline values in each study group. In addition, similar neonatal outcomes (APGAR/blood gases) were observed between groups. After intubation, these doses of remifentanil may be effective in controlling maternal blood pressure in preclamptics.

Letter to the editor: Birts W, Combeer A: Consent of subjects for general anaesthetic in Caesarean section. Br J Anaesth 2011; 107: 639-40; author reply 640.

127. Cook TM, Woodall N, Frerk C: Major complications of airway management in the UK: results of the Fourth National Audit Project of the Royal College of Anaesthetists and the Difficult Airway Society. Part 1: anaesthesia. Br J Anaesth 2011; 106: 617-31.

Important national audit project describing major airway complications related to anesthesia (including obstetrics) over a 1 yr period in the UK. Four out of a total of 184 events (2.2%) occurred in pregnant women. All obstetric cases involved airway problems during intubation for emergency CD, of whom two patients had BMI >35. These data adds to our knowledge of problems due to airway mismanagement for non-scheduled or emergency CD, especially in obese parturients.

128. McKeen DM, George RB, O'Connell CM, Allen VM, Yazer M, Wilson M, Phu TC: Difficult and failed intubation: Incident rates and maternal, obstetrical, and anesthetic predictors. Can J Anaesth 2011; 58: 514-24.

Retrospective, single-center cohort study to assess the incidence of difficult and failed tracheal intubation in 1,052 obstetric general anesthetics from 1984 to 2003 (4.7% and 0.08% respectively). Despite the expected rise in rates of regional anesthesia over this time-frame, there was, reassuringly, no increasing rate of difficult/failed intubation that one may have expected.

Letter to the editor: Boutonnet M, Pasquier P, Ausset S, Tourtier JP: The difficult airway in obstetrical anesthesia: advocacy to improve the quality of assessment. Can J Anaesth 2011; 58: 1053-54.

129. Erden V, Erkalp K, Yangin Z, Delatioglu H, Kiroglu S, Ortakuz S, Ozdemir B: The effect of labor on sevoflurane requirements during cesarean delivery. Int J Obstet Anesth 2011; 20: 17-21.

Prospective observational study (n=50) comparing sevoflurane requirements in patients undergoing prelabor (elective) cesarean delivery (CD) versus intrapartum CD (during labor) with general anesthesia. Using targeted Bispectral index values, sevoflurane requirements were significantly higher in patients during intrapartum CD, which were not explained by between-group differences in prolactin, progesterone or cortisol levels.

Neuraxial Labor Analgesia

PCEA Regimens

130. Wong CA, McCarthy RJ, Hewlett B: The effect of manipulation of the programmed intermittent bolus time interval and injection volume on total drug use for labor epidural analgesia: a randomized controlled trial. Anesth Analg 2011; 112: 904-11.

High-quality RCT (n=190) in nulliparous patients receiving CSE labor analgesia. Women were randomized to receive three different programmed intermittent bolus dose regimens for the maintenance of labor analgesia. Bupivacaine consumption was decreased in women receiving the 'high volume- long bolus interval' regimen [10mL/60 min] versus consumption in women whose regimens involved smaller boluses [2.5 -5mL] and shorter bolus intervals [15-30 min] respectively. Measures of analgesic quality e.g. number of PCEA requests, number of manual bolus doses, cumulative fentanyl doses were not significantly different between groups. Future studies are still needed to determine optimal programmed intermittent bolus regimens.

131. Capogna G, Camorcia M, Stirparo S, Farcomeni A: Programmed intermittent epidural bolus versus continuous epidural infusion for labor analgesia: the effects on maternal motor function and labor outcome. A randomized double-blind study in nulliparous women. Anesth Analg 2011; 113: 826-31.

Moderate quality RCT (n=145) assessing maternal motor block in patients receiving continuous epidural analgesia [CEA] at 10 mL/hr versus programmed intermittent epidural analgesia [PIEB] at 10 mL bolus/hr. Both regimens used 0.0625% levobupivacaine + sufentanil 0.5 mcg/mL with a PCEA function. Motor block and instrumental delivery were less common with PIEB compared to CEA (37% vs 2.7%; 20% vs 7% respectively). Unfortunately, data were not provided on important obstetric and intrapartum confounders that may have influenced the risk of instrumental delivery; therefore, it is uncertain if and to what degree PIEB reduces rates of instrumental delivery.

132. Bazin M, Bonnin M, Storme B, Bolandard F, Vernis L, Lavergne B, Pereira B, Bazin JE, Duale C: Addition of clonidine to a continuous patient-controlled epidural infusion of low-concentration levobupivacaine plus sufentanil in primiparous women during labour. Anaesthesia 2011; 66: 769-79.

Double-blind RCT (n=115) to assess the analgesic effects in labor of adding clonidine (1.36 mcg/mL) to a standard PCEA regimen (0.0625% levobupivacaine + sufentanil 0.45 mcg/mL). Patients in the clonidine group required significantly fewer epidural bolus doses during labor (6 vs 10 boluses; P <0.001), and lower pain scores compared to the control group (group vs time interaction; P<0.001). However, maternal blood pressure readings were lower and the rate of instrumental delivery was surprisingly higher in the clonidine group.

Effects on Uteroplacental Blood Flow

133. Fratelli N, Prefumo F, Andrico S, Lorandi A, Recupero D, Tomasoni G, Frusca T: Effects of epidural analgesia on uterine artery Doppler in labour. Br J Anaesth 2011; 106: 221-24.

RCT in 52 women comparing the effects of epidural labor analgesia versus control on maternal uteroplacental blood flow (using a uterine pulsatility flow index). Uterine flow was significantly decreased at 30 min after epidural analgesia was initiated compared to the control group. However no adverse fetal or neonatal outcomes were observed; thus, the clinical relevance of these findings remain uncertain.

Epidural-associated Maternal Fever

134. Riley LE, Celi AC, Onderdonk AB, Roberts DJ, Johnson LC, Tsen LC, Leffert L, Pian-Smith MC, Heffner LJ, Haas ST et al: Association of epidural-related fever and noninfectious inflammation in term labor. Obstet Gynecol 2011; 117: 588-95.

Interesting observational study investigating inflammatory markers and placental cultures during labor and their potential associations with labor analgesia. Although more women receiving epidurals had fever compared to those receiving no epidural (23% vs 6%: P=0.009), most fevers were not associated with infection (rates of placental infection with epidural=5.4% vs no epidural=4.3%; P=NS). On the basis of high rates of elevated IL-6 levels at hospital admission in the epidural group (36%) versus no epidural group (16%), investigators postulated an inflammatory association with epidural analgesia. Important obstetric confounders (methods of induction or augmentation of labor) and other co-variates (labor pain; time of epidural placement in relation to labor) were not assessed.

135. Wang LZ, Hu XX, Liu X, Qian P, Ge JM, Tang BL: Influence of epidural dexamethasone on maternal temperature and serum cytokine concentration after labor epidural analgesia. Int J Gynaecol Obstet 2011; 113: 40-43.

RCT investigating the effect of epidural dexamethasone (DEX) 0.2 mg versus control on maternal temperature in women receiving epidural analgesia (PCEA) in labor (n=60). Increases in maternal temperature and serum IL-6 levels were reported in the epidural DEX group compared to control. However, the lack of difference in the reported incidence of maternal fever between groups (10% DEX group vs 3.3% control; P=0.6) may be due to a type II error related to a small sample size.

136. de Orange FA, Passini R, Jr., Amorim MM, Almeida T, Barros A: Combined spinal and epidural anaesthesia and maternal intrapartum temperature during vaginal delivery: a randomized clinical trial. Br J Anaesth 2011; 107: 762-68.

RCT assessing maternal temperature in patients undergoing combined spinal-epidural analgesia versus non-pharmacologic labor analgesia (n=70). There was a trend towards higher maternal temperatures in the CSE group up to 6 hours after randomization. More patients in the CSE group developed maternal pyrexia (>38°C) compared to the non-CSE group (14% vs 0% respectively; P=0.03). Similar to epidural analgesia, CSE analgesia appears to be associated with intrapartum fever.

Epidural Analgesia and Neonatal Pyrexia

137. Agakidis C, Agakidou E, Philip Thomas S, Murthy P, John Lloyd D: Labor epidural analgesia is independent risk factor for neonatal pyrexia. J Matern Fetal Neonatal Med 2011; 24: 1128-32.

Single-center, retrospective observational study examining the association between epidural analgesia and neonatal pyrexia (n=960). Using multivariate logistic regression, investigators observed maternal epidural analgesia to be an independent predictor for neonatal pyrexia (OR=3.44; 95% CI=1.9-6.3; P<0.001). Selection bias was not adequately accounted for in the study methodology.

Treatment of Side Effects

138. Sinha A, Paech MJ, Thew ME, Rhodes M, Luscombe K, Nathan E: A randomised, double-blinded, placebo-controlled study of acupressure wristbands for the prevention of nausea and vomiting during labour and delivery. Int J Obstet Anesth 2011; 20: 110-17.

Well-designed, double-blind RCT assessing P6 acupressure (Pressure Right™ wrist band) versus sham for preventing nausea and vomiting in labor (n=340). Similar rates of nausea and vomiting were found in both study groups, which suggested a lack of effect by P6 acupressure in nausea/vomiting prophylaxis.

BMI and Labor Epidurals

139. Sharma V, Swinson AK, Hughes C, Mokashi S, Russell R: Effect of ethnicity and body mass index on the distance from skin to lumbar epidural space in parturients. Anaesthesia 2011; 66: 907-12.

This UK observational study confirms that body mass index and ethnicity are independently associated with distance from skin to epidural space in parturients receiving labor epidural analgesia (n=1406). Of note, African and white patients had significantly greater spinal-epidural space distances than Asian and Chinese patients.

Mode of Delivery and Labor Epidurals

140. Wassen MM, Zuijlen J, Roumen FJ, Smits LJ, Marcus MA, Nijhuis JG: Early versus late epidural analgesia and risk of instrumental delivery in nulliparous women: a systematic review. BJOG 2011; 118: 655-61.

