SUPPLEMENT

Society for Obstetric Anesthesia and Perinatology

SOAP 2003

Abstracts of Scientific Papers presented at the Society for Obstetric Anesthesia and Perinatology 35th Annual Meeting May 14-17, 2003 Pointe Hilton at Squaw Peak Phoenix, AZ

Published for the Society by Lippincott Williams & Wilkins
Society for Obstetric Anesthesia and Perinatology
2002-2003 BOARD OF DIRECTORS

Joy L. Hawkins, MD
President
Alt. Rep. ASA House of Delegates

Lawrence C. Tsen, MD
Secretary

Craig M. Palmer, MD
Meeting Host 2003

Valerie A. Arkoosh, MD
Immediate Past President

Lee S. Perrin, MD
Meeting Host 2004

David J. Birnbach, MD
Chair, ASA Committee on Obstetric Anesthesia

David J. Wlody, MD
Editor

Andrew P. Harris, MD
Rep. ASA House of Delegates

Divina J. Santos, MD
Director at Large

McCallum Hoyt, MD, MBA
Treasurer

2003 ANNUAL MEETING PROGRAM COMMITTEE

Richard N. Wissler, MD, PhD (Chair)
University of Rochester Medical Center
Rochester, NY

Robert D'Angelo, MD
Wake Forest University School of Medicine
Winston-Salem, NC

Linda S. Polley, MD
University of Michigan School of Medicine
Ann Arbor, MI

Craig M. Palmer, MD (Vice Chair)
University of Arizona Health Science Center
Tucson, AZ

Andrew P. Harris, MD, MHS
Johns Hopkins University Hospital
Baltimore, MD

Gurinder M.S. Vasdev, MD
Mayo Clinic
Rochester, MN

Valerie A. Arkoosh, MD
Drexel University College of Medicine
Philadelphia, PA

Lee S. Perrin, MD
St. Elizabeth's Medical Center
Boston, MA

Website: www.anesthesiology.org
Postmaster: Send address changes to Anesthesiology, P.O. Box 1550, Hagerstown, MD 21740.

Anesthesiology (ISSN 0003-399X) is published monthly by Lippincott Williams & Wilkins, at 16522 Hunters Green Parkway, Hagerstown, MD 21740-2116. Business and production offices are located at 530 Walnut Street, Philadelphia, PA 19106-3621. Periodicals postage paid at Hagerstown, MD and at additional mailing offices. Copyright © 2003 by the American Society of Anesthesiologists. Address for subscription information, orders, or change of address (except Japan, India, Bangladesh, Sri Lanka, Nepal and Pakistan): 16522 Hunters Green Parkway, Hagerstown, MD 21740-2116; phone 1-800-638-3030; fax 301-223-8400; in Maryland, call collect 301-223-2200. In Japan, contact LWW Igaku-Shoin Ltd., 3-23-14 Hongo, Bunkyo-ku, Tokyo 113-0033, Japan; phone 81-3-5689-5403; fax 81-3-5689-5404; in India, Bangladesh, Sri Lanka, Nepal and Pakistan, contact Grape Publication Pvt. Ltd. 5-B, Kapil, Shopping Complex, Narsee Milan, Ring Road, New Delhi 110028, India; phone 91-11-579-3211; fax 91-11-579-8976.

Annual subscription rates worldwide: $268.00 Individual Domestic, $355.00 Individual International, $491.00 Institutional Domestic, $551.00 Institutional International. (The Canadian GST tax of 7% will be added to the subscription price of all orders shipped to Canada. Lippincott Williams & Wilkins' GST Identification Number is 895524239. Publications Mail Agreement #8253300.) Subscriptions outside the United States must be prepaid. Subscriptions outside North America must add $40.00 for airmail delivery. Single copies, when available, may be ordered from the publisher. In the US, call 1-800-638-3030; outside the US, call 1-301-223-2200. To send a request via e-mail: customerservice@lww.com. Single copies $39.00. Prices subject to change without notice. Copies will be replaced without charge if the publisher receives a request within 90 days of the mailing date, both in the U.S. and worldwide. Visit us on-line at www.lww.com.
35th Annual Meeting
May 14-17, 2003
Pointe Hilton at Squaw Peak
Phoenix, AZ

Meeting at a Glance

The Society for Obstetric Anesthesia and Perinatology is accredited by the Accreditation Council for Continuing Medical Education to provide continuing medical education for physicians.
Scientific Program

Wednesday, May 14, 2003

8:00 - 10:00 am  Executive Committee
10:00 am - 3:00 pm  Board of Directors Meeting
3:00 - 5:00 pm  Committee Meetings
2:00 - 6:00 pm  Registration
12:00 n - 5:00 pm  Poster Mounting
Airway Workshop (Limited Registration - By Ticket Only)
Neonatal Advanced Life Support Course (Limited Registration - By Ticket Only)
Welcome Reception - (Pointe Hilton at Squaw Peak)

Thursday, May 15, 2003

7:00 am  Registration
7:00 - 7:45 am  Breakfast with Exhibitors & Posters
7:45 - 8:00 am  Opening Remarks & Welcome
Craig M. Palmer, MD; Joy L. Hawkins, MD
8:00 - 9:30 am  Gertie Marx Symposium
Moderator: Richard N. Wissler, MD, PhD
Judges: Gertie F. Marx, MD; GM Bassell, MD; Robert D’Angelo, MD; M. Joanne Douglas, FD, FRCP;
Brett B. Gutsche, MD; Joy L. Hawkins, MD
9:30 - 9:45 am  Distinguished Service Award Presentation
Brett B. Gutsche, MD; Presenter: Joy L. Hawkins, MD
9:45 - 10:15 am  Oral Presentations #1
Moderator: Marc Van de Velde, MD, PhD
10:15 - 11:30 am  Poster Review #1
Moderator: Deborah J. Stein, MD
11:30 am - 12:30 pm  Lunch with Exhibitors and Posters
12:30 - 1:30 pm  “Research Works in Progress — The Cutting Edge?”
Moderator: Edward T. Riley, MD
Moderator: Barbara L. Leighton, MD
2:30 - 3:30 pm  The Zuspan Award by Perinatal Resources Inc
Moderator: Alan C. Santos, MD
Judges: Theodore G. Cheek, MD; McCallum Hoyt, MD, MBA; Mark N. Nawrocki, MD; Thomas F. Purdon, MD;
Richard N. Wissler MD, PhD
3:30 - 4:00 pm  Break with Exhibitors and Posters
4:00 - 4:15 pm  Presentation of the Zuspan Award by Perinatal Resources Inc.
Frederick P. Zuspan, MD
4:15 - 5:30 pm  Panel: Politics, Anesthesia and Obstetrics
Moderator: Andrew P. Harris, MD, MHS
ASA President — James A. Cottrell, MD
ACOG Past President — Thomas F. Purdon, MD
ASA Representative to ACOG — David J. Birnbach, MD
5:30 - 5:45 pm  Questions and Answers
6:00 pm  Wine & Cheese at Exhibits
Scientific Program

Friday, May 16, 2003

6:00 - 7:00 am  Fun Run/Walk
6:30 am     Registration
7:00 - 8:00 am  Breakfast with Exhibitors & Posters
7:00 - 8:00 am  Committee Meetings
8:00 - 9:00 am  Oral Presentations #2
                Moderator: H. Jane Huffnagle, DO
9:00 - 10:00 am  What's New in Obstetrics?
                Kathryn L. Reed, MD
10:00 - 10:30 am  Break with Exhibitors & Posters
10:30 - 11:30 am  Poster Review #2
                Moderator: Michael J. Paech, FANZA
11:30 am - 12:15 pm  What's New in Neonatology?
                       Kevin Coulter, MD
12:15 - 1:15 pm  Clinical Forum: Hypertensive Disorders — Clinical Concerns and Best Options
                Moderators: Brenda A. Bucklin, MD; Robert L. Eberle, MD
1:15 - 1:30 pm    Questions & Answers
1:30 pm  Social Activities
(Golf Tournament begins at 1:00 pm)

In Memorium

Gerald A. Burger, MD
1953-2003
Scientific Program

Saturday, May 17, 2003

6:30 am  Registration

7:00 - 8:00 am  Breakfast at the Posters

7:00 - 8:00 am  Breakfast with the Experts/ PBLD  (Limited Registration - By Ticket Only)

The Complicated Parturient

Presenter: B. Scott Segal, MD

Moderators: Yaakov Belli, MD; David C. Campbell, MD, FRCP; José Carvalho, MD, PhD, FANZCA; David Gambling, MBBS; McCallum R. Hoyt, MD, MBA; Suzanne L. Huffnagle, DO; Linda S. Polley, MD; Lee S. Perrin, MD; Richard M. Smiley, MD, PhD; Lawrence C. Tsen, MD; David J. Wlody, MD; Gurinder M.S. Vasdev, MD

8:15 - 9:15 am  Poster Review #3

Moderator: John A. Thomas, MD

9:15 - 9:45 am  Break at the Posters

9:45 - 10:45 am  Gerard W. Ostheimer Anesthesia Lecture: What's New in Obstetric Anesthesia?

Audrey S. Alleyne, MD

10:45 am - 12:00 n

Educational Panel: The Current Issues in OB Anesthesia

Moderator: Linda S. Polley, MD

Recruiting Students — Nancy E. Oriol, MD

Resident Review Committee (RRC) Update — Craig H. Leicht, MD, MPH

Do Simulators Make a Difference — Ria M. Patel, MD

International Opportunities — Medge Owen, MD

12:00 n - 1:00 pm  Lunch

1:00 - 2:00 pm  Fred Hehre Lecture

Donald Caton, MD

2:00 - 3:30 pm  Oral Presentations — Best Paper of the Meeting Award

Moderator: Craig M. Palmer, MD

Judges: Valerie A. Arkoosh MD; Julie Bedard, MD; Joy L. Hawkins, MD; Samuel C. Hughes, MD; Christopher F. James, MD; Donald H. Penning, MD, FRCP; Andrew Ross, MBBS

3:30 - 3:45 pm  Break

3:45 - 4:30 pm  Debate

Parturients Should Be Allowed to Eat and Drink During Labor

Moderator: M. Joanne Douglas, MD, FRCP

PRO: Geraldine O'Sullivan, MBBS  CON: Samuel C. Hughes, MD

4:30 - 6:00 pm  Business Meeting

7:00 pm  Western Cookout (Ticket Only)

Dinner at the Ranch - go to www.soap.org for menu and details

Presentation of Gertie Marx and Best Paper Awards

Closing Remarks

Please visit www.soap.org for program updates and information.
Membership Application
Society for Obstetric Anesthesia and Perinatology

2209 Dickens Road, P.O. Box 11086
Richmond, VA 23230
(804) 282-5051 / Fax: (804) 282-0090
E-Mail soap@societyhq.com
Website: www.soap.org

Instructions
Please print or type information required.
All fees must accompany this form and all checks must be payable in US Dollars.
VISA, MasterCard, and American Express are also accepted.
Return this completed form and fees to the above address.

