2017 Sol Shnider, M.D. Obstetric Anesthesia Meeting

The premier review meeting for clinical obstetric anesthesia, established in 1976

March 2-5, 2017
Grand Hyatt Hotel on Union Square
San Francisco, California

Syllabus

Jointly provided by American Society of Anesthesiologists and the Society for Obstetric Anesthesia and Perinatology
Welcome to the Sol Shnider, M.D. Obstetric Anesthesia Meeting. About 40 years ago, Sol Shnider, M.D., Samuel C. Hughes, M.D., and Mark A. Rosen, M.D., offered the first annual obstetric anesthesia meeting in San Francisco to honor Dr. Shnider and his important contributions to obstetric anesthesia. The Society for Obstetric Anesthesia and Perinatology is proud to continue this annual tradition in providing clinical updates in obstetric anesthesia by leaders in the specialty. The pre-meeting workshop offers the opportunity to learn ultrasound for the care of the pregnant patient. This meeting will enlighten your obstetric anesthesia clinical practice by providing new insight and knowledge and there will be ample time for you to ask questions and address concerns with faculty during the conference. The planning committee is delighted to offer you this outstanding and engaging learning opportunity.

Sincerely,

Manuel Vallejo, M.D., D.M.D.
SOAP Immediate Past President and Program Chair

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- 51 Session III: Obstetrical Hemorrhage Update
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- 154 Session VII: New Ways in Obstetrical Practice
- 180 Session VIII: Maternal Morbidity and Rare Disease

**Sunday, March 5, 2017**

- 203 Session IX: Breastfeeding and Neonatal Concerns
- 231 Session X: Anesthesia Safety Session 2
Program Committee

Manuel Vallejo, Jr., M.D., D.M.D.
Chair
West Virginia University

Alexander Butwick, M.B.B.S., FRCA, M.S.
Stanford University School of Medicine

Brendan Carvalho, M.B., B.Ch., FRCA
Stanford University School of Medicine

Robert D'Angelo, M.D.
Wake Forest University School of Medicine

Robert Gaiser, M.D.
University of Pennsylvania Health and Sciences

Lisa Leffert, M.D.
Massachusetts General Hospital

Michael Orosco, M.D.
Kaiser San Diego

Mark Rollins, M.D., Ph.D.
UCSF School of Medicine

Barbara Scavone, M.D.
University of Chicago

John Sullivan, M.D.
Northwestern University

Future Meetings

SOAP 49th Annual Meeting
May 18-22, 2016
Seaport Boston Hotel
Boston, MA

SOAP 2018 Sol Shnider Meeting
March 8-11, 2018
Grand Hyatt Hotel
San Francisco, CA

Faculty

Alexander Butwick, M.B.B.S., FRCA, M.S.
Stanford University School of Medicine

Brendan Carvalho, M.B., B.Ch., FRCA
Stanford University School of Medicine

Lawrence Chu, M.D., M.S.
Stanford University School of Medicine

Jeremy Collins, M.D., FRCA, M.B., Ch.B.
Stanford University School of Medicine

Robert D’Angelo, M.D.
Wake Forest University School of Medicine

Robert Gaiser, M.D.
University of Kentucky

Philip Hess, M.D.
Beth Israel Deaconess Medical Center

Jennifer M. Lucero, M.D.
University of California San Francisco

Alex Macario, M.D., M.B.A.
Stanford University School of Medicine

Kenneth Nelson, M.D.
Wake Forest University School of Medicine

Neil Ray, M.D.
UC Davis Medical Center

Mark Rollins, M.D., Ph.D.
UCSF School of Medicine

Mark Rosen, M.D.
Professor Emeritus, UCSF

Barbara Scavone, M.D.
University of Chicago

John Sullivan, M.D.
Northwestern University

Andrea Traynor, M.D.
Stanford University School of Medicine

Manuel Vallejo, Jr., M.D., D.M.D.
West Virginia University

Mark Zakowski, M.D.
Cedar – Sinai Medical Center
Mission of SOAP
The mission of this Society is to improve the pregnancy-related outcomes of women and neonates through the support of obstetric anesthesiology research, the provision of education to its members, other providers, and pregnant women, and the promotion of excellence in clinical anesthetic care.

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

The American Society of Anesthesiologists designates this live activity for a maximum of 17.5 AMA PRA Category 1 Credits™. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

There are two sessions that are applicable for patient safety. The first session is Session V: Obstetric Anesthesia Safety Session 1 on Saturday and the second session is Session X: Obstetric Anesthesia Safety Session 2 on Sunday. Each session is worth 1.5 credits. Please note: In order to claim credit for MOCA®, attendees are required to attend the entire session and complete the evaluation form when claiming CME credit.

Maintenance of Certification in Anesthesiology Program® and MOCA® are registered certification marks of The American Board of Anesthesiology®.

This patient safety activity helps fulfill the patient safety CME requirement for Part II of the Maintenance of Certification in Anesthesiology Program (MOCA) of The American Board of Anesthesiology (ABA). Please consult the ABA website, www.theABA.org, for a list of all MOCA requirements.

AANA Credits (Program offering Friday through Sunday)
This program has been approved by the American Association of Nurse Anesthetists for 17.50 Class A CE credits; Code Number: 1034112; Expiration Date: 3/5/17.

Hands-on Ultrasound for the Obstetric Anesthesia Provider: Cardiac Ultrasound, Hemodynamic Exam, Pulmonary Evaluation, Ultrasound Guided TAP Blocks & Neuraxial Techniques and Basic Fetal Ultrasound
This workshop has been approved by the American Association of Nurse Anesthetists for 4.00 Class A CE credits; Code Number: 1034115; Expiration Date: 3/2/16.

The American Society of Anesthesiologists designates this live activity for a maximum of 4 AMA PRA Category 1 Credits™. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

Target Audience
This meeting is intended for specialists in anesthesiology to include anesthesiologists, nurse anesthetists, residents and fellows. Pediatricians, neonatologists, perinatologists, obstetricians, general practitioners, delivery room nurses, nurse midwives, and clinical pharmacologists may also find educational benefit. 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 meeting.

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

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 2017 Sol Shinder, M.D. Obstetric Anesthesia 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, and AAs or the equivalent. CE credit will be offered to CRNAs.

Evaluations
Electronic evaluations by questionnaire will address program content, presentations, and possible bias.

Special Needs Statement
The Society for Obstetric Anesthesia and Perinatology is 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 414-389-8611 and/or submit a description of your needs in writing to soap@soap.org.

Statement of Need
The SOAP Sol Shinder, M.D. Obstetric Anesthesia Meeting provides a forum devoted exclusively to obstetric anesthesia at which leaders in the field present recent clinical updates and other relevant clinical information.

Commercial Support Acknowledgement
This CME activity is supported by educational grants. A complete list of supporters will be available in the course syllabus.

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

Disclaimer
The information provided at this CME activity is for continuing education purposes only and is not meant to substitute for the independent medical judgment of a healthcare provider relative to diagnostic and treatment options of a specific patient's medical condition.
Learning Objectives

At the conclusion of this learning activity, the participant will be able to:

- Determine how new venous thromboembolism (VTE) bundles will influence the use of anticoagulation before and after delivery
- Recognize sonography of the lumbar spine and list potential advantages and indications for ultrasound-guided neuraxial blocks
- Summarize the advantages, disadvantages, and indications in the paramedian lumbar epidural technique
- Identify key variables of Programmmed Intermittent Epidural Bolus (PIEB) technology that are improvements over Patient Controlled Epidural Analgesia (PCEA)
- List the etiologies of the most common serious obstetric anesthesia complications and identify strategies that can reduce the incidence of severe morbidity and maternal mortality
- Effectively manage a parturient with Zika Virus infection and develop a plan for any parturient with hepatitis viral infection
- Effectively manage a neonate requiring resuscitation
- Explain the difference between a Person-based and a System-based approach in medical error reduction
- Identify the most important publications from 2015 that impact anesthetic care of the parturient
- Discuss the implications of pregnancy and labor on the more severe maternal congenital cardiac lesions and identify strategies for risk assessment
- Identify the implications of pregnancy on the Fontan circulation
- Discuss how pregnancy and platelet transfusions contribute to HLA alloimmunization
- Describe specific components and implementation of a multidisciplinary Enhanced Recovery After Surgery (ERAS) pathway in obstetric anesthesia
- Explain the rationale behind the development of protocols in response to obstetric hemorrhage
- Discuss ways to promote a healthy working environment

Exhibits Information

Exhibits will be open during the following times:

Friday, March 3, 2017:
- 6:30 – 7:30 a.m.
- 9:15 – 10:00 am.
- 2:45 – 3:30 p.m.

Saturday, March 4, 2017:
- 6:30 – 7:30 a.m.
- 9:15 – 10:00 a.m.
- 2:45 – 3:30 p.m.

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. The following planning committee members and/or faculty have indicated that they have relationship with industry to disclose relative to the content of this CME activity:

Alexander Butwick – 6 Gauss Surgical
Alex Macario – 7 Merck, 7 Pacira
Neil Ray – 4 Raydiant Oximetry
Mark Zakowski – 2 Quantum Birthing LLC

Planner/Faculty Disclosure

The following planning committee members and/or faculty have indicated that they have relationship with industry to disclose relative to the content of this CME activity:

Brendan Carvalho, M.B.B.Ch., F.R.C.A., M.D.C.H.
Lawrence Chu, M.D., M.S.
Jeremy Collins, M.D., FRCA, M.B., Ch.B.
Robert D’ Angelo, M.D.
Robert Gaiser, M.D.
Philip Hess, M.D.
Lisa Leffter, M.D.
Jennifer Lucero, M.D.
Kenneth E. Nelson, M.D.
Mark Rollins, M.D., Ph.D.
Mark Rosen, M.D.
Barbara Scavone, M.D.
John Sullivan, M.D.
Andrea Traynor, M.D.
Manuel C. Vallejo, Jr., M.D., D.M.D

Resolutions of Conflicts of Interest

In accordance with the ACCME Standards for Commercial Support of CME, the American Society of Anesthesiologist has implemented mechanisms, prior to the planning and implementation of this CME activity, to identify and resolve conflicts of interest for all individuals in a position to control content of this CME activity.
Friday, March 3, 2017

6:30 – 7:15 a.m.  Registration and Continental Breakfast

7:15 – 7:30 a.m  Opening Welcome
Mark Rosen, M.D.

Session I: Vasopressors and Cardiac Disease in Pregnancy
Moderator: Manuel Vallejo, Jr., M.D., D.M.D.

7:30 – 8:00 a.m.  Vasopressor Choices for Treating Spinal Hypotension
Kenneth Nelson, M.D.

8:00 – 8:30 a.m.  The Parturient with Complex Congential Heart Disease: Understanding Fontan Circulation
Neil Ray, M.D.

8:30 – 9:00 a.m. Management of the Laboring Women with Congential Heart Disease
Mark Rollins M.D., Ph.D.

9:00 – 9:15 a.m. Panel Discussion

9:15 – 10:00 a.m. Coffee Break

Session II: Patient Advocacy and OR Management
Moderator: Barbra Sacvone, M.D.

10:00 – 10:30 a.m. Advocacy - How Legislators and Regulators Affect our Specialty
Mark Zakowski, M.D.

10:30 – 11:00 a.m. Is it Possible to Predict How Long a Surgical Case Will Last?
Alex Macario, M.D., M.B.A.

11:00 – 11:30 a.m. Patient Satisfaction and the HCAHPS Survey as Measures of Quality of Care
Alex Macario, M.D., M.B.A.

11:30 – 11:45 a.m. Panel Discussion

11:45 – 1:00 p.m. Hosted Lunch

Session III: Obstetrical Hemorrhage Update
Moderator: Brendan Carvalho, M.B., B.Ch., FRCA

1:00 – 1:30 p.m. Obstetrical Hemorrhage-CMQCC
Mark Zakowski, M.D.

1:30 – 2:00 p.m. Obstetric Hemorrhage Protocols
Barbra Sacvone, M.D.

2:00 – 2:30 p.m. Advances in Pharmacological Management of Hemorrhage
John Sullivan, M.D.

2:30 – 2:45 p.m. Panel Discussion

2:45 – 3:30 p.m. Coffee Break

Session IV: New Techniques in Obstetric Anesthesia
Moderator: Kenneth Nelson, M.D.

3:30 – 4:00 p.m. Neuraxial Ultrasound: Time to Learn and Not Get Left Behind
Brendan Carvalho, M.B., B.Ch., FRCA

4:00 – 4:30 p.m. An Update on PIEB for Labor Analgesia
Robert D’Angelo, M.D.

4:30 – 5:00 p.m. Paramedian Lumbar Epidural Technique: Why You Should Adopt It
Jeremy Collins, M.D. FRCA, M.B., Ch.B.

5:00 – 5:15 p.m. Panel Discussion

5:30 – 7:00 p.m. Reception

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**Session V: Obstetric Anesthesia Safety Session 1**
Moderator: Manuel Vallejo, Jr., M.D., D.M.D.

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<tr>
<td>7:30 – 8:00 a.m.</td>
<td>Safety in Obstetric Anesthesia</td>
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<td>Philip Hess, M.D.</td>
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<td>8:00 – 8:30 a.m.</td>
<td>Obstetric Anesthesia and Psychiatric Outcomes</td>
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<td>John Sullivan, M.D.</td>
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<tr>
<td>8:30 – 9:00 a.m.</td>
<td>Physicians Wellness</td>
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<td>Manuel Vallejo, Jr., M.D., D.M.D.</td>
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<tr>
<td>9:00 – 9:15 a.m.</td>
<td>Panel Discussion</td>
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<td>9:15 – 10:00 a.m.</td>
<td>Coffee Break</td>
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**Session VI: New Approaches for Learning Obstetric Anesthesia and Review of Last Years Best Articles**
Moderator: John Sullivan, M.D.

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<td>10:00 – 10:30 a.m.</td>
<td>New Approaches and Resources for Learning and Teaching</td>
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<td>Obstetric Anesthesia</td>
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<td>Lawrence Chu, M.D., M.S.</td>
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<tr>
<td>10:30 – 11:30 a.m.</td>
<td>Ostheimer Lecture</td>
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<td>Philip Hess, M.D.</td>
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<td>11:30 – 11:45 a.m.</td>
<td>Panel Discussion</td>
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<td>11:45 – 1:00 p.m.</td>
<td>Lunch on your own</td>
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**Session VII: New Ways in Obstetrical Practice**
Moderator: Robert Gaiser, M.D.

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<tr>
<th>Time</th>
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<tr>
<td>1:00 – 1:30 p.m.</td>
<td>Is it Time to Abandon LUD?</td>
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<td></td>
<td>Kenneth Nelson, M.D.</td>
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<tr>
<td>1:30 – 2:00 p.m.</td>
<td>Optimal Anesthesia Approach to External Cephalic Version</td>
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<td>John Sullivan, M.D.</td>
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<td>2:00 – 2:30 p.m.</td>
<td>Controversies in Obstetric Anesthesia</td>
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<td>Jennifer Lucero, M.D.</td>
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<td>2:30 – 2:45 p.m.</td>
<td>Panel Discussion</td>
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<td>2:45 – 3:30 p.m.</td>
<td>Coffee Break</td>
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**Session VIII: Maternal Morbidity and Rare Disease**
Moderator: Robert D’Angelo, M.D.

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<tr>
<td>3:30 – 4:00 p.m.</td>
<td>Zika and Other Viruses in Obstetric Anesthesia</td>
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<td>Robert Gaiser, M.D.</td>
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<td>4:00 – 4:30 p.m.</td>
<td>Maternal Morbidity and Mortality</td>
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<td>Barbra Scavone, M.D.</td>
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<td>4:30 – 5:00 p.m.</td>
<td>SCORE Project II</td>
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<td>Robert D’Angelo, M.D.</td>
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<td>5:00 – 5:15 p.m.</td>
<td>Panel Discussion</td>
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### Sunday, March 5, 2017

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<th>Time</th>
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<tr>
<td>6:30 – 7:30 a.m.</td>
<td>Registration and Continental Breakfast</td>
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**Session IX: Breastfeeding and Neonatal Concerns**
Moderator: Alexander Butwick, M.B.B.S., FRCA, M.S.

<table>
<thead>
<tr>
<th>Time</th>
<th>Session/Activity</th>
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<tbody>
<tr>
<td>7:30 – 8:00 a.m.</td>
<td>What's New in Neonatal Resuscitation</td>
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<td>Robert Gaiser, M.D.</td>
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<tr>
<td>8:00 – 8:30 a.m.</td>
<td>Pregnancy and the Implications of HLA Alloimmunization</td>
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<td>Neil Ray, M.D.</td>
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<tr>
<td>8:30 – 9:00 a.m.</td>
<td>Baby Friendly Practices and Immediate Skin-to-Skin Contact</td>
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<td>Andrea Traynor, M.D.</td>
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<tr>
<td>9:00 – 9:15 a.m.</td>
<td>Panel Discussion</td>
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<tr>
<td>9:15 – 10:00 a.m.</td>
<td>Coffee Break</td>
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</table>

**Session X: Anesthesia Safety Session 2**
Moderator: Manuel Vallejo, Jr., M.D., D.M.D.

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<tr>
<th>Time</th>
<th>Session/Activity</th>
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<tbody>
<tr>
<td>10:00 – 10:30 a.m.</td>
<td>Enhanced Recovery After Surgery (ERAS) for Cesarean Delivery</td>
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<td>Mark Rollins, M.D., Ph.D.</td>
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<tr>
<td>10:30 – 11:00 a.m.</td>
<td>New VTE Bundles in OB: How Will This Affect OB Anesthesia</td>
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<td></td>
<td>Alexander Butwick, M.B.B.S., FRCA, M.S.</td>
</tr>
<tr>
<td>11:00 – 11:30 a.m.</td>
<td>The Continued Learning Environment</td>
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<td></td>
<td>Manuel Vallejo, Jr., M.D., D.M.D.</td>
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<tr>
<td>11:30 – 11:45 a.m.</td>
<td>Panel Discussion</td>
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<tr>
<td>12:00 p.m.</td>
<td>Adjourn</td>
</tr>
</tbody>
</table>

* Opportunities for Q&A will be provided at the conclusion of each presentation
Session I: Vasopressors and Cardiac Disease in Pregnancy
Moderator: Manuel Vallejo, Jr., M.D., D.M.D.

Vasopressor Choices for Treating Spinal Hypotension
Kenneth Nelson, M.D.

The Parturient with Complex Congenital Heart Disease: Understanding Fontan Circulation
Neil Ray, M.D.

Management of the Laboring Women with Congenital Heart Disease
Mark Rollins M.D., Ph.D.
Vasopressor Choices for Treating Spinal Hypotension

Kenneth E Nelson, M.D.

Disclosures

none.

Spinal Hypotension

“disturbing but not dangerous”

“...the incidence of major complications from hypotension... is almost nonexistent”


“Holy Grail” of Obstetric Anesthesia

Hypotension - Morbidity and Mortality

- Maternal deaths
- Neonatal acidosis
- Lower Apgar scores
- Interference with surgical procedure

Datta et al. Anesthesiology. 1982 Jan;56(1):68-70
“Big Little Problem”

“... some vasoactive drugs such as phenylephrine and high dose dopamine ideally are avoided in the pregnant patient....”

Ch 16, p.284

“Ephedrine is the preferred vasopressor for the prophylaxis or treatment of most cases of hypotension in obstetric anesthesia practice.”

Ch 25, p.463
Survey of UK practice, 2001

<table>
<thead>
<tr>
<th>Vasopressor</th>
<th>Usage, %</th>
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<tbody>
<tr>
<td>Ephedrine</td>
<td>95.2</td>
</tr>
<tr>
<td>Phenylephrine</td>
<td>0.4</td>
</tr>
<tr>
<td>Methoxamine</td>
<td>0.4</td>
</tr>
<tr>
<td>Multiple</td>
<td>3.4</td>
</tr>
<tr>
<td>Unspecified</td>
<td>0.7</td>
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</table>

Anaesthesia 2001; 56:794-8

The Treatment Should not be Worse Than the Disease

“I contend that using a phenylephrine infusion to prevent hypotension during routine cesarean delivery is too aggressive and not safe…”

Bellin Y. Anesthesiology. 2006 Jun;104(6):1348-9

Why was phenylephrine blacklisted?

- Early studies on vasopressors done in pregnant ewes
- Poorer outcomes with direct α-agonists
- Blamed on disproportionate vasoconstriction of uteroplacental blood flow

James, FM III et al. Anesthesiology 1970; 33:25-34

Burden of Proof

- Reasons phenylephrine infusions are not being rapidly adopted into practice
  - “burden of proof” is on the new therapy
  - This is not “life or death” and ephedrine works “OK”
  - Infusions require more effort
  - Evidence is in healthy pts only (what about PreE?)

Smiley RM. Anesthesiology. 2009; 111(3):470-2

Big Little Problem

- Dozens, perhaps hundreds of references
- Many versions of this lecture could exist
Warwick Ngan Kee  
BH8, MB ChB, MD, FANZCA, FHKCA, FHKAM

Rich Smiley, M.D., Ph.D.

Thank You!

Early phenylephrine studies

• 137 elective C/S under epidural anesthesia
• Ephedrine 5 mg increments, or
• Phenylephrine 100 mcg increments


Early phenylephrine studies

• Impedance cardiography
  – Maternal EF, SV, EDV
• Neonatal umbilical venous and arterial PO2, PCO2, pH, base excess, lactate, pyruvate, excess lactate, and L/P ratio

Early phenylephrine studies

- Both ephedrine and phenylephrine increased cardiac preload
- Transient maternal hypotension did not affect fetal acid base status
- Phenylephrine does not cause fetal acidosis


Early phenylephrine studies

2002 Meta-analysis

- Seven RCTs identified (n=292)
- Outcomes assessed:
  - Maternal hypotension
  - Maternal hypertension and bradycardia
  - Neonatal Apgar scores
  - Neonatal umbilical cord pH


Early phenylephrine studies

2002 Meta-analysis

- No differences between phenylephrine and ephedrine:
  - Maternal hypotension
  - Maternal hypertension
  - Neonatal Apgar scores
- More maternal bradycardia with phenylephrine
- Lower umbilical arterial pH with ephedrine


Early phenylephrine studies

2012 Meta-analysis


2012 Meta-analysis


Figure 1. Meta-analysis of trials. The effect of phenylephrine versus ephedrine on umbilical cord arterial blood pH. Dots are mean difference with 95% confidence intervals.
Now that we know **phenylephrine** is the vasopressor of choice, how do we best use it?

**Bolus vs Infusion**
- Bolus is simpler
- Infusion requires:
  - Infusion pump
  - Administration set
  - Setup beforehand
  - Drug mixture in bag

**Bolus Dosing**
- Prior to 2008, several articles made suggestions of bolus dosing in the 20 ug-100 ug range, but no dose-response study

**Bolus Dosing**
- ED95 determination
- 50 elective cesarean deliveries
- Spinal anesthesia:
  - 12 mg 0.75% hyperbaric bupivacaine
  - 10 mcg fentanyl
  - 100 mcg morphine

**Bolus Dosing**
- Double-blinded up-down sequential allocation
- Starting dose 40 ug
- Dose increments 10 ug
- First dose immediately after spinal
- Subsequent doses when SBP < baseline

**Bolus Dosing**
- Fig. 1: Doses of phenylephrine and responses

Bolus Dosing

- ED95 = 159 ug
- Highest dose given = 120 ug
- ED90 = 100 ug


Bolus Dosing

- 184 elective cesarean deliveries
- CSE in lateral decubitus position
- Spinal:
  - 7 mg 0.5% hyperbaric bupivacaine
  - 15 mcg fentanyl


Bolus Dosing

- Patients randomly allocated to:
  - Saline (control)
  - Phenylephrine 1.0 mcg/kg
  - Phenylephrine 1.5 mcg/kg
  - Phenylephrine 2.0 mcg/kg
- First dose at spinal injection
- Rescue doses 100 mcg q1min


Bolus Dosing

- Phenylephrine 1.5 mcg/kg and 2.0 mcg/kg reduced the incidence of hypotension but 1.0 mcg/kg did not


Infusion dosing
**Infusion dosing**

**Bolus vs Infusion**

- 60 cesarean deliveries
- Spinal anesthetic
  - 13.5 mg hyperbaric bupivacaine
  - 10 mcg fentanyl
  - 100 mcg morphine
- Double blinded, randomized
  - 120 mcg intermittent bolus
  - 120 mcg/min infusion


**Bolus vs Infusion**

- Bioreactance CO measurements
- Other routine maternal VS
- Maternal side effects
- Neonatal outcomes


**Bolus vs Infusion**

- No difference:
  - Maternal cardiac output
  - Maternal nausea/vomiting
  - Neonatal outcomes


**Bolus vs Infusion**

- Only difference:
  - Maternal hypotension within first 6 minutes
    - (Higher in the infusion group (P=0.007))
Bolus vs Infusion

- Keep in mind the differences between study designs and clinical practice

Infusion

Closed-loop computer control

- Computer control vs manual control of infusion
- Phenylephrine 100 μg/min at spinal injection
- NIBP q1min to control computer algorithm

- Percentage SBP within 20% of baseline:
  - Computer control: 97%
  - Manual control: 95%

Dosing Recommendations (infusion)

<table>
<thead>
<tr>
<th>Dosing Regimen</th>
<th>Phenylephrine</th>
<th>Norepinephrine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infusion</td>
<td>100 μg/min</td>
<td>5 mcg/ml</td>
</tr>
<tr>
<td>Bolus</td>
<td>150 mg</td>
<td>100 mg</td>
</tr>
</tbody>
</table>


Dosing Recommendations (bolus)

- Calculated ED95 = 159 mcg (ED90 = 100 ug)
- Start with 80 mcg – 100 mcg
- Use common sense
  - Maternal symptoms
  - Maternal heart rate
  - Be proactive, not reactive
  - Use ephedrine when needed
  - Modify for disease states (Pre-E, heart disease)

Norepinephrine

- 104 elective cesarean deliveries
- Spinal anesthesia
  - 11 mg hyperbaric bupivacaine
  - 15 mg fentanyl
- Randomized, double-blinded infusions:
  - Norepinephrine 5 mcg/ml
  - Phenylephrine 100 mcg/ml
- Infusions computer controlled

Ngan Kee et al. Anesthesiology. 2015;122(4):736-45
Norepinephrine

- Both infusions were effective for maternal BP
- Norepinephrine:
  - Greater CO
  - Greater HR

“It’s like phenylephrine without the bradycardia”

Ngan Kee et al. Anesthesiology. 2015;122(4):736-45

Norepinephrine

- 85 elective cesarean deliveries
- Spinal anesthesia
  - 12-15 mg hyperbaric bupivacaine
  - 20 mcg fentanyl
  - 200 mcg morphine
- Randomized to:
  - Phenylephrine 0.1 mcg/kg/min
  - Norepinephrine 0.05 mcg/kg/min
- Infusion fixed-rate


Norepinephrine

- No difference in maternal hemodynamics
- No difference in rescue doses
- No difference in neonatal outcomes
- More ephedrine used in phenylephrine group
- More emesis in phenylephrine group


Norepinephrine

- “Perfect is the enemy of good”
- Data are still too limited
- Clinical significance of CO difference?
- PIV – extravasation issue

Summary

- Phenylephrine is IN
  - Maternal bradycardia is still a problem
- Ephedrine is OUT (albeit not completely)
- Phenylephrine infusions are IN
- Phenylephrine bolusing is OK
  - Depends on your work environment
- Norepinephrine might have a future
  - Stay tuned
Complex Congenital Heart Disease and the Parturient

Neil P. Ray, M.D.
March 3, 2017

Who takes care of the pregnant congenital heart disease patients in your group?
- General Anesthesiologists?
- OB Anesthesiologists?
- Pediatric Anesthesiologists?
- Cardiac Anesthesiologists?
- Pediatric Cardiac Anesthesiologists?

Complex Congenital Heart Disease
- Congenital Heart Disease (CHD) is the most common group of birth defects
- 8/1000 lives births will have a congenital heart defect
- Simple CHD defects are MVP, ASD, VSD and bicuspid aortic values
- Excluding simple defects, only 5-10% of children with CHD will survive into adulthood without surgery
- With surgery, 90+% are surviving into adulthood

Adults with Congenital Heart Disease (CHD)
- 1 Million+ adults now are living with CHD
- There are more adults than children with CHD
- Anesthesiologists are more likely to take care of an adult with CHD than a patient with MH
- Children’s hospitals have dedicated teams to care for these patients
- Most adult hospitals do not have a system in place to care for these patients.

Objectives
- Discuss transposition of great vessels and associated surgical repairs
- Discuss single ventricle lesions and the Fontan pathway
- Review the updated AHA SBE prophylaxis guidelines
- Introduce the perioperative issues with these patients and anesthetic considerations

Financial Disclosures
- Co-Founder and Equity Holder
  Raydiant Oximetry, Inc.
Transposition of the Great Vessels (TGV)

Surgical Options for TGV

- **Correction at the atrial level**
  - Senning Procedure (1957)
  - Mustard Procedure (1963)
- **Correction at the ventricle level**
  - Rastelli Procedure (1969)
- **Correction at the arterial level**
  - Jantene (Switch) Procedure (1985)

Mustard and Senning

- Right ventricle supports systemic circulation
- SVC and IVC will drain into the LA
- Pulmonary veins will drain into the RA

Rastelli Procedure

- LV output is baffled via VSD to aorta
- RV output is externally baffled to PA
- Left ventricle supports systemic circulation

Jantene (Arterial Switch)

- Aorta and PA are switched while the coronary arteries are reimplanted
- Requires circulatory arrest and technically difficult
- Most physiological repair for TGV

Post Operative Complications

- **Mustard and Senning Procedure**
  - Right heart failure from systemic circulation
  - Atrial and ventricular arrhythmias
- **Rastelli Procedure**
  - Residual VSD
  - Conduit obstruction and thrombosis
  - Ventricular arrhythmias
- **Arterial Switch**
  - Aortic and pulmonic valve stenosis
  - Premature coronary artery disease
Hypoplastic Left Heart Syndrome (HLHS)

- Systemic circulation is PDA dependent
- Systemic circulation and pulmonary circulation are from the same source
- Too much blood flow to the lungs will decrease blood availability for systemic circulation

Blood Flow in HLHS

- Coronary blood flow is limited to diastolic run off from PDA
- Too much blood flow to the lungs will result in coronary ischemia

Coronary Blood Flow in HLHS

Medical Management at Birth for HLHS

- IV prostaglandin E infusion to keep PDA patent
- FiO2 of 16-21% for a SpO2 of 75% and Qp/Qs=1
- PaCO2 of 50-55 increase PVR and decrease Qp
- HCT of 50 to maximize O2 content in blood
- TPN to minimize blood flow to GI tract
- Diuretics to combat pulmonary edema
- Stent can be placed in PDA and PA's banned to limit pulmonary blood flow

Goals of Surgery

- Separate pulmonary circulation from systemic circulation
- Get blood to flow into the lungs at a time when PVR is relatively high
- Utilize the existing RV to support systemic circulation

Pulmonary Blood Flow in HLHS

Qp/Qs = 1
SpO2 = 75%
Stage 1 Norwood Repair for HLHS
- Aorta baffled from RV
- PDA ligated
- Atrial Septostomy
- Right Subclavian artery is connected to pulmonary artery to blood flow into the lungs (BT shunt)

Stage 2 Glenn Repair for HLHS
- Performed at 6-12 months
- As lungs mature and grow, PVR decreases
- BT Shunt is removed and SVC is anastomosed to the PA

Stage 3 Fontan Repair for HLHS
- Performed at 3-5 years of age
- IVC is baffled to the PA
- Fenestration created as "pop-off" value in case PVR rises

Additional Indications for a Fontan
- Tricuspid Atresia
- Pulmonary Atresia
- Severe TOF
- 10 year survival is 85%
- 20 year survival is 80%

Perioperative Considerations for Fontans
- Extreme perioperative anxiety
- Inhalation induction for IV placement
- Paradoxical VAE
- Antibodies with the type and screen
- Anticoagulation usage
- Interrogation of AICD
- Opioid tolerance and allodynia
- SBE prophylaxis

Revised AHA Guidelines SBE Prophylaxis 2007
- Patients with a history of endocarditis
- Unrepaired cyanotic CHD
- Repaired CHD with shunts, conduits, prosthetic material, devices and residual defects.

SCIP recommends antibiotics to be started 60 minutes before incision.

SBE prophylaxis requires that antibiotics must be completed 30-60 minutes before incision (Vancomycin).
The care for adults with CHD is complex and evolving.

There is a shortage of anesthesiologists and cardiologists to care for these patients.

The parturient with CHD has additional considerations which will be discussed next.

Final Thoughts

- The care for adults with CHD is complex and evolving.
- There is a shortage of anesthesiologists and cardiologists to care for these patients.
- The parturient with CHD has additional considerations which will be discussed next.