In this systematic review, nulliparous patients receiving epidural analgesia with a cervical dilatation of ≤3 cm were not at increased risk of instrumental vaginal delivery or CD compared with patients receiving 'later' epidural placement [6 studies; n=15,399]. However, marked differences in methodology were noted for the pooled studies in this analysis.

Letter to the editor: Klein MC: Early versus late epidural analgesia and the risk of instrumental delivery in nulliparous women. BJOG 2011; 118: 1540-41; author reply 1541-42.

Epidemiology: Neuraxial Labor Analgesia

141. Osterman MJ, Martin JA: Epidural and spinal anesthesia use during labor: 27-state reporting area, 2008. Natl Vital Stat Rep 2011; 59: 1-13, 16.

CDC report which contains a treasure trove of epidemiologic data related to epidural and spinal anesthesia usage among singleton women undergoing vaginal delivery in 27 states in 2008. Overall, 61% of women received epidural/spinal anesthesia; there were racial/ethnic disparities and age-related differences in the use of neuraxial anesthesia. Patients undergoing forceps or vacuum assisted deliveries had higher rates of neuraxial anesthesia than for those undergoing spontaneous vaginal delivery (84%; 77%; 60% respectively); this is most likely associative not causal.

Patients' Attitudes to Labor Epidural Analgesia

142. Chang KY, Tsou MY, Chan KH, Chen HH: Application of the Rasch model to develop a simplified version of a multiattribute utility measurement on attitude toward labor epidural analgesia. Anesth Analg 2011; 113: 1444-49.

Multi-attribute utility (MAU) based questionnaires have been used to understand patients' attitudes towards labor analgesia (ATLA), but they may be overly complicated for practical use. In this study, investigators simplified MAU questionnaire by using a psychometric method - Rasch technique - to create a unidimensional measure. Reliability and validity were similar for the simplified and full scores of ATLA, which suggest a simplified questionnaire may prove valuable in optimizing assessments of patient attitudes to labor analgesia.

Intravenous Labor Analgesia

143. Volmanen PV, Akural EI, Raudaskoski T, Ranta P, Tekay A, Ohtonen P, Alahuhta S: Timing of intravenous patient-controlled remifentanil bolus during early labour. Acta Anaesthesiol Scand 2011; 55: 486-94.

Cross-over, placebo-controlled study (n=41) assessing analgesic differences using two, different, i.v. remifentanil PCA regimens: bolus delivery after immediate trigger versus delayed delivery (140 secs after trigger). Mean pain and pain relief scores and maternal side-effects (SpO2, maternal hemodynamics, supplementary oxygen usage) were similar in the two dosing regimens. Pain and pain relief were analyzed separately for each study period due to a 'carryover effect' which almost certainly limited statistical power and the study findings.

144. Leong WL, Sng BL, Sia AT: A comparison between remifentanil and meperidine for labor analgesia: a systematic review. Anesth Analg 2011; 113: 818-25.

Meta-analysis of three, labor analgesia studies comparing meperidine to remifentanil PCA. More favorable analgesic profiles were seen with remifentanil versus meperidine (reduced mean VAS score of 25 mm at 1 hr; P<0.001). Although no differences in maternal desaturation rates were found between remifentanil and meperidine, limited conclusions can be drawn due to marked study heterogeneity and insufficient data on adverse outcomes.

Anesthesia for Other Pregnancy-related Procedures

In Vitro Fertilization

145. Circeo L, Grow D, Kashikar A, Gibson C: Prospective, observational study of the depth of anesthesia during oocyte retrieval using a total intravenous anesthetic technique and the Bispectral index monitor. Fertil Steril 2011; 96: 635-37.

Prospective study (n=50) investigating depth of anesthesia, using BIS and sedation scoring, for achieving optimal surgical conditions for women undergoing oocyte retrieval with total intravenous anesthesia (fentanyl and propofol infusion). Moderate sedation was observed during the first 5-10 min of oocyte retrieval, with deep sedation/general anesthesia deemed necessary (mean BIS=47-53) for preventing painful stimulation.

Abortion

146. Dean G, Jacobs AR, Goldstein RC, Gevirtz CM, Paul ME: The safety of deep sedation without intubation for abortion in the outpatient setting. J Clin Anesth 2011; 23: 437-42.

In this retrospective, single-center descriptive study, no cases of pulmonary aspiration were reported in 62,125 surgical abortions during 'deep sedation' with propofol without planned intubation. Although these data indicate that the risk of aspiration of pregnant patients undergoing 'deep sedation' may be overplayed, no cases >24 weeks gestational age were included in this study.

Post-Cesarean Analgesia

Systemic Analgesia

147. Moore A, Costello J, Wieczorek P, Shah V, Taddio A, Carvalho JC: Gabapentin improves post delivery pain management: a randomized, placebo-controlled trial. Anesth Analg 2011; 112: 167-73.

RCT (n=46) in which healthy term parturients undergoing CD were randomized to preoperatively receive either 600 mg gabapentin or placebo. Pain scores with movement were significantly lower in the gabapentin group up to 48 hr post-CD, although the incidence of severe sedation was significantly higher in the gabapentin group up to 24 hr post-CD.

Transversus Abdominis Plane (TAP) Blocks

148. McMorrow RC, Ni Mhuircheartaigh RJ, Ahmed KA, Aslani A, Ng SC, Conrick-Martin I, Dowling JJ, Gaffney A, Loughrey JP, McCaul CL: Comparison of transversus abdominis plane block vs spinal morphine for pain relief after Caesarean section. Br J Anaesth 2011; 106: 706-12.

RCT (n=80) to assess the analgesic effects of bilateral transversus abdominis plane (TAP) blocks, using bupivacaine 2 mg/kg,± IT morphine (100 mcg) in women after elective CD. No clear analgesic benefit was observed between study groups. Therefore the use of TAP blocks may be unnecessary post-CD in women who receive IT morphine. Of note, ultrasound was not used for TAP block placement in this study.

Spinal Anesthesia Failure

149. Fuzier R, Bataille B, Fuzier V, Richez AS, Magues JP, Choquet O, Montastruc JL, Lapeyre-Mestre M: Spinal anesthesia failure after local anesthetic injection into cerebrospinal fluid: a multicenter prospective analysis of its incidence and related risk factors in 1214 patients. Reg Anesth Pain Med 2011; 36: 322-26.

Prospective, multicenter, cohort study to assess the incidence and risk factors related to spinal failure in an obstetic and non-obstetric surgical population (n=1214). The overall incidence was 3.2%, and spinal failure occurred in 12/270 (4%) of obstetric patients within the cohort.

Experimental Pain Research

Pain Assessment

150. Abrishami A, Chan J, Chung F, Wong J: Preoperative pain sensitivity and its correlation with postoperative pain and analgesic consumption: a qualitative systematic review. Anesthesiology 2011; 114: 445-57.

This article provides an interesting systematic review of prior studies investigating the relationships between measures of preoperative pain sensitization and postsurgical pain (acute and chronic). Although a formal meta-analysis was not performed, the intensity of suprathreshold pain (pain above the patient's pain threshold) was observed to be significantly correlated with the intensity of postoperative pain in four studies. Unfortunately marked heterogeneity between studies and the lack of multivariate analyses limit the clinical applicability of these findings.

151. Moore RA, Straube S, Paine J, Derry S, McQuay HJ: Minimum efficacy criteria for comparisons between treatments using individual patient meta-analysis of acute pain trials: examples of etoricoxib, paracetamol, ibuprofen, and ibuprofen/paracetamol combinations after third molar extraction. Pain 2011; 152: 982-89.

Very interesting study which examines individual patient responses as preferred outcome measures for determining analgesic efficacy for acute pain (as opposed to analyses of visual analog pain scores). Using individual data from six RCTs investigating patients' responses to analgesics for pain after third molar extractions, minimum efficacy criteria from 0% to 70% pain relief and numbers needed to treat were calculated to assess time-dependent changes in total pain relief and summed pain intensity differences. These concepts are more likely to be commonly employed for RCTs assessing the comparative effects of analgesics for treating nociceptive pain and for rescue analgesia.

Accompanying editorial: Segerdahl M: Pain outcome variables--a never ending story? Pain 2011; 152: 961-62.

Accompanying editorial endorsing the development of number needed to treat and minimum efficacy criteria for better understanding the efficacy of analgesic response for postsurgical and chronic pain patients.

152. Ruyssen-Witrand A, Tubach F, Ravaud P: Systematic review reveals heterogeneity in definition of a clinically relevant difference in pain. J Clin Epidemiol 2011; 64: 463-70.

Systematic review which highlights the lack of a standardized definition for a 'clinically relevant difference in pain' in RCTs of analgesics. Novel concepts for assessing subject-level analgesic responses are described.

153. Srikandarajah S, Gilron I: Systematic review of movement-evoked pain versus pain at rest in postsurgical clinical trials and meta-analyses: A fundamental distinction requiring standardized measurement. Pain 2011; 152: 1734-39.

Systematic review which exposes the lack of data about movement-evoked pain (MER) in postsurgical studies, as well as inadequate descriptors for defining MER. More consistent terminology is recommended to more clearly differentiate pain at rest and procedure-specific MER.

Opioids and Chronic Pain

154. Gaveriaux-Ruff C, Nozaki C, Nadal X, Hever XC, Weibel R, Matifas A, Reiss D, Filliol D, Nassar MA, Wood JN et al: Genetic ablation of delta opioid receptors in nociceptive sensory neurons increases chronic pain and abolishes opioid analgesia. Pain 2011; 152: 1238-48.

High quality animal study in which investigators used conditional knock-out mice to study the influence of delta opioid receptors in pain control. Delta receptors were deleted in specific primary nociceptive neurons (Nav1.8). After investigators artificially induced inflammatory pain and neuropathic pain, mutant animals displayed increased allodynia compared to 'control mice'. The effects of central and peripheral administered delta agonist (SNC80) did not reduce thermal hyperalgesia or mechanical allodynia in mutant mice. These results suggest that delta receptors may play an important role in mediating analgesia in chronic pain.

Accompanying editorial: Cahill CM, Taylor A: A piece of the puzzle is revealed for delta opioid receptor-mediated analgesia. Pain 2011; 152: 1217-18.