Membership to begin: ☐ January 1, ☐ July 1, 200

Name _____________________________
Last ______ First ______ M.I. ______
Social Security No. _____________________________

Preferred Mailing Address
☐ Office  ☐ Residence
__________________________________________________________

Daytime Phone ( ) ___________________ FAX ( ) ___________________ E-Mail ___________________

Medical Specialty ☐ Anesthesiology ☐ Obstetrics/Gynecology ☐ Neonatology ☐ Other (Specify)
Professional Society Memberships ☐ ASA ☐ ACOG ☐ AAP ☐ Other (Specify)
Practice Setting ☐ University ☐ Private ☐ Government ☐ Other: ☐ In Training Level (Specify)
Hospital / Affiliation _____________________________

Hospital Size _____ Beds _____ # Deliveries _____ /Year _____ % of time in OB Anesthesia

I hereby make application for (Please check one):
☐ Active Annual Dues: $125.00
☐ Associate Annual Dues: $125.00
☐ Retired Annual Dues: $40.00
☐ Resident/Fellow Annual Dues: $40.00
Residency/Fellowship ends: Month _____ Year _____

Payment: ☐ Check # ___________________ ☐ VISA ☐ MasterCard ☐ AMEX ☐ Discover
Signature _____________________________  Name on card _____________________________
Account Number _____________________  Expiration Date _____________________

Make all checks payable to: SOAP or Society for Obstetric Anesthesia and Perinatology
Applicant’s Signature _____________________________
Signature of Resident/Fellows Program Director _____________________________
Sponsored/Recruited by _____________________________
GERTIE MARX

SOAP A1
EFFECTS OF MATERNAL GENERAL ANESTHESIA ON FETAL PHYSIOLOGY
McClaine RJ, Booth JV, Schultz JR, Campbell KA, White WD, Reynolds JD, 'Eubanks S, 'de la Fuente SG, 'Benni P
Anesthesiology – Duke University Medical Center (DUMC), Durham, NC; Surgery – DUMC, Durham, NC; CAS Medical, Branford, CT

Despite its presumed safety, the fetal effects of anesthesia have not been completely delineated. Such knowledge would be useful for determining the type of anesthetic to use in a specific clinical situation. To address this deficit, the purpose of the current study was to use near-infrared spectroscopy (NIRS) and more standard monitoring techniques to determine the fetal responses to maternal general anesthesia (GA).

Near term pregnant sheep at gestational day 121 (term, 145 days) were surgically instrumented with maternal and fetal catheters. During the same surgery, NIRS fiberoptic probes were secured to the fetal skull to record changes in fetal cerebral oxygenated (HbO2), deoxygenated (deoxyHb), and total (totalHb) hemoglobin along with relative changes in blood flow. After a 2-3 day recovery period, various fetal and maternal parameters were monitored before, during, and after 4h of 1.5% isoflurane in oxygen anesthesia. End-tidal CO2 was maintained at < 32mm Hg by active ventilation. Median NIRS hemoglobin values were calculated for various experimental time points.

Nine near-term sheep have been studied to date, all of whom tolerated the anesthetic regimen well. As expected, GA produced significant increases in maternal arterial blood pO2 and oxygen saturation (SaO2). Both parameters returned to baseline after extubation. In the fetus, arterial blood oxygenation initially increased but then decreased during the last half of GA although it stayed above baseline. After extubation, fetal pO2 and SaO2 were actually 10% lower than baseline and remained depressed for up to 2h post-anesthesia. GA increased fetal cerebral oxygenation as reflected by a 30% rise in HbO2, which continued at or above this level for the duration of the anesthesia. After extubation, in contrast to the decrease in systemic oxygenation, fetal cerebral oxygenation remained elevated. We did observe a 25% increase in deoxyHb but this was offset by a 66% (above baseline) increase in totalHb, indicative of a post-anesthesia increase in fetal cerebral blood flow.

These data demonstrate that maternal GA produces an initial but not sustained increase in fetal systemic oxygenation as well as substantial increases in fetal cerebral oxygenation. The fetus is able to maintain this latter increase after extubation by apparently centralizing blood flow. Overall, maternal GA appears beneficial to the fetus. It is important to note that the study was conducted using healthy sheep fetuses. It remains to be determined what additional affects general anesthesia may have during an episode of fetal distress.

SOAP A2
ESTIMATING BLOOD LOSS FOR CESAREAN SECTION-HOW ACCURATE ARE WE?
Shook PR, Schultz JR, Reynolds JD, Barbara P, Spahn TE, DeBalli P
Duke University Medical Center, Durham, NC

With postpartum hemorrhage as a potential complication after cesarean section (C/S), an accurate measurement of estimated blood loss (EBL) is important. However, precisely measuring this parameter during the procedure can be challenging due to mixing of amniotic fluid with blood as well as the numerous methods used to contain lost blood within the surgical field. To determine the accuracy of our recorded EBL, we performed a retrospective analysis of our obstetrical database for C/S patients. We arbitrarily selected the period of January to August 2002 for study. Parturients who received a peri-operative blood transfusion were excluded from the analysis. The patient's estimated blood volume (EBV) in milliliters was calculated by multiplying her weight (kg) by 85. This value was then combined with the pre-op and post-op hematocrit (obtained on postpartum day #2) to determine each patient's calculated blood loss: CBL = EBV ((Pre-op Hct - Post-op Hct)/pre-op Hct). A total of 440 patient records were studied. The mean (+/- SD) reported EBL at our institution is 717 +/- 226 ml. In contrast, the mean CBL is 1011 +/- 635 ml. The difference in mean EBL versus mean CBL is 294 ml, indicating, on average, we under-estimate blood loss during C/S. Furthermore, it appears observer error increased as the CBL increased (see figure).

This retrospective assessment suggests we consistently underestimate the amount of blood loss that occurs during a C/S. As a result, the failure to recognize the extent of obstetric hemorrhage may minimize its true importance in maternal morbidity.
SOAP A3

EPIDURAL SUSTAINED-RELEASE ENCAPSULATED MORPHINE (SKY0401) IN THE MANAGEMENT OF POST-OPERATIVE PAIN FOLLOWING CESAREAN SECTION

Carvalho B, Cohen SE, Gambling DR, Palmer CM, Huffnagle HJ, Polley LS, Muir HA, Segal S, Manveljan G, Riley ET

Stanford University Medical Center, Stanford, CA; Mary Birch Hospital, San Diego, CA; Univ. of Arizona Health Sciences, Tucson, AZ; Thomas Jefferson University, Havertown, PA; Univ. of Michigan, Ann Arbor, MI; Duke Univ. Med. Center, Durham, NC; Brigham and Women's Hospital, Boston, MA; SkyePharma Inc. San Diego, CA; Stanford University Medical Center, Stanford, CA

Introduction: Epidural or IT morphine (MS) is effective for up to 24 h, shifting peak pain levels to the second postoperative day. DepoFoam™ is a new FDA approved, lipid-based sustained-release drug delivery system composed of aqueous chambers encapsulating active drug.1 SKY0401 (SkyePharma Inc) is MS + DepoFoam™ formulated to release MS over 48 h after a single epidural injection. Phase I and II studies have shown favorable results in surgical patients.2,3 This study compares the analgesic efficacy and safety profile of SKY0401 to un-encapsulated MS for post-Cesarean Section (CS) pain.

Methodology: 80 ASA 1-2 parturients undergoing elective CS with CSE were enrolled in this multi-center, randomized, double-blinded study. Patients received 12-15 mg IT bupivacaine with 10 mcg fentanyl followed by a single epidural dose of either 5 mg MS or 10 or 15 mg of SKY0401 (n=20 in each) after cord clamping. Post-operatively, patients received either oral opioid or IV MS for pain relief. Oral opioids were converted to IV MS mg-equivalents for analysis. Analgesia and functional ability to IV MS mg-equivalents for analysis. Analgesia and functional ability were followed for 48 h and adverse events recorded through 7 days. P<0.05 was considered significant.

Results: SKY0401 significantly decreased postoperative opioid consumption and improved functional ability (Table). As expected, time to first postoperative opioid request was similar among groups. VAS pain scores at rest and with activity were lower in the 10 and 15 mg SKY0401 vs. MS group. (p<0.005)

<table>
<thead>
<tr>
<th></th>
<th>MS</th>
<th>SKY0401</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5mg</td>
<td>10mg</td>
</tr>
<tr>
<td>Opioid use (mg) 0-48h†</td>
<td>47 34</td>
<td>34 24</td>
</tr>
<tr>
<td>Opioid use 0-24h</td>
<td>27 28</td>
<td>18 14</td>
</tr>
<tr>
<td>Opioid use 24-48h† †</td>
<td>20 12</td>
<td>16 14</td>
</tr>
<tr>
<td>FA at 24 h (0-20)†</td>
<td>9±4</td>
<td>6±4</td>
</tr>
<tr>
<td>FA at 48 h (0-20)† †</td>
<td>7±4</td>
<td>6±3</td>
</tr>
<tr>
<td>Nausea/Vomiting %</td>
<td>39/22</td>
<td>37/11</td>
</tr>
<tr>
<td>Pruritus %</td>
<td>28</td>
<td>42</td>
</tr>
</tbody>
</table>

Values are Mean ± SD or % tP<0.05; ††P<0.001
FA = functional ability score (0=best / 20=worst)

Conclusion: A single dose of SKY0401 resulted in better post-operative analgesia vs. unencapsulated MS. The 10 and 15 mg doses provided excellent analgesia and were well tolerated. SKY0401 is a promising new epidural analgesic for the management of post-CS pain. Refs: 1. Cancer J 2001; 7(3): 219-27. 2. SkyePharma Int. Reports. 3. Anesthesiology 2000;Oct. Suppl. A967.

SOAP A4

"ULTRA-LIGHT" PCEA TECHNIQUES IN LABOR: MINIMIZING PHYSICIAN WORKLOAD WHILE OPTIMIZING OUTCOME

Carvalho B, Giarrusso K, Durbin M, Lipman S, Rohlf S, Riley ET, Cohen SE

Stanford University Medical Center, Stanford, CA

Introduction: This study evaluated several ultra-light PCEA + background continuous infusion (CI) regimens with goals of minimizing physician boluses and providing good analgesia, high patient satisfaction and a low incidence of assisted vaginal deliveries.