Thank you!
Objectives

1) Morbidity and mortality associated with maternal cardiac disease
2) Implications of labor & delivery on congenital cardiac lesions
3) Review general principles of management

Table 2. Worldwide prevalence at birth (per 1000 live births) of the most common types of congenital heart disease

<table>
<thead>
<tr>
<th>Subtype</th>
<th>Prevalence</th>
<th>95% Confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ventricular septal defect</td>
<td>2.62</td>
<td>2.59-2.65</td>
</tr>
<tr>
<td>Atrial septal defect</td>
<td>1.64</td>
<td>1.61-1.67</td>
</tr>
<tr>
<td>Patent ductus arteriosus</td>
<td>0.87</td>
<td>0.83-0.91</td>
</tr>
<tr>
<td>Pulmonary stenosis</td>
<td>0.50</td>
<td>0.48-0.52</td>
</tr>
<tr>
<td>Tetralogy of fallot</td>
<td>0.34</td>
<td>0.31-0.37</td>
</tr>
<tr>
<td>Coarctation of the aorta</td>
<td>0.34</td>
<td>0.32-0.36</td>
</tr>
<tr>
<td>Transposition of great arteries</td>
<td>0.31</td>
<td>0.28-0.34</td>
</tr>
<tr>
<td>Aortic stenosis</td>
<td>0.22</td>
<td>0.20-0.24</td>
</tr>
<tr>
<td>Ventricular septal defect</td>
<td>2.62</td>
<td>2.59-2.65</td>
</tr>
</tbody>
</table>

Hemodynamic Changes

No Disclosures
Labor & Delivery Considerations

- Increases in circulation volume with contractions and after delivery
- Pain & anxiety my significantly increase heart rate and blood pressure
- Changes in oxygen demand
- Changes in PaCO$_2$ levels
- Changes in clotting factors
- Fluid mobilization in post partum period

Maternal Cardiovascular Complications

<table>
<thead>
<tr>
<th>ZAHARA Risk Score:</th>
<th>Cardiac Event:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Prior arrhythmia</td>
<td>&lt; 0.5 points - 3%</td>
</tr>
<tr>
<td>1.50</td>
<td>0.50 - 1.50 points - 7.5%</td>
</tr>
<tr>
<td>• NYHA functional class III / IV</td>
<td>1.51 - 2.50 points - 17.6%</td>
</tr>
<tr>
<td>0.75</td>
<td>2.51 - 3.50 points - 43%</td>
</tr>
<tr>
<td>• Left heart obstruction</td>
<td>&gt; 3.50 points - 70%</td>
</tr>
<tr>
<td>2.50</td>
<td>(LVOT peak &gt; 50 mmHg)</td>
</tr>
<tr>
<td>• Mitral valve area &lt; 1 cm$^2$</td>
<td>(AV area &lt; 1 cm$^2$)</td>
</tr>
<tr>
<td>4.25</td>
<td>Mechanical valve prosthesis</td>
</tr>
<tr>
<td>• Systemic AV valve regurgitation</td>
<td>0.75</td>
</tr>
<tr>
<td>0.75</td>
<td>Pulmonary AV valve regurgitation</td>
</tr>
<tr>
<td>• Cardiac medication before pregnancy</td>
<td>1.50</td>
</tr>
<tr>
<td>1.00</td>
<td>Cyanotic heart disease</td>
</tr>
</tbody>
</table>

Types of Congenital Heart Disease

- Mild: Small ventricular septal defect
- Moderate: Large aortic stenosis
- Severe: Hypoplastic right and left sides of heart

Maternal Cardiovascular Complications

CARPREG Risk Score:

1. Left ventricular (LV) systolic dysfunction (EF < 40%)
2. Left heart obstruction:
   - Mitral valve area < 2 cm$^2$
   - Aortic valve area < 1.5 cm$^2$
   - Peak LV outflow gradient > 30 mm Hg
3. Previous cardiac event:
   - Clinical heart failure
   - Transient ischemic attack
   - Arhythmia
   - Stroke
4. NYHA function class > 2 or cyanosis (SO$_2$ < 90%)

<table>
<thead>
<tr>
<th>WHO classification of risk of pregnancy in selected disease</th>
<th>CARPREG</th>
<th>ZAHARA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild: Aortic valve stenosis</td>
<td>Moderate: Mitral valve stenosis</td>
<td>Severe: Eisenmenger syndrome</td>
</tr>
<tr>
<td>Moderate: Pulmonary valve stenosis</td>
<td>Severe: Severe aortic stenosis</td>
<td></td>
</tr>
<tr>
<td>Severe: Transposition of the great arteries</td>
<td>Severe: Hypoplastic left heart syndrome</td>
<td></td>
</tr>
</tbody>
</table>

Distribution of cardiovascular and offspring events by primary type of congenital heart disease in 213 completed pregnancies

- Atrial septal defects
- Ventricular septal defects
- Aortic coarctation
- Ebstein anomaly
- Connective tissue disorders
- Tetralogy of Fallot
- Other corrected complex cyanotic heart defects

Values are number of pregnancies.

Table 3

- Mild: Aortic stenosis resulting from bicuspid aortic valve
- Moderate: Moderate aortic stenosis
- Severe: Severe aortic stenosis
- Eisenmenger syndrome

Figure 1

CARPREG: 2 points – >1% chance of cardiac event
CARPREG: ≥1 point – 27% chance of cardiac event
CARPREG: 0 points – 5% chance of cardiac event

CARPREG Risk Score

CARPREG: 2 points – >70% chance of cardiac event
CARPREG: ≥1 point – 27% chance of cardiac event
CARPREG: 0 points – 5% chance of cardiac event

CARPREG: 2 points – >70% chance of cardiac event
CARPREG: ≥1 point – 27% chance of cardiac event
CARPREG: 0 points – 5% chance of cardiac event
Cardiac Events by Lesion

Maternal Cardiovascular Complications
- Heart Failure
- Arrhythmias
- Endocarditis
- Pulmonary Hypertension
- Thromboembolic Events

Multidisciplinary Approach is Key to Optimizing Outcomes
- Obstetrician / MFM
- Anesthesiologist
- Labor Nurses
- Critical Care
- Adult / Pediatric Cardiologist
- Neonatology
- CT Surgery
- Other Specialties

The problem with communication...is the illusion that it has been accomplished.
George Bernard Shaw

High Risk
Pregnancy Contraindicated
- Eisenmenger syndrome
- Transposition of the great arteries, systemic RV with moderate dysfunction and/or severe tricuspid regurgitation
- Univentricular heart with or without Fontan palliation and any of the following:
  - Decreased ventricular function
  - Moderate to severe atroventricular valve regurgitation
  - Cyanosis
  - Protein-losing enteropathy
- Ehlers-Danlos type IV (high risk aortic dissection)
- Coarctation of the aorta, repaired or unrepaired, with significant obstruction
- Turner syndrome with dilated aorta (>27 mm²)
- Current or prior type B aortic dissection
- Heart failure of any cause with functional class III or IV

Abbreviation:
RV, right ventricle.

Atrial Septal Defect
Figures in public domain. Credited to Centers for Disease Control and Prevention, National Center on Birth Defects and Developmental Disabilities.

Atrial Septal Defect

- Echocardiography and assess PA pressures
- Maintain preload
- No bubbles in venous lines
- Complications
  - SVT and ventricular arrhythmias
  - Preeclampsia
  - Small for gestational age infant
  - Increased fetal mortality
  - Paradoxical embolism

Tetralogy of Fallot

- Echocardiography
  - Residual PV insufficiency
  - RV dilation dysfunction
- Pregnancy well tolerated unless:
  - Pulmonary HTN
  - RV Dilation
  - PV regurgitation
  - Paradoxical embolism
- Maintain preload & avoid decrease in SVR
- Complications
  - Atrial and ventricular arrhythmias
  - R-sided heart failure

Antepartum

- Refer to multidisciplinary high risk specialists
- Cardiac assessment (ECG and echocardiography)
- Optimize volume status
- Consider thromboprophylaxis
- Fetal assessment

Practice Guidelines for Obstetric Anesthesia

An Updated Report by the American Society of Anesthesiologists Task Force on Obstetric Anesthesia and the Society for Obstetric Anesthesia and Perinatology®

- Recognition of significant anesthetic or obstetric risk factors should encourage consultation between the obstetrician and the anesthesiologist
- A communication system should be in place to encourage early and ongoing contact between obstetric providers, anesthesiologists, and other members of the multidisciplinary team
**Intrapartum**

- Possible need for ECMO or cardiac bypass?
- Thromboprophylaxis
- Endocarditis prophylaxis
- Neuraxial or other analgesia?
- Mode of delivery
- Postpartum hemorrhage planning
- Delivery location logistics

**Monitoring During Labor**

- Continuous telemetry (Hx of arrhythmias & ischemia)
- Defibrillator pads if risk for poorly tolerated arrhythmias
- Pulse-oximetry cyanotic heart disease
- A-line to monitor during hemodynamic changes
- CVP catheter in some for monitoring and vasoactive drugs
- PA catheter rarely used except titration of pulmonary agents
- Echocardiography if needed to evaluate cardiac performance during instability

**Delivery Planning**

- Assisted Second Stage
- Cesarean Delivery
- Neuraxial vs General

**Postpartum**

- Location of postpartum monitoring... ICU?
- Thromboprophylaxis
- Ambulation / compression stockings
- Continued cardiac monitoring
- Evaluation for PPH
- Follow-up Planning

**RECOGNITION & RESPONSE: Cesarean Delivery**

Women undergoing cesarean delivery should receive:

- Sequential compression devices perioperatively and postpartum
- Pharmacologic prophylaxis (LMWH or UFH) based on risk factors

An "opt-out" strategy where all women undergoing cesarean delivery receive prophylaxis with LMWH or UFH unless there is a specific contraindication is also an acceptable approach

<table>
<thead>
<tr>
<th>MAJOR RISK FACTORS</th>
<th>MINOR RISK FACTORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immobility (strict bed rest ≥1 week in the antepartum period)</td>
<td>BMI &gt;30 kg/m²</td>
</tr>
<tr>
<td>Postpartum hemorrhage ≥1000 mL with surgery</td>
<td>Multiple pregnancy</td>
</tr>
<tr>
<td>Previous STE</td>
<td>Emergency caesarean</td>
</tr>
<tr>
<td>Preeclampsia with fetal growth restriction</td>
<td>Smoking &gt;10 cigarettes/day</td>
</tr>
<tr>
<td>Thrombophilia</td>
<td>Fetal growth restriction</td>
</tr>
<tr>
<td>Antithrombin deficiency</td>
<td>Thrombophilia</td>
</tr>
<tr>
<td>Protein C deficiency</td>
<td>Protein S deficiency</td>
</tr>
<tr>
<td>Factor V Leiden (homozygous or heterozygous)</td>
<td>Prothrombin G20210A (homozygous or heterozygous)</td>
</tr>
<tr>
<td>Prothrombin G20210A (homozygous or heterozygous)</td>
<td>Medical conditions</td>
</tr>
<tr>
<td>Systemic Lupus erythematosus</td>
<td>Systemic lupus erythematosus</td>
</tr>
<tr>
<td>Heart disease</td>
<td>Heart disease</td>
</tr>
<tr>
<td>Sickle cell disease</td>
<td>Sickle cell disease</td>
</tr>
<tr>
<td>Blood transfusion</td>
<td>Blood transfusion</td>
</tr>
<tr>
<td>Postpartum infection</td>
<td>Postpartum infection</td>
</tr>
</tbody>
</table>
Practice Points

• Anesthesiologists should be involved early
• A multidisciplinary approach is key
• A clear management plan should be formulated
• Epidural analgesia is rarely contraindicated
• No evidence supports either general or regional anesthesia as superior for cesarean delivery
Session II: Patient Advocacy and OR Management
Moderator: Barbra Scavone, M.D.

Advocacy - How Legislators and Regulators Affect our Specialty
Mark Zakowski, M.D.

Is it Possible to Predict How Long a Surgical Case Will Last?
Alex Macario, M.D., M.B.A.

Patient Satisfaction and the HCAHPS Survey as Measures of Quality of Care
Alex Macario, M.D., M.B.A.
Advocacy:
How Legislators and Regulators Affect our Specialty

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President, Calif. Society Anesthesiologists
1st VP, SOAP
Associate Professor Anesthesiology, Adjunct, Charles Drew
University Medicine and Science Los Angeles

Conflict of Interest
- No financial disclosures
- Passionate
- Involved
- President California Society Anesthesiologists
- ASA OON task force member
- 1st VP SOAP

Advocacy

Practitioner Desires
- Help patients
- Good work environment
- Do a good job
- Minimizing ‘hassles’ and distractions from patient care

External Forces
- Regulatory
  - State – Dept. Public Health, DOI, DMHC
  - Federal – FDA, TJC, CMS
- Legislative ‘fixes’
  - State
  - National
- Insurance payments
  - Tied to metrics e.g. cesarean rate NTSV, PQRS, MACRA, MIPS, etc.

Medical Practices
- Best medical practices
- Pharmacology
- Physiology
- Good operating conditions
- Good pain relief
- Always aiming ‘sweet spot’
Patient Experience

The OB Patient Experience – A New Paradigm

Patient experience is the new Holy Grail. Just as patient satisfaction became king, women are no longer satisfied. Like any business, a positive customer experience leads to broader acceptance, repeat business, better word-of-mouth, and profit. Long ago, I incorpoated the "Baumman" aspects of running a busy medical practice. In the Baumman approach, the patient is satisfied not only in the clinical encounter but also in their chronic care management relationship. To thrive in 2017, we need to know now:

Wish I didn't need to define "immediate availability" in every environment! The need of change has accelerated and the days of paradigm have passed. The old paradigm has lost shareable growth, stake demand and left personal inconvenience limited competition and regulatory agencies.

"All politics is local"

– Speaker of the House, Tip O’Neil 1935
Moderate Sedation

- Not considered ‘anesthesia’
- Licensed medical professional
- Can be delegated/supervised
- ASA/CMS definition:
  - Purposeful response to verbal or tactile stimulation

Deep Sedation/General

ASA/CMS: deep sedation/general
- Continuum, rescue 1 deeper
- Qualified anesthesia provider CMS
  - Physician anesthesiologist
  - MD/DO non-anesthesiologist
  - DDS/OMFS/podiatrist – per state laws
  - CRNA
  - AA

Deep Sedation/General

- RN deep sedation
- RT deep sedation
- ER physicians
- Dentists/Oral Surgeon

- Procedure or Anesthesia
- Can you really focus on both?

Deep Sedation – other Physicians

- Non-anesthesiologist physicians **may neither delegate nor supervise** the administration or monitoring of deep sedation by individuals who are not themselves qualified and trained to administer deep sedation, and the recognition of and rescue from general anesthesia.

Advocacy

- Patients
- Hospital
- Professional Society
- State
- Federal
- Regulatory

Too Many Rules
OPR

Other Peoples’ Rules (OPR)

• Good intentions
• Hassle factor
• Multitasking
• Decreases patient safety

Systems Analysis

• Goal
• Risk/benefit/cost
• Hassle factor
• Focus factor

OPR

• Affects your daily lives
• Work flow
  – Ease
  – Time
• Income
  – Directly
  – Indirectly

Fundamentals

• Underfunding of Medi-Cal (Medicaid)
• Hospitals want 24x7 coverage L&D
• GAP resources vs. wants/needs/regulation

Bad Hospital Policy

Bad PR Hospital

1998 Northridge Hospital

Epidural denial leaves hospital at risk for lawsuits, bad publicity

Aug 1, 1998
Legislation-Policy-PR

Mus, however, agreed with attorney Kristine Moler: “I am more than understand the doctors’ problems, the issue from Mid-Cal are psychologically now. But the human factor is also significant. I don’t know if this is below the standard of care. But this doctor made a reasonable decision.” State officials are now investigating the hospital for possible regulatory violations.

Legislative ‘Fix’

Private vs. Public Sector

- Private health insurance
  - Employer
  - Individual purchase
- Government (public sector) provides
  - Medicare
  - Medicaid
- Different goals

Government = Public Sector

- High cost per capita
- Chronic illness
- Control costs
  - Rate setting
  - Regulation
  - Accountability controls
- Finance 47% of all births USA 2015

Private Sector - Contracting

- Basic principles
- Negotiate for services
- Free market forces
- Insurance company – profit/cost
- PPO vs. EPO
- Cost shifting
- Creates ‘narrow network’
### Out of Network

- National problem
- Insurance companies designate facility ‘in network’
- Physician care - not contracted
- OON or incorrectly termed ‘surprise bill’

### Out of Network

- Insurance companies created problem
- Now everybody’s problem
- NY OON – Fair Health Database
- California
  - AB533 2015 – OON=Medicare
  - AB72 2016 – OON= higher of 125% Medicare or average contracted rate

### Look Alike Med Errors

### Regulations

- Labeling syringes
- FDA requirement for labeling Drug bottles?
- DEA narcotic handling and documentation
- TJC oxygen risk assessment

- What is true cost of attempting zero errors?

### Ultimate Safe Car
DEA

- Hospital inspections
- Increased scrutiny
- Documentation
- Fines
  - MGH $2.3 million 2015

DEA

Epidural Connector

- Adverse events noted
- International standard proposed ISO 80369-6
  - Enteral
  - Epidural
  - Smaller diameter by 20% vs. IV

- True risk benefit systems analysis
  - Would color coding alone have worked?

Neuraxial Regulation

California Epidural Connector

- SB 158 Flores 2008 – implement Jan 2011
- AB 1867 Pan 2012 – implement Jan 2014
- AB 444 Gibson 2015 – implement Jan 2017
- Zakowski Dec 2016 – Letter CDPH
  - Implement late 2017
Epidural connect

Epidural Connector
- NRFit™
- Epidural hub
- Epidural infusion tubing
- Syringes
- Needles

Epidural connector
Implementation
- New spinal/epidural trays
- Syringes
- Needles
- Supply chain
- Hospital policies

Labeling Syringes
- Neuraxial tray
- Label syringes

ASA HOD 2010, reaffirmed 2015
- NACOR – 0/4 million
- Anesthesia Closed Claims project – 0 mislabel
- AIRS – 0/1,500 reported events

Are you ABA certified?
- Poll audience
### Are you ABA certified?

- Always Be Advocating

### Micro vs. Macro

- National Policy
- Top down vs. bottoms up

- Micro often determines Macro
  - What you do matters!
- Standard of Care vs. FDA

### Conclusion

- Advocacy matters
- Report issues to your state society
- ABA certified

### Advocacy
Is it possible to predict how long a surgical case will last?

Alex Macario MD, MBA
Professor
Department of Anesthesiology, Perioperative and Pain Medicine
Stanford University

To address chronic complaints about “OR inefficiency” due to inaccurate case scheduling, a hospital invests in a new information system to track case times.

However, after adoption of this new computer system, estimates of newly scheduled cases (using historical data of previous similar cases’ surgical times) do not increase accuracy of the OR schedule.

Learning objectives

• Another barrier to truth in scheduling is that the statistical distributions of case times are not bell (normal) shaped distributions
  • This right skewness, for example, complicates using the average of historical case durations because unusually long cases (outliers) have disproportionately large effect
  • Surgeon estimates of case duration may be consistently low if there is concern of not being able to get all cases booked within their allocated OR time

Disclosure

• Merck
• WebMD
• Pacira

Learning objectives

• Averaging historical data for case duration predictions often may not increase prediction accuracy for a variety of reasons including faulty input data such as:
  • The procedure the surgeon aims to do is not correctly entered
  • The electronic system may be using incision to close as the case duration instead of time from patient in the room to patient out of the room
  • If case durations for a surgeon performing a particular procedure vary a lot, then it is intrinsically difficult to make good predictions, no matter how many cases are analyzed

Faulty input data

• Same procedure posted under several different names
  – For example: laparoscopic chole, lap cholecystectomy, lap choly
  – Need standardized procedure dictionary
• Multiple procedures counted as one
  – Lap choly with appy, lap choly with liver bx, lap choly
• Procedures surgeons think they are booking versus what is actually being booked may not be the same
  – Office assistant needs to be trained
• The system may be using incision to close as the case duration instead of pt in room to pt out of room
  – Investigate to determine if this is happening
• If the booked procedure ends up not being done then the time duration should be assigned to procedure performed not what was booked
Case duration data for scheduled Whipple procedures

<table>
<thead>
<tr>
<th>Case duration (hrs)</th>
<th>1</th>
<th>1.5</th>
<th>2</th>
<th>2.5</th>
<th>3</th>
<th>3.5</th>
<th>4</th>
<th>4.5</th>
<th>5</th>
<th>5.5</th>
<th>6</th>
<th>6.5</th>
<th>7</th>
<th>7.5</th>
</tr>
</thead>
<tbody>
<tr>
<td># of cases</td>
<td>2</td>
<td></td>
<td>4</td>
<td></td>
<td>4</td>
<td></td>
<td>8</td>
<td></td>
<td>8</td>
<td></td>
<td>8</td>
<td></td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

Predicting case duration

- Some case durations are easier to predict
  - Specialties that operate on body surface or extremities, where operations are standardized
    - Hysterectomy, hernia repair, cystoscopy
- Other cases are difficult to predict
  - Complex, unstandardized surgery
    - Cancer surgery, major intra-abdominal, neuro
- Accuracy decreases the longer and longer cases are expected to be

Models to predict case duration

- Surgeon estimate
- Mean of historical case duration
- Use surgeon estimate in combination with historical data to create new estimate
- Adjust for case complexity
  - Simple, average, or complex

Prediction error =

the estimated duration of the new case minus
the actual duration of the new case

the magnitudes of the errors of the estimates

Accuracy also includes bias of the estimate

- Bias
  - Indicates whether the estimate is consistently too high or consistently too low
  - In some hospitals surgeons consistently shorten case duration estimates as they have too little OR time & need to “fit” their cases into OR time they have
  - Sometime, surgeons purposely overestimate case durations to keep control/access to their OR time so that if a new case appears their OR time was not given away

Who the surgeon is and what the surgical procedure is are the two most important determinants of surgical time
The skewness of statistical distributions of case times complicates just using the mean of historical case durations
Unusually long cases (outliers) have disproportionately large effect

Analyzing historical case duration data

- Median
  - decreases the impact of unusually long cases
- Trimmed mean
  - delete lower and upper 10% of the durations – take mean
- Geometric mean
  - sum the natural logs of case durations, divide by number of previous cases, and take exponential

When estimating a new case’s duration, the trimmed mean provides values similar to the sample mean,
because a majority of cases have fewer than 10 similar occurrences (of the same procedure by the same surgeon) in the recent past

Studies limit consideration to cases with historical data, and miss the broader problem of estimating case duration for cases for which there is little or no historical data.

Two facilities

<table>
<thead>
<tr>
<th></th>
<th>Hospital</th>
<th>ASC</th>
</tr>
</thead>
<tbody>
<tr>
<td># of cases</td>
<td>11,579</td>
<td>4,842</td>
</tr>
<tr>
<td># of procedures (CPT)</td>
<td>5,156</td>
<td>1,608</td>
</tr>
<tr>
<td># of surgeons</td>
<td>225</td>
<td>160</td>
</tr>
<tr>
<td>median case duration (hrs)</td>
<td>2.5</td>
<td>1.1</td>
</tr>
<tr>
<td>Unique combinations of procedure and surgeon</td>
<td>7,217</td>
<td>2,245</td>
</tr>
</tbody>
</table>
7,217 combinations of surgeon & procedure

- This is consistent with many hospitals having thousands of surgeon preference cards.
- Lumping together similar CPT codes is impractical, because procedures that differ only in the final (fifth) digit have different case times. For example, vitrectomy (67108) takes longer than scleral buckle (67107).
- Limiting consideration to primary CPT codes is impractical, because cases with the same primary CPT codes but different secondary CPT codes have different surgical complexity and case times.

Historical cases available for scheduling (outpatient center)

<table>
<thead>
<tr>
<th>Cases Available</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>No previous cases</td>
<td>28%</td>
</tr>
<tr>
<td>5 or more previous cases</td>
<td>48%</td>
</tr>
<tr>
<td>19 or more previous cases</td>
<td>28%</td>
</tr>
</tbody>
</table>

When no historical time data are available for a new case

Use
1) The surgeon’s prediction
Or
2) Mean of the durations of like cases (same scheduled procedure) performed by other surgeons. This is as accurate (unbiased and precise) a predictor as other, more sophisticated methods to analyze the data.

In order to have correct surgical equipment and supplies available for a surgery, procedure mnemonics are commonly assigned when the case is booked.

For example: ABGN8105, CHES7525

Although this may make sense for surgical trays, using those same codes for case scheduling does not make sense.

When no historical time data are available for a new case

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Although this may make sense for surgical trays, using those same codes for case scheduling does not make sense.

To lump or not to lump

Tension exists between lumping CPT procedures together to have enough cases to base a prediction versus not lumping procedures together and then having a huge number of different case types each with little or no historical data.

<table>
<thead>
<tr>
<th>Procedure mnemonic when booked</th>
<th>Surgical procedure actually performed</th>
<th>Preop diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABGN8105</td>
<td>Laparoscopic cholecystectomy</td>
<td>S/P kidney transplant, gallstones</td>
</tr>
<tr>
<td>ABGN8105</td>
<td>Laparoscopic cholecystectomy w/ intraop cholangiogram</td>
<td>Cholelithiasis</td>
</tr>
<tr>
<td>ABGN8105</td>
<td>Lap cho ky, umbilical hernia repair</td>
<td>Gallstones</td>
</tr>
<tr>
<td>ABGN8105</td>
<td>Laparoscopy, lysis of adhesions</td>
<td>Cholelithiasis</td>
</tr>
<tr>
<td>ABGN8105</td>
<td>Laparoscopy, biopsies of retroperitoneal mass</td>
<td>Abdominal mass</td>
</tr>
<tr>
<td>ABGN8105</td>
<td>Open cholecystectomy w/ IOC</td>
<td>Cholelithiasis</td>
</tr>
<tr>
<td>ABGN8105</td>
<td>Lap cho ky-converted to true cut biopsy of liver</td>
<td>Cholangitis, common bile duct stone</td>
</tr>
</tbody>
</table>
For example, “cystoscopy with bladder biopsy plus ureteroscopy/cystoscopy with retrograde pyelogram” is booked but only the first portion is completed.

There should be a retroactive process that adjusts the recorded descriptor for the surgery that was actually completed, not what was originally scheduled.

Please appreciate:

Even when many previous cases are available for estimating duration, cases still end late (or early) because of variability in surgical times.

For example, if the true median (SD) time for breast augmentation is 2.0 (0.7) hrs, then increasing the # of previous cases used to estimate the time of a future case may improve the accuracy of the estimate from 1.8 to 1.9 hrs.

This 0.1 hr improvement has little effect on on-time performance, relative to the impact of having a SD of 0.7 hrs.

It would be nice to have no uncertainty. But, it is present. The problem is looking for a single number. You won’t get accurate estimates by using historical case duration data. From the data you’ll get an assessment of the uncertainty.

Issue: If surgeons have to underestimate case durations to get onto the schedule, requiring that more accurate data be used may reduce revenue because fewer cases will get on elective schedule

Accept the uncertainty of case duration predictions, and manage the uncertainty

- Enhance the waiting experience
  - Improve the waiting area: coffee, wifi etc
  - “Airport” type monitors with schedule
  - Pagers
  - Patient Education
- Don’t have patients show up a fixed amount of time preop: can adjust time patients are called in based on analysis of that days schedule
  - For preceding cases with known duration then patients can show soon before their case

Take home messages

- Faulty scheduling input data needs to be fixed first
- Who the surgeon is and what the surgical procedure is are the two most important determinants of case duration
- The skewness of statistical distributions of case times complicates just using the mean of historical case durations
- Accept the uncertainty of case duration predictions, and manage the uncertainty
Learning objectives

- Definition of quality in anesthesia varies and depends on who the customer is (patients, surgeons, hospital, and government)
- Patient satisfaction has many confounding variables so may be difficult to detect changes in clinical quality by changes in patient satisfaction
- Assessing quality frequently is done with process measures, not necessarily outcomes important to patients

Quality: 3 perspectives

- Manufacturing (what was done to the patient?)
  - process oriented
  - following established procedures results in an exact controlled process (clinical pathway)
- Structural characteristics (what does the patient look like at hospital discharge?)
  - outcome oriented
  - how well product conforms to predetermined specifications
- Result (is the patient satisfied?)

Patient satisfaction measures

Quality = perception minus expectation

manage expectations to control quality
Patient satisfaction with anesthesia has confounders

- Environment of care
  - How nice is the physical plant?
- Affect of care
  - How friendly are the nurses?
- Flow and timing of care
  - Does the surgery start on time?
- Anxiety of patient preop and relief to be home after surgery
- Midazolam affects what patient remembers

Labor pain control is only mildly predictive of maternal satisfaction with childbirth

- Maternal satisfaction is often high regardless of labor pain scores
- Confounders include
  - 0-10 pain score measurement doesn’t properly capture dynamic, multidimensional and progressive nature of labor pain
  - Race and socio-economic level of parturient
  - Patient involvement in decision making
  - Peripartum support by family or others
  - Communication and relationships with caregivers
  - Robustness of coping skills
  - Self-efficacy: patient’s beliefs in their ability to accomplish a task

Need to probe data presented to you, to ask questions to ensure validity

Post-op phone call to patient:
How satisfied were you with your anesthesia services?
- Very good
- Good
- Average

Hospital Consumer Assessment of Healthcare Providers & Systems (HCAHPS)

- HCAHPS is the first national, standardized survey of patients’ perspectives of hospital care
- Public reporting of hospital scores began in 2008
- Since 2012, scores have played a role in hospital payment through the Hospital Value-Based Purchasing program
- 32-item survey instrument
- Survey is administered between 2 and 42 days after discharge to a random sample of adult patients
- Four administration modes: Mail, Telephone, Mixed (mail with telephone follow-up), & Interactive Voice Response
- About 4,000 hospitals participate in HCAHPS and >3 million patients complete the survey each year.
Value purchasing initiatives link patient satisfaction on HCAHPS with reimbursement

- However
  - Does catering to patient satisfaction have the unintended consequence of having health care providers offer unneeded care (lab tests, films, antibiotics, surgery?)
  - Reporting bias in that perhaps only a select group of patients (with either an extremely positive or negative experience) will complete survey
  - Clustering of scores at the high end: random variation may be more important than real differences
  - Can patients properly evaluate the quality of their medical care?
  - Can hospitals improve health care delivery based on results of patient surveys?
Consumer Assessment of Healthcare Providers and Systems Surgical Care Survey (Surgical CAHPS)

- ASA and American College of Surgeons helped develop
- Administered by the Agency for Healthcare Research and Quality
- Endorsed by the National Quality Forum
- 8 of 47 questions are in the anesthesiology section
- Future iterations of Surgical CAHPS should consider how to more accurately assess anesthesiology’s impact on patient experience

The Acronyms of Quality

- CMS
- ORYX
- SCIP
- PQRS
- CAHPS
- QCDR
- NQS
- NQI
- EPs
- MAV
- MIPS
- MACRA
Assessing quality frequently is done with process measures, not necessarily outcomes important to patients.

Surgical Care Improvement Project (SCIP) Measures (Chart Abstraction)

<table>
<thead>
<tr>
<th>Measure</th>
<th>FY 2017</th>
<th>FY 2018</th>
<th>FY 2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCIP INF-1 Prophylactic antibiotic received within one hour prior to surgery</td>
<td>voluntary</td>
<td>removed</td>
<td></td>
</tr>
<tr>
<td>SCIP INF-2 Prophylactic antibiotic selection for surgical pts</td>
<td>voluntary</td>
<td>removed</td>
<td></td>
</tr>
<tr>
<td>SCIP INF-3 Prophylactic antibiotics discontinued within 24 hours after surgery</td>
<td>removed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCIP INF-4 Cardiac surgery pts with controlled postoperative blood glucose</td>
<td>removed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCIP INF-5 Surgery Pts with Appropriate Hair Removal</td>
<td>removed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCIP INF-6 Urinary catheter removed on POD1 or POD2</td>
<td>removed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCIP Card-2 Surgery patients beta blockers</td>
<td>removed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCIP-VTE-2 Surgery Patients Who Received Appropriate VTE prophylaxis within 24 hrs</td>
<td>removed</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A Moving Target!

Problems with public reporting of quality measures

- Need standards on how accurate a measure needs to be before it is publicly reported or the hospital is paid for it
  - Chart review versus administrative data extraction studies shows inaccuracies
  - Need to establish rules on how to define and report quality measures
    - For example, incidence of deep venous thrombosis goes up if do routine ultrasound before discharge

Pay for quality has had limited success

- Economic incentive is not direct because casual pathway to an adverse event is complex and ambiguous
- Regulatory approach to reduce sentinel events needs to be reexamined
  - Superficial understanding of problem
  - Need pilot test to see what intervention to improve worked
  - Need reliable and valid measurement system

Three concepts

1. Our healthcare quality should be better
2. Federal government policy approach to improving quality has had a small impact
3. Intrinsic motivation by dedicated clinicians to improve the system of care has worked to improve safety and quality
Session III: Obstetrical Hemorrhage Update
Moderator: Brendan Carvalho, M.B., B.Ch., FRCA

Obstetrical Hemorrhage-CMQCC
Mark Zakowski, M.D.

Obstetric Hemorrhage Protocols
Barbra Sacvone, M.D.

Advances in Pharmacological Management of Hemorrhage
John Sullivan, M.D.
OB HEMORRHAGE UPDATE: CMQCC & 2017

Mark Zakowski, M.D.
Chief, Section of Obstetric Anesthesia
Director, Obstetric Anesthesiology Fellowship
Department of Anesthesiology
Cedars-Sinai Medical Center
Los Angeles CA 90048
Associate Prof, Adjunct, Charles Drew University

OB Hemorrhage Update 2017: Learning Objectives

• Recognize obstetric hemorrhage in the peripartum period.
• Understand assessments of patients for potential hemorrhage.
• Implement current hemorrhage therapies.
• Understand the role of communication in prevention, recognition and treatment of obstetric hemorrhage.