Radiologic and Ultrasound Studies: Neuraxial Anesthesia

MRI

155. Higuchi H, Takagi S, Onuki E, Fujita N, Ozaki M: Distribution of epidural saline upon injection and the epidural volume effect in pregnant women. Anesthesiology 2011; 114: 1155-61.

Observational study assessing the anatomic changes induced by the introduction of epidural saline (10 mL) with MRI (at levels T12-L5) in term, pregnant patients (n=8) and in nonpregnant female volunteers (n=8). The reduction in CSF volume was significantly greater in pregnant patients, and epidural saline did not leak from intervertebral foraminae in pregnant patients. These anatomic effects may explain the longitudinal spread of epidural solutions and the epidural volume extension of spinal anesthesia (with a CSE technique) in pregnant patients.

Ultrasound: New Techniques

156. Chiang HK, Zhou Q, Mandell MS, Tsou MY, Lin SP, Shung KK, Ting CK: Eyes in the needle: novel epidural needle with embedded high-frequency ultrasound transducer--epidural access in porcine model. Anesthesiology 2011; 114: 1320-24.

This novel study provides preliminary data on the use of an ultrasound transducer placed within a standard 18G Tuohy needle for locating the thoracic and lumbar epidural space. Using a paramedian insertion technique in anesthetized pigs, the ligamentum flavum was identified in 83% of insertions, with a strong ultrasonic signal identifying the dura mater.The use of an intra-needle ultrasound guided technique offers great opportunity to improve anatomic location during epidural procedures. The next obvious step is a study in human volunteers.

Accompanying editorial: Tsen LC: The all-seeing eye? Ultrasound technologies for neuraxial techniques. Anesthesiology 2011; 114: 1274-76.

Ultrasound versus Clinical Assessment

157. Margarido CB, Mikhael R, Arzola C, Balki M, Carvalho JC: The intercristal line determined by palpation is not a reliable anatomical landmark for neuraxial anesthesia. Can J Anaesth 2011; 58: 262-66.

Observational study in term parturients (n=45) indicating that the intersection of the intercristal line (determined by manual palpation) was above the L4-5 vertebral interspace in all patients. Lumbar interspaces were assessed using spinal ultrasound in the sitting up position. Worringly, the intersection was up to three interspaces higher than the L2-3 interspace in 36% of women in this study.

158. Lee AJ, Ranasinghe JS, Chehade JM, Arheart K, Saltzman BS, Penning DH, Birnbach DJ: Ultrasound assessment of the vertebral level of the intercristal line in pregnancy. Anesth Analg 2011; 113: 559-64.

Observational study, which described poor agreement of clinical assessment of the intercristal line (ICL) with ultrasonographic assessment (in 14/101 comparisons) in 51 term parturients. Clinical assessment of the ICL was ≥1 vertebral level higher than the anatomic position in 40% of assessments. Two experienced anesthesiologists performed the assessments, so the variation among non-experienced anesthesiologists is unclear.

Electron Microscopic Studies

159. Reina MA, Collier CB, Prats-Galino A, Puigdellivol-Sanchez A, Maches F, De Andres JA: Unintentional subdural placement of epidural catheters during attempted epidural anesthesia: an anatomic study of spinal subdural compartment. Reg Anesth Pain Med 2011; 36: 537-41.

Interesting study in which investigators used samples of arachnoid lamina to assess the anatomy of the spinal subdural compartment with electron microscopy. Of note, 20-gauge catheters, with external diameters = 0.85mm, were inserted in vitro into the subdural space, thereby providing anatomic evidence that traction forces during catheter placement may separate the dura mater and arachnoid layer.

Perioperative and Postoperative Patient Monitoring

Hemodynamic Monitoring

160. Dyer RA, Piercy JL, Reed AR, Strathie GW, Lombard CJ, Anthony JA, James MF: Comparison between pulse waveform analysis and thermodilution cardiac output determination in patients with severe pre-eclampsia. Br J Anaesth 2011; 106: 77-81.

Observational study in postpartum patients with severe preeclampsia (n=18) to compare the accuracy and precision of cardiac output measurements derived from pulse waveform analysis (LiDCOplus) versus thermodilution (TD) using pulmonary artery catheters. Central venous calibration with lithium was associated with positive bias for TD (0.58 L/min [95% CI=0.77;0.39]. No significant bias was reported for peripheral calibration (0.16 L/min [95% CI=-0.37;-0.06]). For an average cardiac output of 7 L/min, the limits of agreement were within a 30% range, indicating that LiDCOplus is a viable option for cardiac output monitoring in this patient subpopulation.

See also - Review: Armstrong S, Fernando R, Columb M: Minimally- and non-invasive assessment of maternal cardiac output: go with the flow! Int J Obstet Anesth 2011; 20: 330-40.

Thorough review of published studies investigating minimally and noninvasive techniques for maternal cardiac output monitoring. It is certain that future technologic advances will ultimately lead to more sophisticated methods of measuring maternal cardiac output changes for low and high risk parturients during the peripartum period.

Coagulation Monitoring

161. Butwick A, Ting V, Ralls LA, Harter S, Riley E: The association between thromboelastographic parameters and total estimated blood loss in patients undergoing elective cesarean delivery. Anesth Analg 2011; 112: 1041-47.

Prospective, observational study assessing the potential association between the maternal coagulation profile (assessed by kaolin-activated thromboelastography (TEG)) and total estimated blood loss (EBL) in women undergoing elective CD (n=52). Weak associations were observed between individual TEG parameters (maximum amplitude and maximum rate of thrombin generation) with EBL (r=0.3 respectively). The results of this study suggest that other physiologic/anatomic factors are more likely to be responsible for the degree of blood loss in women undergoing elective CD.

Noninvasive Hemaglobin Monitoring

162. Butwick AJ, Hilton G, Riley ET, Carvalho B: Non-invasive measurement of hemoglobin during cesarean hysterectomy: a case series. Int J Obstet Anesth 2011; 20: 240-45.

In this case series, noninvasive hemoglobin monitoring (SpHb) was used for five patients with abnormal placentation undergoing CD. Their SpHb values were higher than laboratory Hb values in 16/17 (94%) blood samples (median difference between SpHb and laboratory Hb was 2 g/dl [range=0-3.8 g/d]). Further work is needed to assess the accuracy and precision of SpHb assessment in an obstetric setting.

Effects of Anesthesia on Fetal/Neonatal Neurodevelopment

Neuraxial Labor Analgesia

163. Flick RP, Lee K, Hofer RE, Beinborn CW, Hambel EM, Klein MK, Gunn PW, Wilder RT, Katusic SK, Schroeder DR et al: Neuraxial labor analgesia for vaginal delivery and its effects on childhood learning disabilities. Anesth Analg 2011; 112: 1424-31.

Previous epidemiologic research has suggested that the incidence of learning disabilties (LDs) is reduced in children born by CD in mothers receiving neuraxial anesthesia compared with vaginal delivery. In this large, retrospective cohort study in women undergoing vaginal delivery from 1976-1982 (n=4684), investigators further explored putative associations between the development of childhood learning disabilities and neuraxial analgesia. Using data from IQ and achievement tests for reading, written language and math, the authors observed that neuraxial labor analgesia was not associated with LDs before age 19 yr

(adj HR=1.05; 95% CI=0.85-1.31). This epidemiologic data suggest that the use of neuraxial labor analgesia does not appear to significantly influence the development of childhood LDs.

Accompanying editorials: Radcliffe J, Bellinger DC: Learning disability in children as an outcome in anesthesia and analgesia research. Anesth Analg 2011; 112: 1262-64.

Sun LS: Labor analgesia and the developing human brain. Anesth Analg 2011; 112: 1265-67.

General Anesthesia

164. Rappaport B, Mellon RD, Simone A, Woodcock J: Defining safe use of anesthesia in children. N Engl J Med 2011; 364: 1387-90.

Commentary article which highlights growing concern about the neurotoxic effects of anesthetic exposure in neonates and children and the current steps being taken to better investigate these effects in human models.

Letter to the editor: Glass NL, Malviya S: Anesthesia in children-limitations of the data on neurotoxicity. N Engl J Med 2011; 364: 1466-67.

Review: Stratmann G: Review article: Neurotoxicity of anesthetic drugs in the developing brain. Anesth Analg 2011; 113: 1170-79.

Excellent review of the literature (up to early 2011) summarizing relevant data from studies examining the potential for anesthetic agents to cause neurotoxicity in the developing brain.

In Utero Exposure to General Anesthetic Agents

165. Palanisamy A, Baxter MG, Keel PK, Xie Z, Crosby G, Culley DJ: Rats exposed to isoflurane in utero during early gestation are behaviorally abnormal as adults. Anesthesiology 2011; 114: 521-28.

Interesting experimental study in pregnant rats to assess the effects of 4 hr exposure of 1.4% isoflurane (equivalent to 1 MAC) at gestation day 14 - which equates to the 2nd trimester in humans - on behavioral impairment in rat pups compared to control (unexposed) rats. Exposed rats showed signs of impaired acquistion of spatial memory and reduced anxiety behaviour compared to unexposed rats. No differences in locomotor activity, exploratory behavior or object recognition between rat populations were observed. Despite the implication that general anesthesia may negatively impact fetal neurodevelopment, there remains a lack of substantitive data to corroborate whether the adverse effects observed in animal studies apply in utero to human subjects.

Accompanying editorial: Flood P: Fetal anesthesia and brain development. Anesthesiology 2011; 114: 479-80.

Letter to the editor: Shear TD: Is a weekend too long? Anesthesiology 2011; 115: 904.

Reply by the authors: Palanisamy A, Crosby G, Culley DJ: In Reply. Anesthesiology 2011; 115: 904-905.

166. Kong F, Xu L, He D, Zhang X, Lu H: Effects of gestational isoflurane exposure on postnatal memory and learning in rats. Eur J Pharmacol 2011; 670: 168-74.