Methods: After obtaining IRB approval and informed consent, 120 ASA 1-2 women receiving epidural analgesia during labor (<5 cm dilated) were randomly assigned in a double-blind manner to four treatment groups (n=30 in each). PCEA settings were as follows:

- Gp A: CI 10 ml/h; PCEA bolus 6 ml; 8 min lockout
- Gp B: CI 10 ml/h; PCEA bolus 12 ml; 16 min lockout
- Gp C: CI 15 ml/h; PCEA bolus 6 ml; 8 min lockout
- Gp D: CI 15 ml/h; PCEA bolus 12 ml; 16 min lockout.

Results: We provided with 15-20 ml of 0.125% bupivacaine + 10 µg sufentanil and maintained with a PCEA/CI pump using bupivacaine 0.0625% + 0.35 µg/ml sufentanil (1 h limit of 75 ml). Power analysis indicated 29 patients per group to detect a 30% reduction in physician boluses. P<0.05 was considered significant.

Results: Demographic data and neonatal outcome were similar among the groups. Important data are shown in the table. Spontaneous vaginal delivery occurred in 78% of patients, instrumental vaginal delivery in 10% and Cesarean Section in 12% (N.S. among groups).

<table>
<thead>
<tr>
<th>Gp A</th>
<th>Gp B</th>
<th>Gp C</th>
<th>Gp D</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 physician bolus</td>
<td>76%</td>
<td>77%</td>
<td>75%</td>
</tr>
<tr>
<td>1 physician bolus</td>
<td>21%</td>
<td>11%</td>
<td>12%</td>
</tr>
<tr>
<td>&gt;1 physician bolus</td>
<td>3%</td>
<td>12%</td>
<td>13%</td>
</tr>
<tr>
<td>Pain VAS (0-10)*</td>
<td>1.5±1</td>
<td>1.5±1</td>
<td>1.2±1</td>
</tr>
<tr>
<td>Satisfaction (0-100)</td>
<td>82±3</td>
<td>93±9</td>
<td>86±18</td>
</tr>
<tr>
<td>Bupivacaine (mg/h)</td>
<td>8±3</td>
<td>10±4</td>
<td>12±3†</td>
</tr>
<tr>
<td>Success/demand ratio</td>
<td>0.7±4</td>
<td>0.7±4</td>
<td>0.7±4</td>
</tr>
</tbody>
</table>

*Mean±SD †P<0.001 vs. GpA

Conclusion: These ultra-light PCEA techniques provided excellent analgesia with minimal physician workload and a high spontaneous delivery rate. These outcomes are better than, or comparable to those reported previously with higher bupivacaine concentrations.1,2 The regimens studied were all effective, with minimal differences among them. Use of moderate to high-volume, ultra-light PCEA/CI techniques should facilitate provision of labor analgesia in busy obstetric units.

VASODILATION BY MAGNESIUM IN THE DORSAL HAND VEIN

Scott JA, Landau R
Columbia University, New York, NY; Columbia University and University of Geneva, Geneva

Introduction: Magnesium affects blood pressure by modulating vascular tone and reactivity. It is administered to women to prevent eclamptic seizures and for tocolysis. Prior to studying a-and ß-adrenergic vascular sensitivity in women with preeclampsia, we sought to determine the effect of magnesium on venous tone.

Methods: Ten healthy non-pregnant women of childbearing age were studied. Response to magnesium sulfate (MgSO4) was measured in a dorsal hand vein using the linear variable differential transformer (LVDT) technique. Dose-response curves to MgSO4 (0.625mg/h to 2g/h) were studied. Response to magnesium sulfate (MgSO4) was measured in a dorsal hand vein using the linear variable differential transformer (LVDT) technique. Plasma magnesium concentrations at baseline and at the highest dose were determined. ED50 results are expressed as geometric mean (95% confidence interval). Emax results and magnesium concentrations are expressed as mean ± SD.

Results: The ED50 of MgSO4 was 116 mcg/ml (52, 252 mcg/ml) and Emax was 102% ± 20%, where 100% indicates a return to pre-phenylephrine baseline (Figure). Systemic magnesium levels were increased by the infusion (from 2.0 mg/dl to 2.3 mg/dl, p < 0.001 by paired t-test) but concentrations remained normal.

Conclusions: This is the first in vivo demonstration of magnesium-induced venodilation. The MgSO4 dose resulting in vasodilation using the LVDT/hand vein technique is two to three orders of magnitude less than the therapeutic doses of magnesium used for tocolysis or seizure prophylaxis. The vascular effects of systemically administered therapeutic doses of magnesium on vascular reactivity and drug response in preeclampsia will be of interest.

Figure. Dose response curve for the 10 subjects.

X axis: log of the MgSO4 dose, Y axis: % return to pre-constriction baseline. Error bars are SEM.


SUPРАSTERNAL DOPPLER ESTIMATION OF CARDIAC OUTPUT: STANDARD VERSUS SEQUENTIAL COMBINED SPINAL EPIDURAL ANESTHESIA FOR CESAREAN SECTION

Bray JK, Fernando RA, Patel N, Columbia MO
Dept. of Anesthesia, Royal Free Hospital, London, London; Dept of Anesthesia, South Manchester University Hospital, Manchester, Manchester

Introduction: Sequential combined spinal epidural (Seq CSE) anesthesia using a lower intrathecal dose may provide better cardiovascular stability compared to a standard dose (Std CSE), especially in high-risk groups for women requiring cesarean section. The aim of our study was to use suprasternal Doppler estimates of cardiac output to assess the cardiovascular stabilities comparing Std CSE with Seq CSE techniques in women undergoing cesarean section.

Method: Following ethics approval, 40 healthy women at term scheduled for elective cesarean section under regional anesthesia were recruited and randomised to two groups. Baseline recordings of heart rate (HR), blood pressure (BP), linear and volumetric Doppler indices were made in the left lateral tilt position before and after intravenous fluid preloading. All CSE procedures were performed in the sitting position. All women received intrathecal fentanyl 151ug with either hyperbaric bupivacaine 10mg (Std CSE) or bupivacaine 5mg (Seq CSE). An additional 10ml of epidural bupivacaine 0.5% w/v was given at 15 min to the Seq CSE group if predefined sensory targets were not met. The Std CSE group received epidural supplementation at 20 min for the same criteria. Serial measures of BP, HR, cardiac output (CO), minute distance (MD), stroke distance (SDist), stroke volume (SV), peak velocity (PV) and corrected flow time (FTc) were performed at 5 min intervals after the intrathecal injection prior to surgery. Ephedrine 6mg was given for 20% reductions in BP.

Statistical analyses included repeated measures analysis of variance (RMANOVA) and covariance (ANCOVA) of extreme measures. Significance was defined at P<0.05.

Results: Patient data, ephedrine use, HR, BP and CO were similar in groups. Fluid preload increased all Doppler indices (RMANOVA P<0.005). SDist and SV were lower following Seq CSE (ANCOVA P<0.005), with serial measurements showing greater within-subject variability (variance ratio test P<0.05).

<table>
<thead>
<tr>
<th>Group</th>
<th>MD cm</th>
<th>CO L/min</th>
<th>SDist* cm</th>
<th>SV* ml</th>
<th>PV cm/sec</th>
<th>FTc msec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Std CSE</td>
<td>140.41</td>
<td>5.26</td>
<td>17.51</td>
<td>63.94</td>
<td>96.33</td>
<td>36.19</td>
</tr>
<tr>
<td>(n=20)</td>
<td>(217.44)</td>
<td>(1.04)</td>
<td>(2.73)</td>
<td>(10.76)</td>
<td>(7.61)</td>
<td>(41.11)</td>
</tr>
<tr>
<td>Seq CSE</td>
<td>140.38</td>
<td>4.86</td>
<td>16.41</td>
<td>55.39</td>
<td>92.89</td>
<td>356.85</td>
</tr>
<tr>
<td>(n=20)</td>
<td>(217.41)</td>
<td>(1.37)</td>
<td>(4.54)</td>
<td>(16.78)</td>
<td>(16.20)</td>
<td>(41.11)</td>
</tr>
</tbody>
</table>

Data are mean (SD) for lowest recorded measure; *P < 0.05.

Conclusion: SDist and SV changes following sequential CSE for cesarean section suggest no overall improvement in cardiovascular stability compared with standard CSE.

ORAL PRESENTATION #1

SOAP A7
AN NOVEL KAPPA OPIOID AGONIST ON VISCERAL PAIN IN RATS
Tong C, Du D, Eisenach JC
Dept. of Anesthesiology, Wake Forest University Medical Center,
Winston-Salem, NC

Labor pain is severe and frequently requires intervention for pain relief. The first stage of labor originates from cervical dilation, mediated through activation of afferent nerve fibers in the hypogastric nerve. Opioid agonists have been the first line of treatment, either administered systemically or by the spinal/epidural route. However, there are still concerns of side effects with opioids both for maternal and fetus, e.g. respiratory depression, nausea and vomiting. We studied the ability of FE200665, a highly selective kappa opioid receptor agonist which does not cross blood brain barrier, on inhibition of response to uterine cervical distension (UCD) in rats.

Material and Methods: The study was approved by the Animal Care and Use Committee. Ten virgin female rats in random estrous cycle were used. Under general anesthesia with halothane, the right carotid and jugular vein were cannulated for blood pressure and drug administration, and a tracheotomy was performed for mechanical ventilation. Two electrodes were placed in bilateral rectus abdominus muscles for EMG recording. For UCD, a lower abdominal laparotomy was performed and two fine metal rods were inserted through cervical osses for manual distension. Initial distensions were performed until a steady response obtained, then animals were given FE200665 in a cumulative manner. UCD stimulation was performed every 5 min, and changes in blood pressure, heart rate, and electromyographic (EMG) responses were recorded throughout the experiment. Naloxone was given at the end of experiment. Data are expressed as mean ± SD, and analyzed by one way ANOVA. P<0.05 is considered significant.

Results: UCD produced a stimulus-dependent EMG response from 20 to 100 mmHg. FE200665 produced a dose-dependent inhibition of the UCD-evoked EMG response, and this inhibition was partially reversed by naloxone. FE200665 also effectively attenuated the UCD-induced blood pressure changes.