CMQCC V2

Update changes
• Active management 3rd stage labor
  – Oxytocin – no need to wait for cord clamping
• After 2 RBC – 1:1 FFP:RBC (debate 1:2 ratio)
• Optimize –
  – Calcium, acidosis, hypothermia
  – Factor VII has little support
• Support family needs

ACCME Disclosures

• No Financial Conflicts commercial products

Disclaimer:
• Passionate about Maternal and Baby well being
• Owner, Quantum Birthing LLC
OUTLINE

• Obstetric Hemorrhage
• Recognition
• Current treatment protocols
  • 2015 CMQCC
• Communication – keys to success
• Bonus section

OB Hemorrhage

Definition traditional
• > 500 mL vaginal
• >1000 mL cesarean

OB Hemorrhage

Incidence
• 3% all deliveries
• 1-2% life threatening
• Antepartum Hemorrhage stable
• Post Partum Hemorrhage (PPH) increasing
  – 30% increase 1994 to 2006
• Blood transfusion nearly doubled to 2005
  – 4.6/1000

Causes Major OB Hemorrhage

<table>
<thead>
<tr>
<th>Cause</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uterine atony</td>
<td>194</td>
</tr>
<tr>
<td>Retained placenta/membranes</td>
<td>61</td>
</tr>
<tr>
<td>Vaginal laceration/haematoma</td>
<td>53</td>
</tr>
<tr>
<td>Bleeding from uterine incision</td>
<td>62</td>
</tr>
<tr>
<td>Abruption</td>
<td>27</td>
</tr>
<tr>
<td>Placenta praevia</td>
<td>24</td>
</tr>
<tr>
<td>Cervical laceration</td>
<td>10</td>
</tr>
<tr>
<td>Morbidity adherent placenta</td>
<td>16</td>
</tr>
<tr>
<td>Broad ligament haematoma</td>
<td>8</td>
</tr>
</tbody>
</table>

OB Hemorrhage Morbidity

1998-2009, hospital deliveries
• Morbidity Increased 75% P<.05
  – 129/10,000 deliveries = 52,000/year USA
• Blood transfusion nearly tripled to 96/10,000 P<.05
• Hysterectomy increased 24% to 9.1/10,000, P<.05
• Morbidity increased 114% post-partum re-admit
  – 29/10,000 deliveries

-Scottish Confidential Audit Severe Maternal Morbidity July 2014
-CMQCC Hemorrhage Toolkit V2 2015
-Callaghan Obstet Gynecol 2012:120:1029-36
Maternal Mortality Hemorrhage

- #1 cause worldwide
- 15% maternal deaths USA
  - 1.8/100k (down from 2.6/100k)
- 70% deaths due to hemorrhage deemed potentially PREVENTABLE

Maternal Mortality

- Hemorrhage was #1 cause of maternal mortality
  - 33% (10/30) of all maternal mortalities
- SOAP Serious Complication Registry, 2004-2009
  - N=257,000 parturients who received anesthesia

Maternal Mortality Rates by Race/Ethnicity, California Residents: 1999-2010

- CMQCC.org

OB Hemorrhage Causes

- Uterine atony
- Retained placenta
- Placental abnormality
  - Previa
  - Abruption
  - Accreta/Increta/Percreta
- Surgical
  - Cervical/vaginal vault tear
  - Tear/suture cesarean
- Coagulopathy

-D’Angelo Anesthesiology 2014:120:1505-12
Uterine Atony
- Prolonged oxytocin >24 hr
  - Endogenous or exogenous
- Infection (Chorioamnionitis)
- Uterine abnormality
  - Fibroids
- Overdystension
  - Twins, polyhydramnios, macrosomia
- Medications
  - Magnesium, Ca++ channel blocker, potent inhaled anesthetics
- Multiparity

Coagulopathy
- Dilutional
- Amniotic Fluid Embolism
- Sepsis
- Shock
- DIC
- HELLP syndrome

OUTLINE
- Obstetric Hemorrhage
  - Recognition
  - Current treatment protocols
    - 2015 CMQCC v2 + 2017
  - Communication – keys to success
  - Bonus section

OB Hemorrhage 2017
- Definition
- Hemorrhage protocol
  - HR, BP predictive value <<<100%
- Equipment
  - Rapid transfuser
    - Intrauterine balloon (e.g. Bakri)
- Support services
  - Blood bank, IR
- Drills

OB Hemorrhage: Definition
Staged Blood Loss
- Stage 1
  - Blood loss >500 mL vaginal delivery
  - Blood loss >1000 mL cesarean
- Stage 2
  - Blood loss <1500 mL
- Stage 3
  - Blood loss > 1500 mL

OB Hemorrhage 2017
- Large degree of inaccuracy in EBL
- EBL is out – Quantitated Blood Loss is in!
- Graduated markings under buttock drapes
- Weigh sponges/laps
- Technology
Methods to Estimate Blood Loss

Quantifying blood loss by measuring
- Use graduated collection containers (C/S and vaginal deliveries)
- Account for other fluids (amniotic fluid, urine, irrigation)

Develop Training Tools:
Visual aids displayed in Labor & Delivery and/or Postpartum areas are guides for more accurate visual estimation (visual aids can be displayed discreetly for clinicians)

MOEW-Mat. OB Early Warning

<table>
<thead>
<tr>
<th>Vitals – Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blunt Trauma Need to operate/intervene</td>
</tr>
</tbody>
</table>


OUTLINE
- Obstetric Hemorrhage
- Recognition
- Current treatment protocols 2017
- Communication – keys to success
- Bonus section
Readiness

- Supplies
  - Hemorrhage cart
- Medications
- Response team
- Massive transfusion Protocol
  - Blood bank on board
- Team drills and debriefs

Recognition and Prevention

- Hemorrhage risk assessment
  - Admission
  - Prenatal
- QBL – quantitative blood loss measurements
- Third stage labor
  - Active management - oxytocin
  - Protocol

Response

- Obstetric Hemorrhage protocol
- Checklists
- Blood loss stage based management
  - Stage 1 – QBL>500 mL
  - Stage 2 - QBL 500-1500 mL
  - Stage 3 – QBL >1500 mL or unstable
- Psychological support
  - Families and Staff

Reporting and Systems Learning

- Multidisciplinary meetings
  - High risk patients pre-delivery
  - Post-event debriefs
- Multidisciplinary review serious hemorrhages
  - System issues
- Quality Improvement activities
  - Monitor outcomes and metrics

Active Management 3rd stage Labor

- Oxytocin after delivery infant – OLD
  - NEW- after delivery shoulder!
- Vigorous fundal massage
  - Continued (NEW)
- Decreased Post Partum Hemorrhage (PPH) - 60%
- Okay to use with Delayed Cord Clamping

Non-Blood Component

- Liberal Crystalloid/colloid, minimize blood – OLD
- Massive hemorrhage – transfuse blood early - NEW
- Minimize Crystalloid/colloid – NEW
- Crystalloid limit 3.5 L, 2L if blood available right away
- Crystalloid limit 2L, Colloid 1.5 L prior to blood

References:
- Prendiville Cochrane Database Syst Rev 2000;3:CD000007
- Hoffman AJOG 2006
- CMQCC Hemorrhage Toolkit V2- 2015
- Abdul-Kadir Transfusion 2014:54:1756-68
- Scottish Confidential Audit Severe Maternal Morbidity July 2014
Early FFP improves Mortality

- Prospective Observational Multicenter Major Trauma Transfusion study (PROMMTT), n=905, 25% mortality
- Within 6 hours:
  - FFP:RBC <1:2 => 3 times mortality
  - FFP:RBC 1.2-1 => OR 0.41 P<.001
  - FFP:RBC ≥1:1 => OR 0.23 P<.001

PROPPR Trial – Severe Trauma

- FFP:Plt:RBC 1:1:1 vs 1:1:2, RCT, Mortality
- No difference mortality
  - 24 hr 12.7% vs 17%
  - 30 d 22.4% vs 26.1%
- Exsanguination less 24 hr 9.2% vs 14.6% p=.03
- Hemostasis better 86% vs 78% p=.006

Stage 1: Bleeding

- QBL increased
  – >500 mL NSVD, >1000 mL CS
- Vital Signs >15% change
  – HR>110
  – SBP <85
- O2 Sat decreased, <95%
- PostDelivery increased bleeding

Stage 1: Actions

- Call for help –
  – OB, Anesthesiologist, Charge RN
- Activate OB Hemorrhage Protocol
- 2nd IV, fluids, Cross match, Uterotonics
- DDx – consider all options

Stage 2: Bleeding

- QBL <1500
- Continued bleeding
- Vital sign instability –
  – BP
  – Pulse
  – Respiration
Stage 2: Actions
- Additional uterotonic
- Labs, transfuse PRBC on clinical signs
  - Do NOT wait for labs
- FFP if >2 PRBC
- Rapid transfusion equipment helpful
- DDx
- If Vitals worse then expected - laparotomy

Stage 3: Actions
- Move to OR if not already there
- Surgical consult
- Massive transfusion protocol
- Additional lines
- Surgical treatment – hysterectomy should be considered

Stage 3: Bleeding
- QBL >1500 mL
- > 2 u PRBC given
- Unstable Vitals after stage 2 Rx
- DIC
- Rx, stabilize then transfer to ICU

Transfusion
- Based on clinical instability, bleeding
- Do NOT need to wait for labs - NEW
- Whole blood equivalent better - NEW
- PRBC:FFP:Platelets
  - 6:4:1 OR 4:4:1
- >10 PRBC et al – if fibrinogen <80 mg/dL, cryo will raise 80-100, need Rx if in DIC
  - rFactor VIIa use controversial

OB Hemorrhage 2017
- Repeat labs q30 min
- Monitor ionized Calcium
- Normothermia
  - 1°C --> 10% drop clotting factor activity
- Fibrinogen 100-125 mg/dL
  - Cryo 6-10 Unit needed if <100
- FFP:RBC 1:1 after 2nd RBC
- Platelets for stage 3 hemorrhage
### IV Gauge and Rapid Transfuser

<table>
<thead>
<tr>
<th>Gauge IV</th>
<th>Flow (gravity) mL/min</th>
<th>Flow (rapid transfuser) mL/min</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>65</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>140</td>
<td>250</td>
</tr>
<tr>
<td>16</td>
<td>190</td>
<td>350</td>
</tr>
<tr>
<td>14</td>
<td>300</td>
<td>500</td>
</tr>
<tr>
<td>14 + PRBC</td>
<td>15 min</td>
<td>6 min standard rapid transfuser</td>
</tr>
<tr>
<td>14 Central line</td>
<td>500-1000 mL/min (Belmont)</td>
<td></td>
</tr>
</tbody>
</table>

### Risk Factors Atony

- Prolonged 2nd stage
  - >3 hr aOR 2.3, p=.002
- Greater blood loss 600 vs 300 ml p=.001
- Higher maximum oxytocin infusion
- Longer duration oxytocin infusion
- Magnesium
- Episiotomy


### Risk Factors Atony

- What’s NOT on the list?

### Uterotonic Agents

- Oxytocin 10 U
- Methylergonovine 0.2 mg IM
- PGF₂α-carboprost 250 mcg IM/IU
  - Max 8 doses OR
- PGE₁-Misoprostol 800 mcg SL (New dose/route)

### OUTLINE

- Obstetric Hemorrhage
- Recognition
- Current treatment protocols 2014-15
- **Communication – keys to success**
- Bonus section
Communication

- TDC review closed claims
- OB/Anesthesiologist – EBL, instability, efficacy of Rx, need to change strategy
- Blood bank – urgency/quantity
- Help/equipment – Rapid Transfuser, Uterine balloon

Closed Claims OB Hemorrhage

- OB Hemorrhage DISPROPORTIONATE – 30% all hemorrhage claims vs 13% non-hemorrhage p<.001
- Mortality higher 77% vs 27% nonhemorrhage p<.001
- Anesthesia care issues 77% vs 27% P<.001
- Greater payout $600k vs $275k
- Delayed transfusion

Preventability Maternal Morbidity: Communication

Closed Claims: 60% communication lapses

Severe Maternal Morbidity

<table>
<thead>
<tr>
<th></th>
<th>Preventable</th>
<th>Improved care needed</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagnosis/Recognition</td>
<td>31%</td>
<td>23%</td>
<td>52%</td>
</tr>
<tr>
<td>Risk</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment</td>
<td>37%</td>
<td>35%</td>
<td>71%</td>
</tr>
<tr>
<td>Communication</td>
<td>25%</td>
<td>27%</td>
<td>44%</td>
</tr>
<tr>
<td>Policies/Procedures</td>
<td>28%</td>
<td>16%</td>
<td>44%</td>
</tr>
</tbody>
</table>

Communication Strategies

- “Open-air” commands - common error
  - Always direct to someone
- Close the loop – acknowledge
- Multidisciplinary Team Drills
- Leadership
  - Have clear leader of team

- Lofsky APSF Newsletter summer 2007
- Hasegawa J. BMJ Open 2016;6:e010304
- Dutton Anesthesiology 2014:121:450-8
- Scavone Anesthesiology 2014:121:439-41
- Lawton AJOG 2014:210:557.e1-6

OUTLINE

- Obstetric Hemorrhage
- Recognition
- Current treatment protocols 2014-15
- Communication – keys to success
- Bonus section

Accreta

- Advanced center
- Delivery at 34-35 weeks
- Ultrasound 80-90% sensitivity, 95% specificity
- MRI 88% Sensitivity, 100% Specificity

Jehovah’s Witness

- Maternal mortality hemorrhage - 512/100,000
- Planning, product acceptance list
- Cell saver
- Preop hemodilution
- Iron Sucrose protocol (IV)

OB Hemorrhage Protocol: Benefits

- Dignity Health Hospitals (n=29 units)
  - 60,000 births/year, varying size
  - N=32,000+
- Reduced blood utilization
  - 26%, p<.01
- Hysterectomy unchanged but trended down
  - reduced -15%, P=.2

Therapeutic Goals

<table>
<thead>
<tr>
<th>Lab or Vital Sign</th>
<th>Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hematocrit</td>
<td>&gt;24%</td>
</tr>
<tr>
<td>INR</td>
<td>&lt;1.5</td>
</tr>
<tr>
<td>Platelets</td>
<td>&gt;30,000/μL</td>
</tr>
<tr>
<td>Fibrinogen</td>
<td>&gt;100 g/L</td>
</tr>
<tr>
<td>pH</td>
<td>&gt;7.2</td>
</tr>
<tr>
<td>BE</td>
<td>&gt;-5 mEq/L</td>
</tr>
<tr>
<td>Temp</td>
<td>&gt;35°C</td>
</tr>
<tr>
<td>Ionized Calcium</td>
<td>Normal (1.1-1.35 mmol/L, most labs)</td>
</tr>
</tbody>
</table>

- Shields AJOG 2014:
rFactor VIIa

- Indication: DIC, >10 uPRBC given, active bleeding
- Need to have replaced FFP, Cryo, Plts
- Need pH >7.2, Temp >35°C
- Dose 30-90 mcg/kg, repeat 20-30 min if no response
  - Conservative 90 mcg/kg max
- Risk of Thromboembolism
- Usefulness downgraded v2-2015

- CMQCC OB Hemorrhage Toolkit V2-2015

Tranexamic Acid (TXA)

- Anti-fibrinolytic
- 1 gram IV, then 1gm/8 hr OR redose Q4-8 hr
- Improved survival trauma hemorrhage
- WHO recommended list
- Trauma – improved survival, reduced adverse events

- Shakur Lancet 2010;376:23-32
- WHO recommendation prevention PPH 2007
- BMJ 2012;345:e5839, Health Tech Assess 2013:17:10

Tranexamic Acid (TXA)

Trauma benefits, CRASH-2 RCT sub-analysis
- 1 gram load, infuse 1gm/8 hr, start <3hr post trauma
- Improved survival hemorrhage, all risk groups
  - 17% lowest and highest risk
  - 30-36% mid risk groups
- Reduced adverse events
  - Thrombotic events OR 0.69, P=.005
  - Arterial thrombosis OR .058, P=.003
  - Venous Thrombosis OR .83, P=.29

- Roberts J. BMJ 2012;345:e5839

Maternal Mortality and Severe Morbidity

Approximate distributions, compiled from multiple studies

<table>
<thead>
<tr>
<th>Cause</th>
<th>Morality (1-2 per 1000)</th>
<th>ICU Admit (1-2 per 1000)</th>
<th>Severe Morbid (1-2 per 100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VTE and AFE</td>
<td>15%</td>
<td>5%</td>
<td>2%</td>
</tr>
<tr>
<td>Infection</td>
<td>10%</td>
<td>5%</td>
<td>5%</td>
</tr>
<tr>
<td>Hemorrhage</td>
<td>15%</td>
<td>30%</td>
<td>45%</td>
</tr>
<tr>
<td>Preeclampsia</td>
<td>15%</td>
<td>30%</td>
<td>30%</td>
</tr>
<tr>
<td>Cardiac Disease</td>
<td>25%</td>
<td>20%</td>
<td>10%</td>
</tr>
</tbody>
</table>

- Goffman/Main OB Hemorrhage Patient Safety Bundle Sept 2014 Council on Patient Safety in Women’s Health Care

OB Hemorrhage 2017

- 1-2% life threatening hemorrhage
- Delayed diagnosis
- Underestimated blood loss
- DIC – treat or prevent
- Uterine balloon tamponade
- Check laceration vaginal sidewall, cervix, uterus
- Family member in room (?), PTSD
- Pneumatic anti-shock garment

CMQCC Hemorrhage Toolkit v2-2015

Summary

- Recognized OB Hemorrhage
- Understand assessments
  - QBL
  - Staged Blood loss
  - Vital signs/triggers – MOEWs
- Protocols treatment 2015-17
- Communication
- Bonuses
Active Management 3\textsuperscript{rd} stage

- Oxytocin
  - Delivery shoulder
- PPH >1000mL – RR 0.34 (24 to 8/1000 births)
- Maternal Hb <9g/dL RR 0.5 (71 to 36/1000 births)
- Decreased blood transfusion
- Decreased use other uterotonics
- Increased after pains, analgesia to discharge

Cochrane 2015 CD007412
### Uterotonic Medications

<table>
<thead>
<tr>
<th>Medication</th>
<th>Dose</th>
<th>Administration</th>
<th>Indications</th>
<th>Contraindications</th>
<th>Adverse Effects</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Misoprostol (Triprostin IL)</td>
<td>200 mcg</td>
<td>Subcutaneous</td>
<td>Induction, augmentation</td>
<td>Preterm premature rupture of membranes, PROM</td>
<td>-</td>
<td>24 hours</td>
</tr>
<tr>
<td>Methylergonovine (Ergonovine maleate)</td>
<td>0.2 mg</td>
<td>IM</td>
<td>Abnormal uterine bleeding, placenta praevia</td>
<td>Heavy bleeding, coagulopathy</td>
<td>-</td>
<td>6 hours</td>
</tr>
<tr>
<td>Methylergonovine (Ergonovine methanesulfonate)</td>
<td>200 mcg</td>
<td>IM</td>
<td>Postpartum hemorrhage</td>
<td>Preterm labor, uterine atony</td>
<td>-</td>
<td>6 hours</td>
</tr>
<tr>
<td>Oxytocin</td>
<td>5 IU</td>
<td>IV</td>
<td>Labor induction, augmentation</td>
<td>Preterm labor, placenta praevia</td>
<td>-</td>
<td>6 hours</td>
</tr>
</tbody>
</table>
Obstetric Hemorrhage Protocols

Barbara M. Scavone, MD
Professor
Department of Anesthesia and Critical Care
Department of Obstetrics and Gynecology
University of Chicago Medical Center

I have no financial relationships to disclose.

Learning Objectives

• Definitions
• Epidemiology/Impact
• Preventability
• Coordinated team responses

Definitions

Epidemiology/Impact

Preventability
Preventability of Pregnancy-Related Deaths
Results of a State-Wide Review


- North Carolina Pregnancy-Related Mortality Review Committee
- n = 108 deaths
- Cause of death, preventability
- Preconception care, patient-, system-, or provider-related factors

Berg: Obstet Gynecol 2005;106:1228

Postpartum Hemorrhage Resulting From Uterine Atony After Vaginal Delivery
Factors Associated With Severity


- Severe versus non-severe hemorrhage
- Assessed factors associated with severe hemorrhage

Driessen: Obstet Gynecol 2011;117:21-31

Table 2. Distribution of Causes of Pregnancy-Related Deaths and Percent of Preventable Deaths by Cause, North Carolina, 1995-1999

<table>
<thead>
<tr>
<th>Cause of death</th>
<th>% of All Preventable Deaths</th>
<th>% of All Pregnancy-Related Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiomyopathy</td>
<td>21</td>
<td>31</td>
</tr>
<tr>
<td>Hemorrhage</td>
<td>31</td>
<td>32</td>
</tr>
<tr>
<td>Pregnancy-induced hypertension</td>
<td>10</td>
<td>13</td>
</tr>
<tr>
<td>Maternal condition</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Chorioamnionitis</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

40% of deaths preventable
54% due to provider-related factors

Driessen: Obstet Gynecol 2011;117:21-31

Evaluation of the quality of care for severe obstetrical haemorrhage in three French regions


- Severe vs non-severe hemorrhage
  - Often accompanied by sub-standard care
  - Delays in diagnosis and treatment
- Sub-standard care associated with lack of anaesthetist

Boisson-Coeur: BJOG 2001;108:998-999
Stages of Hypovolemic Shock
ATLS

<table>
<thead>
<tr>
<th>Blood Loss</th>
<th>HR</th>
<th>BP</th>
<th>MS</th>
<th>UO</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>&lt; 15%</td>
<td>&lt; 100</td>
<td>Normal</td>
<td>Normal</td>
</tr>
<tr>
<td>II</td>
<td>15–30%</td>
<td>&gt; 100</td>
<td>Normal</td>
<td>Normal</td>
</tr>
<tr>
<td>III</td>
<td>30–40%</td>
<td>&gt; 120</td>
<td>Slight↓</td>
<td>Agitation</td>
</tr>
<tr>
<td>IV</td>
<td>&gt; 40%</td>
<td>&gt; 140</td>
<td>↓↓↓</td>
<td>Confusion</td>
</tr>
</tbody>
</table>

Team Responses

PATIENT SAFETY SERIES
Comprehensive maternal hemorrhage protocols reduce the use of blood products and improve patient safety

Shields. Am J Obstet Gynecol 2011;205:368.e1-8
Outcomes Pre- and Post-Protocol

<table>
<thead>
<tr>
<th>PRL</th>
<th>POST</th>
<th>( P )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 1*</td>
<td>33%</td>
<td>82%</td>
</tr>
<tr>
<td>Stage 2*</td>
<td>8%</td>
<td>50%</td>
</tr>
<tr>
<td>Units/month</td>
<td>16.7</td>
<td>6.3</td>
</tr>
</tbody>
</table>

*Successfully treated at that Stage

Outcomes Pre- and Post-Protocol

<table>
<thead>
<tr>
<th>Change PRE-POST</th>
<th>( P )</th>
</tr>
</thead>
<tbody>
<tr>
<td>TFN per 1000 births</td>
<td>↓25.9%</td>
</tr>
<tr>
<td>Hysterectomy</td>
<td>↓14.8%</td>
</tr>
</tbody>
</table>
Hemorrhage protocols/drills:

- Decreased severity of hemorrhage
- Decreased development of DIC
- Decreased transfusions
- Statistically non-significant decrease in hysterectomy
- Increased staff knowledge/confidence


Shields: Am J Obstet Gynecol 2011;205:568.e1-8

D’Alton: Obstet Gynecol 2014;123:975-77
National Partnership for Maternal Safety: Consensus Bundle on Obstetric Hemorrhage

Elliott K. Main, MD, Diane Griffin, MD, Barbara M. Scavone, MD, Lisa Kone Low, PhD, CNM, Debra Fromer, CNM, RN, Patricia Fontaine, MD, MS, OOB, Gary Gerin, MD, David C. Lagrew, MD, and Barbara S. Levy, MD

The National Partnership for Maternal Safety: A Call to Action for Anesthesiologists

Barbara M. Scavone, MD,* and Elliott K. Main, MD

Main: Anesth Analg 2015;121:142-48
Scavone: Anesth Analg 2015;121:14-16

[Images of the presentation slides showing the consensus bundle and resources]
≥ 4 unit transfusion
ICU admission
Table 1. The Maternal Early Warning Criteria

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systolic BP (mm Hg)</td>
<td>&lt;90 or &gt;160</td>
</tr>
<tr>
<td>Diastolic BP (mm Hg)</td>
<td>&gt;100</td>
</tr>
<tr>
<td>Heart rate (beats per min)</td>
<td>&lt;50 or &gt;120</td>
</tr>
<tr>
<td>Respiratory rate (breaths per min)</td>
<td>&lt;10 or &gt;30</td>
</tr>
<tr>
<td>Oxygen saturation on room air, at sea level, %</td>
<td>&lt;95</td>
</tr>
<tr>
<td>Oliguria, mL/hr for ≥2 hours</td>
<td>≤35</td>
</tr>
<tr>
<td>Maternal agitation, confusion, or unresponsiveness, Patient with preeclampsia reporting a non-remitting headache or shortness of breath</td>
<td></td>
</tr>
</tbody>
</table>
The Role of Tranexamic Acid in Managing Obstetric Hemorrhage

John T. Sullivan, M.D., M.B.A.
President, Society of Obstetric Anesthesiology and Perinatology
Professor, Anesthesiology

Disclosure

I have no financial relationships with bearing on the subject matter of this talk

Learning Objectives

- Review non-obstetric applications of TXA
- Identify limitations of TXA trials in OB
- Compare risk-benefit of TXA in a high thrombotic prevalent population
- Highlight future TXA trials

Patient Blood Management

- Evidence-based, multidisciplinary approach
- Clinical management beyond transfusion
- Spans ante-, intra- and post-partum periods
  - Hemorrhage risk assessment (anemia)
  - Adjuvant therapies (tranexamic acid)
  - Blood loss monitoring strategies (POC testing)
  - Multidisciplinary care ‘bundles’


Pharmacologic Management of PPH

- Uterotonics
- Antifibrinolytics
  - Tranexamic acid
    - Prophylaxis, treatment
- Fibrinogen concentrate
- Recombinant Factor VIIa
- Others?

Tranexamic Acid

- Synthetic lysine analog
- trans-4 aminomethyl cyclohexanecarboxylic acid
- Competitive inhibitor plasminogen activation
- 95% excreted un-metabolized in urine
- Elimination half life: 3 hours
- 1% transfer into breast milk

https://www.drugs.com/pro/tranexamic-acid-injection.html
Levels of Scientific Evidence

- **Category A RCTs**
  - A1 Meta-analysis RCTs
  - A2 Multiple RCTs
  - A3 Single RCT

- **Category B Observational**
  - B1 Cohort, case-controlled
  - B2 Associative stats
  - B3 Descriptive stats
  - B4 Case reports

(B) Benefit
(H) Harm
(E) Equivocal

P<0.01

Prophylactic Tranexamic Acid

- **Category A1 (B): Meta-analysis of 24 RCTs**
  - 9 cardiac, 9 ortho, 2 neuro, 2 oncology,
  - 1 gyne, 1 oral surg
  - Decreased blood loss, transfusion

- **Category A2 (B): 7 RCTs**
  - 6 cardiac, 1 vascular
  - No difference in stroke, MI, death

Therapeutic Tranexamic Acid

- Insufficient evidence for TXA in excessive bleeding
- Consultant/members agree:
  - TXA should be considered in excessive bleeding

[***The safety of antifibrinolytics has not been established in hypercoagulable patients (e.g., pregnancy).***]

ASA task force on blood management: Practice guidelines for perioperative blood management. Anesthesiology 2015;122:241-75
Non-Obstetric TXA Trials
“Silver Bullet?”

Ker K. Effect of tranexamic acid on surgical bleeding: A systematic review and cumulative meta-analysis. BMJ 2013;344:e3054

Orthopedic TXA: Publication Bias?

Ker K. Effect of tranexamic acid on surgical bleeding: A systematic review and cumulative meta-analysis. BMJ 2013;344:e3054

TXA Trauma Trial


TXA-Generic Cost

- Oral
  - $8.20 (250mg caplet)
  - $9.71 (500mg caplet)
- IV
  - $30.34 (250mg/5mL)
  - $58.39 (500mg/5mL)


Incremental Cost-Effectiveness Ratio (ICER)

- Incremental cost & treatment success
- Include broader quality of life measures
- Commonly accepted threshold: $50K/QALY

Incremental Cost

effectiveness ratio (ICER) =

Cost of Tx A - Cost of Tx B

Success of Tx A - Success of Tx B

Weinstein MC: Recommendations of the panel on cost-effectiveness in health and medicine. JAMA 1996;276:1253-8

Postpartum Coagulation Physiology

- Limited published data
- Placental separation from uterus
- Increased platelet activity
- Substantially increased release of tissue factors
- Increased fibrinolytic activity

Postpartum Hemorrhage Physiology

- Compared with normal delivery, in PPH:
  - Decrease in fibrinogen, platelets in PPH
  - Increase in D dimers (fibrin split products)
- TXA associated with:
  - Decrease in D-dimers
  - No change in fibrinogen

Ducloy-Bouthes AS: Postpartum haemorrhage related early increase in D-dimers is inhibited by tranexamic acid: haemostasis parameters of a randomized controlled open labeled trial. BJ A 2016;116:641-8

Prophylactic TXA in CD

- Prophylactic RCTs in low risk parturients
- 12 RCTs, n=3,285
  - Reduced EBL, 78mL (CI 58-98mL)
- 4 RCTs, n=1,534
  - Reduced likelihood of EBL>1000mL
  - RR 0.43 (CI 0.23-0.78)

Novikova N. Tranexamic acid for preventing postpartum hemorrhage. Cochrane 2015 CD0007172

Prophylactic RCTs
Incidence:
Pregnancy: 4
Transfusion (hemorrhage) OR 7.6 (CI 6.2
Whole sentences copied in methods
Science less trustworthy if authors can’t read
Cardiac comorbidity
Hemorrhage
Cardiomyopathy
1.1 deaths per 100K deliveries
Abortion
No meta
Non
Sepsis
"Plagiarism for scientific English"
Whole sentences copied in methods
Science less trustworthy if authors can’t read what has been submitted
Maternal Mortality: Trends

TXA-Transfusion Use in CD

<table>
<thead>
<tr>
<th>Study</th>
<th>TXA</th>
<th>Control</th>
<th>Events Total</th>
<th>Events Total</th>
<th>Risk Ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gossens 2013</td>
<td>60</td>
<td>60</td>
<td>120</td>
<td>120</td>
<td>0.98 (0.93, 1.04)</td>
</tr>
<tr>
<td>Gossens 2010</td>
<td>2</td>
<td>320</td>
<td>320</td>
<td>320</td>
<td>0.26 (0.06, 1.37)</td>
</tr>
<tr>
<td>Swedish 2015</td>
<td>330</td>
<td>330</td>
<td>660</td>
<td>660</td>
<td>0.58 (0.31, 1.08)</td>
</tr>
<tr>
<td>Swedish 2010</td>
<td>0</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>Not estimable</td>
</tr>
<tr>
<td>Swedish 2005</td>
<td>0</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>Not estimable</td>
</tr>
<tr>
<td>Swedish 2002</td>
<td>0</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>Not estimable</td>
</tr>
<tr>
<td>Swedish 2001</td>
<td>0</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>Not estimable</td>
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<tr>
<td>Pre 2012</td>
<td>0</td>
<td>80</td>
<td>80</td>
<td>80</td>
<td>0.41 (0.25, 0.68)</td>
</tr>
<tr>
<td>Pre 2012</td>
<td>0</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>0.20 (0.05, 0.82)</td>
</tr>
<tr>
<td>Trial with last similarities</td>
<td>3</td>
<td>38</td>
<td>38</td>
<td>38</td>
<td>0.24 (0.03, 0.77)</td>
</tr>
</tbody>
</table>

Ker K: Does tranexamic acid prevent postpartum hemorrhage? A systematic review of randomized controlled trials. BJC 2016;1745-52

TXA RCTs in Obstetrics

- Prophylactic RCTs
  - Quality, reliability concerns
- Methodological problems
  - Randomization, allocation, concealment
- Ethical concerns
  - Review board oversight, identical or similar text
- No meta-analysis performed

Ker K: Does tranexamic acid prevent postpartum hemorrhage? A systematic review of randomized controlled trials. BJC 2016;1745-52

Ethics in Scientific Research

- “Plagiarism for scientific English”
- Whole sentences copied in methods
- Science less trustworthy if authors can’t read what has been submitted


Maternal Mortality

United States
1. Cardiac comorbidity
2. Sepsis
3. Non-CV medical conditions
4. Cardiomyopathy
5. Hemorrhage
6. Thromboembolism

Global
1. Trauma
2. Abortion
3. Hemorrhage
4. Hypertensive disorders
5. Sepsis


Thromboembolism Risk in Pregnancy

- Pregnancy: 4-5 increase in thromboembolism vs. non-pregnant
- Incidence:
  - 1.72 per 1K deliveries
  - 1.1 deaths per 100K deliveries
- Transfusion (hemorrhage) OR 7.6 (CI 6.2-9.4)

**TXA: Thromboembolic Complications**

- Case cluster, France, 18 PPH pts tx with TXA
- Irreversible kidney injury, biopsy confirmed thromboembolism
- Mean TXA load: 1.8g ±0.9g
- Mean dur: (0.5-1g/hr x 5.3 hrs)


**Case: Placenta Percreta**

- 35 yo G2P1 at 34 weeks EGA with placenta percreta for cesarean hysterectomy
- Bilateral hypogastric artery balloons
- Prophylactic TXA 1 gm pre-incision, followed by 150 mg/hr infusion
- EBL 800 mL

Hajmaid O: Aortoiliac thrombosis following tranexamic acid administration during urgent cesarean delivery with total hysterectomy. Anesth Analg 2017. epub ahead of print

**Death After an Inadvertent Intrathecal Injection of Tranexamic Acid**

To the Editor:

While performing spinal anes-


**TXA Plus Balloons**

Hajmaid O: Aortoiliac thrombosis following tranexamic acid administration during urgent cesarean delivery with total hysterectomy. Anesth Analg 2017. epub ahead of print

**World Maternal ANtifibrinolytic (WOMAN) Trial**

**Therapeutic Use of TXA**

- 20,060 parturients with PPH (2010-16)
- 193 Hospitals, 21 countries
- Multinational RCT TXA vs. placebo
- Primary outcome: death or TAH
- Secondary outcomes: surgical interventions, transfusion, thromboembolism

http://www.thewomantrial.lshtm.ac.uk/

**Tranexamic Acid–Associated Seizures: Causes and Treatment**

Population TXA Studies

- CRASH-2 Trial (20K, published)
  - TXA use in traumatic bleeding
- WOMAN Trial (20K, in review)
  - TXA use in PPH
- CRASH-3 (8K/10K, recruiting)
  - TXA in TBI
- HALT IT (5K/8K, recruiting)
  - TXA in GI bleeding

WOMAN Trial

- Sample size calculation
  - 15K: 90% power to detect reduction in primary outcome 4% to 3%
- Interval evaluation
  - Oct 2014: 6.4% event rate (2.4% death, 4% TAH)
  - Extended recruitment to 20K, completed
- Publication pending 2017

http://www.thewomantrial.lshtm.ac.uk/

Conclusions TXA in PPH

- Limited benefit of TXA as either prophylaxis or treatment of PPH
- Serious thromboembolic risks must be evaluated and weighed against potential benefits
- WOMAN trial results available soon, generalizability to be debated
- Future study should focus on high risk parturients
Friday, March 3, 2017

**Session IV: New Techniques in Obstetric Anesthesia**

**Moderator:** Kenneth Nelson, M.D.

**Neuraxial Ultrasound: Time to Learn and Not Get Left Behind**  
*Brendan Carvalho, M.B., B.Ch., FRCA*

**An Update on PIEB for Labor Analgesia**  
*Robert D’Angelo, M.D.*

**Paramedian Lumbar Epidural Technique: Why You Should Adopt It**  
*Jeremy Collins, M.D. FRCA, M.B., Ch.B.*
Neuraxial Ultrasound: Time to Learn and Not Get Left Behind

Brendan Carvalho MBBCh, FRCA
Professor
Chief, Obstetric Anesthesia Division
Stanford University, California

Disclosures

Relevant financial relationships or funding to disclose
- Smiths Medical (consulting)
- Pacira Pharmaceuticals (consulting)
- Covidien (research)
- Rivanna Medical (research, consulting)

All investigational products and off-labeled use will be disclosed
Ultrasound for Lumbar Epidural Information Obtained

- Accurate interspace identification
- Establish midline
- Estimate depth to epidural space
- Determine optimal interspace and best insertion point
- Angulation of the Tuohy needle

Accurately Identify Correct Interspace

We are not good at identifying the correct interspace!

- Correctly identify in only 29-41\%\(^1,2\)
- 1-2 space higher than assumed
- Intercristal line interspace variations\(^1,2,3\)


Neuraxial Ultrasound Safety

- ? Minimize conus medullaris or spinal injury
  Case series\(^1,2\)
  Tuffier’s line unreliable to identify lumbar interspaces
  Variations in where spinal cord terminates
  Below L1 in 19\%\(^3\)
  Range T12 to L3\(^4\)
- ? Reduce epidural hematomas
  Difficult block associated with 25-36\%\(^5\)

1. Reynolds Anaesthesia 2001;56:235-247
2. de Sèze Anesth Analg. 2007;104(4):975-9

Estimating Depth To Epidural Space

- Meta-analysis; 13 studies\(^1\)
- Ultrasound-measured vs. needle insertion depth
  - Excellent correlation (r=0.91 [0.87-0.94])
  - Mean difference 0-8 mm
  - Level of evidence: Ia
- Angulation of Tuohy needle
- Obese patients
  - Wider 95\% agreement limits (13 to 7 mm)\(^2\)
  - Probe pressure


Estimating Optimal Epidural Space

- Neuraxial anatomical changes in pregnancy
  - Length interlaminar space
  - Length visible intervertebral dura mater
  - Depth posterior dura mater
  - Depth increased each trimester
- L2-3 best then L3/4 then L4-5
  - Longer interlaminar space
  - Less visible dura mater
  - Shallower depth dura mater

Keplinger, Anaesthesia 2016; 71: 675-83
Neuraxial Ultrasound: Improved Efficacy?