In this exploratory animal study, pregnant rats at gestational day 14 were exposed to 1.3% isoflurane or oxygen for 4 hr. Compared to controls, the isoflurane-exposed offspring rats displayed impaired spatial memory and learning. In the isoflurane group, cellular/molecular changes in synaptic architecture within the hippocampus, and higher levels of mediators (C/EBP homologous transcription factor protein and caspase-12) affiliated with neuronal cell death in the hippocampus were reported. This paper provides more concerning findings, using a rat model, that exposure to isoflurane in utero has deleterious effects on postnatal memory and learning.

167. Culley DJ, Boyd JD, Palanisamy A, Xie Z, Kojima K, Vacanti CA, Tanzi RE, Crosby G: Isoflurane decreases self-renewal capacity of rat cultured neural stem cells. Anesthesiology 2011; 115: 754-63.

With anesthetic neurotoxicity of paramount scientific importance, this in vitro study aimed to investigate the effect of clinically relevant concentrations of isoflurane on rat embryo neural stem cells. Isoflurane concentrations up to 2.8% did not induce neural stem cell death; however, 1.4% and 2.8% isoflurane did significantly reduce stem cell proliferation. These results add to the growing body of evidence that suggest that inhalational agents, at clinically relevant concentrations, have time-dependent deleterious effects on fetal brain development.

Postnatal Effects of Anesthesia on Neurodevelopment

168. Paule MG, Li M, Allen RR, Liu F, Zou X, Hotchkiss C, Hanig JP, Patterson TA, Slikker W, Jr., Wang C: Ketamine anesthesia during the first week of life can cause long-lasting cognitive deficits in rhesus monkeys. Neurotoxicol Teratol 2011; 33: 220-30.

High-quality study indicating that 24 hr of ketamine exposure in postnatal rhesus monkeys (postnatal day 5-6) produces functional deficits in cognitive function after 7 months of age. Using standardized tests to assess learning, motivation, color discrimination and short-term memory, these investigators observed that ketamine-exposed animals had poorer performance in task performance compared to control (unexposed) animals (from week 24-63 of training). After week 36, ketamine exposed rates also displayed poorer performance in learning and color/position discrimination. Although this study provides further evidence that general anesthesia negatively impacts on critical phases of neurodevelopment, the applicability of these observations on human neurodevelopment (including precise thresholds for dose and duration of exposure and duration of effect) remain uncertain.

169. Zou X, Liu F, Zhang X, Patterson TA, Callicott R, Liu S, Hanig JP, Paule MG, Slikker W, Jr., Wang C: Inhalation anesthetic-induced neuronal damage in the developing rhesus monkey. Neurotoxicol Teratol 2011; 33: 592-97.

This study builds on prior work examining the neurotoxic effects of general anesthetic agents on GABA and NMDA receptors. Under physiologically controlled conditions, Rhesus monkeys underwent 8 hr exposure to N_20 (70%) and/or isoflurane (1%), in isolation or in combination, and anesthetic-induced pathologic changes on neuronal architecture were examined. Interestingly, no notable effects were reported after isoflurane or N_20 in isolation, but neuronal damage (apoptosis) was associated with combined N_20/isoflurane exposure.

See also comparative study: Istaphanous GK, Howard J, Nan X, Hughes EA, McCann JC, McAuliffe JJ, Danzer SC, Loepke AW: Comparison of the neuroapoptotic properties of equipotent anesthetic concentrations of desflurane, isoflurane, or sevoflurane in neonatal mice. Anesthesiology 2011; 114: 578-87.

This in vivo study examined the neuronal effects of 6hr exposure to equipotent concentrations of sevoflurane, isoflurane and desflurane (0.55-0.6 MAC) on postnatal day 7-8 mice. The three inhaled anesthetics all increased neocortical neuronal apoptotic cell death in neonatal mice to a similar degree. These results suggest that there may not be quantitative or qualitative differences in cytotoxic effect in neonatal mice among these anesthetic agents.

170. Zhao YL, Xiang Q, Shi QY, Li SY, Tan L, Wang JT, Jin XG, Luo AL: GABAergic excitotoxicity injury of the immature hippocampal pyramidal neurons' exposure to isoflurane. Anesth Analg 2011; 113: 1152-60.

Recent studies have shown that isoflurane exposure can induce neuronal excitotoxicity and apoptosis in the developing brain; however, detailed

mechanistic data has been lacking. This high quality in vitro study, using rat pup hippocampal tissue, investigated how isoflurane modulates GABA receptor evoked synaptic voltage dependent calcium channel overactivation and Ca_2+ ion influx, and how isoflurane modulates Ca_2+-induced Ca_2+ release from intracellular stores. The overall increase in intracellular Ca_2+ concentration is postulated to be a critical component of excitotoxic cell damage and apoptosis induced by isoflurane.

Accompanying editorial: Wei H: The role of calcium dysregulation in anesthetic-mediated neurotoxicity. Anesth Analg 2011; 113: 972-74.

171. Sinner B, Friedrich O, Zink W, Zausig Y, Graf BM: The toxic effects of s(+)-ketamine on differentiating neurons in vitro as a consequence of suppressed neuronal Ca_2+ oscillations. Anesth Analg 2011; 113: 1161-69.

Exploratory study using hippocampal tissue from infant rat pups exposed to NMDA receptor antagonists, including ketamine, for 24 hr. The results of this study indicated that ketamine-induced neuronal apoptosis and disrupted synaptic integrity may be linked with suppression of neuronal Ca_2+ oscillations and reduced expression of target calcium regulatory proteins (CaMKII and synapsin) associated with neuronal development.

Epidemiologic Studies

172. Hansen TG, Pedersen JK, Henneberg SW, Pedersen DA, Murray JC, Morton NS, Christensen K: Academic performance in adolescence after inguinal hernia repair in infancy: a nationwide cohort study. Anesthesiology 2011; 114: 1076-85.

Retrospective, population-wide, observational study in Denmark which compared the academic performance of all children undergoing inguinal hernia repair under general anesthesia ≤1 yr (n=2689) versus a randomly selected, aged matched control sample (n=14575). After adjustment (using logistic regression), no statistical differences in average test scores were found between groups for subjects' 9th grade test scores (-0.04; 95% CI=-0.09-0.01). Similar results were found using propensity scores, which supports a lack of neurotoxic effect of general anesthesia in infants aged up to 1 yr. However, a higher test score non-attainment rate in exposed subjects was observed; it is unclear if exposure to general anesthesia influenced this outcome.

Letter to the editor: Flick RP, Warner DO: Hernia repair, anesthetic exposure, and academic performance in children. Anesthesiology 2011; 115: 1387; author reply 1387-88.

173. Flick RP, Katusic SK, Colligan RC, Wilder RT, Voigt RG, Olson MD, Sprung J, Weaver AL, Schroeder DR, Warner DO: Cognitive and behavioral outcomes after early exposure to anesthesia and surgery. Pediatrics 2011; 128: e1053-61.

In this matched cohort study (n=1050) in Rochester, Minnesta, investigators aimed to provide further insight into the relationship between anesthesia delivered to children under 2 yrs of age and disorders of learning or cognition. Notable findings included a significantly increased risk of learning disabilities (adj HR=2.12; 95% CI=1.26-3.54) and speech-language disorders (adj HR=4.16; 95% CI=1.96-8.87) with ≥2 anesthesia episodes. However, no associations were observed between exposure and the need for educational plans for behavioral/emotional disorders.

Commentary: Williams RK: The pediatrician and anesthesia neurotoxicity. Pediatrics 2011; 128: e1268-70.

This article highlights study design flaws, including multiple confounders, age at exposure, comorbid disorders and the use of historical anesthetic agents (halothane) and monitoring. These flaws limit the analyses of the independent effects of general anesthesia on the neuropsychologic/cognitive outcomes.

Prenatal Surgery

174. Adzick NS, Thom EA, Spong CY, Brock JW, 3rd, Burrows PK, Johnson MP, Howell LJ, Farrell JA, Dabrowiak ME, Sutton LN et al: A randomized trial of prenatal versus postnatal repair of myelomeningocele. N Engl J Med 2011; 364: 993-1004.

The impact of a novel surgical strategy for reducing adverse outcomes in neonates with myelomeningocele are explored in this high-quality multicenter RCT. (n=183) A composite measure for adverse outcomes - the need for a CSF shunt or perinatal mortality - was used. Up to 12 months of age, adverse outcomes occurred in a lower proportion of patients undergoing prenatal repair (via hysterotomy and general anesthesia) versus traditional postnatal surgical repair (68% vs 98%, RR=0.7; 97.7% CI=0.58-0.84). Scores of pediatric mental development and motor function at 30 months were improved in the prenatal group. Interestingly, high rates of maternal and perinatal morbidity (e.g. oligohydramnios, preterm birth, chorioamniotic separation) were observed in the prenatal group. The long-term neurologic effects of prenatal repair also remain uncertain.

Accompanying editorial: Simpson JL, Greene MF: Fetal surgery for myelomeningocele? N Engl J Med 2011; 364: 1076-77.

This editorial advises caution in over-interpreting study findings based on the uncertain risk-benefit of prenatal repair due to mild-moderate improvement in neonatal outcomes versus the high rate of perinatal/maternal complications resulting from corrective surgery in-utero.

Letter to the editor: Prenatal versus postnatal repair of myelomeningocele. N Engl J Med 2011; 364: 2554-56.

175. Maternal-fetal intervention and fetal care centers. Pediatrics 2011; 128: e473-78.

Joint recommendations from the American Academy of Pediatrics and American College of Obstetricians and Gynecologists for women undergoing fetal interventions. The recommendations are aimed at optimizing fetal/neonatal outcomes. Issues pertaining to maternal consent, multidisciplinary care, patient advocacy, and resource allocation within fetal care centers are discussed.

See also - updated guidelines from the American College of Obstetricians and Gynecologists for non-obstetric surgery for obstetric patients. ACOG Committee Opinion No. 474: Nonobstetric surgery during pregnancy. Obstet Gynecol 2011; 117:420-1.

Neonatology/Pediatrics

Breastfeeding

176. Al-Tamimi Y, Ilett KF, Paech MJ, O'Halloran SJ, Hartmann PE: Estimation of infant dose and exposure to pethidine and norpethidine via breast milk following patient-controlled epidural pethidine for analgesia post caesarean delivery. Int J Obstet Anesth 2011; 20: 128-34.