Discussion: Mu opioid receptor agonists are most commonly used to treat labor pain. However, their side effects limit the dose that can be given, and therefore their efficacy. Kappa opioid receptors located in peripheral tissues are involved in antinociception. A kappa opioid agonist with poor penetration of blood brain barrier could potentially provide analgesia without these side effects. This study demonstrated that systemic administration of FE200665 produced a dose-dependent inhibition of UCD-evoked EMG activity, suggesting that peripheral kappa opioid receptors may be a good target for treating labor pain.

Supported in part by a grant from FAER (Foundation for Anesthesia Education and Research from American Society of Anesthesiologists) and NIH grant GM48085.

SOAP A8
ANESTHETIC HYPERALGESIA IN PREGNANCY
Flood P, Daniel D
Columbia University, New York, NY

Introduction: Isoflurane and other inhaled anesthetic drugs increase pain sensitivity at the low concentrations that are present on emergence from anesthesia. We have previously presented data showing that this phenomenon is greater in females than males and suggested that there is a role for estrogen modulation. As anesthetic hyperalgesia varies with the estrus cycle in mice, we hypothesized that hormonal changes in pregnancy would similarly determine the degree of anesthetic hyperalgesia.

Methods: With the approval of the animal care committee at Columbia University, we studied 15 time mated female mice at the end of the first, second and third week of their 21 day gestation period. Thermal pain sensitivity was tested as hind paw withdrawal latency- the amount of time it takes the animal to remove its paw from a standard heat stimulus. Withdrawal latency was tested with and without 0.25% isoflurane. The results are compared to those from mice after oophorectomy.

Results: There was no significant hyperalgesia in response to isoflurane during the first and third week of gestation. At the end of the second week of gestation, there was significant hyperalgesic response to isoflurane (P<0.02).

Discussion: The occurrence of significant hyperalgesia during the second week of the mouse gestation is surprising because estrogen level peaks in the middle of the second week and declines thereafter. We have previously presented data suggesting that low estrogen levels are associated with the hyperalgesic response to isoflurane. It is possible that estrogen withdrawal, rather than the absence of estrogen is responsible for the physiological setting that favors anesthetic induced hyperalgesia.
SOAP A9
LIPOSOMAL BUPIVACAINE FOR AFTERBIRTH PAIN
Grant GI, Bansinath M, 1Kett, A G, 3Barenholz Y, 3Davidson EM
New York University School of Medicine, New York, NY; 2St. Peter’s
University Hospital, New Brunswick, NJ; 3Hebrew University-
Hadassah Medical School, Jerusalem,

Introduction: Postpartum uterine involution may produce severe cramping
pain, especially in multiparous women. This pain is typically exacerbated
during breastfeeding. Currently, afterbirth pain is treated with systemic
analgesics including acetaminophen, NSAIDs, and opioids. Paracervical
block is a simple and reliable means of producing uterine analgesia,
however, it has not been used to treat afterbirth pain. Due to the brief
duration of currently available local anesthetics, paracervical block would
be expected to produce only evanescent uterine analgesia. We have
developed a novel ultra-long acting liposomal bupivacaine formulation.
This study was designed to assess the efficacy of paracervical block with
this liposomal bupivacaine formulation on afterbirth pain in multiparous
women.

Methods: Thirty multiparous women were randomized to receive
paracervical block with 10 ml of 0.25% standard bupivacaine or 1.5%
liposomal bupivacaine (5 ml bilaterally) immediately after vaginal
delivery. The patients were blinded to the nature of the injectate. All
patients were then allowed to receive acetaminophen, NSAIDs and
opioids orally as needed. The patients recorded afterbirth pain at specified
intervals and during breastfeeding in a bedside diary using a 100mm
visual analog pain scale. Visual analog pain scores and consumption of
oral supplementary analgesics were compared between the groups using
chi-squared at p<0.05.

Results: The study was completed for 12 patients who received liposomal
bupivacaine and for 15 patients who received standard bupivacaine.
Visual analog pain scores were < 50mm during the 6 to 24 hour
postpartum interval for eight of 12 patients in the liposomal bupivacaine
group and two of 15 patients in the standard bupivacaine group (p<0.05).
There was no difference in supplementary analgesic consumption between
the groups.

Conclusions: Liposomal bupivacaine prolonged the duration of analgesia
compared to standard bupivacaine after postpartum paracervical block.
From previous investigations, we know the mechanism is retention of
the liposomes at the site of injection, and slow release of bupivacaine
from the liposomal depot. Paracervical block is an effective means of
inhibiting afterbirth pain, while avoiding the systemic side effects of
oral analgesics. The availability of an ultra-long acting local anesthetic
formulation such as liposomal bupivacaine may be an ideal agent for the
treatment of afterbirth pain.

SOAP A10
EFFECT OF LABOR ANALGESIA ON HEART RATE
VARIABILITY
Diaz N, McCarthy RJ, Wong CA
Northwestern University, Chicago, IL

Introduction: Spectral ECG analysis may predict labor outcome. The
purpose of this study was to characterize the effect of IT opioid alone, or
in combination with bupivacaine, on heart rate variability in laboring
parturients.

Methods: After IRB approval and written consent, 18 healthy, parous
women with cervical dilation £ 5 cm, remained at rest for 15 min during
which R-R intervals and VRSP (at 15 mm) were recorded (baseline). At
request for analgesia, patients were randomized to receive either IT fentanyl
25tg (F) or fentanyl 25tg + bupivacaine 2.5mg (FB), and R-R intervals,
BP and VRSP were recorded for 60 min. HRV analysis was performed
using HRV Analysis Software 1.1 (The Biomedical Signal Analysis Group,
University of Kuopio, Finland). Data were compared between groups
using the Mann-Whitney U-test and within groups before and after
analgesia using the Wilcoxon Signed-Rank test.

Results: At baseline there were no differences in VRSP, the square root
of the mean squared differences of successive R-R intervals (RMSSD),
the normalized power of the low or high spectral frequency of the fast
Fourier transform (FFT) or the LF/HF ratios. Immediately prior to IT
analgesia VRSP were not different. All subjects had complete analgesia
for 60 min. The RMSSD was higher in FB (69±18 vs. 4 1±22 ms). FFT
analysis of LF and HF are shown in the Figure.

<table>
<thead>
<tr>
<th>Frequency Domain</th>
<th>Power (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High frequency (0.15-0.4 Hz)</td>
<td>Before neuraxial analgesia</td>
</tr>
<tr>
<td>Low frequency (0.04-0.15 Hz)</td>
<td>Before neuraxial analgesia</td>
</tr>
</tbody>
</table>

The LF/HF ratios were 1.3±0.5 (F) vs. 0.9±0.3 (FB) (P=0.066) after
analgesia.

Discussion: The larger increase following IT analgesia in the RMSSD
in FB suggests a greater degree of sympatholysis with the addition of IT
bupivacaine to fentanyl in laboring patients. Further studies are
warranted.
ORAL PRESENTATION #1

SOAP A11
CHANGES IN AUTONOMIC FUNCTION FOLLOWING EPIDURAL ANESTHESIA IN LABORING PATIENTS
Deschamps AD, Kaufman IK, Chartrand DC, Fiset PF, Plourde GP, Backman SB
McGill University Health Centre, Montreal, Quebec

Neuraxial blockade in laboring patients has a profound effect on the autonomic nervous system, with significant consequences on maternal hemodynamics and placental perfusion. Monitoring of blood pressure and heart rate in these patients is insufficient to quantify dynamic changes in autonomic outflow (parasympathetic and sympathetic) because only the final net effect on target organs is measured. Dynamic changes in autonomic outflow may be assessed using spectral analysis of heart rate (HRV) and blood pressure (BPV) variability. We studied 13 pregnant laboring patients before and after epidural anesthesia for labor pain using 12 ml of bupivacaine 0.125% and 2 μg·ml⁻¹ of fentanyl in fragmented doses. HR, continuous non-invasive BP and respiratory rate (RR) were recorded at a sampling rate of 1 kHz on a computer, and block height was assessed with ice. Spectral analysis by wavelet transform of HRV and BPV variability was performed to quantify the dynamic changes in parasympathetic and sympathetic outflow. Systolic BP pre-epidural, and at 5 min and 10 min post epidural were 112.2 ± 20.4 (SD), 109.2 ± 12.6 and 110.5 ± 11.0 mmHg respectively (NS). Corresponding heart rates were 86.3 ± 14.6, 87.8 ± 22.2 and 84.2 ± 23.7 bpm (NS). RR was not significantly different between conditions, and block height ranged between T6 and T3. Spectral analysis of both high frequency (HFP) and low frequency (LFP) power of BPV showed decreases starting at 5 min post epidural (p<0.01, decreased sympathetic outflow). Changes in HRV analysis were significant only at 10 min post epidural, with an increase in HFP (p<0.05, increased parasympathetic outflow) and a decrease in LFP/HFP (p<0.01, decreased sympathetic outflow).

Conclusions: 1) Unlike the monitoring of heart rate and systemic blood pressure, spectral analysis by wavelet transform of HRV and BPV may be used to assess dynamic changes in both parasympathetic and sympathetic outflow caused by epidural anesthesia. 2) Spectral analysis of BPV is a useful tool to assess early changes in sympathetic outflow that could be missed by using the ratio of LFP/HFP of HRV. 3) When studying the effect of anesthetic procedures on the output of the autonomic nervous system, the use of both HRV and BPV is preferable to provide indices of the changes in parasympathetic (HRV) as well as sympathetic (BPV) tone.
**SOAP A13**

**FETAL EFFECTS OF COMBINED SPINAL-EPIDURAL (CSE) VS. EPIDURAL LABOR ANALGESIA: A PROSPECTIVE, RANDOMIZED STUDY.**

Patel N, Fernando RA, Robson S, Columbia MO, Lyons GR

*Department of Anesthesia, Royal Free Hospital, London, UK; Dept of Obstetrics & Gynecology, Newcastle; Dept of Anesthesia, South Manchester University Hospital, Manchester; Dept of Anesthesia, St James' University Hospital, Leeds*

**Introduction:** Fetal heart rate (FHR) abnormalities have been associated with intrathecal analgesia more frequently than epidural analgesia for labor. Our aim was to determine if there was a difference in cardiotocograph (CTG) patterns, Apgar scores and umbilical cord acid-base status following initiation of labor analgesia via the intrathecal or epidural route.