- 14 RCTs (1768 pts) + 5 cohorts (227 pts)
- Ultrasound guidance vs. palpation
- Level of evidence Ia
- ↓ Technical failure (RR 0.51, 95% CI 0.32-0.80)
- ↓ Number needle punctures
- ↑ First pass success
- ↓ Needle redirections
- ↓ Procedure time (↑ Setup)

Shaikh F. BMJ 2013 Mar 26; 346:f1720

Ultrasound Epidural Predicted Difficult Placement

- Obesity, scoliosis or previous spinal surgery
- Ultrasound vs. landmark in orthopedic patients having spinal anesthesia
  - ↑ 1st pass success (65 vs. 32%)
  - ↓ Needle passes (6 [1–10] vs. 13 [5–21])
  - ↑ Time to establish landmarks (6.7 vs. 0.5 min)
  - ↓ Spinal time (5.0 vs. 7.6 min)
- Confirms case reports and earlier single-operator study in parturients


Impalpable Bony Landmarks

- No difference in BMI (ultrasound 39.1 vs. palpation 38.3)
- Fewer needle passes ultrasound vs. palpation
  - 3.0 [IQR 1.8–3.2] vs. 5.5 [IQR 3.2–7.2]
- No difference in total procedural time
  - 191.8 ± 49.4 s vs. 192 ± 110.9 s

Creaney M. Int J Obstet Anesth 2016; 28:12-16

Labor Ultrasound: Improved Analgesic Efficacy?

- Decreases epidural catheter replacements and block failures
- Improved analgesia
- Higher maternal satisfaction


Neuraxial Ultrasound: Improved Safety?

- Traumatic procedure (RR 0.27; 95% CI 0.11-0.67)
- No difference unintended dural punctures
- Trend lower incidence headache and backache

Secondary outcome
- Level of evidence: III

Perlas A. Reg Anesth Pain Med 2016;41: 251
Shaikh F. BMJ 2013 Mar 26; 346:f1720
Kessler. Anaesth Intensive Care 2014; 42: 447-448

Learning curves in obstetric epidural anesthesia

- low SD CG
- high SD CG
- mean CG
- low SD VG
- high VG
- mean VG

Kessler. Anaesth Intensive Care 2014; 42: 447-448

Equipment

Machine Knobology

2D + Gain + Depth
Anatomy

• Posterior Complex
  • Ligamentum Flavum
  • Posterior Dura.

• Anterior Complex
  • Anterior Dural
  • Posterior Longitudinal Ligament
  • Vertebral Body

Bone Landmarks

Image Pattern Recognition

2D / B mode Ultrasound Image:
Hyperechoic
Hypoechoic

“Saw tooth sign” Interspaces

“Cone sign” Spinous Process

“Bat sign” Interspace

Carvalho J. Anesth Clin 2008; 26: 145-158

Carvalho J. Anesth Clin 2008; 26: 145-158
Depth Measurements


Obesity and Neuraxial Ultrasound

- Midline (spinous process) easy to determine
- Depth (parasagital view or transverse process)
- Image optimization

Sahota JS. Anesth Analg 2013;116:829-835
Carvalho J. Anesth Clin 2008; 26: 145-158
Manickam BP. Br J Anaesth 2016; 116: 568-569
Srinivasan KK. Med Ultrason 2014;16: 356-363

Dynamic Scanning vs. Static Images
Interspace Identification

Spinous Process to Interspace
**Automated image interpretation and depth measurements**

**Determine Epidural Catheter Position**

- Catheter’s path detected during saline injection in 33 patients (89%) with color Doppler
- Catheter tip confirmation:
  - 68% detected (color Doppler)
  - 75% detected (M-mode)

**Posterior vs. lateral epidural catheter position:**
Less pain and rescue analgesia doses

Goswani V. Can J Anesth 2016;63(8):911-9

**Elsharkawy H. Can J Anesth 2017;January**

**Real-time Scanning and Needle Visualization**

**Neuraxial Ultrasound**

**Time to Learn and Not Get Left Behind**

- All or most obstetric patients
- Predicted difficult epidural placement
  - Obesity or difficult palpation
  - Scoliosis
  - Spine surgery
- Previous difficult epidural or dural puncture
- Rescue failed neuraxial technique
- Screen potentially difficult patients
- Future: Real-time placement

Niazi A. Acta Anaesthesiol Scand 2014; 58: 875-881
Menace C. Anaesth Crit Care Pain Med 2016 In press
Brendan Carvalho
bcarvalho@stanford.edu
Department of Anesthesiology, Stanford University, California
An Update on PIEB for Labor Analgesia

Robert D’Angelo, MD

Disclosures

None

Labor Analgesia Admin:

• Survey: 133 California Hospitals*
  – 25% use PCEA
• Labor Analgesia Technique:
  – Continuous Infusion or Intermittent Bolus
  – Patient Controlled Epidural Analgesia
  – Programmed Intermittent Epidural Boluses

*IJOA 2006;15:217-22

Outline:

• Ob PCEA
  – Review
• PIEB
  – Review
  – Equipment
• Recommendations

PCA in Obstetrics:

• 1976: PCA Meperidine
  – Lancet 1976; 1: 17
• 1988: PCEA Bupivacaine
  – Can J Anaesth 1988; 35: 294
• 2005: PIEB Levobupivacaine
  – IJOA 2005; 14: 305

PCEA Review
PCEA: Advantages

- Self-Administered Boluses PRN
  - Individualized to Patient Needs
  - Flexible as Analgesia Requirements Change with Labor Progress
  - Lower Hourly Rates than CI
    - Decreased Side Effects
- Reduces Anesthesia Workload
  - ↓ Redoses and Pump Changes

PCEA v Continuous Infusion:*

- Randomized Prospective Design
- Methods:
  - Assessed Workload and Patient Perception of Technology and the Anesthesiologist
- 60% ↓ in Workload (Redoses)
- 90% Positive Perception

*OB Gyn 1991; 77:348

Ob PCEA v Continuous Infusion:*

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- Methods:
  - Assessed Workload and Patient Perception of Technology and the Anesthesiologist
- 60% ↓ in Workload (Redoses)
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*OB Gyn 1991; 77:348

Ideal PCEA Settings

There Are None!

Ob PCEA Studies:*

- Studies: 33
- Patients PCEA/Total: 2,048/3,205
- Techniques Compared:
  - PCEA to IB, CI, IV PCA: 20
  - PCEA Variations: 13
    - Include Basal Rate: 18
    - Basal Rate: 0-12 ml/hr
    - Bolus Dose: 2-12 ml/hr
    - Lockout: 5-40 min
    - Hourly Limit: 12-24 ml


Ob PCEA: Outcome # of Studies*

- ↓ Drug Use 11
- ↓ Motor Block 4
- ↓ Pain Scores 4
- ↑ Patient Satisfaction 7
- ↓ Workload 11
- No Sig. Differences 8
- Disadvantages 0

* Multiple Benefits Noted in Some Studies

Ob PCEA Overview:

- Significant Study Variation
- No Definitive Large Study
- No Ideal Regimen Exists
  - Many ways to Accomplish Analgesia Goals with PCEA
    - Titratable Analgesia
    - Minimize Anesthesia Interventions
Theoretical Disadvantages:
• Safety Concerns
  – Overdose Potential
  – Device Malfunction
  – High Blocks from Self Administration
• None Reported in 33 Studies Enrolling >2,000 Patients*
• 25 Years Clinical Experience

Meta-Analysis:*  
• PCEA v. CI in Labor Patients
• 9 Studies
• 640 Patients
  *BJA 2002; 89: 459-65

PCEA Meta-Analysis:*  
9 Studies: 640 Patients  
<table>
<thead>
<tr>
<th>Outcome</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ob/Neonat Outcome</td>
<td>NSD</td>
</tr>
<tr>
<td>Side Effects</td>
<td>NSD</td>
</tr>
<tr>
<td>Labor Analgesia</td>
<td>NSD</td>
</tr>
<tr>
<td>Patient Satisfaction</td>
<td>NSD</td>
</tr>
<tr>
<td>Motor Block</td>
<td>0.003</td>
</tr>
<tr>
<td>Drug Use</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Interventions (Workload)</td>
<td>&lt;0.00001</td>
</tr>
</tbody>
</table>
*BJA 2002; 89: 459-65

PCEA Meta-Analysis:*  
9 Studies: 640 Patients  
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</tr>
<tr>
<td>Interventions (Workload)</td>
<td>&lt;0.00001</td>
</tr>
</tbody>
</table>
*BJA 2002; 89: 459-65

Review:*  
• 29 Studies: 2,083 Patients
  – NSD: Analgesia, Outcome, Satisfaction
  – Bolus Dose/Lockout Interval:
    • No Ideal Dose or Lockout
  – Basal Infusion:
    • ↓ Redoses and Improves Analgesia
  *Anes Analg 2009; 108: 921-8

Sentinel Event Report:*  
• Switched from CI to PCEA
• 3,600 Delivery/Year
• Only Variable to Change
• Reported:
  – ↓ Pain, ↑ Satisfaction, ↓↓MB, ↓↓↓ Interventions
  *Dunstan CR, Walpole R. IJOA 2007; 16: 93-4
Sentinel Report:
- "...changing from CI to PCEA...labour ward has produced the advantages demonstrated in the literature."
- "Midwives were also happier with the new analgesic regimen because of a reduced anaesthetic involvement and better patient autonomy."
- "...clear benefits for patient, midwife, and obstetric anaesthetist."
*JJOA 2007; 16: 93-4

WFU Clinical Experience:*  
- 6,500 Deliveries/Year  
- >150,000 PCEA Cases since 1993  
  - 1 Syringe Pump, 3 Infusion Pumps  
- Significantly Reduces Workload  
- Excellent Safety Record  
  - No Cases of Device Failure or LA Toxicity related to PCEA Device  
- Clear Benefits  
  *Internal WFU QA Data

Recommended Protocol:  
- 1st Goal: ↓ Workload  
- Bup 0.1%, Fent 2mcg/ml (250ml)  
- PCEA Settings:  
  - Basal Infusion: 10 ml/hr  
  - Demand Bolus: 5 ml  
  - Lockout: 10 min  
  - Hourly Limit: 30 ml

Clear Evidence  
PCEA Superior to IB and CI Techniques

Programmed Intermittent Epidural Boluses  
PIEB (PIB)

Why PIEB?  
- PCEA Basal Infusion = Slow Drip  
  - Develop Inadequate Spread over Time  
- Administer Basal Infusion as Boluses  
  - 10ml/hr → 10ml q60’ or 5ml q30’  
- Better Spread:  
  - Improve Analgesia  
  - ↓ Drug Use, Workload, Side Effects
Ob PIEB Studies:

- Studies (PIEB v PCEA): 10
- Patients PIEB/Total: 1,025/1,971
- Similar to PCEA: Considerable Variation
- Solutions Compared: 9
  - Bupi, Levo, Ropi, Fent, Sufent
- PCEA Basal Range: 5-12ml/hr
- PIEB Recipes: 7
- Dosing Interval: 3ml q30'-10ml q60'


Ob PIEB Findings:

<table>
<thead>
<tr>
<th>Outcome</th>
<th># of Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>↓ Drug Use</td>
<td>9</td>
</tr>
<tr>
<td>↓ Motor Block</td>
<td>1</td>
</tr>
<tr>
<td>↓ Pain Scores</td>
<td>1</td>
</tr>
<tr>
<td>↑ Patient Satisfaction</td>
<td>3</td>
</tr>
<tr>
<td>↓ Workload</td>
<td>5</td>
</tr>
<tr>
<td>No Sig. Differences</td>
<td>1</td>
</tr>
<tr>
<td>Disadvantages</td>
<td>0</td>
</tr>
</tbody>
</table>

* Multiple Benefits Noted in Some Studies

PIEB Meta-Analysis:

- RCT: 9
- PIEB/Total Patients: 350/694
- Benefits of PIEB:
  - ↓ Drug Utilization: ↓ 1.9mg/hr
  - ↑ Maternal Satisfaction: ↑ 7mm (0-100)
  - Workload: NSD (Trend)
  - Duration of Labor: NSD
  - Mode of Delivery: NSD

PIEB Meta-Analysis:

ANESTHETIC INTERVENTIONS

- Drug Use (mg/hr)
- Maternal Satisfaction

*Anes Analg 2013; 116: 133-44

*Anes Analg 2013; 116: 133
PIEB Devices

- Each Has Limitations
- Hospira Sapphire
  - Not Wireless
  - Can’t Toggle between PCEA/PIEB
  - Not EMR Compatible
  - Hospira 2-Yr Batteries
- B Braun Body Guard
  - Still in Design Phase (Integration)

PIEB Devices (cont):

- Smiths Medical Cadd Solis
  - First Pump Approved by FDA
  - Doesn’t Include AC Adapter
  - Batteries Replaced Every 90 hrs
- CareFusion Alaris
  - 60ml max Syringe Pump Only
  - Close to EMR Compatible

PIEB Pumps:

- Not Quite Ready for Primetime
- If Ready to Purchase
  - Work with Administration/IT
  - Hands On Pump Fair/Ask Questions
    - Wireless?
    - EMR Compatible?
    - Ease of Programmability & How?
    - Target Dates for Each?
    - Commitment to Update in Writing
  - Start Using in PIEB Mode

Future PCEA (CIIB):*

- Computer-Integrated Intermittent Bolus
- Algorithm Alters Basal: Bolus Requests
- PCEA Bolus Individualized
  - Further Reductions in Dose
  - Improved Satisfaction?
- No Commercial Version

Summary: Ob PCEA

- 25 years Clinical Experience
- Benefits:
  - ↓ MB ↓ Drug Use, ↓↓↓ Workload
  - Excellent Safety Record
- Patients Like It:
  - Feel in Control
- If it Saves Time & Work
- You will Love It!

Summary: Ob PIEB
• Advantages over PCEA
  – ↓ Drug Use, ↓ Workload, ↑ Satisfaction
  – Statistical Benefits Demonstrated
  – Clinical Benefits TBD
• Current Devices Have Limitations
  – Not Quite Ready for Primetime
• Purchase if in Market
  – Ensure Upgradability
  – Start Using in PIEB Mode

Compared to CI/IB Techniques
PCEA AND PIEB:
STATE OF THE ART
LABOR ANALGESIA

Thank you!
rdangelo@wakehealth.edu

TRY IT (PCEA/PIEB)
You’ll Like It!

Review of Analgesia Options:*
• 15 Year Review: 10,331 Patients
  – Epidural, Spinal, CSE, CI, IB, PCEA, PIEB
• “…no Significant differences occurred among all the available administration schemes of neuraxial analgesia.”
• “…unable to standardize drugs schemes and their combinations.”

*Arch Gynecol Obstet 2014; 290: 21-34
Paramedian Lumbar epidural technique:

Why you should adopt it:

Jeremy Collins MB ChB, FRCA
Stanford University

I have nothing to disclose

[First wet-tap in 2016]

J J Bonica

Techniques for identifying the epidural space: a survey of practice amongst anaesthetists in the UK

- 1285 respondents
- 96% used midline approach for lumbar epidurals
- 4% paramedian (experienced consultants)

Why midline more popular?

- most teach midline
- requires less three-dimensional spatial awareness
- Ligamentum flavum at widest in midline
- “faster” (Chestnut’s Obstetric Anesthesia)
- less painful?

The Regional anesthesia “learning curve”

<table>
<thead>
<tr>
<th></th>
<th>Number of attempts</th>
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</thead>
<tbody>
<tr>
<td>Midline</td>
<td>1.22 +/- 0.31</td>
</tr>
<tr>
<td>Paramedian</td>
<td>1.76 +/- 1.29</td>
</tr>
</tbody>
</table>

Stanford Hospital: Obstetric Anesthesia Division
Paramedian vs. midline anatomy

- Less reliant on flexion
- Greater anatomic tolerance
- Avoids supraspinous and interspinous ligaments
**Lumbar Epidural Anatomy**
* A New Look by Cryomicrotome Section

- freeze cadaver within 15hrs of death
- lumbar spine removed intact
- 20 micron slices
- Reveals distinct left and right ligamentum flavum
- Not always fused in midline

Hogan Q. Anesthesiology. 1991 Nov;75(5):767-75.

---

**More painful?**

- Longer passage of needle through tissues
- Hit periosteum of lamina (on purpose!)

---

**Acute tissue damage following epidural cannulation**
A comparison between the midline and paramedian approach in obstetric patients

- 40 patients randomized to paramedian or midline insertion
- Assessments of pain by VAS
- Tissue damage assessment by MRI
- No differences between groups

The needle enters at OBLIQUE angle

- reduction in PDPH?
- reduction in wet tap
- Easier threading of catheter
- Can travel through epidural space further

Less csf leak?

- Valve effect of oblique tract
- Arachnoid and dural hole are offset

<table>
<thead>
<tr>
<th></th>
<th>Skin-LOR (mm)</th>
<th>LOR-dural contact (mm)</th>
<th>Likely dural perforation if advanced?</th>
<th>Tenting of dural during passage of catheter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midline</td>
<td>48.6</td>
<td>3.9 (1-7)</td>
<td>14/14</td>
<td>10/14</td>
</tr>
<tr>
<td>Paramedian</td>
<td>57.9</td>
<td>7.6 (5-13)</td>
<td>2/14</td>
<td>0/14</td>
</tr>
</tbody>
</table>
Cephalad advancement of epidural catheter | Lateral or caudal deviation of catheter
--- | ---
Midline | 4 | 10
Paramedian | 14 | 0


Inoue S. Rev Bras Anestesiol 2011;61: 764-769

Muneyuki M. Anesthesiology 1970: 33: 19-24

Muneyuki M. Anesthesiology 1970: 33: 19-24
- 151 patients examined radiologically
- Thoracic: chance of catheter 3 spaces cephalad: 50%
- Lumbar: chance of catheter 3 spaces cephalad: 0.5%

Muneyuki M. Anesthesiology 1970: 33: 19 24

- 5 x incidence of intravascular catheters with midline approach
- 2 x incidence of paresthesia on insertion with midline approach


Blomberg Anesthesia 1989, 44: 742-746

Advantages of the paramedian approach for lumbar epidural analgesia with catheter technique

A clinical comparison between midline and paramedian approaches

Blumberg Anesthesia 1988, 44: 742-746

<table>
<thead>
<tr>
<th></th>
<th>Repeated insertions</th>
<th>Equivalent LOR</th>
<th>Catheter difficult to thread</th>
<th>Paresthesia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midline (25)</td>
<td>7</td>
<td>6</td>
<td>11</td>
<td>9</td>
</tr>
<tr>
<td>Paramedian (25)</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>1</td>
</tr>
</tbody>
</table>

Ultrasound guidance

Visibility
(1= very good; 6=insufficient)

<table>
<thead>
<tr>
<th>Shadow/window</th>
<th>Transverse</th>
<th>Longitudinal median</th>
<th>Longitudinal paramedian</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flavum</td>
<td>2.5</td>
<td>0.34</td>
<td>0.55</td>
</tr>
<tr>
<td>Dura</td>
<td>4.4</td>
<td>2.3</td>
<td>1.4</td>
</tr>
<tr>
<td>Vessels</td>
<td>5.7</td>
<td>3.6</td>
<td>1.7</td>
</tr>
<tr>
<td>Nerves</td>
<td>5.9</td>
<td>5.5</td>
<td>1.9</td>
</tr>
</tbody>
</table>

Summary
- Anatomical advantage
- Less flexion required
- Depth gauge
- A back up technique for difficult blocks
- Potential for less wet tap
- Easy threading of catheter with less paresthesia
- Catheter stays cephalad and in midline
- Standardize for transition to thoracic epidural space

PLEASE DO IT!
PARAMEDIAN
LUMBAR
EPIDURAL
ALWAYS
SO
EFFORTLESS

Thank you
Saturday, March 4, 2017

Session V: Obstetric Anesthesia Safety Session 1
Moderator: Manuel Vallejo, Jr., M.D., D.M.D.

Safety in Obstetric Anesthesia
Philip Hess, M.D.

Obstetric Anesthesia and Psychiatric Outcomes
John Sullivan, M.D.

Physicians Wellness
Manuel Vallejo, Jr., M.D., D.M.D.
Safety in Obstetric Anesthesia
How to Use a QI Program to Improve Care

Philip Hess, MD
Associate Professor, Harvard Medical School
Chief of Obstetric Anesthesia
Beth Israel Deaconess Medical Center

Declaration
I have no conflicts of interest to report

Patient Safety
Patients are at risk
- Poor health
- Side effects of medicines or procedures
- Health care is complex
Goal: Accidental or preventable injuries produced by medical care

Why Errors Happen
Active failure – direct contact with the patient
- Mistakes, poor judgement and procedural violations
Latent failure – as a result of workplace or system
- Time pressure, understaffing, poor equipment
- Over active alarms, poor protocols and procedures, and design deficiencies

Active Failure

Latent Failure


Theory of Human Error

Person Approach
- People make mistakes
- Lack of training
- Lack of skills
- Lack of intelligence
- Evaluate and train
- Reprimand and fire

System Approach
- Systems can create or prevent error
- Systems should be designed to:
  - Reduce error rate
  - Minimize harm when an error happens

Error Prevention

Identified published cases
Categorized in 9 (Nine) forms
Created 4 'systems' to prevent these errors.

‘Systems’
- Label all syringes
- Read all labels
- Double check the label
- Use of non-Luer lock connectors

‘Systems’

Person dependent

Quality Programs

Quality Assurance (QA)
- Data collection and analysis
- Quality indicator dashboards
- Benchmark metrics

Limits:
- Quality of data
- Choice of measures

Case #1

- 24 year old Ga Po 39 weeks requested epidural pain relief
- Epidural catheter placed at L3/L4 on first attempt
- 3cc of lidocaine 1.5% with epinephrine administered
- Followed by 12 cc of 0.1% Ropivacaine with fentanyl 2mcg/cc

7 minutes after injection:
- Blood pressure 70/35, HR 135
- Sensory level to neck
- Unable to move legs, arms weak
- Fetal bradycardia

STAT cesarean delivery
- No medicine required for surgery
QA vs. QI

<table>
<thead>
<tr>
<th>QA</th>
<th>QI</th>
</tr>
</thead>
<tbody>
<tr>
<td>• STAT cesarean delivery</td>
<td>• Improvement needed</td>
</tr>
<tr>
<td>• Regional anesthesia used</td>
<td></td>
</tr>
</tbody>
</table>

Quality Programs

- Quality Improvement (QI)
  - Industrial engineering techniques
  - Systems-based solutions
  - Retrospective and Prospective

Achieve a different level of safety

QI Models

- Lean – Elimination of Waste
- Six Sigma – Elimination of Variation
- Process Management – Cyclical Improvement
- Hazard analysis – Elimination of vulnerabilities

Lean Example – Visual Workspace

Eliminate Variation

Placenta accreta
- 1:750 USA / Canada
- Median blood loss 1L to 3L

Error #2

- 33 year old G2 P1 with increta
- Cesarean delivery uneventful, followed by large blood loss from deep pelvic veins
- Transfusion maintained vital signs until bleeding was controlled
Eliminate Variation

Multidisciplinary meeting
- One month prior
- Nine services
Preop briefing
- Shared mental model
Blood bank coordination
- Protocol
- Blood nurse

Error #2

Postoperative volume overload
- Hematocrit 47%
- Remained intubated ~23 hours
- Diuretics were administered
- Oxygen requirement >24 hours

QA vs. QI

QA
- Planned ICU admission
- < 24 hours intubation

QI
- Circulatory overload

Transfusion Associated Circulatory Overload

- 3% to 5% of all surgical transfusions
- Incidence after cesarean 1.4%

Anesthesiology 2015; 122:21-8
- Improvement in evaluation of blood loss

Training in Visual Blood Loss Estimation

Blood Loss vs. Circulatory Volume

- Improved quantification of blood loss
- No quantification of circulatory volume
  - This is the desired outcome
Positive pressure ventilation = increased intrathoracic pressure

Case #3
- 24 year old G1P0 term pregnancy
- Sudden onset of fetal bradycardia
- STAT cesarean called

Case #2
- 5 minutes to enter OR
  - Difficulty arranging team, moving patient
- 15 minutes to delivery
  - Missing equipment, too many people in the room
  - No antibiotic administered
  - Baby with brain injury

In Situ Simulation Program on a 4- or 6-week iterative schedule

Simulation Training
System Debrief

Changes over time

Simulation Times
Conclusion

- Mistakes and errors will happen
- Goal is to minimize errors and reduce harm
- Quality Assurance (QA) – Targets and measures
- Quality Improvement (QI) – Active assessment and alteration of systems

Thank you
Obstetric Anesthesia and Psychiatric Outcomes

John T. Sullivan, M.D., M.B.A.
President, Society of Obstetric Anesthesiology and Perinatology
Professor, Anesthesiology

Learning Objectives

- Provide postpartum depression (PPD) background
- Identify PPD risk factors, etiology
- Compare relationship of labor analgesia-PPD
- Highlight research on PPD and inflammation
- Review treatment strategies

Postpartum Depression

- Incidence
  - 14.5% at 3 months
  - 500K women in United States per year
- Mechanisms
  - Biologic: gonadal steroid withdrawal, oxytocin
  - Psychosocial stressors: sleep deprivation, etc.
- Etiology not well defined


PPD Adverse Effects

- Family discord
- Loss of income
- Impact on breast-feeding
- Poor cognitive function/development children
- Suicide
- Infanticide


Edinburgh Postnatal Depressive Scale

- Score of 13: sensitivity 86%; specificity 78% in US


Disclosure

I have no financial relationships with bearing on the subject matter of this talk

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Acute Pain-Mode of Delivery

Eisenach JC: Severity of acute pain after childbirth, but not type of delivery, predicts persistent pain and postpartum depression. Pain 2008;140:87-94

Severity of acute pain after childbirth, but not type of delivery, predicts persistent pain and postpartum depression

James C Eisenach *, Peter H Paz, Richard Smiley, Patricia Lazar/Drummond, Ruth Landau, Timothy T. Houle

- Mode of delivery not related to chronic pain (10.0%) and PPD (11.2%)
- Acute postpartum pain predicts chronic pain and PPD (OR 2.5, 3.0)

Eisenach JC: Severity of acute pain after childbirth, but not type of delivery, predicts persistent pain and postpartum depression. Pain 2008;140:87-94

Peripartum Suicide

- Accidental/incidental deaths not included in CDC mortality data
- Case rate 4.6/100 K in Colorado
- Leading cause of maternal death in US?

https://www.cdc.gov/reproductivehealth/maternalinfanthealth/prrs.html


PPD Risk Factors

- History of depression or psychiatric diagnosis
- Unplanned pregnancy
- Limited social support
- Catastrophizing cognitive distortion
- Adverse events:
  - Adverse neonatal outcome
  - Emergent cesarean?
  - Labor pain experience?


Severity of acute pain after childbirth, but not type of delivery, predicts persistent pain and postpartum depression

James C Eisenach *, Peter H Paz, Richard Smiley, Patricia Lazar/Drummond, Ruth Landau, Timothy T. Houle

- Prospective longitudinal cohort study
- N=837 VD, 391 CD patients
- Pain assessment at 36 hrs, 8 wks
- Primary: Does CD predict persistent pain?
- Secondary: Does acute pain predict chronic pain and PPD?

Eisenach JC: Severity of acute pain after childbirth, but not type of delivery, predicts persistent pain and postpartum depression. Pain 2008;140:87-94

Peripartum Suicide Background

- 14.5-17.8/100K total US maternal deaths
- 3.7-4.6/100K rate of peripartum suicide
- 20-30% of all maternal deaths in US?
  1. Suicide
  2. Trauma
  3. Cardiac comorbidity


Factors Associated with PPD

<table>
<thead>
<tr>
<th>Factor</th>
<th>OR</th>
<th>95% CI</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epidural analgesia</td>
<td>0.31</td>
<td>0.16-0.61</td>
<td>0.001</td>
</tr>
<tr>
<td>Childbirth classes</td>
<td>0.44</td>
<td>0.22-0.87</td>
<td>0.018</td>
</tr>
<tr>
<td>Satisfaction with care</td>
<td>0.38</td>
<td>0.17-0.83</td>
<td>0.016</td>
</tr>
<tr>
<td>Pain at 10 cm</td>
<td>1.23</td>
<td>1.07-1.40</td>
<td>0.004</td>
</tr>
<tr>
<td>EPDS score 3 days</td>
<td>1.36</td>
<td>1.21-1.52</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Cesarean delivery</td>
<td>2.55</td>
<td>1.30-4.99</td>
<td>0.006</td>
</tr>
<tr>
<td>Hx premenstrual syndrome</td>
<td>3.13</td>
<td>1.62-6.03</td>
<td>0.001</td>
</tr>
</tbody>
</table>

**Major Depression-Inflammatory Etiologic Theory**
- Increased pro-inflammatory cytokines in neurodegenerative dz with depressed sx
- Elevated cytokines in severe dz (e.g., suicide)
- SSRI resistant depression: higher cytokines
- Cytokines →glial cell IDO to convert tryptophan →quinolinic acid →↓serotonin
- Depression-heterogeneous dz, many subtypes

*Young JJ. A review of the relationship between proinflammatory cytokines and major depressive disorder. J Affect Dis 2014;169:15-20*

**Unidimensional Pain Measurement**
- No objective measures of pain
- Pain scales (VRS, VAS) simple but incomplete
- Underutilized dimensions:
  - Expectations, anxiety, rest, satisfaction
- Pain burden (AUC) adds element of time
- Multidimensional questionnaires

*Carvalho B: Moving beyond the 0-10 scale for labor pain measurement. Anesth Analg 2016;123:1351-3*

**Catastrophizing Cognitive Distortion**
- Patient subtype experiences pain differently
- Increased anticipation, attention & emotional response to pain
- Pain measurement imperfect-subject to bias


**Inflammation & Health Outcomes**
- Inflammation pathogenesis implicated in:
  - Cardiovascular dz, neurodegenerative dz, type 2 diabetes, cancer, aging, depression
- Mechanistic theories:
  - Immune deregulation, hormone changes, oxidative stress, mitochondrial dysfunction, epigenic modification


**Confounding Variables**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Epidural</th>
<th>No Epidural</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cesarean delivery</td>
<td>15.0%</td>
<td>36.4%</td>
<td>0.01</td>
</tr>
<tr>
<td>Oxytocin administration</td>
<td>66.4%</td>
<td>50.5%</td>
<td>0.018</td>
</tr>
<tr>
<td>Breastfeeding</td>
<td>70.1%</td>
<td>49.5%</td>
<td>0.002</td>
</tr>
</tbody>
</table>

*Not an RCT
Choice of epidural labor analgesia in China: selection bias?

### Inflammation and PPD
- Prospective observational trial
- 135 parturients for elective CD
  - Matched 90 PPD at-risk pts: 45 controls (2:1)
- CSF, serum biomarkers assayed at spinal anesthetic placement
- Correlation with development of PPD (Inventory Depressive Symptoms-SR)

Miller ES: Biomarkers of inflammation in perinatal depression: are cerebrospinal fluid inflammatory cytokines associated with perinatal depression? SMFM 2017 A-691

---

### CSF Cytokines and PPD

<table>
<thead>
<tr>
<th>Cytokine</th>
<th>aOR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>IL-1β</td>
<td>66.67</td>
<td>1.72-2579.63</td>
</tr>
<tr>
<td>IL-6</td>
<td>0.48</td>
<td>0.20-1.13</td>
</tr>
<tr>
<td>IL-8</td>
<td>0.97</td>
<td>0.93-1.01</td>
</tr>
<tr>
<td>IL-18</td>
<td>1.19</td>
<td>0.33-4.26</td>
</tr>
<tr>
<td>IL-23</td>
<td>29.11</td>
<td>1.69-502.73</td>
</tr>
<tr>
<td>IL-33</td>
<td>1.56</td>
<td>0.96-2.53</td>
</tr>
<tr>
<td>IFNβ</td>
<td>1.18</td>
<td>0.76-1.84</td>
</tr>
<tr>
<td>TNFα</td>
<td>0.48</td>
<td>0.26-1.51</td>
</tr>
<tr>
<td>MCP1</td>
<td>1.00</td>
<td>1.00-1.00</td>
</tr>
</tbody>
</table>

Miller ES: Biomarkers of inflammation in perinatal depression: are cerebrospinal fluid inflammatory cytokines associated with perinatal depression? SMFM 2017 A-691

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### SSRIs: Serum Cytokines
- Elective CD: 14 on SSRIs; 121 not on SSRIs

<table>
<thead>
<tr>
<th>Cytokine</th>
<th>SSRI (n=14)</th>
<th>No SSRI (n=121)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serum IFNγ</td>
<td>3.2 (2.6-3.2) pg/mL</td>
<td>4.7 (3.2-9.5)</td>
<td>0.044</td>
</tr>
<tr>
<td>Umbilical IL8</td>
<td>2.1 (2.8-15.8) pg/mL</td>
<td>8.6 (2.1-6.2)</td>
<td>0.022</td>
</tr>
</tbody>
</table>

Miller ES: The association of SSRIs with inflammatory cytokines in maternal cerebrospinal fluid, peripheral blood and umbilical cord blood. SMFM 2017; A-690

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### SSRI Compliance & Pregnancy
- SSRI: increased risk of cardiac septal defects?
  - 3.7% exposed, 3.1% unexp. OR 1.06 (1.13-1.20)
  - aOR 1.06 (0.91-1.24) (sibling controlled)
- Compliance and adverse outcomes:
  - 47% (13/27) peripart. suicides-SSRI discontinued
  - Physician-recommended (4)
  - Self discontinuation (9)


---

### Depression, Breast-Feeding & Epidural Analgesia
- Breast-feeding: short & long-term effects:
  - Reduced infection, asthma, SIDS
- Depressive symptoms correlate negatively:
  - Breast-feeding initiation, duration
- Uncertain impact of epidural analgesia and breast feeding
  - High dose opioid techniques reduce breast-feeding

Hawkins JL: Epidural analgesia for labor and delivery. NEJM 2010;362:1503-10

---

### Oxytocin, Depression & Labor Analgesia
- Oxytocin: neuropeptide, anti-depressive effects
- Epidural analgesia-increase oxytocin use
  - Greater tolerance, prolonged 2nd stage?
- Breast-feeding prolongs endogenous oxytocin
- Ding study: oxytocin use:
  - 50.5% no analgesia
  - 66.4% epidural analgesia
  - P=0.018


---

120
PPD & Anesthesia Hypotheses

- Pain/traumatic trigger
  - Intra- and postpartum management, selection bias
- Inflammation
  - Neuraxial anesthesia & fever, sympathectomy
  - NSAIDs (prevalent use postpartum)
- Oxytocin interaction
  - Induction/augmentation, breast-feeding
- Chronic pain relationship

Conclusions

- Postpartum depression is the most prevalent serious complication of childbirth
- Postpartum suicide is the leading cause of maternal death
- The labor experience, including pain, may contribute to PPD in susceptible patients
- Pain should be evaluated multidimensionally

Principal Treatment Strategies

- Readiness
- Recognition/Prevention
- Response
- Reporting/Learning Systems

Council on Patient Safety in Women’s Health. 2016:  
Promoting a Healthy Working Environment

Manny Vallejo, MD, DMD
Assistant Dean and DIO
Professor of Medical Education, Anesthesiology, Obstetrics & Gynecology
West Virginia University School of Medicine

No financial disclosures

Learning Objectives
1. Define and discuss burnout and depression
2. Discuss how burnout and depression can affect patient care
3. Discuss ways to promote a healthy working environment

Depression
• Also known as major depressive disorder or clinical depression
• “Mood disorder that causes a persistent feeling of sadness and loss of interest; it affects how you feel, think and behave and can lead to a variety of emotional and physical problems”
• You may have trouble doing normal day-to-day activities, and sometimes you may feel as if life isn’t worth living
• Before intern year, only about 4% of doctors have clinical depression = same rate for the rest of the population
• During internships, rates shoot up to 25%

Burnout
• A growing crisis within the medical workforce
• One half (50%) of all students and practicing physicians experience burnout
• By definition, burnout is a long-term stress reaction characterized by
  – depersonalization, including cynical or negative attitudes toward patients
  – emotional exhaustion, a feeling of decreased personal achievement
  – loss of enthusiasm
  – cynicism
  – decreased personal accomplishment
  – and a lack of empathy for patients
• Raise your hand if you have ever had problems sleeping related to work?
• In the 2013 Stanford Physician Wellness Survey, sleep-related impairment was the single strongest predictor of burnout and was highly associated with depression in physicians

“AS A PATIENT, YOU’D NEVER GUESS THAT HALF OF ALL AMERICAN DOCTORS ARE BURNED OUT, BECAUSE THE CULTURE OF MEDICINE Dictates that DOCTORS SHOW NO WEAKNESS’”

Quote in Time Magazine
Medical Errors

- A study of nearly 8,000 surgeons found that burnout and depression were among the strongest predictors of a surgeon’s reporting a major medical error.