Observational study assessing drug transfer and 'safety' in the infants of 20 breastfeeding women who received PCEA with pethidine (20 mg bolus; lockout 20 min) after CD. Absolute and relative infant doses for pethidine and norpethidine were subtherapeutic; infant exposure (ratio of drug in infant to maternal plasma) was 1.4% for pethidine and 0.4% for norpethidine. Overall, these drug levels appear to be safe for the breastfeeding neonate.

177. Sauberan JB, Anderson PO, Lane JR, Rafie S, Nguyen N, Rossi SS, Stellwagen LM: Breast milk hydrocodone and hydromorphone levels in mothers using hydrocodone for postpartum pain. Obstet Gynecol 2011; 117: 611-17.

This study provides important data on the pharmacokinetics of hydrocodone in breast milk of 30 postpartum, lactating mothers. Overall, the total neonatal opiate dosage (combined hydrocodone and hydromorphone [metabolite])=0.1-9.9%, which were within a 'safe' or subtherapeutic range. However, daily doses of hydrocodone >40 mg were not recommended for nursing mothers.

Letter to the editor: Koren G: Breast milk hydrocodone and hydromorphone levels in mothers using hydrocodone for postpartum pain. Obstet Gynecol 2011; 117: 1439; author reply 1439.

178. Vital signs: hospital practices to support breastfeeding --- United States, 2007 and 2009. MMWR Morb Mortal Wkly Rep 2011; 60: 1020-25.

A survey of US hospital and birth centers in 2009 indicated that best practices for breastfeeding are instituted comprehensively in only 3.4% of facilities. Local and national initiatives are needed to improve breastfeeding education and support for mothers prior to hospital discharge.

179. IPA, ICM, and FIGO joint statement on breastfeeding, including breastfeeding by HIV-infected mothers. Int J Gynaecol Obstet 2011; 114: 89-90.

Updated guidelines on breastfeeding by FIGO Committee for Safe Motherhood and Newborn health – in line with WHO guidelines – recommend exclusive breastfeeding for the first 6 months of life and continued breastfeeding for up to 2 yr.

180. Oddy WH, Li J, Whitehouse AJ, Zubrick SR, Malacova E: Breastfeeding duration and academic achievement at 10 years. Pediatrics 2011; 127: e137-45.

In this cohort study, academic achievement of children at 10 yr of age varied according to duration of breastfeeding (n=2868). Importantly, adjustments were made for family/parental socioeconomic status and early childhood stimulation. Breastfeeding for ≥6 months was associated with improved academic scores in mathematics, reading and spelling. In particular, boys appeared to have improved academic performance, if breastfed. This study adds weight to the promotion of breastfeeding for ≥6 months.

Neonatal Outcomes for Preterm Infants

181. Carlo WA, McDonald SA, Fanaroff AA, Vohr BR, Stoll BJ, Ehrenkranz RA, Andrews WW, Wallace D, Das A, Bell EF et al: Association of antenatal corticosteroids with mortality and neurodevelopmental outcomes among infants born at 22 to 25 weeks' gestation. JAMA 2011; 306: 2348-58.

In this high-quality multicenter cohort study, the use of antenatal steroids for mothers with preterm labor was linked with favorable outcomes for peri-viable infants born at 22-25 weeks' gestation with birth weights between 401g and 1000g (n=10,541). At 18-22 months follow-up, death or neurodevelopment impairment was significantly reduced in infants receiving antenatal steroids versus no steroids (adj OR=0.60; 95% CI=0.53-0.69).

Improving Newborn Care and Assessment for Preterm Infants

182. Rüdiger M, Braun N, Gurth H, Bergert R, Dinger J: Preterm resuscitation I: Clinical approaches to improve management in delivery room. Early Human Development 2011; 87: 749-53.

For anesthesiologists with a specific interest in resuscitation of preterm infant, this commentary article is highly recommended. This paper describes new concepts for improving delivery room care and newborn assessment of preterm infants: individualized 'support of transition' as opposed to resuscitation, video-recordings to improve the quality of early post-delivery care and redefinition of the APGAR score, specifically for premature infants and infants receiving treatment.

IVF Pregnancy and Neonatal Outcomes

183. Janvier A, Spelke B, Barrington KJ: The epidemic of multiple gestations and neonatal intensive care unit use: the cost of irresponsibility. J Pediatr 2011; 159: 409-13.

Interesting institutional analyses of neonatal complications related to IVF pregnancies. Infants born to mothers with multiple gestation due to artificial reproductive technologies accounted for 17% of neonatal ICU admissions. Significant reductions in neonatal complications were projected by using a single embryo transfer for infertile couples (such as assisted ventilation; number of NICU days).

Neonatal Mortality

184. Reddy UM, Bettegowda VR, Dias T, Yamada-Kushnir T, Ko CW, Willinger M: Term pregnancy: a period of heterogeneous risk for infant mortality. Obstet Gynecol 2011; 117: 1279-87.

Large, population-wide study using National Center for Health Statistics data (n=46,329,018 singleton live births). Investigators assessed racial and ethnic-differences in neonatal mortality rates between $37_{0/7}$ and $41_{6/7}$ weeks' gestation. Ethnic disparities were evidenced by small declines in infant mortality rate in blacks (7%) compared to Hispanics (35%) and whites (22%) from 1995 to 2006. The risk for neonatal mortality was higher at 37 weeks compared to 40 weeks for all ethnic groups.

Letter to the editor: Chabra S: Concept of gestational age in "completed weeks": lost in translation. Obstet Gynecol 2012; 119: 183-84; author reply 184-85.

Hypoxic-Ischemic Encephalopathy

185. Higgins RD, Raju T, Edwards AD, Azzopardi DV, Bose CL, Clark RH, Ferriero DM, Guillet R, Gunn AJ, Hagberg H et al: Hypothermia and other treatment options for neonatal encephalopathy: an executive summary of the Eunice Kennedy Shriver NICHD workshop. J Pediatr 2011; 159: 851-858.e1.

Important document from an expert panel convened by the NICHD highlighting data and knowledge gaps for treatment options for hypoxic-ischemic encephalopathy (HIE). Although induced hypothermia is a promising therapy, there is a great need to (i) develop biomarkers for detecting disease and assessing therapeutic response, (ii) optimize management strategies, including hypothermia, and (iii) improve resources for effectively treating HIE.

Neurodevelopment and Perinatal Factors

Cognitive Dysfunction and Perinatal Ischemic Injury

186. Yang T, Zhuang L, Terrando N, Wu X, Jonhson MR, Maze M, Ma D: A clinically relevant model of perinatal global ischemic brain damage in rats. Brain Res 2011; 1383: 317-23.

Compelling animal study, using term rat pups, demonstrating that perinatal ischemic injury leads to neuronal death in the hippocampus and long-lasting cognitive dysfunction. Of note, apoptotic changes and neurocognitive dysfunction were increased with longer periods of in utero hypoxia. This model of perinatal hypoxia/asphyxia should encourage future work to investigate targeted neuroprotective approaches.

Cerebral Palsy

187. O'Callaghan ME, MacLennan AH, Gibson CS, McMichael GL, Haan EA, Broadbent JL, Goldwater PN, Dekker GA: Epidemiologic associations with cerebral palsy. Obstet Gynecol 2011; 118: 576-82.

Australian case-control study which aimed to identify risk factors for cerebral palsy using data from linked perinatal databases, cerebral palsy registers and maternal questionnaires (n=587 [cases], 1154 [controls]). Using univariate analyses, investigators found that preterm birth (<32 weeks gestation), intrauterine growth retardation, maternal infection during pregnancy, and multiple birth were strong risk factors for cerebral palsy. Unfortunately, recall bias, the use of unadjusted ORs and failure to account for interaction among independent variables affected the quality of the data analyses.

188. Carlo WA, McDonald SA, Tyson JE, Stoll BJ, Ehrenkranz RA, Shankaran S, Goldberg RN, Das A, Schendel D, Thorsen P et al: Cytokines and neurodevelopmental outcomes in extremely low birth weight infants. J Pediatr 2011; 159: 919-25.e3.

Based on the assumption that perinatal inflammation is associated with an increased risk of cerebral palsy (CP), this high quality multicenter cohort study sought to identify pro- and anti-inflammatory cytokines associated with CP in extremely low birth weight (ELBW) infants (n=755). After co-variate adjustment, interleukin 8 levels were significantly increased on days 0-4 and up to day 21 among the ELBW infants who developed CP. Future work is recommended to investigate the influence of altered cytokine-specific gene expression in CP infants.

Autism and Perinatal/Obstetric and Neonatal Risk Factors

189. Gardener H, Spiegelman D, Buka SL: Perinatal and neonatal risk factors for Autism: a comprehensive meta-analysis. Pediatrics 2011; 128: 344-55.

Impressive meta-analysis of 40 studies assessing perinatal and neonatal risk factors for autism. Metaregression was used to identify methodologic differences between studies. In total, nine obstetric/perinatal (including maternal hemorrhage) and seven neonatal factors (including low 5 min APGAR) were associated with autism risk. Importantly, anesthesia was not associated with autism risk. However, our understanding of risk profiles is significantly limited by the heterogeneity of methodologies employed among studies.

Psychological Impairment and Mode of Delivery

190. Li HT, Ye R, Achenbach TM, Ren A, Pei L, Zheng X, Liu JM: Caesarean delivery on maternal request and childhood psychopathology: a retrospective cohort study in China. BJOG 2011; 118: 42-48.

Retrospective cohort study which aimed to investigate whether mode of delivery influenced the development of childhood psychopathology (CPP) (n=4190). Using behavioral scoring assessments, investigators found that children born by CD and assisted vaginal delivery had the lowest and highest problem scores respectively. Mechanisms to explain variations in these problem scores according to mode of delivery remain uncertain.

Academic Achievement and Gestational Age at Delivery

191. Aarnoudse-Moens CS, Oosterlaan J, Duivenvoorden HJ, van Goudoever JB, Weisglas-Kuperus N: Development of preschool and academic skills in children born very preterm. J Pediatr 2011; 158: 51-56.