**Method:** After ethics approval, 115 healthy women at 2-6 cm cervical dilatation requesting regional analgesia were recruited into this prospective, double-blind study and randomised into 2 groups: Epidural group received 20ml 0.1% w/v bupivacaine + 2 mcg/ml fentanyl; CSE group received 2.5 mg bupivacaine + 5 mcg fentanyl intrathecally. CTG was recorded for 30 min prior to block (pre-injection) and for 60 min after (post-injection). CTG assessments included baseline FHR, variability, number of accelerations per hour and number of decelerations. Overall, traces were categorized as 'pathological', 'suspicious' or 'normal' according to national guidelines. Fetal outcome data collected included mode of delivery, 1 and 5 min Apgar score, umbilical artery (UA) pH and base excess (BE). Data was analyzed on an intention-to-treat basis and included repeated measures analysis of variance, Chi-square and McNemar tests (P<0.05).

**Results:** Patient data, obstetric characteristics, mode of delivery, Apgar scores and umbilical cord gases were similar between groups. A total of 113 CTGs were analyzed. There were no differences in CTG variables between groups. However within groups, there was a significant increase in the total number of 'pathological' and 'suspicious' CTGs (P<0.05) and a reduction in acceleration rate (P<0.01) post-injection.

<table>
<thead>
<tr>
<th>Outcome measure</th>
<th>Epidural (n=53)</th>
<th>CSE (n=62)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>pre inj</td>
<td>post inj</td>
</tr>
<tr>
<td>Baseline FHR (bpm)</td>
<td>134 (8)</td>
<td>135 (10)</td>
</tr>
<tr>
<td>Variability (bpm)</td>
<td>10 (3.5)</td>
<td>9.7 (3.7)</td>
</tr>
<tr>
<td><em>Accelerations (n/h)</em></td>
<td>11 (0.8)</td>
<td>8.4 (0.8)</td>
</tr>
<tr>
<td>Decelerations (n)</td>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>Pathological CTG, n</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>*Suspicious CTG, n</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>Apgar 1 &amp; 5 min</td>
<td>9(9,9); 10(10,10)</td>
<td>9(9,9); 10(10,10)</td>
</tr>
<tr>
<td>UA pH</td>
<td>7.25 [0.01]</td>
<td>7.23 [0.01]</td>
</tr>
<tr>
<td>UA BE (mmol/L)</td>
<td>-8.22 [0.76]</td>
<td>-7.87 [0.73]</td>
</tr>
</tbody>
</table>

*Data are number, mean (SD) / [SEM], or median [IQR]. *P < 0.05

**Conclusion:** No significant difference was found in CTG variables, Apgar scores or umbilical cord acid-base status between women who received either initial intrathecal or epidural labor analgesia.

**References:**

---

**SOAP A14**

**ALTERED VASOACTIVITY AS A MARKER FOR PREECLAMPSIA**

Maratea A, Ecker J, Leffert L, Pian-Smith MCM

*Department of Anesthesia and Critical Care, Department of Obstetrics and Gynecology, Mass General Hospital, Boston, MA*

Preeclampsia affects approximately 5% of all gestations and results in considerable morbidity and mortality. Although the underlying pathophysiology is not fully understood, it is clear that the decrease in vascular resistance normally seen in pregnancy does not occur. This may reflect systemic endothelial activation, perhaps as a result of very early pathophysiologic events. Currently, suspected preeclampsia is evaluated by a combination of physical examination and readily available laboratory assays. We have previously presented data from a pilot study using a new noninvasive device, the HDI Pulsewave CR-2000, which demonstrated differences in vasoactivity between preeclamptic and normal term parturients. This device analyzes the waveform and diastolic decay patterns of the radial pulse using a computer program. Data generated includes blood pressure, cardiac output, stroke volume, large artery elasticity, small artery elasticity (SAE), systemic vascular resistance, and total vascular impedance. It has reliably and reproducibly detected impaired small artery elasticity in disease states such as hypertension, diabetes, atherosclerosis, and smoking, and has correlated arterial elasticity with cardiac risk factors. While our preliminary data suggested a decrease in arterial compliance in preeclamptic parturients that was more prominent in large than small vessels, we now present further data derived from a larger sample size indicating that the decrement in elasticity is attributable to small vessel disease, a finding well correlated with that in other hypertensive conditions. Mean SAE +/- SD for preeclamptics vs controls: 4.4m1/mmHgX 100/-1.7 vs 6.4 +/- 2.6 (p=0.024). Preliminary findings also suggest that small vessel abnormalities tend to normalize 6-10 weeks postpartum. Given these findings, we are studying the efficacy of this device as an aid in differentiating third trimester parturients with pregnancy induced hypertension from those with true preeclampsia (as subsequently confirmed by traditional laboratory testing). We will present preliminary data from a projected cohort of 200 third trimester hypertensive patients presenting for evaluation of suspected preeclampsia. Exclusion criteria include preexisting hypertension, renal disease, or diabetes predating the pregnancy, or ongoing antihypertensive or magnesium sulfate therapy. Ultimately, we expect this non-invasive measurement will find a valuable role in the clinical diagnosis and management of preeclampsia.

Maternal demise remains a sentinel event calling attention to possibly no decrease in the maternal mortality ratio in the last fifteen years. While childbirth has decreased dramatically in Western nations, there has been no decrease in the maternal mortality ratio in the last fifteen years. Maternal demise remains a sentinel event calling attention to possibly preventable causes of death. Investigation of maternal deaths can also provide clues for understanding maternal morbidity.

Methods: Death certificates of females aged 10 to 50 years were linked with death certificates of live births and fetal deaths through the State Center for Health Statistics, increasing case ascertainment in our state by 153% over the previous method using just cause of death codes. The state-based hospital discharge database was also searched for discharge status, ICD-9 codes and CPT codes related to pregnancy. Requests for information about the death were sent to caregivers and autopsy results were obtained from the Medical Examiners Office where available. A newly established Maternal Mortality Committee reviewed the clinical data and records.

Results: From 1992-1996 a total of 400 deaths occurred in our state to women while pregnant or within one year of termination of pregnancy. Of these, 108 were pregnancy-related: related to or aggravated by pregnancy or its management and not accidental. Remarkably, the leading cause of death was cardiomyopathy. Ruptured tubal ectopic pregnancy was the second leading cause of death, followed by intracerebral hemorrhage and most often associated with preeclampsia. Of these 108 deaths, 2 were directly related to anesthesia. Both were general anesthetics. The first was due to aspiration during induction for emergency cesarean section (CS) for fetal distress. The second was due to respiratory failure and inability to re-intubate following extubation from an elective CS for cephalo-pelvic disproportion. Obesity and chronic obstructive lung disease were complicating factors in this case. Hemorrhage was responsible for 9 deaths, 4 following CS. Of these, one involved a placenta percreta. Hemorrhage following vaginal delivery caused 5 deaths, including 2 from cervical lacerations and 2 from uterine atony.

Conclusions: These findings suggest areas for increased attention to identify and address preventable causes of death including clinical care factors, patient factors and health care system factors. Anesthesiologists involved in maternal mortality review committees can provide valuable insights in addressing major causes of death beyond those related to anesthesia.

---

**SOAP A16**

**COMBINED SPINAL-EPI DURAL (CSE) VS. EPIDURAL LABOUR ANALGESIA: DOES INITIAL INTRATHecal ANALGESIA REDUCE SUBSEQUENT EPIDURAL BUPIVA CAINA REQUIREMENTS?**

Fernando RA
Department of Anesthesia, Royal Free Hospital, Hampstead, London

Introduction: It has been suggested that intrathecal analgesia, using the CSE technique, during the first stage of labor may reduce subsequent epidural bupivacaine requirements. Our aim was to estimate the minimum local analgesic concentration (MLAC) or median effective concentration (EC50) of epidural bupivacaine following an initial intrathecal or epidural injection.

Methods: After ethics approval, 115 women requesting epidural analgesia at 2-6 cm cervical dilatation were recruited into this prospective, double-blind, up-down sequential allocation study and randomized to 2 groups: Epidural group - received 20 ml 0.1% w/v bupivacaine + 2 mcg/ml fentanyl as first injection (1st inj); CSE group - received 2.5mg bupivacaine + 5mcg fentanyl intrathecally. Analgesia was assessed using a 100mm visual analogue pain score (VAPS). Only women with effective analgesia (VAPS d10mm at 30 min) were included in the study. When further analgesia was requested, 20 ml bupivacaine was given (2nd inj). The concentration was determined by the response of the previous subject randomised to that group. An effective dose (VAPS d10mm 30 min post 2nd injection) directed a 0.01% w/v decrement whereas an ineffective dose directed a 0.01% w/v increment for the next subject. The assessments included duration of analgesia, VAPS and sensory block height at 0, 15 and 30 min for both injections. The MLAC of epidural bupivacaine for the 2nd injection was estimated using the Dixon & Massey formula. Analyses included repeated measures analysis of variance, with P<0.05 as significant.

Results: 80 women completed the study. Patient data, obstetric characteristics and VAPS at each time point were similar in both groups. MLAC estimates showed that bupivacaine requirements were increased by a factor of 1.38 in the CSE group (95% CI 0.95-2.06, P=0.078). Compared to the epidural group, block height was significantly lower post 1st injection (P<0.02) and prior to the 2nd injection (P<0.001) in the CSE group.

<table>
<thead>
<tr>
<th>Group</th>
<th>% w/v (95% CI)</th>
<th>Duration (1st inj, min mean (SD))</th>
<th>Max block height to pinprick: median (IQR)</th>
<th>Ppost 1st inj</th>
<th>Ppre 2nd inj</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epidural</td>
<td>0.034</td>
<td>111 (38)</td>
<td>T6</td>
<td></td>
<td>T9</td>
</tr>
<tr>
<td>(n=40)</td>
<td>(0.02, 0.05)</td>
<td>(T8, T4)</td>
<td>(T11, T7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CSE</td>
<td>0.047</td>
<td>86 (21)</td>
<td>T8</td>
<td></td>
<td>L1</td>
</tr>
<tr>
<td>(n=40)</td>
<td>(0.04, 0.05)</td>
<td>(T10, T6)</td>
<td>(L4, T10)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Unpaired t-test P = 0.078; † P < 0.001; ‡ P = 0.02

Conclusion: Initial intrathecal labor analgesia did not reduce subsequent epidural bupivacaine requirements. The 38% increase in MLAC with CSE may be due to the greater degree of analgesic block height regression.