The Burnout Problem

- Approximately 46-80% of physicians report moderate to high levels of emotional exhaustion.
- A national study of 7,288 US physicians showed that 45.8% were experiencing at least one symptom of burnout.
- Studies of medical residents have yielded even more varied estimates of burnout ranging from 18-82%.

Extent of the Problem

- A physician whose health is compromised by burnout is more likely to provide suboptimal care.
- Studies of medical students and residents have demonstrated that burnout (which is closely related to but distinct from depression) is associated with:
  - greater numbers of medical errors
  - high self-reported rate of cheating on examinations
  - lying about clinical data
  - providing less compassionate patient care, and
  - in general having less altruism (the concern for the wellbeing of others).

Extent of the Problem

- Guille and colleagues documented that depression during residency training is a well-described potential precursor to suicide.
- The risk of death by suicide appears to develop in medical school during the clinical years.
- Peaks with clinicians in their 50’s.

Suicide

- According to the American Foundation for Suicide Prevention, as many as 400 doctors, the equivalent of two to three graduating medical-school classes, die by suicide every year.
- Evidence of job problems around the time of death was more common in physicians who died by suicide than other suicide victims.
- Physicians who died by suicide frequently had more difficult, emotionally draining, and/or demanding patients throughout their careers and near the times of their deaths.

Why Don’t Physicians Seek Help

- Physicians do not avail themselves to treatment because they are reluctant to seek help and tend to engage in self-treatment.

Suicide

- According to the American Foundation for Suicide Prevention as many as 400 doctors, the equivalent of two to three graduating medical-school classes, die by suicide every year.
- Evidence of job problems around the time of death was more common in physicians who died by suicide than other suicide victims.
- Physicians who died by suicide frequently had more difficult, emotionally draining, and/or demanding patients throughout their careers and near the times of their deaths.
Reasons Include

- Lack of personal time
- A preference to manage problems on one's own
- Lack of convenient access to mental health services
- Concerns about confidentiality are all significant barriers to mental health treatment for residents in training and practicing physicians

Wellness

- Defined as “the state or condition of being in good physical and mental health”
- Stress affects every aspect of wellness – its how you react to stress

Potential Solutions

- Ideas for physician wellness programs were published as early as 1897 in an editorial
- Focusing on finding pleasure in the simple things in life, and continuing to stay engaged in life outside of medicine even when fatigued and working an erratic schedule

Potential Solutions

- Studies indicate that peers are the most acceptable sources of support for physicians, yet in the United States there are no consistent programs for peer support through advocacy organizations

AMA’s Five STEPS to Create a Wellness Culture

1. Create a framework
2. Develop a program
3. Foster at an individual level
4. Empower faculty and trainees to confront burnout
5. Create a sustainable culture of wellness and resiliency
Duty Hour Limitation: Does it Matter?

- ACGME limits on duty hours was first implemented in 1989, and revised in 2003, and again in 2011
- The new ACGME requirements were designed in part to address issues of resident stress, burnout, sleep deprivation, and medical errors
- Unfortunately, the results of duty hour changes have been disappointing

**Why?**

Establishing a Wellness Committee

- Made up of volunteers from each department who work with organizational leaders to periodically measure burnout through a survey
- Meets on a regular basis for brainstorming sessions to review current projects, plan new initiatives, discuss survey data, and respond to new opportunities or stresses
- “We sit down with each department and review their data from this year compared to last year”

Duty Hour Limitation: Does it Matter?

- Our profession has not yet found the minimal threshold of exposure below which both resident health and clinical performance improvement nor do such duty requirements address the root causes of dissatisfaction that might in fact require a significant overhaul of the way in which residents are trained
- In the end, the importance of the learning environment was generally overlooked, as if nothing else mattered but the amount of time at work
- => The Continuous Learning Environment (CLER)

---

**PHQ9**

- The Survey Says...
Reset Room

- A place physicians and other providers can go if they need a moment to reset during their day
- If there is a traumatic event they wish to recover from, or they just want to get away for a moment, make a phone call, or take a short nap, they can duck into the reset room
- Physicians and other providers can enter this quiet space for reflection or to disconnect for a moment
- The reset room does not have to be located directly in prime patient care areas but can ideally be located away from these areas where the resident can quietly “get away”

Balance in Life Program at Stanford University

- A program to promote psychological well-being, physical health and mentoring
- Every week, one of the six groups of surgery residents has a mandatory psychotherapy session with a psychologist
- Each senior resident mentors a junior resident, and residents are given time for team bonding
- Young doctors rarely have time to go see a doctor of their own, so the wellness team issues lists of doctors and dentists it recommends
- “…and there’s now a refrigerator in the surgery residents’ lounge, stocked with healthy foods”
Take Your Dad to Work Day
In Summary

• Approximately 50% of residents (and faculty) are experiencing burnout
• Burnout and depression compromises personal well being
• Burnout leads to suboptimal patient care and medical errors
• Building resilience through social support and social activities, health promoting behavior, professionalism, and mentorship is key
• There is more to life than just work

References

• Okanlawon T. Physician wellness: preventing resident and fellow burnout. AMA 2015
• Oaklander M. Doctors are stressed, burned out, depressed, and when they suffer, so do their patients. Time September 7–14, 2015.
Session VI: New Approaches for Learning Obstetric Anesthesia and Review of Last Years Best Articles
Moderator: John Sullivan, M.D.

New Approaches and Resources for Learning and Teaching Obstetric Anesthesia
*Lawrence Chu, M.D., M.S.*

Ostheimer Lecture
*Philip Hess, M.D.*
What’s New in Clinical Obstetric Anesthesia
Sam Hughes Lecture
Publications from 2015

Philip Hess, MD

What’s new in OB anesthesia?

- Mortality and Morbidity
- Cesarean Delivery
- Obstetric Hemorrhage
- Effects of Anesthesia

Mortality and Morbidity

Trends in Maternal Mortality


Maternal Mortality

Disclosures

- No conflicts of interest
Maternal Mortality

CDC’s Pregnancy Mortality Surveillance System

Maternal deaths within one (1) year

10 category Cause-of-death coding
- ACOG and the CDC Maternal Mortality Study Group

Maternal Mortality

20,959,533 live births during 2006–2010

3,358 pregnancy-related (8,645 total deaths)

16.0 deaths per 100,000 live births
- 86.5% within 42 days (13.6 per 100,000)

Maternal Morbidity

Race


Maternal Morbidity

Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD) Maternal-Fetal Medicine Units (MFMU) Network

25 hospitals – 4 years – 109,208 deliveries
- Non-Hispanic white 48% (n=552,040)
- Non-Hispanic black 22% (n=533,688)
- Hispanic 25% (n=527,291)
- Asian 5% (n=55,999)

Maternal Morbidity

Severe Postpartum Hemorrhage

Obstet Gynecol 2015;125:1460-7
Maternal Morbidity

Peripartum Infection

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Non-Hispanic White</th>
<th>Non-Hispanic Black</th>
<th>Hispanic</th>
<th>Asian</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unadjusted OR (95% CI)</td>
<td>3.19 (1.13-9.16)</td>
<td>3.28 (1.85-5.89)</td>
<td>1.64 (0.31-8.70)</td>
<td>1.57 (0.40-6.24)</td>
</tr>
<tr>
<td>Adjusted OR (95% CI)</td>
<td>3.15 (0.81-12.25)</td>
<td>3.15 (0.21-4.51)</td>
<td>1.30 (0.13-1.26)</td>
<td>1.83 (0.85-3.84)</td>
</tr>
</tbody>
</table>

Maternal Morbidity

Severe Perineal Laceration

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Non-Hispanic White</th>
<th>Non-Hispanic Black</th>
<th>Hispanic</th>
<th>Asian</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unadjusted OR (95% CI)</td>
<td>1.0 (reference)</td>
<td>0.97 (0.64-1.46)</td>
<td>1.65 (0.50-5.32)</td>
<td>0.90 (0.41-2.00)</td>
</tr>
<tr>
<td>Adjusted OR (95% CI)</td>
<td>1.0 (reference)</td>
<td>0.75 (0.36-1.60)</td>
<td>0.66 (0.20-2.27)</td>
<td>0.90 (0.32-2.59)</td>
</tr>
</tbody>
</table>

Maternal Mortality

Age

Advanced maternal age (≥35 yr): 27.4%

Maternal Comorbidity

  - 6% Cardiovascular outcome
Maternal Comorbidity

  - 6% major events (mortality, LVAD, transplant)
  - 10% adverse maternal events (2% mortality)
  - 50% adverse fetal outcomes

Maternal Mortality


Maternal Mortality

Preventable?

41% of deaths ‘Good to Strong’
- Hemorrhage (70%)
- Preeclampsia (60%)
- Cardiovasc (29%)

Obstetric Anesthesia

Parturients are older and have more complex medical histories.
High risk patients sent to Level IV centers

Challenge:
How do we improve care?

Guidelines

Toward Improving the Outcome of Pregnancy
March of Dimes 1975
Integrated system for regionalized perinatal care
Levels of neonatal care
  - 3 levels – improved mortality

JAMA 2010;304:1952-1960
Am J Obstet Gynecol 2015;212:259-71
Guidelines

Levels of Maternal Care.
Leves of Maternal Care.
Am J Obstet Gynecol 2015;212:259-71

LEVEL I (Birth center)
Uncomplicated pregnancies
Ability to stabilize and transfer
Anesthesia services available
• Labor analgesia
• Surgical anesthesia

LEVEL II (Specialty care)
High-risk antepartum, intrapartum, or postpartum conditions
Severe preeclampsia, Obesity, Previa
Anesthesia services available at all times
• Board-certified anesthesiologist with special training or experience in obstetric anesthesia
• Available for consultation

LEVEL III (Subspecialty care)
Complex maternal medical, obstetric, fetal conditions

LEVEL IV (Regional perinatal health care)
Most complex maternal conditions and critically ill

Anesthesia services available at all times
• Board Certified anesthesiologist
• Special training or experience in obstetric anesthesia
• In charge of obstetric anesthesia

ICU Admissions

Crit Care Med 2015;43:78-86
ICU Admissions

- French hospital discharge database
  - (Programme de Médicalisation des Systèmes d’Information)
- 11,824 pregnancy-related ICU admissions in France from 2006 to 2009
  - 3.62 per 1,000 deliveries

Diagnosis

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>% of admissions</th>
<th>Rate / 100,000 deliveries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hemorrhage</td>
<td>34.2</td>
<td>1.24</td>
</tr>
<tr>
<td>Hypertensive DO</td>
<td>22.3</td>
<td>0.81</td>
</tr>
<tr>
<td>Cardiovascular</td>
<td>8.0</td>
<td>0.29</td>
</tr>
<tr>
<td>Infectious</td>
<td>*</td>
<td>0.13</td>
</tr>
<tr>
<td>Thromboembolic</td>
<td>2.8</td>
<td>0.10</td>
</tr>
<tr>
<td>Anesthesia</td>
<td>*</td>
<td>0.02</td>
</tr>
<tr>
<td>AFE</td>
<td>*</td>
<td>0.02</td>
</tr>
</tbody>
</table>

Crit Care Med 2015;43:78-86

ICU Admissions

Sepsis


Sepsis

- Maternal Mortality Surveillance records from the Michigan Department of Community Health
  - Sepsis identified by:
    - Death certificate cause of death,
    - Maternal Mortality Medical Surveillance Committee, or
    - Specific source of infection leading to organ failure

Sepsis

558 maternal deaths
  - 14 per 100,000 live births

Sepsis:
  - 15% of pregnancy-related mortality
  - 2.1 deaths/100,000 live births

Sepsis

- Inadequate care:
  - Delayed identification
  - Delayed treatment
  - Inadequate antibiotic coverage

Obstet Gynecol 2015;126:747-52
Sepsis - MOEWS

- Performs poorly in pregnancy
- Positive predictive value <2%
  - [Am J Obstet Gynecol 2010;203:573.e1-5]

Multiple obstetric – focused versions

6 MOEWS and MEWS

- 913 women with chorioamnionitis
- 5 with severe sepsis
- Low PPV of all 6 MOEWS
- None performed as well as the MEWS

Cesarean Delivery

“There is no justification for any region to have a cesarean delivery rate higher than 10-15%”


194 WHO member states
- 54 countries with published rates
- 118 countries with estimated from previous
- 22 countries calculated from economic / social factors

2012:
- 22,900,000 cesarean deliveries (est)

Maternal Mortality Rate
≥ 19.1% (95% CI, 16.3% to 21.9%)
≥ 20% when only high quality data used

Neonatal Mortality Rate
≥ 19.4% (95% CI, 18.6% to 20.3%)
≥ 24% when only high quality data used

86% of anesthesia-associated mortality during cesarean

Failed airway ~ 1 / 250 parturients

Mortality from anesthesia has decreased
? Improved practice and equipment?
Cesarean Anesthesia
Conversion to GA

Maternal and Fetal Outcomes Following Unplanned Conversion to General Anesthetic at Elective Cesarean Section.
J Perinatol 2015;35:695-9

4337 deliveries from 2008 to 2013
- Single center
- Non-emergent

 Identified conversion to general anesthesia

Cesarean Anesthesia
Conversion to GA

Rate of general anesthesia: 3.8%

<table>
<thead>
<tr>
<th>Type of Anesthesia</th>
<th>Number planned</th>
<th>Convert to GA</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epidural</td>
<td>132</td>
<td>15</td>
<td>11.4%</td>
</tr>
<tr>
<td>Spinal</td>
<td>3831</td>
<td>67</td>
<td>1.74%</td>
</tr>
<tr>
<td>CSE</td>
<td>291</td>
<td>0</td>
<td>0%</td>
</tr>
</tbody>
</table>

General anesthesia associated with

* Delayed neonatal respiration

Patient Safety Minute
Obstetric Airway

Guidelines
Obstetric Airway

Anaesth 2015;70:1286-306

Guidelines
Obstetric Airway

Three Algorithms:
1. Safe Obstetric General anesthesia
   Planning and preparation, up to second failed attempt
2. Obstetric Failed Tracheal Intubation
3. ‘Can’t Intubate, Can’t Oxygenate’
5 valuable charts to aid decision-making
Poster-ready format


Cesarean Delivery
Adverse Events


Cesarean Delivery
Adverse Events

2003 to 2012
Hospital discharge records
785,000 cesarean deliveries

Cesarean Delivery
Adverse Events

Anesthesia events
Rate = 730 / 100,000
Non-anesthesia events
Rate = 890 / 100,000

Anesthesia events
• Minor – 94% of events
  • Dural puncture headache
• Major (≥ 1% risk of death)

Non-anesthesia events
• Myocardial infarction
• Heart failure
• Respiratory failure
• PE / DVT
• DIC
• Renal failure
• Sepsis
• Stroke

Anesthesiol 2015;123:1013-23
Cesarean Anesthesia
Hypotension

Aortocaval compression
- Supine hypotension syndrome
- Fetal perfusion decrease

Foundation for lateral tilt
How much tilt is required?


10 healthy pregnant women (37 – 39 wks)
10 healthy volunteers
MRI performed at 4 positions of tilt
Aortic and vena cava volumes measured (L2-3 and L3-4)

Cesarean Anesthesia
Hypotension

<table>
<thead>
<tr>
<th>Tilt Angle</th>
<th>Pregnant</th>
<th>Nonpregnant</th>
</tr>
</thead>
<tbody>
<tr>
<td>0°</td>
<td>5.4 ± 0.9</td>
<td>4.6 ± 0.8</td>
</tr>
<tr>
<td>15°</td>
<td>5.6 ± 0.8</td>
<td>4.7 ± 0.7</td>
</tr>
<tr>
<td>30°</td>
<td>5.4 ± 0.6</td>
<td>4.6 ± 0.6</td>
</tr>
<tr>
<td>45°</td>
<td>5.4 ± 1.1</td>
<td>4.5 ± 0.6</td>
</tr>
<tr>
<td>Mean arterial pressure (mmHg)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0°</td>
<td>77 ± 8</td>
<td>76 ± 3</td>
</tr>
<tr>
<td>15°</td>
<td>80 ± 4</td>
<td>77 ± 5</td>
</tr>
<tr>
<td>30°</td>
<td>76 ± 4</td>
<td>76 ± 5</td>
</tr>
<tr>
<td>45°</td>
<td>80 ± 10</td>
<td>75 ± 6</td>
</tr>
<tr>
<td>Heart rate (beats/min)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0°</td>
<td>81 ± 14</td>
<td>72 ± 4</td>
</tr>
<tr>
<td>15°</td>
<td>79 ± 12</td>
<td>73 ± 7</td>
</tr>
<tr>
<td>30°</td>
<td>79 ± 14</td>
<td>71 ± 6</td>
</tr>
<tr>
<td>45°</td>
<td>81 ± 14</td>
<td>71 ± 6</td>
</tr>
</tbody>
</table>
Cesarean Anesthesia
Hypotension

Hypotension is potentially bad
- Fluids: Ineffective
- Ephedrine: Tachycardia
  Fetal acidosis
- Phenylephrine: Bradycardia
  Decreased cardiac output


104 parturients
- Scheduled cesarean delivery
- ASA 1 or 2
- Singleton
- Term
Spinal anesthesia
- 11mg bupivacaine (hypobaric) / 15μg fentanyl
- 2 liter IV fluid cohydration
- Hip wedge

Randomized to infusion of:
- Norepinephrine
- Phenylephrine
Infusion maintained by computer-controlled, closed-loop feedback system.
Primary outcome: Cardiac Output
Postpartum Care

IJOA 2015;24:124-30

Postpartum Care

- Select patient population
- Education!
- Sports drink 2h preop
- Active warming in OR
- Spinal anesthesia with diamorph
- Early feeding
- Early mobilization

Postpartum Care

Enhanced recovery / fast tracking
- Cardiac surgery
- Colorectal
- Orthopedic
- Gynecologic
- Urology

Reduced morbidity, faster recovery

Postpartum Care

<table>
<thead>
<tr>
<th>Day of discharge</th>
<th>Number discharged n (%)</th>
<th>Readmissions n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
<td>114 (45%)</td>
<td>5 (4%)</td>
</tr>
<tr>
<td>Day 2</td>
<td>375 (49%)</td>
<td>21 (6%)</td>
</tr>
<tr>
<td>Day 3+</td>
<td>271 (36%)</td>
<td>35 (13%)</td>
</tr>
</tbody>
</table>

Protocols and Guidelines

Does the Presence of a Condition-Specific Obstetric Protocol Lead to Detectable Improvements in Pregnancy Outcomes? 
Am J Obstet Gynecol 2015;213:86 e1-6
Protocols and Guidelines

NICHD / MFMU

25 hospitals – 4 years – 115,502 patients

Protocols:
- Hemorrhage
- Shoulder dystocia
- Preeclampsia

Am J Obstet Gynecol 2015;213:86 e1-6

Protocols and Guidelines

No change in outcomes
No change in morbidity

Am J Obstet Gynecol 2015;213:86 e1-6

Guidelines


Guidelines

- American College of Obstetricians and Gynecologists (2013)
- Royal College of Obstetrician and Gynaecologists (2011)
- Society of Obstetricians and Gynaecologists of Canada (2009)
- Royal Australian and New Zealand College of Obstetricians and Gynaecologists (2014)

Am J Obstet Gynecol 2015;213:76 e1-10

Guidelines

References # range from 12 to 110

Minimal review of RCT and meta-analyses
- ACOG: NONE!

Few points of agreement

Am J Obstet Gynecol 2015;213:76 e1-10

Points of Agreement

- Definition: Clinical markers > visual EBL
- Active management of 3rd stage
  - Medications in agreement
- Surgical or interventional radiology
  - 2nd line after medications
- Units should have resuscitative equipment
- Internal iliac balloons are +/- in accreta

Am J Obstet Gynecol 2015;213:76 e1-10
Obstetric Hemorrhage

Placenta Accreta


Placenta Accreta

Nationwide Inpatient Sample
- 2000-2011 data
- Discharges from 1000 hospitals
- 20% sample of the US

Trends in primary and repeat cesarean delivery: Nationwide Inpatient Sample, United States, 2000-2011

Download slide

Download slide

Download slide

Download slide
**Hemorrhage Resuscitation**

Transfusion ratio of Platelets, plasma, red cells
- Whole blood: 1:1:1
- Standard practice: 1:1:2

---

**Hemorrhage Resuscitation**

Transfusion of Plasma, Platelets, and Red Blood Cells in a 1:1:1 vs a 1:1:2 Ratio and Mortality in Patients with Severe Trauma: The PROPPR Randomized Clinical Trial. JAMA 2015;313:471-82

---

**Hemorrhage Resuscitation**

Multisite randomized study

In the ambulance
- Blood bank sent seal container
- Strict criteria for exclusion
- Randomized once seal broken
- Strict management of transfusion

---

**Hemorrhage Resuscitation**

1:1:1
- 1 U platelets
- 6 U FFP
- 6 U pRBC

1:1:2
- 3 U FFP
- 6 U pRBC
- 1 U Plt every other

---

**Hemorrhage Resuscitation**

Application to obstetric hemorrhage?
- DIC at delivery
- Usually one organ
- Shorter surgical times
- Lack of predictive nature
- Morbidly adherent placenta
- Transfusion related acute lung injury

---

**Hemorrhage Resuscitation**

Murad MI et al., Transfusion 2010; 50:1370-83

---

**Hemorrhage Resuscitation**

Hemorrhage
Resuscitation


<table>
<thead>
<tr>
<th>TRALI cases</th>
<th>Number of transfused surgeries</th>
<th>Rate (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Surgery</td>
<td>45</td>
<td>1.3% (1.0% to 1.8%)</td>
</tr>
<tr>
<td>OB/Gyn</td>
<td>0</td>
<td>0% (0 to 1.3%)</td>
</tr>
</tbody>
</table>

The Effects of Anesthesia Associations or Causality? A ≠ B

Anesthesia and The Developing Brain


Anesthesia and The Developing Brain

37 healthy infants
- MRI two weeks post delivery

Anesthesia
- None n=13
- Spinal anesthesia n=12
- Epidural analgesia n=12

Behavioral testing 12 months
Anesthesia and The Developing Brain

Mag Res Imag 2015;33:213-21

The Developing Brain


Early Hum Develop 2015;91:23-9

The Developing Brain

Rats: maternal stress produces
- Spatial learning
- Memory deficits

Humans?

Early Hum Develop 2015;91:23-9

The Developing Brain

2nd trimester enrollment
- Reported stressful life events - 2nd Tri
- Interview for Recent Life Events - 18 mo
- State-Trait Anxiety Inventory
- Edinburgh Postnatal Depression Scale

Child testing
- 6 mo, 18 mo, 48 mo

Attention

<table>
<thead>
<tr>
<th>Maternal stressors 2nd Trimester</th>
<th>Shifting</th>
<th>Focusing</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.49 P = 0.03</td>
<td>0.22 P=0.06</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Maternal stress at 18 months</th>
<th>Shifting</th>
<th>Focusing</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.08 P=0.87</td>
<td>-0.06 P=0.34</td>
<td></td>
</tr>
</tbody>
</table>

Early Hum Develop 2015;91:23-9

Anesthesia and The Developing Brain

Analgesia ≠ Un-medicating
Cesarean ≠ Vaginal
The Developing Brain

Mom’s life events during pregnancy affects the infant’s spatial working memory at 18 months

Early Hum Develop 2015;91:23-9

Anesthesia and The Developing Brain

- Sevoflurane (mice) Long-term learning impairment
- Propofol (rats) TNF-α in the cortex and thalamus
- Morphine (human) behavioral up to 2 years

Anesthesia and The Developing Brain


J Anesth 2015;29:749-57

Anesthesia and The Developing Brain

Kids who need surgery ≠ Kids who don’t

Anesthesia and The Developing Brain

Epidural “Fever”

- Epidural analgesia
- Inflammation
- Infection
- Neurologic injury

- Fever
Epidural “Fever”


Inflammatory biomarkers = active labor

Epidural “Fever”


Inflammatory biomarkers in mom = no injury
Inflammation in fetus = neurologic injury

Epidural “Fever”


Chorionic (maternal) inflammation = no neurologic injury
Funisitus (fetal) inflammation = neurologic injury

Epidural “Fever”


Swedish Birth Registry
- 300,000 deliveries
- 10 years
- Nulliparous women with singleton pregnancies at term
- Spontaneous onset of delivery
Epidural analgesia: 44%
**Epidural “Fever”**

- Women who received Epidural Analgesia
  - Shorter
  - Higher BMI
  - Larger fetus

- Multivariate analysis:
  - Epidural: No neurologic sequela
  - Fever: Convulsions
  - Neonatal cerebral ischemia

- Epidemiology
  - Dystocia and prolonged labor
  - Instrumental delivery
  - Chorioamnionitis or other infections
  - 6-fold higher rate of fever (1.4% vs. 0.24%)

**Labor Analgesia**

- Second Stage

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

- 310 nulliparous laboring women
- Second stage epidural infusion
  - Bupivacaine/fentanyl
  - Fentanyl
- Second stage: 75 min vs. 73 min
- No difference in labor outcomes
Labor Analgesia
Second Stage

Weak legs ≠ Weak Uterus

Thank you!
Saturday, March 4, 2017

Session VII: New Ways in Obstetrical Practice
Moderator: Robert Gaiser, M.D.

Is it Time to Abandon LUD?
Kenneth Nelson, M.D.

Optimal Anesthesia Approach to External Cephalic Version
John Sullivan, M.D.

Controversies in Obstetric Anesthesia
Jennifer Lucero, M.D.
Is it Time to Abandon Left Uterine Displacement?

Kenneth E Nelson, M.D.

Disclosures

none.

Left Tilt and Aortocaval Compression

Do you use “left uterine displacement” after spinal anesthesia for Cesarean delivery?

First suggestion of Aortocaval Compression?

Antecubital and femoral venous pressure in normal and toxemic pregnancy

McLennan CE. Am J Obstet Gynecol 1943;45:568–91

First report of Supine Hypotensive Syndrome?

Supine Hypotensive Syndrome in late Pregnancy


“Displacement” ↔ “Tilt”

Report of arterial contrast radiography from 1935
Compression of the aorta by the uterus in late human pregnancy. Variations between femoral and brachial pressure with changes from hypertension to hypotension.


"Supine hypotensive syndrome is characterized by pallor, bradycardia, sweating, nausea, hypotension and dizziness and occurs when a pregnant woman lies on her back and resolves when she is turned on her side."

...when there is aortocaval compression due to the weight of the fetus, signs of shock may be experienced.

Wikipedia

We’re not good at estimating tilt

• 16 Anesthetists during cesarean sections
• Tilted table as per routine practice
• Asked to assess degree of tilt
• Estimated: 7° - 35°
• Actual: 7° - 15° (only one patient was actually 15°)
• Almost all overestimated tilt, some by a lot!

We’re not good at estimating tilt

![Graphic showing measured and estimated degrees of table tilt at Caesarean section.](Image)


We don’t like tilt

- “Personal communication” cited in an editorial

  “...volunteers expressed concern at a mean angle of 9 degrees (range 4 to 14 degrees)...”

Kinsella SM. Anaesthesia. 2003;58(9):835-6

CPR in Pregnancy

- 27 degrees!

![Image showing CPR during pregnancy.](Image)


CPR in Pregnancy

- 27 degrees!

- Ability to position (and not roll off)
- Ability to provide mouth-to-mouth
- Chest compression force

![Graphic showing experiment setup.](Image)


Effect of tilt

- Many early studies (c.1950s – 1970s)
- Both OB and anesthesia literature
- Very little dealing with spinal anesthesia and CD
Effect of tilt

Studies from the “modern era”...

• 60 healthy elective cesarean deliveries
• Spinal anesthetic performed
• Randomized:
  – Supine with 15° tilt (n=31)
  – Full left lateral (n=29)
• Study position maintained for 15 minutes


Effect of tilt

• During 15 minutes of measurement:
  – Maternal HR
  – Maternal symptoms
  – FHR
  – Ephedrine use
  – UE NIBP
  – LE NIBP
    - lower in supine vs lateral


Effect of tilt

Due to "aortic compression"!


Effect of tilt

No effect on the baby!

Effect of tilt

- 32 non-laboring 3rd trimester women
- CO via Bioimpedence cardiography
- Seven different positions:
  - Supine
  - Left and right lateral
  - Left and right 12.5° and 5°


Effect of tilt

- Left lateral was significantly different from the two right tilts:
  - (right 5° P=0.04)
  - (right 12.5° P=0.01)
- Otherwise no differences


Effect of tilt

- 25 healthy parturients presenting for elective CD
- NICO (CI) measured in 4 different positions:
  - Sitting
  - Supine with 15° left tilt
  - Left lateral
  - Right lateral
- FHR and umbilical Doppler flow


Effect of tilt

- Sitting = Supine
- L lateral = R lateral
- Lateral > Sitting/Supine

**Effect of tilt**

- No FHR abnormalities in all 4 positions
- Umbilical blood flow unchanged in all 4 positions
- Statistical differences clinically insignificant

![Image](https://example.com)

*Armstrong et al. Anesth Analg. 2011;113(2):318-22*

**Effect of tilt**

- 157 non-laboring term parturients
- Positioned in random order
  - 0, 7.5, 15, and 90 degrees
- NICO
- NIBP upper and lower extremities

![Image](https://example.com)


**Effect of tilt**

- All pts were asymptomatic throughout
- No significant SBP or HR changes found
- <15° tilt: CO decreased by 5%
  - With large variation
  - 11 patients had a 20% or greater decrease

*Note: no anesthetic present!*

![Image](https://example.com)


**Effect of tilt**

- 89 elective cesarean deliveries
- Randomized to 15° tilt or supine
- Spinal anesthetic placed
- Continuous NICOM (Cheetah)

![Image](https://example.com)

*Lee et al (Columbia) SOAP Abstract 2016*

**Effect of tilt**

- At baseline, tilt made no difference in CO
- Between time of spinal and delivery, difference in CO was “minor”

![Image](https://example.com)

*Lee et al (Columbia) SOAP Abstract 2016*
Methods:

10 parturients, singleton full term gestation
Aorta and IVC measured on MRI at L1-2 and L3-4
Supine and three tilt positions:
15, 30, and 45 degrees

Results:

Aorta is not compressed at any angle
IVC compression not relieved by 15° tilt
Only partially relieved at 30°

Bioimpedance CO same in all groups
All women asymptomatic in all positions
Compression of the aorta by the uterus in late human pregnancy 1. Variations between femoral and brachial pressure with changes from hypertension to hypotension.


"(Bieniartz) demonstrated an imaginary cross-section illustration of the abdominal cavity... where the aorta and IVC were similarly remarkably compressed by the gravid uterus."

"The illustrations of Bieniartz et al. were later modified and widely presented in many articles and textbooks."

Higuchi et al. Anesthesiology. 2015;122(2):286-93.

Common iliac artery compression?
Study Limitations:

“...enrolled parturients were healthy Japanese women, who were quite slender by the standards of many Western countries.”

Summary

- Supine Hypotensive Syndrome is real
- Inter-individual variation is great
- 15° tilt probably doesn’t help much
  - And is difficult to estimate and/or achieve
- Less than 15° probably does nothing
- Many unknowns remain:
  - Obesity
  - Preeclampsia
  - Uteroplacental insufficiency

Summary

- No, we should not “abandon tilt”
- But we should also not assume it routinely helps
- A small subset of patients might be particularly susceptible
- A true 15 degrees is A LOT!
Optimizing Outcomes in External Cephalic Version

John T. Sullivan, M.D., M.B.A.
Associate Chief Medical Officer, Northwestern Memorial Hospital
Professor, Anesthesiology

Disclosure

I have no relevant financial relationships involving the subject matter of this talk

The administration of intrathecal opioids as part of neuraxial anesthetic techniques and terbutaline for tocolysis represent off-label use of these drugs

Learning Objectives

- Review cesarean delivery epidemiology & opportunities with breech presentation
- Delineate factors associated with increased External Cephalic Version (ECV) success
- Define the dose-response relationship between neuraxial anesthesia and ECV success
- Outline the resource utilization and cost effectiveness of ECV

Reducing Cesarean Deliveries

- US cesarean delivery rate: 33%
  - 50% increase in 10 years
  - Increased maternal hemorrhage & infection with cesarean delivery
  - Neonatal benefit?

Main EK: Cesarean deliveries, outcomes, and opportunities for change in California: toward a public agenda for maternity care safety and quality. CMQCC White Paper 201

Trends in Cesarean Delivery

- 2,083 parturients with breech randomized to planned cesarean or vaginal delivery
- Outcome: neonatal death or serious morbidity
  - Cesarean delivery: 1.6%
  - Vaginal delivery: 5.0%


“planned vaginal delivery of a term, singleton breech may no longer be appropriate”
“persistent breech presentation at term…should undergo a cesarean delivery.”