Retrospective study comparing cognitive and academic abilities of pre-school and primary school children, who were born very preterm (gestational age <30 weeks) versus term-born (n=200). Very preterm infants had significantly poorer numerical reasoning skills and mathematical abilities than term infants, differences that persisted over time. Although these findings are interesting, future work needs to account for all factors (e.g., perinatal) that influence infants' academic achievement.

Excessive Postnatal Weight Loss

192. Chantry CJ, Nommsen-Rivers LA, Peerson JM, Cohen RJ, Dewey KG: Excess weight loss in first-born breastfed newborns relates to maternal intrapartum fluid balance. Pediatrics 2011; 127: e171-79.

In this high-quality, prospective cohort study (n=316) of exclusively breastfed, first-born, term infants, the prevalence of excess weight loss, defined as ≥10% of birth weight at postnatal day 3, was surprisingly high (19%). Interestingly, a high rate of maternal intrapartum fluid balance was independently associated with excess weight loss (adj RR=3.18; 95% CI=1.4-13.3).

Congenital Heart Disease at Birth

193. van der Linde D, Konings EE, Slager MA, Witsenburg M, Helbing WA, Takkenberg JJ, Roos-Hesselink JW: Birth prevalence of congenital heart disease worldwide: a systematic review and meta-analysis. J Am Coll Cardiol 2011; 58: 2241-47.

This impressive systematic review, comprising 114 papers, summarizes changing patterns of birth prevalence of congenital heart disease (CHD). Total birth prevalence has increased over time; a current estimate is 9.1 per 1000 live births (95% CI=9.0-9.2), an estimate which forebodes a major global health burden. Steady increases in ventricular and atrial septal defects and patent ductus arteriosus have occurred since the 1970s.

Health Care Reform and Health Policy

United States

194. Institute of Medicine. Clinical preventive services for women: closing the gaps. 2011. http://www.hrsa.gov/womensguidelines/.

This important announcement from HRSA, based on a comprehensive IOM review, will ensure that the planned Affordable Care Act will provide women's preventative health care (including prenatal care, screening for GDM and breastfeeding education) with no cost sharing between new health plans. This forthcoming public health reform will have sweeping implications for improving women's health.

195. von Gruenigen VE, Deveny TC: Health care reform: will quality remodeling affect obstetrician-gynecologists in addition to patients? Obstet Gynecol 2011; 117: 1167-69.

Worthwhile commentary article summarizing the implications for practicing OB-GYN physicians of impending health care reform related to the Patient Protection and Affordable Care Act. The authors speculate that the 'knock-on effects' of implementing quality performance standards and more rigorous oversight of physician practice, using quality metrics, will reduce the number of elective inductions, antenatal fetal testing and ultrasounds.

196. Saleeby E, Brindis CD: Women, reproductive health, and health reform. JAMA 2011; 306: 1256-57.

This commentary article gives a good overview of how implementation of the Affordable Care Act will transform the current model of care for the health of women in the US.

See also: Johnson KA: Women's health and health reform: implications of the Patient Protection and Affordable Care Act. Curr Opin Obstet Gynecol 2010; 22: 492-97.

Global Health

197. WHO. Priority medicines for mothers and children 2011. World Health Organization. 2011. http://www.who.int/medicines/publications/A4prioritymedicines.pdf.

This joint announcement by the WHO, UNICEF and UNFPA lists 30 essential drugs deemed essential for preventing or treating major diseases and complications impacting the mother and child. Relevant drugs include oxytocin; magnesium sulphate, calcium gluconate; betamethasone, nifedipine (for preterm birth); ampicillin, gentamicin, metronidazole and misoprostol (for maternal sepsis after unsafe abortion).

198. Mills M, Rindfuss RR, McDonald P, te Velde E: Why do people postpone parenthood? Reasons and social policy incentives. Hum Reprod Update 2011; 17: 848-60.

Fascinating review of evidence to confirm our suspicions that birth postponement of the first child has occurred in most Western societies. The mean age of mothers at first delivery has increased by 1 yr each decade across OECD countries since the 1970s. Progressive and/or societal changes in health policy, contraceptive use, the employment market, women's education, gender roles, economic uncertainty, personal/family/relationship dynamics are postulated to be important drivers of this change.

The Practice of Research

199. Zarin DA, Tse T, Williams RJ, Califf RM, Ide NC: The ClinicalTrials.gov results database--update and key issues. N Engl J Med 2011; 364: 852-60.

Interesting article highlighting concerns about the quality of data entry, such as the number of primary outcome measures and lack of specificity in describing study designs, in trial records registered at ClinicalTrials.gov. A total of 79,413 registry entries and 2178 trial records were analyzed between Sept 2009 – Sept 2010.

200. Riley RD, Gates S, Neilson J, Alfirevic Z: Statistical methods can be improved within Cochrane pregnancy and childbirth reviews. J Clin Epidemiol 2011; 64: 608-18.

Have you ever been skeptical about the accuracy of the systematic reviews of the Cochrane Pregnancy and Childbirth Group (CPCG)? This review paints a sobering picture of the statistical flaws that are likely to have weakened the methodologic rigor of existing CPCG reviews. In 75 reviews, areas of weakness included failure to adequately address publication bias, insufficient/incorrect interpretation of random-effects analyses, and inadequate assessment of between-study heterogeneity.

Patient Safety

Operating Room Drug Errors

201. Merry AF, Webster CS, Hannam J, Mitchell SJ, Henderson R, Reid P, Edwards KE, Jardim A, Pak N, Cooper J et al: Multimodal system designed to reduce errors in recording and administration of drugs in anaesthesia: prospective randomised clinical evaluation. BMJ 2011; 343: d5543.

In this prospective study, investigators compared the rates of anesthesia-related drug errors between two delivery systems - a patented multimodal drug delivery system (DDS) versus conventional practice in drug administration - among 89 anesthesiologists. The DDS includes customized drug trolleys, pre-filled labeled syringes, barcode readers, and a computerized system with audio-visual verification software for overseeing drug inventory. There were fewer drug errors per 100 administrations using the DDS compared to conventional practice (9.1 vs 11.6; P=0.045). These systems may ultimately reduce iatrogenic patient harm, reduce documentation errors and allow more time for patient care in the operating room.

Accompanying editorial: Haller G, Clergue F: Drug administration errors in anaesthesia and beyond. BMJ 2011; 343: d5823.

Simulation Research

202. Lipman S, Daniels K, Cohen SE, Carvalho B: Labor room setting compared with the operating room for simulated perimortem cesarean delivery: a randomized controlled trial. Obstet Gynecol 2011; 118: 1090-94.

Randomized study to compare practices for managing perimortem cardiac arrest in a labor room (primary site) using a manikin. Using 15 teams, the median time to perform incision was longer if the manikin was transferred from the labor room to the operating room compared to commencing incision in the labor room (7.5 min vs 4.3 min; P<0.004). These findings suggest that perimortem CD should be performed in the labor room.

Patient Safety Initiatives/Programs

203. Grunebaum A, Chervenak F, Skupski D: Effect of a comprehensive obstetric patient safety program on compensation payments and sentinel events. Am J Obstet Gynecol 2011; 204: 97-105.

This article describes details of a multidimensional, comprehensive patient-safety program for improving obstetric care and reducing severe perinatal adverse outcomes at a tertiary obstetric center. Within a 6 yr period, a substantial decrease in sentinel events and compensation payments was observed.

What's New in Obstetrics: "Evolving Consensus on Standardization of FHR Pattern Management"

Julian Parer, M.D., Ph.D.

Agreement about the terminology and descriptions of fetal heart rate (FHR) patterns (nomenclature) is now well established, largely based on the report of the National Institute of Child Health and Human Development (NICHD) workshop of 1997,[1] but consensus on FHR interpretation and management has been extraordinarily difficult to achieve in US obstetrics. Interpretation deals with the significance for the fetus in terms of risk of potentially damaging metabolic acidemia. It is also now understood that part of this interpretation is recognizing or projecting the probability of a pattern of lower risk of acidemia evolving into one with a higher risk so that timely intervention can occur.[2] Management means how the obstetrical team actually responds to a FHR pattern to minimize fetal metabolic acidemia without excessive operative or other interventions.

Many professional bodies and individuals, particularly overseas, have classified FHR patterns and recommended management approaches (eg, the Royal College of Obstetricians and Gynaecologists, the Society of Obstetricians and Gynaecologists of Canada, and the Royal Australian and New Zealand College of Obstetricians and Gynaecologists and the Japan Society of Obstetrics and Gynecology). For various reasons none of these guidelines has achieved widespread adoption in the United States. There was therefore much enthusiasm for the announcement in 2008 that the NICHD was again convening a meeting to revisit and update the findings of the report published more than a decade earlier.

The subsequent publication endorsed the definitions and the findings of the prior workshop, without making changes in the terminology.[3] The various FHR patterns were classified into categories I (normal), II (indeterminate), and III (abnormal), approximately the same gradations that were used in the clinical statement in the 1997 document. This has been called the 3 tier system, and it was espoused on the basis of simplicity and ease of teaching.[4] These categories have been endorsed in the American College of Obstetrics and Gynecology practice bulletin of 2009.[5]

Unfortunately, category II consists of a vast heterogeneous mixture of patterns, based on variations in baseline rate, variability, and decelerations, and there is little guidance for management of these patterns by obstetrical providers. For example, few would disagree that a FHR pattern with minimal variability and persistent severe late decelerations is more threatening than one with moderate variability and mild variable decelerations, yet both are category II. There cannot be any such management guidance unless category II, containing probably 80% of all variant patterns, is subdivided further.

Subcategorization of this group of tracings was not done on the basis of inadequate evidence, although this conclusion ignores the rich fund of observational studies from the earliest days of monitoring, the 1960s and the 1970s, when data linking various FHR patterns to acidemia were collected. These studies cannot be repeated because it would now be considered unethical by many practitioners to observe some of these patterns without intervention.[6]

The 2008 NICHD report has resulted in a number of reactions from practitioners and investigators. Editorial comments and at least 10 abstracts on the subject have appeared in the United States alone this year. The general conclusion is that category I (normal FHR pattern) may be associated with a somewhat better short-term outcome than category II, but there is no evidence that category II is sufficiently discriminating to assist in FHR management.