**SOAP A17**

**A STUDY TO ASSESS THE EFFICACY AND SAFETY OF SOAP A17**

Philadelphia, PA; 6 Columbia University, New York, NY; 7 University of Southwestern, Dallas, TX; 5 Drexel University College of Medicine, 3 Wake Forest University, Winston Salem, NC; 4 University of Texas, University of Miami, Miami, FL; 2 Stanford University, Stanford, CA; 7 Magee Women's Hospital, Pittsburgh, PA; 9 Columbia University, New York, NY; 7 University of Arizona, Tucson, AZ

**Introduction:** The addition of bupivacaine to intrathecally-administered fentanyl has been shown to increase the quality and duration of spinal labor analgesia; however side effects of opioids and motor block potential.

**Methods:** Following IRB approval from all involved institutions, healthy primiparous women in active labor requesting labor analgesia were enrolled in this prospective, randomized, double blind multi-institutional study. All patients were in spontaneous labor and randomization was stratified for augmentation of labor with oxytocin. Patients were randomized to one of three possible CSE groups. Group 1 received 3.75 mg of spinal levobupivacaine, Group 2 received 2.5 mg of spinal levobupivacaine, and Group 3 received a combination of 2.5 mg spinal levobupivacaine plus 20 mcg fentanyl. An epidural infusion of levobupivacaine 0.1% plus 2 mcg/ml fentanyl was initiated 10 minutes after the spinal injection if the patient was satisfied with the analgesia achieved from the spinal. Pain scores and patient satisfaction measures were recorded every 15 minutes for the first 90 minutes and then hourly until delivery. Assessments of vital signs, symptoms of nausea, vomiting and pruritus, and motor block were also made. All statistical analyses were performed on an intent-to-treat population. The primary efficacy variable (the percentage of patients requesting top-ups within 90 minutes) was estimated via the Kaplan-Meier method.

**Results:** A total of 271 patients were enrolled and randomized (89 in Group 1, 93 in Group 2, and 89 in Group 3). A 3.75 mg injection of spinal levobupivacaine was found to be more effective than a 2.5 mg injection when administered to initiate labor analgesia, based on the percentage of patients requesting epidural top-ups within 90 minutes of the spinal (59.6% vs 72%, p=0.024). Group 3 (2.5 mg levobupivacaine plus 20 mcg fentanyl) however had the overall lowest percentage of patients requesting epidural top-ups (19.1%, p<0.001) and the shortest time to pain free contractions. No statistically significant differences between any of the treatment groups were noted for percent of patients achieving a pain-free contraction overall, pain VAS score over time, maximum change in VAS score, maximum grade of motor block, maximum loss of motor power, rate of study medication administered during the first stage of labor, percent of patients requiring assisted delivery and percentage of patients with nausea and vomiting. As expected, patients in Group 3 had the highest incidence of pruritus (70.8% for Group 3 as compared to 9.0% and 5.4% in Groups 1 and 2, p<0.001).

**Discussion:** These results show that 3.75 mg was superior to 2.5 mg of intrathecal levobupivacaine for initiation of spinal analgesia for labor. It produced a faster onset and greater pain relief and was not associated with significant motor block. A combination of 2.5 mg levobupivacaine plus 20 mcg fentanyl, however, was the most effective treatment. For patients in whom spinal opioids are not indicated, spinal levobupivacaine appears to be a reasonable alternative. Further study to determine the optimum dose of levobupivacaine for initiation and maintenance of labor analgesia is necessary.

---

**SOAP A18**

**PLASMA OXYTOCIN AND UTERINE CONTRACTION RATES IN WOMEN RECEIVING LABOR ANALGESIA**

Finegold H, Rauk P, Chaio J, Mandell G, Ramanathan S

**Introduction:** Regional anesthesia has been associated with a decrease in the neuroendocrine response to labor pain. This study compares the effects of CSE and LE on the release of endogenous oxytocin in parturients.

**Methods:** Full-term parturients, at least 3 cm dilated, in active labor, not receiving exogenous oxytocin was recruited. Patients were randomized to receive CSE (bupivacaine 0.25% 2.5 mg with fentanyl 25 mcg) or LE (10 ml bupivacaine 0.25%) Data including uterine contraction rate (UCR), plasma oxytocin, and VAS scores were collected before and after anesthesia at the following points: t-20, t-10, t+5, t+10, t+15, t+20, t+25, t+30, t+60.

Serum oxytocin was measured by radioimmunoassay.

**Results:** There were 9 patients in the LE group and 11 patients in the CSE group. Patients in both groups were demographically similar. Komogorov-Smirnov tests were used to determine that the oxytocin values were not normally distributed. Friedman's nonparametric ANOVA revealed no significant change in oxytocin median values compared to baseline in either group (graph). There was no significant change in the number of uterine contractions (UCR) twenty minutes before the block and twenty minutes after the block in either group (Table). VAS pain scores in the CSE group in the first 20 min were significantly lower than those in the LE group. At 30 minutes the VAS scores were not different between the groups. No patient experienced uterine hypertonicity or fetal bradycardia.

**Discussion:** There was no difference in the oxytocin levels between the two groups. Larger studies are required to determine the effects of labor analgesia on oxytocin release, and UCR.

**Table**

<table>
<thead>
<tr>
<th>UCR in T-20±sd</th>
<th>T+20±sd in LE</th>
<th>T-20±sd</th>
<th>T+20±sd</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSE 7.73±2.05</td>
<td>6.67±2.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LE 7.12±1.96</td>
<td>6.65±2.10</td>
<td>P=0.10</td>
<td></td>
</tr>
</tbody>
</table>

---

*Note: All values are presented as the median value.*
**ORAL PRESENTATIONS #3**

**SOAP A19**

THE VIRTUAL SPINE

Glassenberg R, Glassenberg SZ
Northwestern University, Wilmette, IL; Stanford University, Seattle, WA

**Introduction:** Currently only artistic drawings, CT scans, and plastic models are available to help visualize the anatomy of the spine and epidural space. Videotapes provide non-interactive, didactic instruction as to proper sterile technique. Virtual reality software, navigated via a mouse or joystick, is sufficient for interaction with simple landscapes or architecture, but cannot provide a realistic interface with tactile response for medical simulation.

**Methods:** A Virtual Reality simulator was created to simulate the interaction of a needle in lumbar tissue. Three-dimensional models of bone, spinal cord, skin, ligaments, muscle, and fat were constructed in 3D Studio MAX. Algorithms were written employing the Sensable Technologies’ GHOST SDK to simulate the tactile response of these tissues to penetration by a Tuohy needle. The simulator uses the Sensable Phantom Desktop, a 3D force-feedback "pen" interface with 6 degrees of freedom (DOF) input and 3 DOF haptic output. A 3D-glass syringe was modeled to provide the tactile response to loss-of resistance upon entering the epidural space.

**Results:** The user interacts with the virtual spine by holding a pointing device shaped like a syringe. As the virtual needle penetrates the tissue, the user receives a realistic tactile response generated by motors in the Phantom device. The user simultaneously receives visual feedback on the screen and force-feedback from the "syringe". The user can initially view the simulator with transparent anatomy to gain directional skills. The surfaces can then be made opaque, limiting visual feedback and requiring the student to navigate using only tactile response.

**Conclusion:** This simulation allows the user to experience all the potential difficulties associated with placing an epidural, without exposing a patient to the complication of a dural puncture.

**BEST PAPERS OF THE MEETING**

**SOAP A20**

GENOTYPE OF THE BETA2-ADRENERGIC RECEPTOR DETERMINES RESPONSE TO TOCOLYSIS

Landau R, Morales MA, Antonarakis SE, Blouin J, Smiley RM
University Hospital of Geneva, Geneva, Switzerland; Columbia University, New York, NY

**Background:** The mechanisms involved in preterm labor (PTL) remain unclear. Stimulation of the $\beta_2$-adrenergic receptor ($\beta_2$AR) results in uterine relaxation, although $\beta_2$-agonists have not been consistently successful as tocolytics. The $\beta_2$AR displays genetic variability, and a Arg→Gly substitution at position 16 increases receptor desensitization in response to agonist exposure. We have recently demonstrated that homozygosity for Arg 16 protects against preterm delivery. In this study our goal was to determine whether $\beta_2$-agonists are more effective in women with the Arg 16 genotype who develop PTL.

**Methods:** With IRB approval and written consent, 47 women with PTL between 24-34 weeks gestation were studied. PTL was defined as $>$3 regular uterine contractions/30min, lasting $>$30 sec, with cervical changes and intact membranes, and was treated with 48h iv hexoprenaline ($\beta_2$-agonist). Effect of tocolysis (delivery $<$48h, $<$7 days or term) was recorded. Genomic DNA was isolated and alleles at position 16 of the $\beta_2$AR were identified according to established techniques.

**Results:** Tocolysis was 100% successful in delaying delivery for 48h in Arg 16 homozygotes (n=15) (Figure). In contrast, only 23/32 (72%) of women with the 2 other genotypes delivered after 48h. Term delivery occurred in 30/47 women (64%); 14/15 (93%) of Arg16 homozygotes and 16/32 (50%) of women with the two other genotypes delivered at term (p=0.004; RR 0.13 (95%CI 0.02;0.88).

**Discussion:** This is the first study reporting an association between $\beta_2$AR genotype and tocolysis efficacy. Our data is consistent with the prediction that homozygosity for Arg 16 results in less desensitization and therefore a better therapeutic response to $\beta_2$-agonists. Our finding may explain why efficacy of $\beta_2$-agonists differs markedly between patients. Future assessments of the usefulness of such tocolytic therapy will need to control for receptor genotype.