American College of Obstetrics Gynecology, December 2001

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Outcomes of children at 2 years after planned cesarean birth versus planned vaginal birth for breech presentation at term: The International Randomized Term Breech Trial

Hilary Whyte, MD, a Sara E. Hannah, MD, a,b,e Sanjey Sengal, MD, a Walter J. Hannah, MD, c Ursula Offerhaus, RA, d Sukh Aneekdath, MD, c Mary Cheng, MD, e Animesh Gafni, PhD, f Patricia Goulet, BA, a Michael Holawa, MD, f Ellen D. Flood, RN, PhD, f Eleanor Hotton, PhD, f Rose Kang, MD, f Darren McKay, BSc, c Susan Ross, PhD, a,b,d Andrew Willan, PhD, a,b,c,e for the 2-year Infant Follow-up Term Breech Trial Collaborative Group (Appendix)

- 2 year follow-up
- 94% of severe short-term morbidity normal
- Outcome: neonatal death or serious morbidity
  - Cesarean delivery: 3.1%
  - Vaginal delivery: 2.8%

Whyte H. AJOG 2004;191:864-71

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“The decision regarding the mode of delivery should depend on the experience of the health care provider.”
“Obstetricians should offer and perform external cephalic version whenever possible.”

American Congress of Obstetrics Gynecology, July 2006, Reaffirmed 2012

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External Cephalic Version


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External Cephalic Version (ECV)

- Breech presentation
  - 3.8% of pregnancies
  - 6-8% of cesareans
- ECV success rate 30-85%
- Obstetric factors predict outcome
- Tocolysis improves ECV success
- Neuraxial techniques alter ECV success?

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ECV Outcome Priorities

- Maternal safety
- Fetal safety
- Increased vaginal deliveries
- Analgesia
- Maternal satisfaction
- Cost effectiveness
- Resource utilization

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Incidence of Breech Presentation vs. Gestational Age

Cunningham FG: Williams Obstetrics, 2nd Ed., www.accessmedicine.com

ECV Timing

The Early External Cephalic Version (ECV) 2 Trial: an international multicentre randomised controlled trial of timing of ECV for breech pregnancies

- RCT, 1,543 singleton breech
- ECV at 34-36 vs. 37+ weeks’ EGA
- Primary outcome: CD rate

ECV Timing

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Early ECV</th>
<th>Delayed ECV</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertex at Delivery</td>
<td>59.0%</td>
<td>50.9%</td>
<td>0.002</td>
</tr>
<tr>
<td>CD Rate</td>
<td>52.0%</td>
<td>56.0%</td>
<td>0.12</td>
</tr>
<tr>
<td>Premature Labor</td>
<td>3.4%</td>
<td>2.2%</td>
<td></td>
</tr>
<tr>
<td>Neonatal Morbidity</td>
<td>0.1%</td>
<td>0.5%</td>
<td></td>
</tr>
</tbody>
</table>

Hutton E: The Early External Cephalic Version (ECV) 2 Trial: an international multicentre randomised controlled trial of timing of ECV for breech pregnancies. BJOG 2011;118:564–577

ECV Contraindications

- 5 existing guidelines (3 international, 2 Dutch)
- Noted in all guidelines: oligohydramnios
- Not supported by evidence:
  - Oligohydramnios, polyhydramnios, previous cesarean, fetal growth restriction, ruptured membranes, macrosomia


ECV: Safety

- Transient FHR abnormalities 5.7%
- Persistent FHR abnormalities 0.37%
- Vaginal bleeding 0.47%
- Placental abruption 0.12%
- Emergency cesarean 0.43%


ECV: Neonatal Morbidity

Son M: Is there an association between attempted external cephalic version and neonatal morbidity? AJOG 2017; 216:S393
ECV: Predictors of Success

- Fetal head non-engagement
- Multiparity
- Posterior placenta
- Transverse lie
- Less than 65 kg
- Obstetrician experience?


Tocolysis

- β2 agonists increase ECV success1
  - 8 trials, N=993, RR: 1.38, 95% CI: 1.03-1.85
- NTG not found to be effective
  - 3 trials, inferiority to β agonists, no difference vs. placebo
- Calcium channel blockers not effective2
  - 3 trials, inferior to terbutaline RR 0.67, equivalent to placebo

1Cluver C: Cochrane Database 2012;1:CD000184.

Maternal Pain During ECV


Analgesic Options

- No analgesia
- Intravenous opioid
- Neuraxial blockade:
  - Spinal, epidural, CSE
  - Low (analgesic) and high (anesthetic) dosing techniques

Systemic Opioid

- Remifentanil vs. placebo
  - 0.1 mcg/kg/min infusion
  - 0.1 mcg/kg/min rescue (4 min lockout)

Munoz H: Remifentanil versus placebo for analgesia during external cephalic version: a randomised clinical trial. JObA 2014; 23:52-7
Neuraxial Technique Benefits

- Superior maternal analgesia
- Superior maternal satisfaction
- Emergent cesarean without GA
- Increased procedural success
- Reduced cesarean delivery?

Neuraxial Technique Considerations

- Procedural success
- Dosing
- Side effects
- Logistics
- Cost effectiveness

Pain and Satisfaction


ECV Procedural Success

- Range of reported success 30-85%
- Heterogeneity in reported trials
  - Inclusion criteria: e.g. transverse lie
  - Primary outcome: ECV success vs. NSVD
- Dose-response effect observed

Hofmeyr G: Interventions to help external cephalic version for breech presentation at term. Cochrane Database of Systematic Reviews 2004; 1: CD000184

Mechanism of Action

Theories

- Abdominal wall relaxation
- Increased maternal tolerance
- Increased manipulation force

Evidence

- Abdominal wall relaxation
- Increased maternal tolerance
- Decreased manipulation force

Sullivan JT: IJOA 2009;18:328-34
ECV Success: Low Dose (Analgesia) Spinal & CSE Techniques

- Spinal opioid analgesia
  - Bupivacaine 2.5 mg, sufentanil 10 mcg
  - 44% intrathecal, 42% no intrathecal, $P=0.86$
- Combined spinal-epidural (CSE) analgesia
  - Bupivacaine 2.5 mg, fentanyl 15 mcg
  - 47% CSE, 31% IV fentanyl, $P=0.14$


ECV Success: High Dose Spinal (Anesthesia) Technique

- Spinal local anesthetic
  - Bupivacaine 7.5 mg
  - 67% spinal vs. 34% no spinal, $P=0.004$ (Nullip)
  - 87% spinal vs. 57% no spinal, $P=0.009$ (Parous)

2Weiniger CF: BJOG 2010;104:613-618.

ECV Success: High Dose Epidural (Anesthesia) Techniques

- Traditional epidural anesthesia
  - Lidocaine 2%, mL to achieve T6
  - 69% epidural vs. 32% no epidural, $P=0.01$
- Lidocaine 2%, epinephrine 1:200K, 13 mL
  - 59% epidural vs. 33% no epidural, $P<0.05$


Metanalysis of RCTs ECV Success


No Evidence of Publication Bias


Dose Response: Published RCTs ECV Success
Dose Response: All RCTs

ECV Success


Metanalysis RCTs Cesarean Delivery


Dose Response Study

- Double-blinded, RCT
- Sample size: 240 (60 per group)
- CSE (IT fentanyl 15 mcg plus bupivacaine)
  - 2.5, 5, 7.5, 10 mg

Chalifoux LA: A randomized controlled trial of the effect of intrathecal bupivacaine dose on the success of external cephalic version for breech presentation. Submitted for publication 2017

ECV Dose Response Study

Hypotension

- Incidence: 8¹–63²%
  - Non-laboring patients
  - Supine
  - Uterocaval compression

Bupivacaine Dose (mg) 2.5 5 7.5 10
Hypotension Incidence 47 77 91 86

- Role for prophylactic vasopressor

¹Dugoff L. Obstet Gynecol 1999;93:345–9
²Sullivan JT: IJOA 2009 18:328-334

Neuraxial Anesthesia Safety
Emergent Cesarean Deliveries

<table>
<thead>
<tr>
<th>Study</th>
<th>Neuraxial Anesthesia</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schorr</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Dugoff</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Mancuso</td>
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<tr>
<td>Weiniger</td>
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<td>0</td>
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<tr>
<td>Sullivan</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Weiniger</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Logistics

- LDR vs. OR
  - Time to perform emergent cesarean
- Monitoring requirements
  - Different low vs. high dose?
- Anesthesiologist presence

Cost Effectiveness

- ECV and neuraxial intervention add cost
  - ECV cost effective if success $>32\%$\(^1\)
  - Neuraxial intervention cost effective if 11% increase in ECV success\(^2\)


Version: Conclusions

- B2 agonist tocolysis: increased ECV success
- Neuraxial techniques: superior analgesia and maternal satisfaction
- ECV procedural success: increased with neuraxial anesthesia (dose-response effect)
- ECV & anesthetic for ECV: likely cost effective
Objectives

Upon completion of the presentation participants will be able to discuss the current evidence for:

- 1-Oral Intake in Labor
- 2-Post-Partum Tubal Ligation as an urgent case
- 3-Management for adherent placental disease

Oral Intake in Labor

- Obstetric Perspective
- Midwife Perspective
- Anesthesia Perspective

Clinical Opinion

Restriction of oral intake during labor: whither are we bound?

- Recommends loosening the oral intake restrictions
- In low risk laboring women allow them to eat and drink
The influence of epidural administration of fentanyl infusion on gastric emptying in labour

J S Porter, E Benett and F Reynolds

Objective
These are the effects of epidural analgesia containing fentanyl on maternal gastric emptying in labour urea using the rate of postpartum aspiration. Women were randomly allocated to receive urea or epidural analgesia. Histoplasma (11.5%) alone or in combination with fentanyl 200 g and 50 g as a rate of 10-20 mL/h. Plasma levels were compared between the groups for study 5. In study 5, the time to maximum plasma concentration was significantly reduced in women receiving 50 g fentanyl compared with control subjects (p<0.05). We conclude that the dose of fentanyl that may alter gastric emptying varies greatly from patient to patient.

Modern Obstetric-Anesthesia

- Low concentration local anesthetic
- Fentanyl added to the infusion
- Programmed intermittent bolus

Should we consider giving our patients food?
Maternal outcomes in women supplemented with a high-protein drink in labour

Manuel C. Vallejo,1 Benjamin T. Corb,2 Talena L. Stein,2 Shubhdeep Singh3 and Amy L. Phelps2

1Department of Anesthesiology, Magee-Womens Hospital of UPMC, University of Pittsburgh School of Medicine, and Duquesne University School of Business, Pittsburgh, Pennsylvania, USA
2Department of Anesthesiology, Magee-Womens Hospital of UPMC, University of Pittsburgh School of Medicine, and Duquesne University School of Business, Pittsburgh, Pennsylvania, USA
3Department of Anesthesiology, Magee-Womens Hospital of UPMC, University of Pittsburgh School of Medicine, and Duquesne University School of Business, Pittsburgh, Pennsylvania, USA

Abstract: Background: Because of the potential aspiration risk, oral intake is restricted during labour.

Aim: To determine whether high-protein drink supplementation at labour decreases nausea and vomiting and promotes patient satisfaction.

Materials and Methods: The study was registered with trial clinicaltrial.gov (NCT01414478). Labelling women was randomized into two groups. Group P received a high-protein drink (320 ml) with six supplements, PBN, and Group C served as control and received only ice chipper for both

Practical Guidelines for Obstetric Anesthesia

An Updated Report by the American Society of Anesthesiologists Task Force on Obstetric Anesthesia and the Society for Obstetric Anesthesia and Perinatology

- Recommendations oral intake of moderate clears may be allowed for uncomplicated laboring patients
- Scheduled cases clears 2h before induction of anesthesia, Solids 6 to 8h before
- Laboring patients with additional risk factors for aspiration should have further restriction for oral intake. Solid foods should be avoided in laboring patients.

Conclusion-Oral Intake

- Oral Intake during labor should take into consideration both maternal and fetal considerations
- Aspiration is still a REAL concern in Obstetrics
- Clear protein beverages did not change labor outcomes but improve patient satisfaction
In a population-level analysis, we used data from the 2006–2010 National Survey of Family Growth, we fit multivariable-adjusted models using logistic regression to describe the likelihood of sterilization for all United States women who gave birth during 2006–2010. We examined the likelihood of sterilization (vasectomy, tubal ligation) according to race/ethnicity and insurance status.

Objective—Using the 2006–2010 National Survey of Family Growth, we fit multivariable-adjusted models using logistic regression to describe the likelihood of sterilization for all United States women who gave birth during 2006–2010. We examined the likelihood of sterilization (vasectomy, tubal ligation) according to race/ethnicity and insurance status.

Methods—We used 2006–2010 National Survey of Family Growth data to fit multivariable-adjusted models using logistic regression to describe the likelihood of sterilization for all United States women who gave birth during 2006–2010. We examined the likelihood of sterilization (vasectomy, tubal ligation) according to race/ethnicity and insurance status.

Results—Overall, sterilization rates were higher for married than unmarried women, but rates were not significantly different by insurance status. The highest sterilization rates were among non-Hispanic white women. Vasectomy was low for all racial/ethnic groups. Privately insured whites were more likely to rely on vasectomy compared to the other insurance groups. Publicly insured blacks and whites were more likely to rely on tubal ligation compared to the other insurance groups. Rates of postpartum or interval sterilization were significantly different among racial/ethnic groups. African Americans and Latinas were significantly less likely to undergo sterilization than non-Hispanic whites and non-Hispanic blacks.

Conclusions—Low-income racial/ethnic minority women are less likely to undergo sterilization following delivery compared to low-income whites and privately insured women of similar parities. This could result from unique barriers to obtaining permanent contraception and could expose women to the risk of future unintended pregnancies.

Conclusions were access or utilization by underserved populations important issue in reduction of maternal mortality.
Request and fulfillment of postpartum tubal ligation in patients after high-risk pregnancy

Alexandra Albanese, Maureen Funch, Dana R. Gosset
Northwestern University Feinberg School of Medicine Department of Obstetrics and Gynecology Chicago, IL, USA

Received 21 May 2010; revised 16 August 2010; accepted 22 August 2010

Objectives: To determine the rate of request and fulfillment of postpartum tubal ligation (PPTL) in high-risk patients, and to compare these rates to low-risk patients. Method: This was a retrospective cohort study of women delivering at a university hospital in 2009. We included all patients who received prenatal care during the index pregnancy, and who had a live birth or stillbirth. Results: Of 850 participants (464 low risk and 386 high risk), 231 requested PPTL (7.5%). This was more likely among high-risk patients (13.8% vs. 4.1%, p < 0.001). Of the patients requesting PPTL, 118 (51.1%) underwent the procedure immediately postpartum. Conclusion: Though women with high-risk pregnancies were more likely to request PPTL, they were no more likely to complete the procedure. Due to lack of high-risk patient responses, the choice of patient for request was an important factor in improving completion rates. Providers should consider these factors carefully, especially in high-risk women, and advise the best patient’s course in this procedure.

Contraception After Delivery and Short Interpregnancy Intervals

Among Women in the United States

Kari White, PhD MPH☆, Stephanie B. Tool, MD MPH☆, and Joseph E. Potter, PhD○
☆Health Care Organization & Policy, University of Alabama at Birmingham, Birmingham, AL
○Department of Obstetrics and Gynecology, University of Colorado School of Medicine, Aurora, CO

Conclusions—Few women use long-acting reversible contraceptives after delivery, and those using less-effective methods have an increased risk of unintended pregnancy.

The American College of Obstetricians and Gynecologists

COMMITTEE OPINION

Number 530 • July 2012

Committee on Health Care for Underserved Women

This information should not be construed as altering any mandate or sequence of treatment or procedure to be followed

• Only 50% of women who undergo counseling and consent actually undergo PPTL
• Inadequate staffing of anesthesia and hospital resources
• Postpartum Tubal Ligation should be considered an urgent procedure and staffed and scheduled accordingly

MANAGEMENT OF ADHERENT PLACENTAL DISEASE

• Incidence is increasing- 10-fold rise
• Cesarean delivery rates now exceed 30%

| TABLE 1. Risk of Placenta Accreta With Placenta Previa by Number of Prior Cesarean Deliveries |
|-----------------|------------------|
| Number of Prior CS | Risk of Placenta Accreta % |
| 0               | 3.3              |
| 1               | 11               |
| 2               | 40               |
| 3               | 61               |
| 4+              | 67               |

Adherent Placental Disease

Conclusions-PPTL

• PPTL is an urgent case
• Access to sterilization is a barrier to low-income Women of color
• Increasing mortality among Black non-Hispanic Women related to unintended births
• Women with High Risk Pregnancy were more likely to request PPTL, but not more likely to have the procedure
• ACOG Statement- PPTL should be considered urgent procedure and staffed appropriately
Prenatal Diagnosis

- Utilization of Ultrasound and MRI increasing
- MRI use becoming more helpful in surgical planning
- Ultrasound is still considered the first line for diagnosis
- Serial ultrasounds becoming more common among high-risk patients

Multidisciplinary Approach

- MFM
- Obstetric Anesthesiology
- Gynecology
- Gynecology-Oncology
- OR-team staff
- Labor and Delivery Staff
- U/S radiology
- Interventional Radiology
- Neonatology
- Social Work
- Urology
- Cell Saver
- Blood bank

Delivery Planning

- Team meetings
- Review serial imaging
- Surgical planning teams needed
- Location of procedure
- Elective C-Hyst vs. Cesarean delivery with possible C-Hyst
- Readiness for urgent or emergent procedure
- Patient proximity to hospital

Anesthesia Consideration

- No evidence that one technique is better for outcomes
- Neuraxial, General Anesthesia, or Combination
- Each case is unique—One size does not fit all
- Cell Saver
- Invasive monitoring
- Large Bore IV/Central venous access

Israeli survey of anesthesia practice related to placenta previa and accreta

A. Ioscovich,1,2, D. Orbach-Zinger,3, A. I. Butwick,2, Y. Ginosar,3, G. Orsher-Zinka,4 and C. F. Weiniger,3

Department of Anesthesiology, Perioperative Medicine and Pain, Shaare Zedek Medical Center, Hebrew University, Jerusalem, Israel
2 Department of Anesthesiology and Critical Care Medicine, Stanford University School of Medicine, Stanford, California, USA
3 Department of Anesthesiology and Clinical Care Medicine, National Emmanuel University Hospital, Zichron Yaakov, Israel
4 Department of Anesthesiology, Hadassah Medical Center, Hebrew University, Jerusalem, Israel

- Survey of 26 Israeli Hospitals
- Response Rate 100%
- ~65% Spinal for Previa
- ~69% General anesthesia for Low Suspicion
- ~96% General anesthesia for High Suspicion
Anesthetic management of placenta accreta in a low-resource setting: a case series

L.A. Muñoz,1 G.J. Mendoza,2 M. Gomez,1 L.E. Reyes,2 J.J. Arevalo1
1Department of Anesthesiology, Fundación Universitaria de Ciencias de la Salud, Hospital de San Jose, Bogotá, Colombia
2Department of Critical Care, Hospital de San Jose, Bogotá, Colombia

- Retrospective Review
- 39 Identified cases
- C-Hyst performed in all cases
- 34 Patients had Neuraxial with 15 conversion to General Anesthesia
- Median EBL- 2000, No deaths
- Multidisciplinary approach valuable

Precesarean Prophylactic Balloon Catheters for Suspected Placenta Accreta
A Randomized Controlled Trial
Raul Salin, asi, Alexander Chodbi, asi, Shakira Roman, asi, Gali Garne, asi, Michael Radin, asi, and Eladio Gadea, asi

- RCT- Prenatal Diagnosed accreta
- Control vs, preoperative balloon catheters
- Catheters placed in the Ant Div Int Iliac Art
- Primary Outcome- #PRBC’s
- Findings showed no difference in Primary or Secondary outcomes
- Complications with balloon in 2 treatment women (buttock claudication & leg pain and weakness)

What is the Role of Interventional Radiology?

Bleeding from Small Branches of the Internal Iliac Artery

Bleeding Stops after Gelfoam Embolization of the Anterior Division

Superior gluteal Artery arising from Post Division is preserved
Adherent Placental Disease

- Increasing cesarean deliveries are resulting in more accreta cases
- Management of adherent placental disease should be multidisciplinary approach
- Anesthesia management varies based on a’priori disease and surgical plan
- Interventional Radiology has a role in the management
Saturday, March 4, 2017

Session VIII: Maternal Morbidity and Rare Disease
Moderator: Robert D’Angelo, M.D.

Zika and Other Viruses in Obstetric Anesthesia
Robert Gaiser, M.D.

Maternal Morbidity and Mortality
Barbra Scavone, M.D.

SCORE Project II
Robert D’Angelo, M.D.
Zika and Other Viruses in Obstetric Anesthesia

ROBERT GAISER, M.D.
PROFESSOR AND CHAIR
UNIVERSITY OF KENTUCKY

Learning Objectives

- Review the infection of Zika, Human Immunodeficiency, and Herpes Simplex Viruses
- Devise a plan for the care of the patient with HIV
- Adjust transfusion protocols based upon Zika virus
- Adjust preoperative assessment based upon infection with HSV

What is a Virus?

- Capsules with genetic material inside (DNA or RNA)
- Infect normal cells and use these cells to replicate
- Difficult to treat given that virus is located within normal cell

Falcons Blame Super Bowl Loss on Anesthesia

"It's like anesthesia inveted our esophagus making us choke -- It was all Anesthesia's fault"

Zika Virus
2016 was the year of the Zika Virus

- Zika virus
- Mosquito-borne Flavivirus (West Nile virus, dengue virus, yellow fever virus)
- Andes encephalitis mosquito
- Symptoms develop 3-7 days after bite of infected mosquito
- Symptoms: fever, rash, joint pain, Zika eyes, myalgia, headache
- Increased risk of developing Guillain-Barré Syndrome by presence of Zika RNA in blood or urine
- Triplex Real-time RT-PCR Assay (not FDA approved)

CDC Weekly - 2016

Laboratory Testing for Zika Infection

- Zika immunoglobulin M capture enzyme-linked immunosorbent assay (developed 2/16)
- Triplex real-time reverse transcription-polymerase chain reaction (used to differentiate RNA from dengue, chikungunya, and Zika) – developed 3/17

Conway of NL - CDC 2016-6;30(7):714-82

Concern with Zika Virus

- One in five develop symptoms if infected
- Spread from pregnant woman to fetus
- Microcephaly

Walker J. NEJM 2016;375:953

Concern with Zika Virus

- Autopsy of fetus infected with Zika virus
  - Calcifications of the brain
  - No effect on cerebellum, brain stem, and spinal cord
  - Lysed brain cells on microscopy

Walker J. NEJM 2016;375:953

More than Microcephaly

- 11 infants with congenital Zika infection
- Prenatal: ultrasound revealed brain damage
- Postnatal: reduction in cerebral volume, ventriculomegaly, cerebellar hypoplasia, fetal akinesia
- Congenital Zika syndrome

Melo A. JAMA Neurology 2016;73:1407

Zika Virus Infection in Brazil

- 125 pregnant women in Brazil who had illness characterized by rash and documented infection compared 61 unaffected pregnancies
  - Adverse outcomes in fetus: 47% vs 11% (55% in first trimester; 32% second trimester; 20% in third trimester)
  - 42% with abnormal brain imaging
  - 4 with microcephaly
Bussi P. NEJM 2016;375:2321
Birth Defects Among US Women with Zika Virus Infection

- Incidence of microcephaly: 7/10,000 live births
- Births in US from Jan-Sept 2016 with lab evidence of infection
- 442 women with Zika (6% overall, 11% had infection during first trimester)
  - 35 live births with 21 birth defects
  - 47 pregnancy losses with 5 birth defects
  - 4 had microcephaly; 14 had microcephaly and brain abnormalities; 4 had brain abnormalities

Cases in United States

- Locally acquired mosquito-borne cases reported: 219 (223 cases in Florida; 6 in Texas)
- Travel-associated cases reported: 47 (1001 in NY, 2 in Wyoming)
- Laboratory acquired cases reported: 4
- Total: 490
  - Sexually transmitted: 49
  - Guillain-Barré syndrome: 13

CDC, January 25, 2017

Public Health Emergency of International Concern

- Declared by WHO in Feb 2016 one year after identified in Brazil
- Only fourth time WHO declaration of emergency
  - H1N1 2009
  - Polio 2014
  - Ebola 2014
- A situation that is serious, unusual or unexpected; carries implications for public health beyond the affected state's national border; and may require immediate international action.

Zika Virus and Blood Management

- Cannot use screening as 80% of infected donors are asymptomatic
- Donors who travel to an endemic area should be deferred for 4 weeks
- Problem – does not address sexual contact with individuals who have travelled to this area

Goodnough LT. Anesth Analg 2016;112:282

Results from Screening

- FDA expiration for screening: 1 year
- Dec 16, 2015: 2 donations in US and Puerto Rico
- FDA approval for screening: enteric vomiting

Concerns for Health Care Workers

- Universal precautions
- Concern with aerosolization of blood or body fluids (virus identified in blood, urine, saliva, CSF, semen, and amniotic fluid)
- Avoid needle stick injuries

CDC 2016
Prevention of Zika Virus Transmission in L&D

- Particularly concerning, given blood and amniotic fluid
- Anesthesia providers in the labor and delivery setting should adhere to Standard Precautions and wear sterile gloves and a surgical mask when placing a catheter or administering intrathecal injections; additional PPE should be worn based on anticipated exposure to body fluids.
- Double gloves might minimize the risk for percutaneous injury when sharps are handled.
- Patient body fluids also should not come into direct contact with health care personnel clothing or footwear.

Oko EM. MMWR 2016;65:290

Implications for the Anesthesia Provider

- Universal precautions
- Mother with Zika infection during pregnancy has a 6% chance of infant with congenital Zika syndrome (11% if first trimester)
- Blood is screened for Zika virus
- Consider Zika if travel to at risk area

Herpes Simplex Virus

- 169 patients over 6 years
- 164 secondary; 5 primary
- 59 patients GA; 75 patients spinal; 35 patients with epidural
- 1 patient with spinal anesthesia had transient neurologic deficit that resolved and not related to spinal (transient unilateral leg weakness)
- No patients with secondary infection had problems


Neuraxial Anesthesia and Herpes Simplex Virus-II

- Conclusion
  - Spinal anesthesia is safe for secondary infection
  - Spinal anesthesia is relatively contraindicated in patients with primary infection

Herpes Simplex Encephalitis

- 2 cases per 250,000/year
- 90% are due to HSV-1 and 10% due to HSV-2
- Associated with significant morbidity with mortality decreasing due to acyclovir (approx. 20%)

J Clin Diag Research 2006;10:25

Oral Herpes Simplex and IT Morphine

- IT morphine has been linked to Herpes Simplex Labial reactivation
- 103 women with 10% of HSV
- Blood obtained for HSV Ig
- Group 1 – IT morphine; Group 2 – IV morphine
- 27 patients with postoperative HSV (19 from Group 1; 8 from Group 2)
- No difference in recurrence between seropositive and seronegative
- Not related to pruritus

Davies PW. Anesth Analg 2005;100:472
HSV-I and Neuraxial Morphine
- 27 yo G3P1 w/ PMH of oral herpes with recurrences twice a year
- Elective repeat cesarean section
- Spinal anesthesia (bupivacaine, fentanyl, morphine
- POD #3 - mother w/ oral lesions
- POD #5 - baby w/ oral lesion
- 2 weeks of IV acyclovir followed by 6 months oral acyclovir

Neonatal HSV
- Incidence 0.6/100,000 births
- Cause of death and neurodevelopmental disability
- Recommend:
  - inclusion of HSV history as part of anesthesia assessment if the anesthetic plan includes neuraxial spread

Implications for the Anesthesia Provider
- Concern w/ spinal anesthesia and patients w/ primary HSV-II w/ no data to support
- IT morphine in parturients (epidural fentanyl and spinal neperidine in nonparturients) increases the risk of HSV reactivation
- Case report of HSL transmission of mother to neonate – consider including hx of HSL in preoperative assessment

Human Immunodeficiency Virus

Incidence of HIV in United States
- In 2015, 39,513 diagnosed w/ HIV (total 1.2 million living w/ HIV)
- Of the new diagnoses, women accounted for 19% (7,402) – 86% heterosexual contact and 14% IV drug use
- 1 of 8 people w/ HIV are unaware of infection

Mother to Child Transmission
- Occurs during pregnancy, around the time of birth, or during breastfeeding
- ACOG recommends prenatal testing w/ ability to opt out; women at high risk repeat testing in third trimester
- ACOG recommends testing of all women aged 13-64 at least once every three years
- If not tested, rapid screening when in labor
- Initially AZT monotherapy during pregnancy (reduced transmission from 25% to 8%)
- New isomarated antiretroviral therapy (transmission 1.2%)
- Recommendation for triple therapy (ceased preterm delivery)
  - AZT + 3TC + ETV
  - AZT + 3TC + NVP
  - TDF + 3TC or FTC + ETV
  - TDF + 3TC or FTC + NVP

Mother to Child Transmission
- Cesarean section prior to onset of labor (38 weeks gestation) in patients w/ high viral loads decreased risk from 25% to 8%.
- However if viral load is < 1000 copies/mL, transmission is 2.0% for cesarean section or vaginal delivery

ACOG FAQ 133, Jan 2016
Fowler MG. NEJM 2016;374:1276
aids.gov 2017
Kraft SF, Erald Olster Gynecol Reprod Biol 2017;16:332
ART and Pre-Eclampsia

- HIV alone does not increase the risk of severe preeclampsia
- Antiretroviral therapy increases the risk of severe preeclampsia
- Preeclampsia tended to occur earlier resulting in preterm delivery and LBW infants

Pre-exposure Prophylaxis

- Administration of antiretroviral medications to individuals at high risk of infection (recommended by CDC in 2012)
- Tenofovir and emtricitabine daily reduced infection by 46% 
- Must be used daily
- Average cost $1425/month
- Not covered by Medicaid or Medicare

Implications for the Anesthesia Provider

- Infections with HIV continue with 1 out of 8 not knowing that they are infected
- More at risk patients will be treated with ART prophylaxis
- Current recommendation to decrease perinatal transmission is triple therapy
- ART is linked to preeclampsia and preterm delivery
- Cesarean delivery will depend upon viral load

Conclusion

- Viruses are transmitted to offspring that depend upon in utero transmission
- Zika virus and other viruses require precautions
- Response to Zika and other viruses for congenital anomalies
- HSL transmitted during pregnancy implications
- While both can reactivate, cause disease increase with IT
- Morbidity and mortality increase with IT
Maternal Morbidity and Mortality

Barbara M. Scavone, MD
Professor
Department of Anesthesia and Critical Care
Department of Obstetrics and Gynecology
University of Chicago Medical Center

I have no financial relationships to disclose.

Learning Objectives

• Morbidity and mortality data
  – Global
  – Other developed world
  – US
• Preventability
• Anesthesia-related

Definitions

Maternal Mortality Ratio (MMR)

• Numerator: Pregnancy-related deaths
  – Direct
    • Examples: hemorrhage, hypertensive disease
  – Indirect
    • Exacerbation of medical condition
• Denominator: 100,000 live births
• During/within 6 weeks/1 year of pregnancy

Kassebaum: Lancet 2014; 384:980
Developed world = 12.1
Developing world = 232.8

Creanga: Obstet Gynecol 2015;125:5

MMR = 16.0

Black woman > 39 yrs
>1 in 1000 risk of dying

Creanga: Obstet Gynecol 2015;125:5-12
Creanga: Obstet Gynecol 2015;125:5-12

Half of maternal morbidity due to postpartum hemorrhage

Callaghan: Obstet Gynecol 2012;1205:1029-36
Preventability

North Carolina Pregnancy-Related Mortality
Review Committee

- n = 108 deaths
- Cause of death, preventability
- Preconception care, patient-, systems-, or provider-related factors

Berg: Obstet Gynecol 2005;106:1228

Overall 41 (40%) of deaths preventable
- 22 (54%) provider-related factors (delays)
- 4 (10%) systems-related factors

Berg: Obstet Gynecol 2005;106:1228-34

Preventability of Pregnancy-Related Deaths
Results of a State-Wide Review
Cynthia J. Berg, MD, Michael T. Bower, MD, Helen S. Boll, MD, Jennifer L. Brower, MD, Patricia L. Huggins, MD, Jack G. Myers, MD, Kenneth J. Muse, Jr, MD, and William M. Geller, MD, MPH

- North Carolina Pregnancy-Related Mortality
  Review Committee
- n = 108 deaths
- Cause of death, preventability
- Preconception care, patient-, systems-, or provider-related factors

Berg: Obstet Gynecol 2005;106:1228

California Pregnancy-Associated Mortality Review
Committee

- n = 207 deaths
- Cause of death, contributing factors
- Patient-, facility-, or provider-related factors

Main: Obstet Gynecol 2015;0:1

Provider-related factors largest contributor
Good to strong chance to alter 41% of deaths

• Mission to improve patient safety in maternal healthcare through multidisciplinary collaboration and culture change
• Patient safety bundles
  – Recommendations protocols/systems improvements
  – Practical suggestions and tools for implementation

D’Alton: Obstet Gynecol 2014;123:973
Mode of delivery:

- Cesarean: 86% of deaths
- Unknown: 14% of deaths
- Known vaginal delivery: 0% of deaths

Risk factors:
- Obesity
- African-American race
- Cesarean or other surgical procedure

Deaths from airway obstruction or hypoventilation during emergence and recovery

Systems errors: Postoperative monitoring, adequate supervision

Conclusions

- US compares unfavorably to other high-resource countries
- Preventable
  - Provider-related factors
  - Team responses/Protocolized care
- Anesthesia-related
  - Cesarean delivery
  - Obesity
  - Epidural after accidental dural puncture
  - Spinal after epidural
SCORE PROJECT II
AIRS REGISTRY

Robert D’Angelo, M.D.
Wake Forest University Medical School

OVERVIEW:
• SCORE Project Review
• Benchmarking
• Anesthesia Quality Initiatives
  • AQI
  • AIRS
  • AIRS: SCORE II

NO DISCLOSURES

BACKGROUND:
• Serious Complications 2002
  • No Large Ob Anesthesia Databases
  • True Incidence Unknown
  • Significant Variation in Literature
    • Epidural Abscess: 1:1,930\(^1\) or 1:302,757\(^2\)

SCORE PROJECT:
• Serious Complication Repository
• 2004 - 2010
• Goals:
  • 1°: Establish Incidences
  • 2°: Improve Patient Safety

\(^1\) Anesthesiology 1986; 91:1526; \(^2\) Anesthesiol Clin 2008; 26:23
**SCORE:**
- 25 Institutions Participated
- Captured Data:
  - > 300,000 Deliveries
  - 158 Serious Complications
    - 95 Anesthesia Related

*Anesthesiology 2014; 120: 1505-12

**RESULTS:**
- Total Deliveries: 307,500
- Total Anesthetics: 257,000 (83.5%)
- RA for Vag Delivery: 160,688 (76%)
- Cesarean Deliveries: 96,000 (31.3%)
- RA for CD: 90,795 (94.4%)
- PDPH: 1,647 (0.7%, 1:144)
- EBP/Repeat EBP: 917/98 (11%)

*Anesthesiology 2014; 120: 1505-12

**COMPLICATIONS:**
- Maternal Deaths:* 0
- Maternal Deaths: 30 (1:10,250)
- Cardiac Arrests:* 2 (1:128,000)
- Cardiac Arrests: 43 (1:7,200)
- MI: 2 (1:128,000)
- High Spinal: 58 (1:4,000)
- Failed Intubation: 10 (1:533)
- Anaphylaxis:** 4 (1:64,000)

* Anest Related, **Not Anest Meds; Anesthesiology 2014; 120: 1505-12

**COMPLICATIONS:**
- Epidural Abscess: 4 (1:63,000)
- Meningitis: 0
- Epidural Hematoma: 1 (1:250,000)
- Neurologic Injury: 7 (1:36,000)
- Resp Arrest L&D: 16 (1:14,000)
- Unrec Spinal Cath: 14 (1:15,000)
- Total: 85 (1:3,000)

*Anesthesiology 2014; 120: 1505-12

**MATERNAL DEATHS:**

<table>
<thead>
<tr>
<th>Causes*</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hemorrhage</td>
<td>10</td>
</tr>
<tr>
<td>Preeclampsia cardiac disease</td>
<td>5</td>
</tr>
<tr>
<td>Hypertension</td>
<td>3</td>
</tr>
<tr>
<td>Aneurysm/embolism</td>
<td>3</td>
</tr>
<tr>
<td>Pulmonary embolism</td>
<td>2</td>
</tr>
<tr>
<td>Anaphylaxis</td>
<td>2</td>
</tr>
<tr>
<td>Vaginal embolism</td>
<td>2</td>
</tr>
<tr>
<td>Hypoxia</td>
<td>2</td>
</tr>
<tr>
<td>Cocaine</td>
<td>2</td>
</tr>
<tr>
<td>Intracranial hemorrhage</td>
<td>2</td>
</tr>
<tr>
<td>Infection/infusion</td>
<td>2</td>
</tr>
<tr>
<td>Urinary tract infection</td>
<td>2</td>
</tr>
<tr>
<td>Unreported cause</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>20</td>
</tr>
</tbody>
</table>

* Each patient is listed in only one category although many can easily be listed in multiple categories; for example, depending on the clinical presentation, an aortic/renal embolism can also be categorized under cardiac and hemorrhage categories.