There is pressure from obstetrical nurses and certified nurse-midwives (CNMs) in our community hospitals to assist by developing suggestions for management within category II. At least 2 community hospitals in our region have set up such internal guidelines, based on a 5 tier color-coded system.[7]

These locally developed guidelines primarily involve such features as when to inform the physician or CNM, when to request their analysis of the tracing, and when to request their presence at the bedside. Nurses and CNMs would also like to be guided in when they are justified in moving a patient to the operating room or when to call for a good Samaritan when the primary obstetrician is not immediately available.

None of this guidance is possible with the vast spectrum of patterns currently included in category II. All of these graded responses are sufficiently intrusive that it is unfair to simply leave them to the individual nurse's judgment. Obstetricians bear a responsibility for participating in developing such guidelines on an interdisciplinary basis.

There is sufficient information in the literature about the risk of acidemia associated with certain category II patterns, the interplay between FHR variability and decelerations, and the risk that a pattern will progress to category III to set up management plans that can be tested for effectiveness. The espousing of a 3 tier system does not allow this and seems to be a retrogressive step that is likely to impede progress in the validation of specific algorithms.

Against this background, evidence is accumulating that a 5 tier system does relate to degrees of acidemia and fetal damage[8] and, if appropriately rule based, can improve consistency in interpretation among providers.[9] There is also emerging evidence that if taught and accepted hospital-wide, such an approach can reduce newborn metabolic acidemia without increased intervention.[10]

An obvious solution is for official bodies and professional associations to set up a framework that conforms to the currently available data (admittedly limited), which can be tested for effectiveness by eager investigators. The Japan Society of Obstetrics and Gynecology has done this with 5 tiers on a national level and is expecting validation (or the opposite) to emerge from subsequent studies. We in the United States should do the same.

References

1. National Institute of Child Health and Human Development Research Planning Workshop. Electronic fetal heart rate monitoring: research guidelines for interpretation. Am J Obstet Gynecol 1997;177:1385-90.

2. Freemen, RK, Nageotte, MP. Comments on American College of Obstetricians and Gynecologists practice bulletin no. 106, 2009. Am J Obstet Gynecol 2010;202:411-2.

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Abstract #:OP2-1

Post-Operative Pain After Elective Cesarean Section Under Spinal Anesthesia: Primary Versus Repeat

Christopher Ciliberto, M.D.[1]; Clemens Ortner, M.D., M.Sc.[1]; Philippe Richebé, M.D., Ph.D.[1]; Laurent Bollag, M.D.[1]; Monica Siaulys, M.D., Ph.D.[2]; Ruth Landau, M.D.[1]
University of Washington - Seattle, WA[1]; Hospital e Maternidade Santa Joana - Sao Paulo, Sao Paulo[2]

Introduction: In the US, 1.4 million cesarean sections (CS) are performed annually out of which 30% are elective repeat CS (1). In a retrospective analysis, analgesic consumption after an elective CS with a spinal anesthetic was similar to that after an unplanned CS under epidural anesthesia (2). There is some suggestion that central sensitization may occur with repeated surgical procedures (3), which may suggest that women undergoing a repeat CS will require increased pain medication. To the best of our knowledge, pain outcomes and analgesic requirements in healthy women undergoing a primary elective CS have not been compared to those in women undergoing a repeated procedure under the same standardized spinal anesthetic with multimodal analgesia.

Methods: 451 women scheduled for an elective CS were enrolled in this prospective longitudinal study. Spinal anesthesia was standardized (bupivacaine 12mg, fentanyl 25µg & morphine 100µg). Post-op analgesia included acetaminophen and diclofenac, iv morphine in PACU and oxycodone or tramadol for breakthrough pain. Post-op pain scores (12h, 24h, 48h) at rest, while sitting, uterine cramping and wound hyperalgesia at 48h were recorded. Pain at 8 weeks and 6 months was assessed by phone interview using brief pain inventory (BPI). Statistical analysis included t-test for equality of means ($p<0.05$).

Results: 304 women had a primary and 147 a repeat CS (Table). There was a trend for all pain outcomes to be higher in women undergoing a repeat CS, but only pain at rest at 48h was statistically significantly higher ($p=0.05$); analgesic consumption was however similar in both groups. Although pain at 6m was overall uncommon, women in the primary group reported their worst pain during the last wk as 3.0 ± 2.5 vs 4.6 ± 2.5 in women in the repeat CS group ($p=0.13$) (Table).

Conclusion: This is the first prospective report comparing pain outcomes in healthy women undergoing an elective primary or repeat CS under spinal anesthesia with multimodal post-operative analgesia. While there was a trend towards higher pain scores overall in women undergoing a repeat CS, with up to 7% of women reporting moderate pain at 6 months, the only significant difference in pain outcomes was pain scores at rest 48h. Based on these findings, women undergoing a repeat CS are unlikely to require different post-op pain management.

1 Zhang, AJOG 2010
2 Carvalho, IJOA 2010
3 Cabañero, Anesthesiol 2009

Additional Files:

Table. Demographics and pain outcomes (N=451)

	Primary CS N=304	Repeat CS N=147	P value
Age (years)	30 ± 5.2	32 ± 4.8	0.00
BMI	29.5 ± 4.6	29.7 ± 4	0.54
Pain scores 12h post-op			
At rest (0-10)	3.2 ± 2.7	3.1 ± 2.8	0.80
While sitting (0-10)	4.7 ± 2.8	4.6 ± 2.9	0.75
Uterine cramping (0-10)	2.0 ± 2.6	2.1 ± 2.8	0.65
Pain scores 24h post-op			
At rest (0-10)	2.7 ± 2.5	2.8 ± 2.7	0.70
While sitting (0-10)	3.6 ± 3.8	2.5 ± 2.8	0.39
Uterine cramping (0-10)	1.7 ± 2.2	2.4 ± 2.7	0.08
Pain scores 48h post-op			
At rest (0-10)	1.4 ± 2	1.9 ± 2.6	0.05
While sitting (0-10)	2.1 ± 2.3	2.5 ± 2.6	0.13
Uterine cramping (0-10)	1.2 ± 2	1.5 ± 2.3	0.15
WHI 48h	0.35 ± 0.69	0.48 ± 0.81	0.10
48h opioid use (mg MEQ)	14.6 ± 9.4	13.1 ± 9.3	0.11
Women with pain at 8 weeks	N=30 (10%)	N=18 (12%)	
Average pain past week (0-10)	2.6 ± 2.1	2.4 ± 1.4	0.67
Worst pain past week (0-10)	4.0 ± 2.4	4.6 ± 2.4	0.41
Pain now (0-10)	0.8 ± 2.1	0.6 ± 1.7	0.68
Women with pain at 6 months	N=16 (5%)	N=11 (7%)	
Average pain past week (0-10)	2.1 ± 1.8	2.9 ± 2.4	0.34
Worst pain past week (0-10)	3.0 ± 2.5	4.6 ± 2.5	0.13
Pain now (0-10)	0.6 ± 2.2	0.7 ± 2.4	0.91

Data presented as mean ± SD

Pain is reported by VRPS (0= no pain; 10 worst pain imaginable)

Pain at 8 weeks and 6 months was assessed by brief pain inventory (BPI)

WHI = wound hyperalgesia index (calculated as Σ distances to scar from point of hyperalgesia/length of the scar, measured with Von Frey filament)

Opioid use = Intravenous Morphine-Equivalents (ivMEQ) were calculated applying

- tramadol (mg tramadol x 10)/120
- oxycodone: (mg oxycodone x 10)/20

Abstract #:OP2-2

The Use of General Anesthesia for Cesarean Delivery: A Population-Based Sample from New York State

Jill M. Mhyre, M.D.[1]; Paloma Toledo, M.D., MPH[2]; Lisa R. Leffert, M.D.[3]; Melissa E. Bauer, DO[1]; Brian T. Bateman, M.D.[3]
The University of Michigan Health System - Ann Arbor, MI[1]; Northwestern University, Feinberg School of Medicine - Chicago, IL[2]; Massachusetts General Hospital - Boston, MA[3];

Introduction: The proportion of general rather than neuraxial anesthesia (GA) for cesarean delivery (CD) has been proposed as a quality measure for obstetric anesthesia,(1) and yet, little empiric data is available about its use at a population level in the United States. We analyzed New York Inpatient administrative data, which includes a categorical variable for anesthesia, to identify temporal trends and predictors of the use of GA for CD.

Methods: Hospitalizations for delivery were extracted for 1998-2008 using an enhanced algorithm of ICD-9-CM diagnostic and procedural codes. Patients were included in our analysis if ≥90% of the CD records from their delivering hospital reliably specified type of anesthesia (i.e. regional or GA). Logistic regression models including all CDs clustered by hospital, were used to identify independent predictors of the use of GA, and to assess for temporal trends after adjusting for relevant demographic characteristics, obstetric complications, and hospital-level variables.

Results: We identified 2,638,853 admissions for delivery, including 757,256 CDs in 195 unique hospitals. 258,886 women from 95 hospitals met inclusion criteria. Across all years, GA was used in 8.7% of all CDs; this rate decreased from 15.5% in 1998 to 4.7% in 2008, (P<0.001 for trend). This temporal trend persisted after adjusting for patient age and race, obstetric complications, and hospital level variables (adjusted odds ratio [aOR] 0.82 per year increase, 95% confidence interval [CI] 0.77, 0.88, P<0.001). The strongest predictors of whether a woman would receive GA for CD were: 1) the occurrence of additional surgery, specifically an exploratory laparotomy (aOR 7.7, 95% CI 5.0,12.0) or hysterectomy (aOR 5.1, 95% CI 3.4, 7.6), and 2) payer mix (compared with >72% private insurance; 60-72% aOR=1.8, 95% CI 1.2, 2.7; 48-59.9% aOR=6.5, 95% CI 2.3, 18.7; <48% aOR=4.7, 95% CI 2.8, 8.0). In 2008, the general anesthesia rate was below 15% in 95% of hospitals, below 10% in 82%, below 5% in 50%, and below 2.5% in 23% of institutions analyzed.