*Images were retouched from corrupted files.*
BEST PAPERS OF THE MEETING

SOAP A21
MEK INHIBITOR U0126 DELAYS RU486-INDUCED PRETERM LABOR IN RATS
Li Y, 3 Je H, 3 Morgan KG, 3 Malek S
Beth Israel Deaconess Medical Center, Harvard Medical School, Boston, MA; 3 Boston Biomedical Research Institute, Watertown, MA; 3 Boston University, Boston, MA

The antiprogestrone RU486 can be used to induce a reliable model for preterm labor/birth in pregnant rats. The purposes of the present study were 1). To explore the subcellular mechanisms of the effect of RU486 on myometrial contractility, 2). To investigate the hypothesis that changes in Extracellular Regulated Kinase (ERK) signaling contribute to changes in either caldesmon (CaD) activity or myometrial contractility. The administration of RU486 (2mg/kg, SC) to Sprague-Dawley rats on day 19 of pregnancy (n=6) induced preterm delivery 22:25±0:24 hrs after treatment. Myometrium was harvested from CO2-euthanized rats during RU486 treatment. Myometrium was harvested from CO2-euthanized rats during RU486 treatment (AUC/dry weight, 381.49±44.92 g.s/mg). During RU486-induced preterm labor as well as in natural labor, an increase phosphorylation of CaD was seen, using an antibody specific for Ser 789, an ERK phosphorylation site. Consistently, ERK1/2 was significantly activated after RU486 treatment. Myosin light chain (LC2O) phosphorylation levels also increased significantly in myometria during RU486-induced preterm labor compared to sham group (p<0.05). To determine if there is a cause and effect relationship between activation of the ERK/CaD pathway and the regulation of myometrial contractility, we pretreated 18-day pregnant rats with the MEK activation inhibitor U0126 (100mg/kg in DMSO, SC, q6h), then induced preterm labor with RU486 on day 19 of pregnancy. Treatment with U0126 delayed the onset of parturition in a statistically significant manner (n=6, p<0.01) to an average of 25.18±6.64 hrs after RU486 administration. The magnitude of delay in preterm labor is comparable to that caused by oxytocin antagonist. The delayed labor in the U0126 treated group, continued to be associated with activation of ERK2 and phosphorylation of CaD in myometrium compared to the sham group (both p<0.05). In conclusion, CaD phosphorylation, through an ERK1/2-mediated signaling pathway, as well as an increased LC2O phosphorylation level contributes to RU486-induced increased contractility. There is no difference between RU486-induced preterm labor and natural labor in terms of in vitro contractility and biochemical profile regarding the phosphorylation of ERK2, CaD and LC2O. U0126 delayed RU486-induced preterm labor in rats, suggesting that the ERK/CaD pathway might be used as a new target(s) for the development of drugs for the treatment of preterm labor, either alone or in combination with other tocolytics.


SOAP A22
GENETIC VARIABILITY OF THE MU-OPIOID RECEPTOR IN AN OBSTETRIC POPULATION
Landau R, Smiley RM, Antonarakis SE, Blouin JL
University Hospital of Geneva, Geneva, Switzerland; Columbia University, New York, NY

Background: There is genetic variability of the µ-opioid receptor (µOR), with several single nucleotide polymorphisms (SNP). The most frequent mutation, A118G, occurs at an allelic frequency of 10-20%1-2, and increases binding affinity and potency of β-endorphin 3-fold1. The effect of this SNP has been studied in relation to opiate addiction and alcohol dependence. Since this receptor is the major target for opioid drugs, genetic differences in the receptor could provide an explanation for interindividual differences in opioid requirements for analgesia. We examined the genotype distribution of the µOR A118G variant among pregnant women.

Methods: With IRB approval and written informed consent, we obtained blood samples for genotyping from women delivering at our 2 institutions. Genomic DNA was isolated and alleles of the µOR were identified using the pyrosequencing SNP typing technology (sequencing primer: TGGTCCGGACAGGT, Genbank accession number: NM_000914). Proportions of genotypes are expressed as percentage of total (95% CI).

Results: Allelic distribution was determined in 140 parurients (Table). Overall, 92 women were A118 homozygous (66%; 58-73%), 42 were heterozygotes (30%; 23-38%) and 6 were G118 homozygous (4%; 2-9%)(Figure).

Table: Allelic distribution (gene counting method)

<table>
<thead>
<tr>
<th>Allele</th>
<th>Total Count of Alleles</th>
</tr>
</thead>
<tbody>
<tr>
<td>A118</td>
<td>226</td>
</tr>
<tr>
<td>G118</td>
<td>54</td>
</tr>
</tbody>
</table>

Figure: Genotype distribution (n=140)

Discussion: This is the largest cohort-study report on µOR genotype distribution in a non-addict group, and the first description of the A118G variant in an obstetric population. We report a relatively high frequency for the G118 allele, which has been associated with increased µ-agonist binding. Studies on the effect of this allele on labor analgesia requirements will be of interest.

SOAP A23
GASTRIC EMPTYING IN OBESE TERM PREGNANT WOMEN
Wong CA, Fitzgerald P, Raikoff K, Avram MJ
Northwestern University, Chicago, IL

Introduction: Studies in non-pregnant patients suggest that ingestion of clear liquids up until 2 h before induction of anesthesia does not adversely affect gastric pH and volume. We recently showed that gastric emptying in term, non-laboring, volunteer pregnant women is not delayed after ingestion of 50- vs. 300 mL water. The purpose of the present study is to compare gastric emptying in term, obese, non-laboring women after ingestion of 50 mL (control) and 300 mL (treatment) water.

Methods: 8 obese (pre-pregnant BMI >35 kg/m²), term (>37 w gestation) pregnant volunteers participated in this IRB approved, crossover study. Gastric emptying was assessed using serial gastric ultrasound images and acetaminophen absorption. Volunteers were NPO overnight. After obtaining a baseline blood sample and ultrasound, volunteer’s swallowed liquid acetaminophen, 1.5 g in 15 mL, followed by 50 mL or 300 mL of water (in random order on two different study days). Gastric ultrasounds were performed every 10 min for 1 h, gastric antral cross section area was determined, and t½ for gastric emptying was calculated. Blood was obtained every 10 min to 1 h, then every 30 min for 90 min, for plasma acetaminophen concentration analysis by HPLC. Areas under the acetaminophen concentration vs. time curve (AUC), peak concentrations (Cmax) and time to peak (tmax) were determined. Control and treatment data were compared with the Wilcoxon signed rank test. P <0.05 was considered significant.

Results: There was no difference in the gastric emptying t½ after ingestion of 50 mL vs. 300 mL water (31±16 vs. 31±28 min). There were no differences in the AUC at 120 min, or in Cmax or Tmax (Table).

Table. Acetaminophen gastric absorption (mean ± SD).

<table>
<thead>
<tr>
<th>Water Ingested</th>
<th>AUC_{120min} (µg min mL⁻¹)</th>
<th>Cmax (µg mL⁻¹)</th>
<th>tmax (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 mL</td>
<td>702.8±426.8</td>
<td>11.4±7.2</td>
<td>56.8±40.0</td>
</tr>
<tr>
<td>300 mL</td>
<td>627.6±214.6</td>
<td>9.0±4.0</td>
<td>61.9±42.4</td>
</tr>
</tbody>
</table>

Conclusion: There was no difference in gastric emptying after 50 vs. 300 mL water in this small group of obese volunteer women at term. The tmax of gastric emptying was similar to a study in non-obese pregnant women (24 to 34 min) and to studies of non-pregnant subjects. This suggests that these patients may safely drink clear liquids up until 2 h prior to the induction of anesthesia without risk of delayed gastric emptying or increased gastric volume.

IM EPHEDRINE DECREASES THE INCIDENCE OF MATERNAL HYPOTENSION AFTER CSE LABOR ANALGESIA

Flood P, Scott J, Negron MA
Columbia University, New York, NY

Introduction: Fetal bradycardia occurs after approximately 14% of CSE procedures (Vaughan, 2001). This evidence of fetal hypoperfusion may or may not be associated with maternal hypotension. Two major theories have been put forward to explain this phenomenon. Sympathectomy induced by the spinal anesthetic may result in regional hypotension that may or may not be detected by measurement of the blood pressure in the arm. A second possibility is that the sudden reduction in circulating catecholamines due to rapid analgesia removes the tonic negative influence of beta-2 adrenergic stimulation, resulting in increased uterine tone. We have begun a double blind randomized trial to test whether a single, pre-procedure intramuscular dose of ephedrine (25 mg) will 1) reduce the incidence of fetal bradycardia and/or 2) reduce maternal hypotension after CSE using our standard technique.

Methods: Laboring, nulliparous or multiparous women of any cervical dilation who were to receive combined spinal-epidural analgesia were eligible. Just before preparation of the back for the CSE procedure, an IM injection was performed. The syringe contained 0.5 ml of saline, or 25 mg ephedrine in 0.5 ml. CSE was performed with a 17G Tuohy needle and a 27G Whitacre spinal needle, with a spinal dose of 2.5 ml bupivacaine and 25 μg fentanyl. Maternal blood pressure was measured at 5-minute intervals starting 5 minutes before the CSE procedure and continuing until 1 hour after the spinal injection. The FHR tracing was examined for one hour after the procedure. Fetal bradycardia was defined as a reduction in fetal heart rate to less than 120 for longer than 1 minute. Results: Although we have just begun enrollment in this trial, (31 subjects as of January 15) a statistical difference in our secondary outcome is evident. In the first 20 minutes after CSE, patients who received saline had a significant decrease in systolic blood pressure from baseline, while those who received ephedrine did not (ANOVA; P<0.001, P>0.05). There was no difference in reduction of maternal diastolic blood pressure or heart rate between the groups. At this early phase in our study, it is not possible to determine whether a change in maternal hypotension will translate into a reduction in fetal bradycardia. Four patients have had fetal bradycardia in the first hour after CSE (13%). One bradycardia occurred in a patient who had received ephedrine and three were in patients who were in the control group. IM ephedrine appears to be a practical method to reduce the incidence of maternal hypotension.

\[
\text{Graph showing systolic blood pressure over time (in mm Hg) with curves for saline and ephedrine.}
\]

SOAP A26
SHOULD SPINAL ANESTHESIA FOR CESAREAN SECTION DELIVERY OF VERY PREMATURE INFANTS BE REVISITED?

*Anesthesie, **Maternité, # Réanimation Neo Natale, Hopital Cochin, Paris, France

Spinal anesthesia for cesarean section reduces maternal mortality and morbidity. It may however be associated with an increased risk of neonatal mortality in very premature infants as compared to general or epidural anesthesia (Roze et al, 8èmes Journées Francophones de Recherche en Néonatologie, Pasteur Institute, Paris december 2002). We have studied the influence of anesthetic technique (general [GA] epidural [EPI] or spinal [SPI]) on neonatal outcome for living newborns born at gestational age of 27 to 32 weeks delivered by C-section in our institution from our prospectively collected perinatal database from 1993 to 2002. Among 1554 cases of live-born infants, 892 infants (57%) were delivered by cesarean section. The mothers of 407 (45%) infants had received GA, the mothers of 386 (43%) infants had received SPI and the mothers of 98 (11%) EPI, mainly (80%) for cesarean delivery during labor. The neonatal mortality rate was higher among the infants whose mothers had received EPI (10.2%) or GA (9.8%) when compared with neonates whose mothers had received SPI (4.9%, p<0.01). Considering elective C-section, SPI-associated neonatal mortality (4.8%) was still lower than GA-associated mortality (7.2%), yet non significantly. Apgar scores at 5 min were higher in the SPI group (6.4 ± 4.0) when compared with EPI (5.1 ± 3.6) and GA (4.0 ± 3.8). To compare the clinical outcome of these 3 types of anesthesia, we matched 60 (out of 69) non surviving preterm (27-32 wk delivered by cesarean) with 2 surviving neonates by a random-based procedure. We used for matching criteria the duration of gestation at cesarean section, the birthweight (± 100g), history of maternal hypertension or pre-eclampsia, and the use of antenatal glucocorticoid therapy. Spinal anesthesia remained still associated with a significantly lower risk of neonatal death than general anesthesia.