*Anesthesiology 2014; 120: 1505-12

**CARDIAC ARRESTS:**

<table>
<thead>
<tr>
<th>Causes*</th>
<th>Number</th>
<th>Survive &amp; Resuscitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hemorrhage</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>Preeclampsia cardiac disease</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>Aneurysm/embolism</td>
<td>7</td>
<td>3</td>
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<tr>
<td>Anaphylaxis</td>
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<tr>
<td>Pulmonary embolism</td>
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<td>0</td>
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<tr>
<td>Hypoxia</td>
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<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Urinary tract infection</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Hypotension</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>MI</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>43</td>
<td>14 (32.6%)</td>
</tr>
</tbody>
</table>

* Each patient is listed in only one category although many can easily be listed in multiple categories; for example, depending on the clinical presentation, an aortic/renal embolism can also be categorized under cardiac and hemorrhage categories.

*Anesthesiology 2014; 120: 1505-12
HIGH SPINALS: 58 TOTAL
- Unrecog Spinal Catheter: 14 (24%)
  - 13 on L&D (94%) or 1:12,000 Epidurals
- 50% Epidural, 50% Spinal
- # with Risk Factors: 32/44 (73%)
  - Obesity: 18/44 (41%)
  - SAB Past Failed Epid: 12 (27%)

SCORE FINDINGS:
- Estimated Incidences of Complications
  - Serious Complications Rare
- 1° Limitation:
  - Too Few Complications
  - Inadequate Information
  - Unable to Create Practice Advisories

MISSED COMPLICATIONS
- SCORE Captured 307,500 Deliveries
- US Deliveries: 20,000,000*
- Est. Ob Anes Complications Missed:
  - 640 Failed Intubations
  - 260 Epidural Abscesses
  - 680 Unrecognized Spinal Catheters
  - Significant Missed Morbidity

NEXT STEPS 2012:
- National Ob Anes Complication Registry
  - SOAP: Limited Resources
  - Coinciding National Quality Initiatives
  - Benchmarking

BENCHMARK:
- Standard against which things are compared or ‘against the competition’*
- Healthcare Benchmarking:
  - Internally to Drive Practice QI
  - Externally to Create Guidelines
  - Externally as Financial ‘Incentives’


STS DATABASE: 1989*
- Adult Cardiac, General Thoracic, Congenital Heart Surg
- Developed Quality Performance Measures
  - 31 Composite, Outcome, Process, Structure Measures
  - Examples: Risk Adjusted Operative Mortality for CABG and Preoperative Beta Blockade
- STS Measures Altered CTS Practice
  - Many Now Included as CMS/JC Quality Measures

* http://www.sts.org/national-database

*www.merriam-webster.com
QUALITY INITIATIVES:

- CMS EMR Incentive Program: “Meaningful Use”
- CMS PQRS:
  - Quality Measures for Medicare Part B
  - Uses National Provider Identifier (NPI) and Tax ID#
  - Payment Adjustments
- JC Surgical Care Improvement Project (SCIP):
  - Medicare Withhold: Payments to Top Performers

WHY IS THIS IMPORTANT?

- Pay For Performance (Quality) is Here
- Impact: Hospital, Practice, Individual
- Defining Quality?
  - STS Defines Quality for CV Surgery
  - Anesthesia Quality Measures Lacking
  - If not Anesthesia, Gvmt/Insurers Will Define
- ASA: Anesthesia Quality Institute

ANESTHESIA QUALITY INSTITUTE:

- Created in 2009
- Launched Database: National Anesthesia Clinical Outcomes Registry (NACOR) in 2010
  - Benchmarking Anesthesia Practices and Practitioners
  - “Become the Engine for the Continual Improvement of Practice Efficiency, Patient Outcomes, and Best Practice”
  - Open to all Anesthesia Practices
  - $/Provider/Year to Participate

ANESTHESIA INCIDENT REPORTING SYSTEM (AIRS):*

- National Complication Registry
- Joint Venture with SPA: Peds Registry
- Partnered with SOAP:
  - SPA Template
  - Ob Anesthesia Complication Registry
- Ready to Roll Out

AIRS OB ANESTHESIA MODULE:

- 100% Live
- Direct Access or Link from AQI Website
- Future Links from ASA, AANA, SOAP Websites
- Confidential or Anonymous Reporting
  - Easy to Navigate, Drop-down Menus
  - Minutes to Complete, Allows Free-Texting

QI LIMITATIONS:

- NACOR: Designed to Capture Metrics: Age, AS-PS, Type of Anes, PACU Temp, Pain Assess, PONV
- Not Detailed Information on Serious Complications
- QI Module within Epic: “Worthless”
- Cannot Improve ‘Quality’ Without Data
- In Response: AQI Created:
  - Anesthesia Incident Reporting System (AIRS) in 2012*

* www.aqihq.org
* https://www.aqihq.org/airs/airsIntro.aspx
*https://www.aqihq.org/airs/airsIntro.aspx
*https://www.aqihq.org/airs/airsIntro.aspx
OB ANESTHESIA COMPLICATIONS:

- Maternal Death
- Cardiac Arrest
- Failed Intubation
- High Spinal Requiring Respiratory Assistance or Intubation
- Respiratory Arrest in L&D
- Aspiration
- Neuraxial Infection*

- Neuraxial Hematoma*
- Serious Neurologic Injury*
- Related to Blood Patch
- Anaphylaxis
- Undesired Intraoperative Awareness
- Blood Transfusion Reaction*

* Related to Anesthesia

AIRS COMPLICATION REGISTRY

Sample Webpages

AQI HOMEPAGE*

*www.aqihq.org

AIRS HOMEPAGE*


CONFIDENTIAL REPORT

ANONYMOUS REPORT:
WE NEED YOUR HELP!

- To Achieve Benchmarking Goals and Define Anesthesia Quality
  - Practice Real QI
    - Gather Detailed Information on Complications
    - Report Serious Complications into AIRS
  - Improve Patient Safety
  - Create Practice Advisories/Guidelines

AIRS REPORTING:

- www.aqihq.org
- www.aqiairs.org
- TBA: Links from ASA, SOAP Homepages
- Report Problems with AIRS Pages to:
  - askaqi@asahq.org
  - rdangelo@wakehealth.edu
- Feature Article: ASA Newsletter March 2017
NEAR FUTURE QI:

- Epic Creating Registry: Customizable Reports
- Auto Streaming of CMS/JC Quality Metrics to NACOR
- Auto Messages Popups to Report Serious Complications to AIRS

SUMMARY:

- Benchmarking and Pay-for-Performance is Here
- Proactive Quality Improvement
  - Participate in NACOR
  - Report Ob Anesth Complications to AIRS
  - www.aqihq.org or www.aqiaisrs.org
- Ultimate Goals:
  - Define Anesthesia Quality
  - Improve Patient Safety

THANK YOU!

rdangelo@wakehealth.edu
Session IX: Breastfeeding and Neonatal Concerns
Moderator: Alexander Butwick, M.B.B.S., FRCA, M.S.

What’s New in Neonatal Resuscitation
Robert Gaiser, M.D.

Pregnancy and the Implications of HLA Alloimmunization
Neil Ray, M.D.

Baby Friendly Practices and Immediate Skin-to-Skin Contact
Andrea Traynor, M.D.
Update on Neonatal Resuscitation

Robert Gaiser, M.D., M.S.Ed.
Professor and Chair
University of Kentucky

Financial disclosure: Director for ABA

GOALS

- Review the update of neonatal resuscitation
- Apply the new principles in the clinical situation
- Identify pitfalls in neonatal resuscitation

Typical Day on L&D

- 24-year old G3P2 presents with little prenatal care
- 37 weeks gestation
- Epidural placed at 6 cm cervical dilation
- Following uncomplicated delivery, baby not breathing
- A stat is called overhead to the room.
- 15 people arrive yet you are the only one skilled in airway management

Malpractice in Obstetric Anesthesia

- Obstetric Anesthesia Closed Claims Update
- Newborn brain injury
  - Poor tracing
  - Anesthesia delay due to POOR communication

Minehart RD. Sim Healthcare 2012;7:166

Problem with Communication

- Social norm of communication
  - Politeness norm of not constraining others’ actions and being indirect about criticism
- Communicating under pressure
  - Reveal quickly situation
  - Criticize other’s actions
  - Do not restrict input from others

Best Means for Detecting and Correcting Errors

Minehart RD. Sim Healthcare 2012;7:166

Communication Strategies

- Advocated information: 45 Anesthesia Providers 100%
- Advocated plans: 45 Anesthesia Providers 93%
- Inquired information: 45 Anesthesia Providers 30%
- Inquired obstetric plans: 45 Anesthesia Providers 11%

- Advocated information: 45 Obstetricians 83%
- Advocated plans: 45 Obstetricians 73%
- Inquired information: 45 Obstetricians 75%
- Inquired anesthesia provider’s plans: 45 Obstetricians 59%

Davies JM. Anesthesiology 2009;110:131-9
Communication

- Key to optimal working conditions
- Viewed as a core competency
- Poor communication leads to disappointment and anger
- Good communication improves working conditions and patient satisfaction

Important

- Neonatal Resuscitation: 2015 International Liaison Committee on Resuscitation Scientific Evidence
- Every five years ILCOR revises resuscitation guidelines
- Circulation 2015;132:S543-S560

Time Perception

- Participants in simulated neonatal resuscitation
- Leaders and assistants
- Both underestimate the passage of time

Birth of Baby

- Generally happy time
- Generally not much to do
- Generally good outcome

At Birth

- Transition from intrauterine to extrauterine life
- Forced to make many changes immediately
- 10% of newborns require some assistance to begin breathing
- 1% need extensive resuscitation

Before Birth

- All oxygen supplied via uterine blood flow
- Uterine blood flow at term, 500-700 cc/min
- Very little blood passes through the lungs
- Alveoli filled with amniotic fluid
Before Birth
- Little blood flow in pulmonary artery
- Most of blood flow into aorta depends upon ductus arteriosus

After Birth
- Lungs only source of oxygen
- Absorb fluid from alveoli
- UA/UV clamped
- Increase pulmonary blood flow
- Ductus arteriosus constricts

Respiration
- First vital sign affected by deprivation of oxygen
- Two types of apnea
  - Primary
    - After an initial period of attempts to breath
    - Responds to stimulation
  - Secondary
    - Continued oxygen deprivation
    - Will not respond to stimulation

Apnea
- If breathing does not begin after stimulation, assume secondary apnea
- Hemodynamic effects
- Will require PPV
- Primary apnea may occur in-utero

Factors Associated With Need for Neonatal Resuscitation
- Maternal diabetes
- Preeclampsia
- Anemia
- Infection
- Drug overdose
- Post-term gestation
- Fetal malformation
- Meconium
- Emergency cesarean section
- Prolonged ruptured membranes
- NRFHR

Who Should Do the Resuscitation
- Guidelines for Regional Anesthesia in Obstetrics, 2000
- NOT THE ANESTHESIA PROVIDER
- 2015: Every birth should be attended by at least 1 person who can perform the initial steps of newborn resuscitation and PPV, and whose only responsibility is care of the newborn.
**Major Change in Delivery**
- In infants not predicted to require resuscitation, delayed clamping of the cord for more than 30 seconds (but how long?)
- Associated with less IVH, higher blood pressure and blood volume, less need for transfusion, and less

Wyckoff MH.  Circulation 2015;132:S543-S560

**Keep Them Warm!**
- Admission temperature strong predictor of mortality
- Temperature should be between 36.5 and 37.5
- Hypothermia associated with increased risk of IVH, respiratory risks, hypoglycemia, and late-onset sepsis
- Avoid temps greater than 38

Wyckoff MH.  Circulation 2015;132:S543-S560

**Very-Low Birth Weight Infants**
- Likely to become hypothermic
  - Prewarm room
  - Covering infant in plastic
  - Placing infant on thermal mattress

Wyckoff MH.  Circulation 2015;132:S543-S560

**Meconium Happens**
- Tracheal suctioning does not affect incidence of meconium aspiration
- Tracheal intubation is not indicated for thick or thin meconium(2015)
- Resuscitation of thick meconium consists of positive pressure ventilation


**Term Infants Become Cold**
- Hypothermia is associated with:
  - Poor feeding
  - Respiratory distress
  - Intraventricular hemorrhage
  - Bleeding
  - Hypoglycemia

WHO guideline – Delivery Room Temperature > 25ºC (78ºF)
- Skin-to-skin
- Plastic coverings

**USE A PULSE OXIMETER**
- When resuscitation anticipated
- When positive pressure ventilation is used
- Supplementary oxygen administered
- Apply to preductal location

**Guiding Questions**
- The order of the 3 assessment questions has changed to
  - (1) Term gestation?
  - (2) Good tone?
  - (3) Breathing or crying?

**First Step in Resuscitation**
- Place on Warmer
- Warmer must be on prior to resuscitation
- Large surface area to volume
- Large evaporative loss

**Stimulate the Baby**
- Dry the infant and remove wet linen
- Rub the infants back
- Flick the infants feet
- Suction the mouth first (prevent aspiration if infant should gasp) then nose
- Posterior pharynx stimulation may produce bradycardia

**Evaluate the Infant**
- Respirations (40 – 60 breaths/min)
- Heart rate (should be more than 100 bpm)
- Almost all compromised infants will respond to ventilation
- Heart rate judges efficacy of resuscitation

**Most Important Vital Sign**
- Increase in heart rate is most sensitive indicator of resuscitation efficacy
- Auscultation
- Consideration to EKG
- EKG does not replace pulse oximetry
We Are Not as Good as We Think

- 64 experienced practitioners participated in this simulation
- Assessed HR via palpation and auscultation
- Wrong heart rate 50% of time leading to errors in resuscitation

Chitkara R. Resuscitation 2013;84:369

Yet EKG is faster

- 46 infants with pulse oximetry and EKG
- Time to place device
  - EKG – 20 sec
  - Pulse ox – 38 sec
- Time to achieve audible HR signal
  - EKG – 2 sec
  - Pulse Ox – 24 sec

Katheria A. Pediatrics 2012;130:1177

Ventilating the Newborn

- Must use pressure manometer
- Initial pressure 30 – 40 cm H2O
- Subsequent pressure 15 – 20 cm H2O
- Deliver breaths at a rate of 40 to 60 breaths per minute
- Look for improvement

After initiating respirations, ask assistant to assess HR.
- If HR is not improving, assess chest movement and ask about breath sounds
- Increasing HR is the primary sign of effective ventilation during resuscitation.
- Term infants should begin positive pressure ventilation with ROOM AIR Preterm infants with oxygen/air mix (21-30%)

Resuscitation of Asphyxiated Newborn Infants with Room Air or Oxygen

- Multinational of 11 institutions enrolling 703 infants (94 not fulfilling inclusion criteria)
- Criteria: apneic infants with heart rate < 80 bpm (excluding wt <1000 gm and lethal anomalies)
- Resuscitate with either Room Air (21% O2) or 100% O2

Saugstad OD. Pediatrics 1998;102:e1

Resuscitation of Asphyxiated Newborn Infants with Room Air or Oxygen

- 288 infants – Room Air (RA)
- 321 infants – 100% oxygen (O)
- Median Ages – 38 weeks in both groups
- Median Birth Weight – 2600 gm in RA and 2560 in O
- Mortality in first 7 days of life – 12.2% in RA and 15% in O

Saugstad OD. Pediatrics 1998;102:e1
Resuscitation of Asphyxiated Infants with RA or O

- Severe hypoxic-ischemic encephalopathy – 21.2% RA and 23.7% O
- Apgars at 1 and 5 min – higher in RA group
- Time to first breath 0.4 min shorter in RA group
- Time to first cry 0.4 min shorter in RA group
- No difference in resuscitation failures

Saugstad OD. Pediatrics 1998;102:e1

Resuscitation of Asphyxiated Infants with RA or O

- Hypoxanthine accumulates during hypoxia
- Hypoxantine is an oxygen free radical generator
- Resuscitation with RA increases oxygen free radicals

Saugstad OD. Pediatrics 1998;102:e1

28 Days Later

- Measured reduced to oxidized glutathione ratio which is an accumulated index of oxidative stress
- RA group – no difference with control nonasphyxiated group
- O group – significantly lower revealing a protracted oxidative stress
- Activity of superoxide dismutase higher in erythrocyte of O group

Vento M. Pediatrics 2001;107:642-7

28 Days Later

18 to 24 Months Later

- No difference in weight, height, or head circumference
- Cerebral palsy – 10% in RA and 7% in O
- 15% in RA and 10% in the O group had neurologic abnormalities

Saugstad OD. Pediatrics 2003;112:296-300
Room Air vs O2
- Meta-analysis of 8 studies
- 1500 pts (772 in O2 group)
- No difference in death or ischemic encephalopathy

Grau J. Can J Anesth 2011;58:3075

Chest Compressions
- Heart rate less than 60 despite 30 seconds of effective ventilation or for HR of 0
- Should intubate infant
- Depth – approximately one third of anterior-posterior diameter of chest
- Two thumb is preferred (generates higher blood pressure and coronary perfusion pressure)
- Oxygen should be 100% during CPR

Wyckoff MH. Circulation 2015;132:S543-S560

Chest Compressions
- One ventilation interposed after every third compression
- Should be a two second cycle
- Total: 30 breaths and 90 compressions per minute
- 120 events per minute

Medications
- 30 seconds of well coordinated CPR, check pulse
- HR > 60 bpm – stop chest compression
- HR < 60 bpm – administer medication

How TO Give Meds?
- 40 participants in simulated neonatal resuscitation
- 1 scenario place UV line and other IO line
- Avg time for placement – 46 sec faster for IO
- No difference in errors

Rajani AK. Pediatrics 2011;128:954

Epinephrine is the First Line Drug
- Epinephrine 1:10,000
- 0.01 – 0.03 mg/kg intravenously through an umbilical line (0.1-0.3 ml/kg)
- Intravenous is the preferred route (1 cc syringe)
- Administration of a higher amount endotracheally but the safety and efficacy have not been evaluated (10 cc syringe)
  - Up to 0.1 mg/kg (0.3 to 1.0 ml/kg)
Volume

- Baby is pale, evidence of blood loss, or baby responding poorly to resuscitation
- Acceptable solutions
  - Normal saline
  - Ringer’s lactate
  - 0-negative blood
- Dose 10 ml/kg over 5 to 10 minutes

Sodium Bicarbonate

- Correct metabolic acidosis
- Do not give unless lungs are adequately ventilated
- Recommended dose: 2 mEq/kg (4 ml/kg of 4.2% solution)
- Administer slowly, no faster than a rate of 1 mEq/kg/min

Naloxone

- Naloxone is not recommended during the primary resuscitation (2010)
- Continued respiratory depression after PPV AND history of maternal narcotic administration within past 4 hrs
- No studies reporting efficacy of endotracheal naloxone
- Intravenous is preferred

Still Have A Long Way to Go

- Examined databases in Australia
- Naloxone use dropped from 4% to 1%
- But
  - 42% used without ventilation first
  - 14% mom never received opioids
  - 80% infants not monitored after administration

Gill AW. J Paed Child Health 20007;43:795-8

Intubation

- Should be accomplished in twenty seconds (time it takes you to read this slide)
- Blade Size
  - No 0 for preterm newborns
  - No 1 for term newborns
- Have suction available
- Intubation attempts correlate with IVH in preterm infants
- Do not use routine capnography

Sauer CW. J Ped 2016;177:108

Laryngeal Mask Airway

- 68 infants with HR < 60 bpm randomized to LMA or ET
- No difference in success on first attempt, insertion time, or ventilation time
- LMA is an effective alternative

Yang C. BMC Ped 2016;16:17
Ok to Not Start Resuscitation

- Noninitiation of resuscitation and discontinuation of CPR are ethically equivalent, and PROVIDERS SHOULD NOT HESITATE TO WITHDRAW SUPPORT WHEN FUNCTIONAL SURVIVAL IS HIGHLY UNLIKELY

- In conditions associated with a high rate of survival and acceptable morbidity (gestational age $\geq 25$ wks), resuscitation is indicated
- In conditions with uncertain prognosis and morbidity is high, parental concerns should be supported

What is Fetal Viability?

- Definition of fetal viability is 24 weeks’ gestation
- Given this definition, antenatal corticosteroids should NOT be given for preterm labor $\sim 24$ weeks’ gestation
- Important to define viability for parent
- Has significant legal implications

- Planned Parenthood of Southeastern Pa. v. Casey: Whenever viability may occur, be it at 23–24 weeks, the standard at the time, or earlier, as may be the standard sometime in the future, the attainment of viability serves as the critical fact in abortion legislature

Rethinking Viability

NY Times May 2016

Redefining Fetal Viability

- Cohort study of infants born at 22-25 weeks’ gestation with birthweight of 401 to 1000 gm
- Result: lower incidence of death or neurodevelopment delay:
  - 23 weeks: 68.4% vs 80.3%
  - 24 weeks: 52.7% vs 67.9%

- For infants 23-24 weeks’ gestation:
  - Lower incidence of death or neurodevelopment delay
- For infants 22 weeks’ gestation:
  - Lower incidence of death or NEC

ACOG Consensus Statement

- 0.5% of births occur before third trimester
- Periviable birth: 20-24 and 25-26 weeks gestation
- Factors affecting viability:
  - Steroids, location of birth, gender, antibiotics
  - Most important: gestational age, steroids, birth weight, sex, and plurality
  - Greater need for cesarean delivery and vertical incision
  - Discussion: optimize survival or minimize suffering

ACOG. Obstet Gynecol 2016;127:157

Carlo WA. JAMA 2011;306:234
When to Stop Resuscitation

- After 10 min of adequate resuscitation, discontinuation of resuscitation may be justified if there are no signs of life
- Apgar of 0 is universally poor

McGrath JS. Early Human Devel 2016;102:31

Post Resuscitation

- International Liaison Committee on Resuscitation
- Mild hypothermia 33.5-34.5°C of newborns >36 weeks gestation age
- Within 6 hours birth
- Reduces death and disability from hypoxic encephalopathy

Pfister RH. J Perinatol 2010;30:S82

How Do I Improve Resuscitation?

- 34 interns randomized to team training or no training
- Both groups instructed on resuscitation
- Greater team work in trained group
- Resuscitation completed 2.6 min faster in simulator
- Persisted for 6 months

Thomas EJ. Pediatrics 2010;125:539

Summary – Take Home Message

- If you are the anesthesia provider for the mother, you should not be responsible for resuscitating the newborn
- Assess breathing or heart rate (by auscultation)
- Usually always responds to PPV
- Ok to use room air (full term)
- Ok to use LMA
- Ok to not initiate in poor prognosis and to stop after 10 minutes
Pregnancy and the Implications of HLA Allosensitization

Neil P. Ray, M.D.
March 5, 2017

Case Report #1
- 27 y/o Pregnant Heart Transplant Recipient
  - Heart Transplant at age of 10 for cardiomyopathy
  - Uncomplicated post-transplantation course free from rejection and opportunistic infections.
  - Uneventful pregnancy and delivery
  - 3 months post-partum EF: 58% to 25%
  - 5 months post-partum requires 2nd heart transplant


Case Report #2
- Female patient presents to OR for pelvic tumor debulking
  - History of pregnancy x 2, 15 years before surgery.
  - 1 unit of non-leukoreduced RBCs, 12 days before surgery.
  - Preoperative platelet count was 351,000 /mm³.
  - Massive transfusion support required during procedure.
  - 12 units of platelets given for platelet count of 49,000 /mm³
  - Additional 24 units of platelets given post-op for platelet count of 20,000 /mm³
  - Highest post-op platelet count was 36,000 /mm³
  - Patient diagnosed with alloimmune platelet refractoriness (alloPR)


Case Report #3
- Newborn Baby born at term with IVH & thrombocytopenia
  - Healthy pregnancy
  - Newborn born with petechiae and bruises
  - CBC revealed platelet count of 20,000/mm³ with a normal HCT and WBC.

Objectives
- Understanding the HLA antigen system
- Risk Factors for forming HLA antibodies
- Pregnancy and HLA antibodies formation
- Strategies to reduce HLA antigen exposure

Financial Disclosures
- Co-Founder and Equity Holder
  Raydiant Oximetry, Inc.
Human Leukocyte Antigen (HLA)

- HLA system is synonymous with MHC
- Class I region, which includes the HLA genes HLA-A, B and C, expressed on nearly all nucleated cells
- Class II region, which includes HLA genes HLA-DR, DQ and DP only expressed on B cells, antigen-presenting cells (APCs) and on activated endothelial cells.
- Class III region, which includes the genes for components of the complement cascade and cytokines, e.g. TNF, IL1

Causes of HLA Allosensitization

- Transfusion of blood products
- Transplantation of organs
- Pregnancy
- Influenza vaccine
- Heart valve allografts
- Left ventricular assist devices (HeartMate1)

Incidence of HLA Allosensitization and Pregnancy

- Female patient with no pregnancy history (1.7%)
- Female patient with history of 1 pregnancy (11.2%)
- Female patient with history of 2 pregnancies (22.5%)
- Female patient with history of 3 pregnancies (27.5%)
- Female patient with history of 4+ pregnancies (32.2%)
- Male patient awaiting kidney transplant with a history of multiple RBC transfusion (16.7%)

Consequences of HLA Allosensitization

- Platelet refractoriness
- Miscarriages
- Humoral rejection of transplanted organ
- Transfusion associated graft vs host disease
- Transfusion related acute lung injury (TRALI)

Mitigation Strategies for TRALI

- TRALI is now thought to be a result of HLA antibodies from donor blood reacting to HLA antigens on WBCs of recipient.
- Incidence of TRALI has decreased from 1/4000 to 1/12000 since donor screening was implemented
- Donor screening includes screening for women with 2+ pregnancies and/or HLA antibody testing.

Strategies to Reduce HLA Exposure

- Avoidance of transfusing blood products
  - gestational thrombocytopenia (< 100/mm³)
  - Hemoglobin 8 to 10 g/dL
- Leukoreduced RBCs
- ABO & HLA matched RBCs
- ABO/HLA platelets
- Single donor platelets
- Apheresis for blood product collection
What is a Safe Platelet Count for Neuraxial Anesthesia in Parturients?

- Goodier: “the unknown risk of hematoma continues to justify the decision to avoid neuraxial anesthesia in thrombocytopenic parturients.”
- 2015 Goodier et al – 499 patients with platelet counts >50k
- 2016 Bernstein et al – 256 patients with platelet counts >50k
- The AABB (American Association of Blood Banks) recently changed their guidelines so that a prophylactic platelet transfusion for elective lumbar punctures when platelet counts are above 50,000/mM3 is no longer recommended.

2015 Goodier et al – 499 patients with platelet counts >50k
2016 Bernstein et al – 256 patients with platelet counts >50k

Blood Banking Practices for Platelet Transfusions

- Donor collection of whole blood vs apheresis
- Single vs pooled donor administration
- ABO matching for platelet transfusions
- HLA matching for platelet transfusions
- Pre or post-collection leukoreduction

Apheresis vs Whole Blood Collection

- Allows donors to give more of the most needed components more frequently.
- Allows recipients to receive a large amount of a product from a single donor.
- Single donor of platelet apheresis is equivalent to 6 whole blood donations from 6 individuals.
- Donations can be made more frequently (24 times a year).

ABO Matching and Platelet Transfusions

- Often ABO incompatible platelets are transfused given the “low-risk” and short life span (5 days).
- Small amount of ABO incompatible plasma in ABO incompatible platelets leads to an immune responsive that impairs platelet adhesion.
- Patients receiving ABO incompatible platelets tend to require more units verse ABO compatible platelets.

Managing Platelet Refractoriness

- Transfuse HLA-matched platelets
- Transfuse ABO-compatible platelets (10x)
- IV gamma globulin
- Plasmapheresis
Case Report #1

- 27 y/o Pregnant Heart Transplant Recipient
- Heart Transplant at age of 10 for cardiomyopathy
- Uncomplicated post-transplantation course free from rejection and opportunistic infections.
- Uneventful pregnancy and delivery
- 3 months post-partum EF: 58% to 25%
- 5 months post-partum requires 2nd heart transplant


Case Report #1 Details

- Patient developed de novo donor-specific antibodies (DSAs) despite immunosuppression.
- Patient was exposed to HLA Class II antigens from fetus which were inherited from the father.
- The newly transplanted organ need to accommodate the HLA antibody profile, as well as any potential blood products given during 2nd sternotomy.

Case Report #2

- Female patient presents to OR for pelvic tumor debulking
- History of pregnancy x 2, 15 years before surgery.
- 1 unit of non-leukoreduced RBCs, 12 days before surgery.
- Preoperative platelet count was 351,000 /mm³.
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- Highest post-op platelet count was 36,000 /mm³
- Patient diagnosed with alloimmune platelet refractoriness (alloPR)


Case Report #2 Details

- Patient was confirmed to have HLA antibodies.
- Presumed exposure from fetal HLA antigens and HLA antigens from WBCs (non-leukoreduced RBCs).
- HLA alloantibody levels were observed to increase following repeated transfusion of incompatible platelets.
- Such transfusions may worsen platelet refractoriness by stimulating further allosensitization.
- Patient expired 8 days after procedure.

Case Report #3

- Newborn Baby born at term with IVH & thrombocytopenia
- Healthy pregnancy
- Newborn born with petechiae, bruises and IVH
- CBC revealed platelet count of 20,000/mm³ with a normal HCT and WBC.

Case Report #3 Details

- NAIT-Neonatal Alloimmune Thrombocytopenia
- Maternal antibodies to fetal HLAs on platelets
- Maternal antibodies to fetal HPA-1 platelets
- IGG antibodies can cross the placenta
- Occurs after first successful pregnancy
- 80% maternal reoccurrence rate for NAIT
Human Platelet Antigens (HPA-1)

- 98% population is HPA-1 positive
- 2% population is HPA-1 negative
- IVIG may help prevent IVH for future pregnancies
- 1/350 women will have HPA-1 antibodies

Final Thoughts

- Consult your local blood bank to learn about how platelets are collected at your institution.
- Work with transfusion committee to develop mitigation strategies for HLA allosensitization.
- Incorporate HLA allosensitization into the risk/benefit analysis when considering to transfuse.
- Consider platelet refractoriness from HLA allosensitization when bleeding or the platelet count does not respond to a platelet transfusion.

Thank you!
Baby Friendly Initiative and Immediate Skin to Skin Contact

Andrea J. Traynor, M.D.
Clinical Associate Professor
Stanford University School of Medicine

I have no financial, pharmaceutical, or other disclosures

• I’m here to convince you that this is physiologic

• It needs to be a priority

• Multidisciplinary implementation
Baby Friendly Hospital Initiative

- World Health Organization
- UNICEF

6,000 hospitals in China
87% hospitals in Cuba
80% babies born in Taiwan

Sweden = global leader

416 US Hospitals
20% of US babies are born at Baby-Friendly hospitals

Requirements

1. Have a written breastfeeding policy that is routinely communicated with staff.
2. Train all health care staff in skills necessary to implement this policy.
3. Inform all pregnant women about the benefits and management of breastfeeding.
4. Place babies in skin-to-skin contact with their mothers immediately following birth for at least an hour. Encourage mothers to recognize when their babies are ready to breastfeed and offer help if needed.
5. Show mothers how to breastfeed and maintain lactation, even if they should be separated from their infants.
6. Give newborn infants no food or drink other than breastmilk, unless medically indicated.
7. Allow mothers and infants to remain together 24 hours a day.
8. Encourage breastfeeding on demand.
9. Give no artificial teats or pacifiers to breastfeeding infants.
10. Foster the establishment of breastfeeding support groups and refer mothers to them on discharge from the hospital or clinic.

Place babies in skin-to-skin contact with their mothers immediately following birth for at least an hour.
Oxytocin Release

- Touch
- Light pressure
- Massage-like stroking
- Warm temperature


Frontal Cortex

Regulates cognition

Oxytocin affects cortical modulation of other areas of the brain

Nucleus Accumbens

Processes rewarding stimuli

“Pleasure center” in the brain

Plays a role in addiction
**Hippocampus**
- Part of the limbic system
- Emotion
- Memory
- Autonomic Nervous System

**Periaqueductal Gray**
- “Analgesia center”
- May play a role in maternal love and bonding

**Raphe Nuclei**
- “Happy Center”
- Releases serotonin
- Site of action for SSRI s
Locus Coeruleus

“Stress Center”

Synthesizes norepinephrine

Involved in PTSD

Oxytocin increases responsiveness of alpha 2 adrenergic receptors

inhibition

Amygdala

“Fear Center”

Emotional Intelligence

Emotional Memory

Oxytocin inhibits the amygdala
Exogenous Oxytocin

- Released by skin to skin contact
- Widespread effects in the brain
- BONDING
- PLEASURE
- ANALGESIA
- EMOTIONAL MEMORY
- LEARNING AND COGNITION
- STRESS RELIEF

- Makes you want to give someone a hug, doesn’t it???