Conclusion: In this sample of hospitals, the use of GA for CD decreased markedly during the 11 year study period; adjustment for changes in maternal and obstetric characteristics did not significantly account for this change. Nevertheless, the use of GA for CD continues to vary by a factor of 5 between institutions. The fact that the delivering hospital's payer mix is among the most important predictors of whether a woman would receive GA for CD suggests that institutional resources, socioeconomic differences in patients and/or the availability of epidural analgesia exert a powerful influence over anesthetic selection for CD. The GA rate for CD appears to demonstrate many desirable attributes of a useful quality measure,(2) including sensitivity to the equitable distribution of healthcare.

1. http://www.guideline.gov/
2. http://qualitymeasures.ahrq.gov/

Abstract #:OP2-3

The Effect of Phenylephrine Administration on Maternal Cerebral Tissue Oxygenation Following Spinal Anesthesia for Cesarean Delivery

Terrence K. Allen, MBBS, FRCA; William D. White, MPH; Basem Mishriky, M.D.; Ashraf S. Habib, MBBCh, FRCA
Duke University Medical Center - Durham, NC

Introduction: Phenylephrine (PE) is widely used to treat or prevent hypotension associated with spinal anesthesia in obstetric patients. Its effect on cerebral tissue oxygenation (SctO2) in obstetric patients having spinal anesthesia (SA) has not been described. This might be important in high risk obstetric patients with altered cerebrovascular reactivity such as those with chronic hypertension and preeclampsia. In this observational study we investigated the effects of phenylephrine administered by a bolus vs a prophylactic infusion for the management of hypotension on SctO2 in women having spinal anesthesia for cesarean delivery (CD).

Methods: Following IRB approval ASA 1 and 2 patients scheduled for CD under SA were alternately assigned to either a PE bolus (PEB) or infusion (PEI) group. Measurements of NIBP, CO (Physioflow®) and SctO2 (Foresight®) were obtained at baseline and following the initiation of SA with bupivacaine 12 mg, fentanyl 15 mcg and morphine 150 mcg. 2L of Lactated ringers coload was administered before delivery. Systolic blood pressure (SBP) was maintained within 20% of baseline by titrating a PE infusion initiated at 50 mcg/min according to an algorithm in the PEI group and by administration of 100 mcg PE boluses for the treatment of 20% drop in SBP in the PEB group. The study continued until 10 min after oxytocin administration. We modeled the effect of time, PE administration method and its interaction with time, CO and baseline SctO2 on SctO2 using repeated measures ANCOVA from initiation of spinal anesthesia to 15 min post spinal.

Results: 14 patients were included in the study (7 per group). The median (IQR) dose of PE was 100 (0-1100)mcg in the bolus group vs. 2247 (1323-3163) mcg in the infusion group. There were no differences in SctO2 and CO at initiation of spinal anesthesia. Accounting for PE administration method, baseline SctO2 and time, there was a significant correlation between Sct02 and CO with SctO2 increasing by 0.319% for every 1L/min increase in CO (p=0.0019). SctO2 decreased over time in both groups (p<0.0001) with an additional 0.414% reduction in the PEI vs. PEB group per minute (p=0.0390) (figure 1).

Conclusion: Our results demonstrate that PEI is associated with greater reductions in SctO2 when compared with PEB perhaps as a result of the larger doses and longer administration time by this method. These findings may have implications for patients at increased risk of peripartum cerebrovascular events.

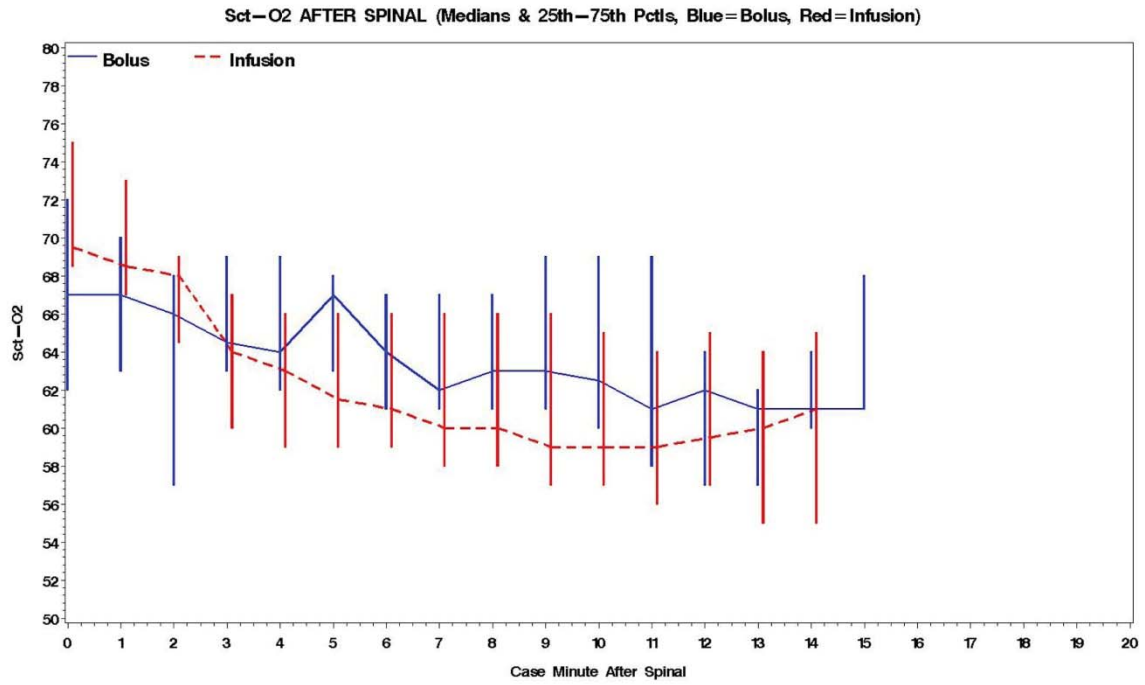

Figure 1. Change in $SctO_2$ over time in patients receiving a prophylactic phenylephrine infusion vs boluses for the management of hypotension. Time 0 represents initiation of spinal anesthesia. Values are median (IQR)

Abstract #:OP2-4

Glycopyrrolate Pretreatment Before Phenylephrine Infusion During Spinal Anesthesia for Cesarean Delivery: Effect On Cardiac Output and Hemodynamic Control

Warwick D. Ngan Kee, MBChB, M.D., FANZCA, FHKCA, FHKAM;
Shara WY Lee, M.Sc., Ph.D.; Kim S. Khaw, MBBS, FRCA, FHKCA, FHKAM;
Floria F. Ng rn, BA.Sc.
The Chinese University of Hong Kong - Shatin, NT

Introduction: Phenylephrine (PHE) given during spinal anesthesia (SA) for cesarean delivery (CD) often induces a baroreceptor-mediated decrease in heart rate (HR) which may decrease cardiac output (CO) [1]. Anticholinergic drugs may attenuate this effect but may also cause more labile blood pressure (BP) control. Our aim was to evaluate glycopyrrolate (GLY) given at the start of a standardized PHE infusion. The primary outcome was non-invasively measured CO. Accuracy of BP control was assessing using performance error calculations (PEC) [2].

Method: With IRB approval and written consent, 104 healthy patients scheduled for elective CD were recruited in a prospective randomized double-blinded controlled trial. After SA using hyperbaric bupivacaine 11 mg + fentanyl 15 mcg, IV GLY 4 mcg/kg or saline placebo was given. Systolic BP measured at 1-min intervals was maintained near baseline using closed-loop feedback computer-controlled PHE infusion (range 0-100 mcg/min) with fluid cohydration [2]. CO was measured using suprasternal Doppler ultrasonography by the same experienced blinded operator at baseline and 5-min intervals for 20 min. Standard neonatal assessment was performed and patients were asked if they had dry mouth in the PACU. HR and CO data were standardized to % of baseline and CO changes over time were summarized as area under the curve. Data were compared using the Mann-Whitney test. $P<0.05$ was considered significant.

Results: 11 patients were excluded for shivering or technical problems. For GLY vs placebo, serial CO was greater (Fig 1), mean HR until uterine incision was greater (118.2 (SD 13.5) vs 95.8 (7.0) %, $P<0.001$) and median PHE infusion rate was lower (29.1 vs 34.1 mcg/min, $P=0.006$). PEC analysis of BP control showed greater positive bias, greater inaccuracy and greater wobble in the GLY group (all $P<0.05$). For GLY vs placebo, nausea incidence (7/44 vs 4/49) and neonatal outcome were similar but more patients had dry mouth (16/44 vs 3/49, $P=0.0002$).

Conclusion: GLY given with a PHE infusion increases CO and HR and decreases PHE requirement, but also decreases accuracy of BP control and causes a dry mouth. No difference in neonatal outcome is seen in low risk patients.

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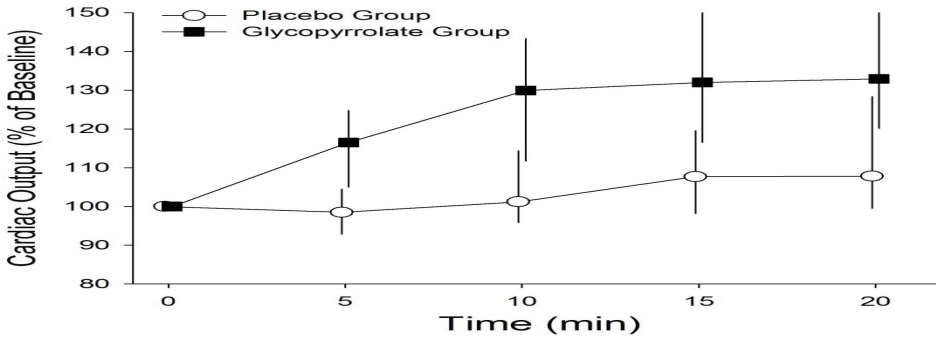
Additional Files:

Fig 1. Cardiac Output Changes as Percentage of Bas

Data are median and interquartile range. Significant difference between groups (*



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