- Exogenous Oxytocin
  - Given routinely
  - Studied for analgesic effects
  - Minimal blood brain barrier permeability
  - 0.018% of plasma dose

Skin to Skin and Breastfeeding

- 1070 women
- Immediate S2S
- S2S 92% vaginal births
- S2S 57% of urgent CS

Vila-Candel R. 2017; J Human Lactation; 1-9

Skin to Skin and Cortisol

- Randomized Controlled Trial
  - S2S; n=23, 19h per day
  - Standard; n=19
- Late preterm infants (32-35 weeks)
- Follow up at 1 and 4 months corrected age
- Cortisol levels
- Swedish Parenthood Stress Questionaire

Morelius E. Early Human Development 2015; 91:63-70

Skin to Skin and Infection

- 102 infants, 1300-1800g
- >4 days hospitalization
- + MRSA or multidrug resistant staph
- Mothers not colonized
- 60 min S2S twice per day vs. routine care

Skin to Skin and Infection

- 52% of S2S group vs. 11% of control group decolonized after 7 days
- 84% of the new bacteria in infants = from the mother
- Number needed to treat = 4


Risks and Benefits

- Term CS
- Retrospective – pre and post intervention
- Shorter PACU stay (reduced by 14 min)
- Shorter maternal hospital stay
  - (4d vs. 4.4d, p <0.001)
- Reduced neonatal admissions for suspected infection

Source: Posthuma S. J Maternal Fetal Med 2017; 30(2) 159-63

Implementation

- Recommended by WHO and UNICEF Baby Friendly initiative

Multidisciplinary Approach
- Nurses
- Pediatricians
- Obstetricians
- Anesthesiologists
Implementation

Someone needs to stay with the baby!

Look for signs of neonatal distress

Color

Respiratory distress

What We Do

- Mother without a bra, with a covering blanket and gown
- Baby delivered, handed to Neo team – to warmer for a brief evaluation
- Weight and length not done
- Anesthesia team assesses mom, uterus and need for meds in conjunction with OB

What We Do

At 1-3 minutes of life, if the anesthesia provider approves and baby is well, baby is placed prone directly on mom’s skin in a vertical orientation between her breasts, covered with blankets.

Neo team hands off to baby RN, who assumes care of baby.

RN monitors baby and assists with breastfeeding, if baby is ready.
What We Do

• Mom PACU with S2S
• Breastfeeding in PACU
• Newborn RN hands off to L&D RN when mom is stable

Conclusion

Skin to skin contact after delivery is physiologic

Many benefits for mother and baby (and maybe father!) beyond breastfeeding success

Risk is minimal

Recommended Reading

Morelius E. Early Human Development 2015; 91:63-70
Posthuma S. J Maternal Fetal Med 2017; 30(2) 159-63
www.WHO.int

GOAL IS CONTINUOUS S2S NOT JUST BREASTFEEDING!

Erythromycin, vitamin K, glucose done with baby S2S in PACU

A head to toe assessment and baby weight done by RN prior to transfer

Patients want skin to skin contact

We need to help make it happen

Thank You!
Session X: Anesthesia Safety Session 2
Moderator: Manuel Vallejo, Jr., M.D., D.M.D.

Enhanced Recovery After Surgery (ERAS) for Cesarean Delivery
Mark Rollins, M.D., Ph.D.

New VTE Bundles in OB: How Will This Affect OB Anesthesia
Alexander Butwick, M.B.B.S., FRCA, M.S.

The Continued Learning Environment
Manuel Vallejo, Jr., M.D., D.M.D.
Enhanced Recovery after Surgery (ERAS) for Cesarean Delivery

Sol Shnider Conference
March 5, 2017

Mark Rollins, MD, PhD
Director Obstetric Anesthesia
UCSF Department of Anesthesia

Objectives

ERAS
1) Concept of an ERAS Pathway & Impact
2) Components Applicable to Cesarean Delivery
3) Current Evidence
4) Pain Management

No Disclosures

ENHANCED RECOVERY IS FOUNDED ON FOUR WORKING PRINCIPLES

1. All patients should be on a pathway to enhance their recovery. This enables patients to recover from surgery, treatment, illness and leave hospital sooner by minimising the physical and psychological stress responses.
2. Patient preparation ensures the patient is in the best possible condition, identifies the risk and commences rehabilitation prior to admission or as soon as possible.
3. Preoperative patient management components of enhanced recovery are embedded across the entire pathway; pre, during and after operation/treatment.
4. Patients have an active role and take responsibility for enhancing their recovery.

Colorectal ERAS

Figure 1: The enhanced recovery surgical pathway

PREPARATION

ERAS

Colorectal ERAS

ENHANCED RECOVERY IS FOUNDED ON FOUR WORKING PRINCIPLES

1. All patients should be on a pathway to enhance their recovery. This enables patients to recover from surgery, treatment, illness and leave hospital sooner by minimising the physical and psychological stress responses.
2. Patient preparation ensures the patient is in the best possible condition, identifies the risk and commences rehabilitation prior to admission or as soon as possible.
3. Preoperative patient management components of enhanced recovery are embedded across the entire pathway; pre, during and after operation/treatment.
4. Patients have an active role and take responsibility for enhancing their recovery.
Why do ERAS?

- Decreased LOS by 2.3 days [95% CI −3.09 to −1.47]
- Decreased Overall Morbidity (RR) = 0.60, [95% CI 0.46–0.76]
- Decreased Nonsurgical Complications (RR) = 0.40, [95% CI 0.27–0.61]
- Similar Readmission Rates
- Similar Surgical Complication Rates

Spine Surgery

- Decreased opioid consumption on POD 1 & 2
- Earlier ambulation
- Lower nausea dizziness and sedation POD 1 - 6
- Decreased PACU stay
- No infections either group

Gynecologic Surgery

- Decreased post-op opioid use in first 48 hours (80% reduction)
- Decreased hospital stay (reduced by 4 days)
- Faster return of bowel function
- No difference in complications or mortality or readmission rate
- 19% decrease in cost
**Implementation**

**ERAS**
- Subset first (Elective C/D)?
- All C/D but have exceptions for comorbidities?
- All C/D?
- Standardized order sets in place?
- QA/QI EMR data collection period?

**Outcome measures**

**ERAS**
- Operative time
- Satisfaction
- Length-of-stay
- Pain
- Nausea & itching
- Complications
- Cost
- Readmission Rates (mother & newborn)
- Breastfeeding
Outcome measures

ERAS

Compliance with protocol

Pre-Op

ERAS

1) Nutritional clear liquid
2) Pre-Op for Surgery (eq. NPO, Consent, etc.)
3) Review patient Desires & Expectations
4) Bleeding Risk / Other Considerations
5) Incentive Spirometry Education
6) Pre-Op Acetaminophen
7) Antacid
8) Standardize Pre-Op fluids

AntePartum

ERAS

• Pre-Op Consultation (optimize any needs)
• Education Materials
• Discuss “What to Expect”
• Patient enrolls in EMR
• Materials on Newborn Care, establishing a pediatrician, car seat.
• Provide antibacterial scrub and nutritional clear liquid

Cochrane Database of Systematic Reviews

Preoperative carbohydrate treatment for enhancing recovery after elective surgery (Review)

Smith MD, McCall J, Plank L, Herbison GP, Soop M, Nygren J


• Preoperative carbohydrate treatment was associated with a small reduction in length of hospital stay when compared with placebo or fasting in adult patients undergoing elective surgery
• Aspiration pneumonitis was not reported in any patients, regardless of treatment group allocation.

Bedside Gastric Ultrasonography in Term Pregnant Women Before Elective Cesarean Delivery: A Prospective Cohort Study

Arzola C. Anesth Analg 2015. 121:752

Okabe T. BJA 2015 114(1):77

• Fasting Solid Food > 6-hrs and Clears > 2 hours

53/103 had “No fluid”
49/103 had “baseline residual amounts”
1/103 had “higher than baseline fluid”
Intra-Op

ERAS
1) Neuraxial Opioid
2) Fluid Management
3) Vasopressors
4) Antibiotics
5) Antiemetics
6) Partner in OR / Skin-to-skin

Intrathecal Morphine 100µg & 200µg For Post-Cesarean Delivery Analgesia

<table>
<thead>
<tr>
<th>Analgesia</th>
<th>IT Morphine 100µg</th>
<th>IT Morphine 200µg</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opioid Use (0-24h)</td>
<td>54 ± 35mg</td>
<td>44 ± 35mg</td>
<td>.04</td>
</tr>
<tr>
<td>Opioid Use (24-48h)</td>
<td>54 ± 32mg</td>
<td>60 ± 31mg</td>
<td>.18</td>
</tr>
<tr>
<td>IV morphine required</td>
<td>30%</td>
<td>18%</td>
<td>.02</td>
</tr>
<tr>
<td>IV Morphine Use (0-24h)</td>
<td>2.5 ± 3.3mg</td>
<td>1.3 ± 3.5mg</td>
<td>.054</td>
</tr>
<tr>
<td>IV Morphine Use (24-48h)</td>
<td>0.02 ± 0.2mg</td>
<td>0 ± 0mg</td>
<td>.32</td>
</tr>
<tr>
<td>Mean VPS (0-24h)</td>
<td>2.0 ± 1.1</td>
<td>1.6 ± 1.1</td>
<td>.01</td>
</tr>
<tr>
<td>Mean VPS (24-48h)</td>
<td>2.5 ± 1.0</td>
<td>2.5 ± 1.0</td>
<td>.92</td>
</tr>
</tbody>
</table>

Intrathecal Morphine Doses For Post-Cesarean Analgesia

**Analgesia**

- **Nausea and Vomiting 10% to 50%**
- **Respiratory Depression < 0.25%**

**Side Effects**

<table>
<thead>
<tr>
<th>IT Morphine 100µg</th>
<th>IT Morphine 200µg</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antiemetic Use</td>
<td>24%</td>
<td></td>
</tr>
<tr>
<td>Nausea Episodes (0-24h)</td>
<td>1.6 ± 1.3</td>
<td>1.9 ± 1.3</td>
</tr>
<tr>
<td>Nausea Episodes (24-48h)</td>
<td>0.02 ± 0.13</td>
<td>0.04 ± 0.46</td>
</tr>
<tr>
<td>Patients receiving NSAIDs</td>
<td>87%</td>
<td>87%</td>
</tr>
<tr>
<td>Time of Surgery to Discharge</td>
<td>89 ± 20 hrs</td>
<td>89 ± 19 hrs</td>
</tr>
</tbody>
</table>

In the pre-CS survey sample, pain during CS was associated with Cesarean delivery. However, there was interindividual variability among the distribution of rankings of patients' preferences. For Post-Cesarean Delivery Analgesia

**Patient Preferences for Outcomes Associated with Cesarean Delivery**

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Rank</th>
<th>Relative value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain during cesarean</td>
<td>8.4</td>
<td>27 ± 18</td>
</tr>
<tr>
<td>Pain after cesarean</td>
<td>8.3</td>
<td>18 ± 10</td>
</tr>
<tr>
<td>Vomiting</td>
<td>7.8</td>
<td>12 ± 7</td>
</tr>
<tr>
<td>Nausea</td>
<td>6.8</td>
<td>11 ± 7</td>
</tr>
<tr>
<td>Cramping</td>
<td>6.0</td>
<td>10 ± 8</td>
</tr>
<tr>
<td>Itching</td>
<td>5.6</td>
<td>9 ± 8</td>
</tr>
<tr>
<td>Shivering</td>
<td>4.6</td>
<td>6 ± 6</td>
</tr>
<tr>
<td>Anxiety</td>
<td>4.1</td>
<td>5 ± 4</td>
</tr>
<tr>
<td>Somnolence</td>
<td>2.9</td>
<td>3 ± 3</td>
</tr>
<tr>
<td>Normal</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

Data are mean ± sd. Rank = 1 to 10 from the most desirable (1) to the least desirable (10) outcome, relative value = dollar value patients would pay to avoid an outcome, e.g., they would pay $27 of their $100 to avoid pain during cesarean delivery.

Intrathecal morphine dose: 50mcg vs. 100mcg vs. 150mcg


Pain scores at rest and with movement. Numeric rating scale scores for cesarean delivery. They found that the incidence of nausea was low, with less pruritus at 6 hours with 50 mcg IT morphine.

No difference in pain scores

No difference in morphine use

Epidural Morphine Doses For Post-Cesarean Analgesia

Post Cesarean Pain

Post Cesarean Pain (Efficacy of Two Epidural Morphine Doses)

Post-Op ERAS

1) Early Mobilization / Out of Bed POD 0
2) Foley Removal by 12 hours
3) DVT prophylaxis
4) Multimodal Pain Control (RTC NSAIDs & Acetaminophen)
5) Bowel Regimen
6) Incentive Spirometry
7) Advance to Regular Diet POD 0
**Two months after childbirth:**

*Women with severe acute postpartum pain had a 2.5-fold increased risk of persistent pain and a 3.0-fold increased risk of postpartum depression compared to those with mild postpartum pain.*

---

**Post-Delivery Pain**

(*Mean pain scores for first 24 hours after delivery*)

![Graph showing comparison between Vaginal Delivery and Cesarean Delivery pain scores](Image)

---

**Cesarean Delivery Pain**

(*Impact on Daily Activities during first 24 hours*)

<table>
<thead>
<tr>
<th>Activity Impacted</th>
<th>Vaginal Delivery</th>
<th>Cesarean Delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walking</td>
<td>40%</td>
<td>72%</td>
</tr>
<tr>
<td>Mood</td>
<td>19%</td>
<td>40%</td>
</tr>
<tr>
<td>Sleep</td>
<td>36%</td>
<td>57%</td>
</tr>
<tr>
<td>Interactions with Others</td>
<td>8%</td>
<td>20%</td>
</tr>
<tr>
<td>Ability to Concentrate</td>
<td>13%</td>
<td>31%</td>
</tr>
<tr>
<td>Pain (8-weeks)</td>
<td>10%</td>
<td>9%</td>
</tr>
<tr>
<td>Depression (8-weeks)</td>
<td>11%</td>
<td>11%</td>
</tr>
</tbody>
</table>

---

**Postoperative Analgesic Practice For Cesarean Delivery**

**Survey of Institutional Practice:**

- **Intrathecal Morphine (spinal)**: 77%
- **Use of Epidural following C/D**: 21%
- **Routine Use of PCA**: 12%
- **NSAIDS**: 81%
  - “Round The Clock” = 42%
  - PRN = 51%
  - Other (often single dose) = 7%
- **Acetaminophen**: 45%

---

**NSAIDs On-Demand vs. Fixed-Interval**

<table>
<thead>
<tr>
<th>Fixed (fixed-interval group)</th>
<th>On-Demand group</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vomiting</td>
<td>2 (54)</td>
<td>1.52 ± 0.1 (16)</td>
</tr>
<tr>
<td>Pain at delivery to first opioid dose (subjective)</td>
<td>4.5 ± 1.5 (16)</td>
<td>4.1 ± 1.5 (16)</td>
</tr>
<tr>
<td>Pain at delivery to first opioid dose (subjective)</td>
<td>4.5 ± 1.5 (16)</td>
<td>4.1 ± 1.5 (16)</td>
</tr>
<tr>
<td>Pain at delivery to second opioid dose (subjective)</td>
<td>4.5 ± 1.5 (16)</td>
<td>4.1 ± 1.5 (16)</td>
</tr>
<tr>
<td>Pain at delivery to third opioid dose (subjective)</td>
<td>4.5 ± 1.5 (16)</td>
<td>4.1 ± 1.5 (16)</td>
</tr>
<tr>
<td>Opioid analgesic dose (subjective)</td>
<td>100 ± 31 (16)</td>
<td>100 ± 31 (16)</td>
</tr>
</tbody>
</table>

Fixed-interval NSAID dosing provides more effective post-operative cesarean analgesia and results in better patient satisfaction compared to on-demand dosing.


---

**Scheduled acetaminophen with as-needed opioids compared to as-needed acetaminophen plus opioids for post-cesarean pain management**

A.R. Valentine, B. Carvalho, T.A. Lazo, E.T. Riley

- **Department of Anesthesiology, Stanford University Medical Center, Stanford, CA, USA**

- **Delivered a chart review of 240 records (120 each group)**
- **IT morphine 200 mcg**
- **15mg ketorolac or 600mg ibuprofen q 6hrs**

1) Scheduled acetaminophen (650 q 6hrs with oxydodine prn)
2) pm combination opioid-acetaminophen
Scheduled acetaminophen with as-needed opioids compared to as-needed acetaminophen plus opioids for post-caesarean pain management

A.R. Valentine, † B. Carvalho,‡ T.A. Lajoie,§ E.T. Riley

†Stanford University School of Medicine, Stanford, CA, USA
‡Department of Anesthesia, Stanford University Medical Center, Stanford, CA, USA

Correspondence to: Brendan Carvalho, Department of Anesthesia, c/o Stanford University Medical Center, Stanford, CA 94305, USA.

ABSTRACT

Combination opioid-acetaminophen drugs are commonly used for pain management after cesarean delivery. The aim of this retrospective study was to compare as-needed acetaminophen plus opioids for post-cesarean pain to scheduled acetaminophen plus opioids. Women undergoing cesarean delivery at an academic institution were randomly assigned to receive acetaminophen 650 mg every 6 hours with oxycodone 5 mg for breakthrough pain in the first group (As-Needed Group, n = 120) or receive a combination of acetaminophen 1200 mg every 6 hours with morphine 2 mg intrathecally if required in the second group (Scheduled Group, n = 120). The primary outcome was opioid use. We performed a retrospective chart review of women who underwent cesarean delivery before and after a clinical practice change. All patients received spinal anesthesia containing intrathecal morphine 200 μg. The mean reduction in oxycodone dose was significant in the Scheduled Group, as was the number of patients requiring oxycodone (<0.001). Fewer patients in the Scheduled Group exceeded the 3 gdaily limit of acetaminophen compared to the As-Needed Group (p < 0.001). Opioid use was less in the Scheduled Group compared to the As-Needed Group: 14 mg compared to 23 mg (p < 0.001). The number of patients who used acetaminophen above the limits of 2 g daily was significantly lower in the Scheduled Group (p < 0.001). In the Scheduled Group, the number of patients with side effects was significantly lower than in the As-Needed Group (p < 0.001). Although side effects were reported less frequently in the Scheduled Group, the difference did not reach statistical significance (p = 0.055).

In conclusion, scheduled acetaminophen plus opioids was associated with less opioid use, reduced daily acetaminophen dose, and lower frequency and severity of side effects compared to as-needed acetaminophen plus opioids for post-cesarean pain management.

Additional Discharge Items

ERAS

1) Home Health Visit
2) Lactation Consultant / Circumcision
3) Car Seat / Flu Shot
4) Follow Up Appointments (OB and Peds)
5) Newborn Screen
6) Birth Certificate
7) Discharge Meds
OVERVIEW

• Epidemiology: Venous Thromboembolism (VTE)
• VTE Bundle
• Guidelines for Neuraxial Anesthesia
• Relevance to Ob Anesthesia Practice

VTE Incidence: USA

Postpartum Pulmonary Embolism

Maternal Deaths 2011-2012

Guidelines
Guidelines for Anticoagulation in Pregnancy

Indications for Anticoagulation

- Venous thromboembolism (VTE)
- Women with mechanical heart valves
- Antiphospholipid antibody syndrome

Babu SM et al. Chest 2012; 141 (Suppl): e691-736

Problem 1

http://www.safehealthcareforeverywoman.org/national-partnership.php

A comparison of recommendations for pharmacologic thromboembolism prophylaxis after cesarean delivery from three major guidelines

BJOG 2016; 123: 2157-62

National Partnership for Maternal Safety: Consensus Bundle on Venous Thromboembolism

Mary E. D’Alton, MD, Alexander R. Friedman, MD, Elizabeth M. Sizemore, MD, PhD, Douglas M. Montgomery, MD, Michael J. Pallas, MD, Ryan D’Orio, MA, RNC, APN, Jennifer C. Pick, MD, MPH, Alphonse B. Yancey, MD, Deborah Karzmark, CM, DNP,Batia S. Levy, MD, and Steven L. Clark, MD

Obstetric venous thromboembolism is a leading cause of severe maternal morbidity and mortality. Maternal death from thrombosis is avoidable and preventable, and thromboprophylaxis is the most readily implementable measure to systemically reduce the maternal death rate. Observational data support the benefit of risk-stratified prophylaxis in reducing obstetric thromboembolism. This bundle, developed by a multidisciplinary working group and published by the National Partnership for Maternal Safety under the guidance of the Council of Resident Safety in Women’s Health Care, aspirin maternal thromboprophylaxis risk assessment for obstetric patients, with appropriate use of indicated and mechanical thromboprophylaxis. Safety strategies for women consist of careful nursing practices and close observation of every testing unit. The safety bundle is organized into four domains: Readiness, Recognition, Response, and Reporting and System Learning, through the seven competencies. As an example, this resource is available in a checklist format, and distribution among institutions is strongly encouraged. (Am J Obstet Gynecol 2016;215:00-00)
- Readiness
- Recognition
- Response
- Reporting / Systems Learning

Who to Anticoagulate?

Table 1: National Partnership for Maternal Safety Recommendations for Antepartum Outpatient Prophylaxis

<table>
<thead>
<tr>
<th>Clinical History</th>
<th>Anticoagulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple prior venous thromboembolism episodes</td>
<td>Treatment dose LMWH heparin or UFH</td>
</tr>
<tr>
<td>Prior venous thromboembolism with high-risk thrombophilia</td>
<td>Prophylactic dose LMWH heparin or UFH</td>
</tr>
<tr>
<td>Prior venous thromboembolism with acquired thrombophilia</td>
<td>No treatment</td>
</tr>
<tr>
<td>Idiopathic prior venous thromboembolism</td>
<td></td>
</tr>
<tr>
<td>Prior venous thromboembolism with pregnancy or oral contraceptive</td>
<td></td>
</tr>
<tr>
<td>Prior venous thromboembolism with low-risk thrombophilia</td>
<td></td>
</tr>
<tr>
<td>Family history of venous thromboembolism with high-risk thrombophilia</td>
<td></td>
</tr>
<tr>
<td>High-risk thrombophilia (testing acquired)</td>
<td></td>
</tr>
<tr>
<td>Low-risk thrombophilia</td>
<td></td>
</tr>
<tr>
<td>Prior venous thromboembolism probed</td>
<td></td>
</tr>
<tr>
<td>Low-risk thrombophilia and family history of venous thromboembolism</td>
<td></td>
</tr>
</tbody>
</table>

Problem 2

Other Recommendations

- **Antepartum admission > 72 hr:**
  - LMWH or bid UFH
  - If 'High-Risk' for childbirth: 5000 U UFH bid

- **Post Vaginal Delivery:**
  - History of VTE or thrombophilia: LMWH or UFH

- **Post-Cesarean Delivery:**
  - If 'High-Risk' for VTE: Thromboprophylaxis

Anesthesia & Anticoagulated Patients
EPIDURAL/SPINAL HEMATOMA

- Most recent population data
  - 0:62,450 1
  - 1:251,463 2
- Closed Claims data 3
  - 1990-2016
  - 546 OB claims
  - No spinal/epidural hematoma post-neuraxial block

1. Bateman BT Anesth Analg 2013
2. D’Angelo Anesthesiology 2014
3. Leffert L et al. unpublished observations

Problem 3

Guidelines for neuraxial anesthesia + anticoagulation

- National Anesthetic societies:
  - ASRA: 2010
  - ASRA: 2016
  - ESA: 2010
  - NMPS: 2016

Guidelines for neuraxial anesthesia + anticoagulation

- Heparin / LMWH
- Expert consensus
- Limited PK / PD data
- PK / PD of anticoagulants in pregnancy?

HEPARIN
HEPARIN

- Glycosaminoglycan
- Variable MW
- Mode of action:
  - Binds to ATIII

Before

- NB = Neuraxial Block; CW = Catheter withdrawal

<table>
<thead>
<tr>
<th></th>
<th>ASRA 2010</th>
<th>ASRA 2016</th>
<th>ESA</th>
<th>NPMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before NB/CW</td>
<td>No time interval (&lt;10,000U/day or 1-2 doses/day)</td>
<td>4-6 hrs (≤10,000 IU/day)</td>
<td>4-6 hrs (&lt;10,000U/day)</td>
<td>No time interval (&lt;10,000U/day)</td>
</tr>
<tr>
<td>After NB/CW</td>
<td>1 hr</td>
<td>Can start immediately</td>
<td>1 hr</td>
<td>No restriction</td>
</tr>
</tbody>
</table>

4-6 hrs

Prophylactic SQ heparin

Heparin and Pregnancy

- SC heparin (143 U/kg) in pregnant vs non pregnant subjects

* For therapeutic dose UFH

IV Heparin

LMWHs
LMWHs

- Chemical / enzymatic depolymerization
- Mechanism of action:
  - Binding with ATIII
  - Inhibit FVIIa / tissue factor
  - Increase release of tissue factor pathway inhibitor
- Reduced anti-IIa / anti-Xa ratio
- More predictable anticoagulant response
- Fewer side-effects

Prophylactic LMWH and Neuraxial Blocks

<table>
<thead>
<tr>
<th></th>
<th>ASRA 2010</th>
<th>ASRA 2016</th>
<th>ESA</th>
<th>NPMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before NB/CW</td>
<td>10-12 hr</td>
<td>10-12 hr</td>
<td>12 hr</td>
<td>12 hr</td>
</tr>
<tr>
<td>After NB/CW</td>
<td>6-8 hr (1st dose NB)/ &gt;2 hr (CW)</td>
<td>6-8 hr after CW if &gt;12 hr has elapsed since surgery (CW)</td>
<td>4 hr</td>
<td>4 hr</td>
</tr>
</tbody>
</table>

NB = Neuraxial Block; CW = Catheter withdrawal

Therapeutic LMWH and Neuraxial Blocks

<table>
<thead>
<tr>
<th>LMWH</th>
<th>ASRA 2010</th>
<th>ASRA 2016</th>
<th>ESA</th>
<th>NPMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before NB/CW</td>
<td>24 hr</td>
<td>24 hr / ?</td>
<td>24 hr</td>
<td>24 hr</td>
</tr>
<tr>
<td>After NB/CW</td>
<td>24 hr (1st dose NB)/ &gt;2 hr (CW)</td>
<td>NB: ?</td>
<td>CW; initiate LMWH after CW</td>
<td>4 hr</td>
</tr>
</tbody>
</table>

NB = Neuraxial Block; CW = Catheter withdrawal

Last...but not least

- ASRA 2016: Restrict use NSAIDs + anticoagulants post-neuraxial block!
- No supporting data
- NSAIDs – improve post-CS analgesia + reduce opioid use
  1. Ella N. Anesthesiology 2005; 103: 1296-304

System-Based Recommendations

- Establish local protocol
- Consult patients BEFORE Delivery
- Closely communication with OB –
  - Multidisciplinary plan ESSENTIAL
- Patient-centric decision
OB Specific Recommendations

- If last dose LMWH <12 hr (prophylactic) / <24 hr (therapeutic)
  - PCA (labor)
  - General anesthesia (c-section)
- Postpartum thromboprophylaxis - LWMH:
  - SQ UFH For 1st 24 hrs
- Reduce dose LMWH – renal impairment

OB Specific Recommendations

- Prophylactic SQ UFH (<10,000 U/day):
  - No Contraindication

Summary

- New guidelines from OB and anesthesia societies
- Modification for OB Anesthetic practice
- Establish local protocols
- Communicate early: OB and patient

Many Thanks

Email: ajbut@stanford.edu

https://www.facebook.com/obstetricanesthesia
What's Your Role in the Continued Learning Environment?

Manny Vallejo, MD, DMD
Assistant Dean and DIO
Professor of Medical Education, Anesthesiology, Obstetrics & Gynecology
West Virginia University School of Medicine
No Financial Disclosure

Objectives

- Describe the rationale and goals for the continued learning environment
- Identify resources and provide examples of how to guide efforts towards optimizing the continued learning environment at your institution

ACGME 6 Core Competencies

1. Patient Care: Provide patient centered care that is developmentally and age appropriate, and effective for the treatment of health problems and promotion of health
2. Medical Knowledge: Understand the scope of established and evolving biomedical, clinical, epidemiological and social-behavioral knowledge, and demonstrate the ability to acquire, critically interpret and apply this knowledge in patient care
3. Practice-Based Learning and Improvement: Demonstrate knowledge, skills and attitudes needed for continuous self-assessment, using scientific methods and evidence to investigate, evaluate, and improve one’s patient care practice

Lifelong Learning Definition

- Learning has many dimensions other than just a formal teaching classroom approach
- Lifelong learning is the “ongoing, voluntary, and self-motivated” pursuit of knowledge for either personal or professional reasons
- Concept of lifelong learning was 1st introduced in Denmark in 1971

New Executive Order

ACGME Role

- The actions of ACGME must fulfill the social contract, and must cause sponsors to maintain an educational environment assuring the
  - Safety and quality of resident care and graduates of the future
  - Provide a humanistic educational environment where residents are taught core principles of professionalism and effacement of self interest to meet the needs of their patients
  - Education not marginalized or seen as less relevant to the institutional mission
ACGME 6 Core Competencies

4. **Communication Skills**: Demonstrate interpersonal and communication skills that result in information exchange and partnering with patients, their families, and professional associates

5. **Professionalism**: Demonstrate a commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient population

6. **Systems-Based Practice**: Understand how to practice quality health care and advocate for patients within the context of a health care system

CLER Objectives

- The Clinical Learning Environment Review (CLER) was launched in late 2012 as a key component of the Accreditation Council for Graduate Medical Education’s (ACGME’s) Next Accreditation System (NAS)
- Experiential learning and active engagement in the healthcare system varies both within and across sites
- Intent is to continually improve institutional performance in certain focus areas

CLER Goal

- Provide formative feedback to sponsoring institutions on the effectiveness of resident and fellow engagement in 6 focused areas

Patient Safety

- Residents SHOULD be taught about the role of systems thinking in forging sustainable improvement in healthcare quality
- There are many opportunities to learn from experienced and talented front line health professionals

CLER Six Focus Areas

- Patient Safety
- Professionalism
- Fatigue Management
- Transitions In Care
- Healthcare Quality
- Medical Supervision

The Patient Safety Committee

- Focus on how to become aware and how to work to address the patient safety initiatives
- Know situations that necessitate filing a patient safety report
- Increase utilization of the Institute for Healthcare Improvement (IHI) membership purchased by the GME Office for the use of all residents and fellows
- Publish a “Lessons Learned” fact sheet so that everyone can learn from errors and near misses made in the past, and how to keep them from happening again
Healthcare Quality

- Everyone in the organization SHOULD work to address quality improvement
- Trainees are not as knowledgeable in the concepts and methodology of quality improvement work
- The need for constant improvement in healthcare systems and processes is critical in remaining effective and competitive in any environment
- Residents and fellows SHOULD be encouraged to design and implement interprofessional quality improvement efforts that align with the continued learning environment overall goals of the institution

The Healthcare Quality Improvement Committee

- Goal is to make sure all programs are employing an effective Quality Improvement Curriculum, with the ultimate goal of teaching all residents, fellows, and faculty how to successfully conduct a Quality Improvement project

Supervision

- Supervised patient care is the backbone of training in the United States
- How does one appropriately?
  - Titrate supervision to allow for the full development of clinical judgment and the ultimate readiness for independent practice
  - Delegate authority
- Also requires ongoing attention from hospital leadership

Supervision

- All supervision must be provided in a constructive and helpful way WITHOUT retaliation or retribution
- Retaliatory and derogatory comments and actions by supervising physicians SHOULD not, and WILL NOT be tolerated
- Over supervision is identified as a challenge and can have negative consequences of producing physicians who are unprepared for independent practice

Zero Tolerance: Use of profanity, verbal threat, or any act of violence will NOT be tolerated on school grounds or at school events.
The Supervision Committee

- Develop an easily accessed tool illustrating which procedures and actions residents and fellows are cleared to perform without direct supervision, either by an attending physician, or a more senior resident/fellow
- Web based “Mistreatment/Supervision Button” available on the GME Website, (http://medicine.hsc.wvu.edu/gme), which can be utilized by anyone who has been forced to endure, or witnesses someone undergoing retaliatory or derogatory supervision

| Anesthesia Resident Clinical Responsibilities and Procedural Supervision Requirements |
|---------------------------------|----------------|----------------|----------------|----------------|
| Anesthesia | POW/C0B/1 | POW/C0A1/2 | POW/C0A3 | POW/C0A3 |
| Gastro Tube – SIG/Dischoff | X | | | |
| Sedation | X | | | |
| Arterial/Line Placement – Central/Peripheral | X | | | |
| Urinary Venous Catheter | X | | | |
| Central Venous Line | X | | | |
| Nasotracheal Intubation | X | X | | |
| Endotracheal Intubation | X | X | | |
| Peritoneal/Arterial Line | X | X | X | X |
| Tracheal Tube Replacement | X | X | | |
| Fiberoptic Array Management | X | X | | |
| EGD | X | X | | |
| Esophagus | X | X | | |
| Ventilation Management | X | | | |
| Digital Block | X | | | |
| Epidural Injections | X | | | |
| A - After 6 months | | | | |

Mistreatment/Supervision Button

- Anonymous way for the promotion of a non-derogatory and non-retaliatory culture

Transitions in Care

- Residents and Fellows MUST follow the ACGME’s duty hour standards
- Duty hour standards have necessitated an increase in transitions of patients’ care
  - amongst trainees
  - from one site of care to another (i.e. OR to ICU)
- By calling attention to the importance of good hand-offs, such supervision could promote better care transitions throughout the continued learning environment
- Resident and fellow hand-offs SHOULD be supervised and evaluated by faculty members in a fashion similar to evaluation of other clinical care and communication competencies

The Transitions in Care Committee

- Develop tools to help residency and fellowship programs to accomplish this goal
- Creation of specialty specific electronic medical record templates for resident transfer of care
Fatigue Management

- There is more to resident fatigue and burnout than just duty hours
- It’s time to provide programs that teach physicians and faculty to care for themselves as well as they care for their patients
- With the increase in physician suicides, wellness has taken on new meaning and urgency
- We need to teach residents, fellows, and faculty, how to take care of themselves physically, mentally and spiritually

The Wellness and Fatigue Management Committee

- Take a more systematic approach to fatigue management and wellness that includes all health professionals

In Conclusion

- There needs to be a closer link between education and health care delivery
- Professional learning = experiential learning + active engagement in the context of the continued learning healthcare environment
- Multi-department and multi-systems training approach within the healthcare institution
- The Continued Learning Environment addresses these issues

References