In this prospective cohort study, spinal anesthesia of the mother for cesarean delivery was not associated with an increased risk of neonatal mortality in very premature infants as compared with general or epidural anesthesia.
SOAP A27
PREOPERATIVE CAESAREAN SECTION FASTING TIME: VARIATION IN PRACTICE AMONG ANESTHESIOLOGISTS
RESULTS OF AN INTERNATIONAL SURVEY
Ross LA, Moosikasuwun MN, Zhaku B, Neuman GG, Mathews DM
St. Vincents Catholic Medical Center-St. Vincents Manhattan, New York, NY

There is a significant variation of practice among anesthesiologists concerning NPO restrictions prior to elective caesarean section. ASA guidelines focusing on obstetric anesthesia state that the oral intake of clear liquids during labor improves patient comfort without increasing maternal complications while intake of solid food during labor increases maternal complications. As well, they state that a fasting period of 8 hours or more for solids is preferable for uncomplicated parturient undergoing elective caesarean delivery but are equivocal as to whether oral intake of clear liquids increases maternal risk of pulmonary aspiration (1). We mailed a questionnaire to all anesthesiologists who are members of the Society for Obstetric Anesthesia and Perinatology (SOAP) to survey current practice with regard to NPO requirements. A total of 993 questionnaires (83.3% domestic and 16.7% foreign) were sent with a return of 48.3%. A total of 30 had to be excluded for various reasons (3-incomplete, 4-no long practicing obstetric anesthesia, 9-returned by postal service and 14 retirees). We therefore analyzed 450 questionnaires (45.3% of those sent). The figure below summarizes the results. For solid foods, a majority of respondents (65%) maintain an 8-hour NPO restriction, although a 6-hour restriction is also widely practiced (31%). For liquids, the current practice is more divergent: 21%, 37%, 23% and 18% of respondents maintain 2, 4, 6, and 8 hour restriction, respectively. Thirty-one percent of respondents maintain an NPO restriction for solids that is shorter than the current ASA guidelines. The appropriate length of fluid NPO restriction prior to elective caesarean section needs further clarification.

References:
ASA Practice Guidelines for Obstetrical Anesthesia.

SOAP A28
LOW DOSE OF HEAVY BUPIVACAINE FOR CESAREAN SECTION
Restrepo CE, Arango JA, Gutierrez LF, Pertuz CA, Socha NI, Zapata CJ
SCARE, Medellin, Antioquia

Spinal anesthesia is a very common (1) and useful technique for caesarean section because it offers a profound, uniform and quick sensory and motor blockade. However, it has adverse effects like hypotension (2), prolonged PACU recovery and longer discharge time.

This study addressed the success and the frequency of adverse effects using lower dose of hyperbaric bupivacaine plus fentanyl intrathecally for caesarean section.

Methods: One-hundred parturients scheduled for urgent or elective caesarean delivery received hyperbaric bupivacaine 7.5 mg. combined with fentanyl 25 mg. intrathecally. The height of the block was evaluated at 10 and 15 minutes. Intraoperative use of vasoconstrictors, analgesic supplementation and conversion to general anaesthesia were recorded. Sensory and motor block was measured at the end and one-hour after the surgery. The satisfaction was assessed for each patient.

Results: Spinal anaesthesia was successful in 98% of the patients. There was no relationship between demographics dates and anaesthetic level. Vasoconstrictors were needed in 29% of the parturients. 82% of the patients did not have motor block 1 hour after surgery.

Conclusions: Spinal anaesthesia with 7.5 mg. of hyperbaric bupivacaine combined with 25 µg. of fentanyl provides reliable block for caesarean section with lower incidence of hypotension and prolonged motor block.

Key words: Anaesthesia, spinal; Anaesthesia, Obstetrical; cesarean section, bupivacaine, fentanyl.

References:
SOAP A29
VERY LOW DOSE SPINAL ANESTHESIA FOR CESAREAN SECTION IN A MORBIDLY OBESE PREECLAMPTIC PATIENT

Reyes M, Pan P
Wake Forest University, Division of OB Anesthesia, Winston-Salem, NC

Introduction: Pregnant, preeclamptic and morbid obese patients may be more sensitive to spinal local anesthetic and its side effects. Here we reported such a case requiring only a very low dose hyperbaric spinal bupivacaine for C/S. We are unable to find another case report using comparable low dose successfully for C/S.

Case Report: BB was a 35y/o, G1, black female, with IUP of 26 wks GA; and had diabetes, obstructive sleep apnea and hypertension. She presented to L/D with severe preeclampsia, shortness of breath, non-reassuring fetal tracing and breech presentation. She was 4’ 10” tall with pre-pregnancy wt of 314 lbs. Initial BP was 216/115. Physical examination was significant for morbid obesity, class IV airway, short neck, and edema. After starting Mg infusion and controlling her BP to around 180’s/100’s with labetalol, the obstetrician requested for C/S. While attempting to place an epidural catheter in the sitting position for C/S, an unintentional dural puncture occurred at L3-4 level. The epidural catheter was then inserted 4 cm intrathecally. Free flow CSF returned from the intrathecally-placed epidural catheter with or without aspiration. We administered 1 ml of 0.25% hyperbaric spinal bupivacaine with dextrose as our initial spinal dose. (We mixed 2-ml 0.75% hyperbaric spinal bupivacaine with 4-ml preservative-free saline to obtain above conc and baricity.) She became symptomatically hypotensive (80/40) requiring resuscitation with multiple doses of ephedrine and phenylephrine. 15 mins after the 1-ml spinal dose, her sensory blockade to noxious stimuli was T6 bilaterally. Surgical incision began 45 mins afterward. Additional 1ml of the 0.25% hyperbaric bupivacaine was administered during the course of surgery (0.5 ml at start of surgery, and 0.5 ml during the 2nd half of surgery), not because of patient’s pain/discomfort, but to ensure the blockade did not recede from the initial 2.5mg bupivacaine given 45 mins ago. Surgery completed successfully in 60 mins without any supplement analgesia. Her postop course was unremarkable and was discharged on POD #3.

Discussion: This is the first case report of a successful C/S under such a low dose of spinal anesthetic without supplement. It does not suggest the use of low dose spinal anesthetic, but underscores the wide variability in sensitivity to spinal anesthetic and its side effects especially in pregnant, preeclamptic and morbid obese patients. It further emphasizes the importance of frequent BP and respiration monitor even when low dose spinal anesthetic is used as in labor CSE. It also offers potential explanations to complications, such as high/total spinal or even cardiac arrest, reported in some patients who supposedly received an otherwise normal spinal dose.

SOAP A30
A COMPARISON OF FENTANYL AND DIAMORPHINE AS ADJUNCTS IN SPINAL ANAESTHESIA FOR CAESARIAN SECTION

Introduction: Pregnant, preeclamptic and morbid obese patients may be more sensitive to spinal local anesthetic and its side effects. Here we reported such a case requiring only a very low dose hyperbaric spinal bupivacaine for C/S. We are unable to find another case report using comparable low dose successfully for C/S.

Case Report: BB was a 35y/o, G1, black female, with IUP of 26 wks GA; and had diabetes, obstructive sleep apnea and hypertension. She presented to L/D with severe preeclampsia, shortness of breath, non-reassuring fetal tracing and breech presentation. She was 4’ 10” tall with pre-pregnancy wt of 314 lbs. Initial BP was 216/115. Physical examination was significant for morbid obesity, class IV airway, short neck, and edema. After starting Mg infusion and controlling her BP to around 180’s/100’s with labetalol, the obstetrician requested for C/S. While attempting to place an epidural catheter in the sitting position for C/S, an unintentional dural puncture occurred at L3-4 level. The epidural catheter was then inserted 4 cm intrathecally. Free flow CSF returned from the intrathecally-placed epidural catheter with or without aspiration. We administered 1 ml of 0.25% hyperbaric spinal bupivacaine with dextrose as our initial spinal dose. (We mixed 2-ml 0.75% hyperbaric spinal bupivacaine with 4-ml preservative-free saline to obtain above conc and baricity.) She became symptomatically hypotensive (80/40) requiring resuscitation with multiple doses of ephedrine and phenylephrine. 15 mins after the 1-ml spinal dose, her sensory blockade to noxious stimuli was T6 bilaterally. Surgical incision began 45 mins afterward. Additional 1ml of the 0.25% hyperbaric bupivacaine was administered during the course of surgery (0.5 ml at start of surgery, and 0.5 ml during the 2nd half of surgery), not because of patient’s pain/discomfort, but to ensure the blockade did not recede from the initial 2.5mg bupivacaine given 45 mins ago. Surgery completed successfully in 60 mins without any supplement analgesia. Her postop course was unremarkable and was discharged on POD #3.

Discussion: This is the first case report of a successful C/S under such a low dose of spinal anesthetic without supplement. It does not suggest the use of low dose spinal anesthetic, but underscores the wide variability in sensitivity to spinal anesthetic and its side effects especially in pregnant, preeclamptic and morbid obese patients. It further emphasizes the importance of frequent BP and respiration monitor even when low dose spinal anesthetic is used as in labor CSE. It also offers potential explanations to complications, such as high/total spinal or even cardiac arrest, reported in some patients who supposedly received an otherwise normal spinal dose.

Method. In a randomized, double-blinded trial. 99 patients presenting for elective caesarean section were studied. Each patient was given either 15ug of fentanyl (F), 0.25mg of diamorphine (D), or both (FD) in addition to 0.5% hyperbaric bupivacaine. Intraoperative parameters measured were, discomfort, nausea, pruritus, ephedrine used and time taken to establish block. Postoperative parameters measured were, discomfort, morphine PCA use, nausea and pruritus.

Results. There was no difference in intraoperative discomfort or time to achieve adequate block between the groups. There was no difference in intraoperative ephedrine use between the groups. There was no difference in postoperative morphine PCA use between the D and FD groups, but substantially more in the F group. There was a significant difference in postoperative pruritus between the groups, being most in the FD group. There was no difference in postoperative nausea between the groups.

Discussion. The results show that diamorphine provides the same intraoperative benefit as fentanyl, with no increase in time to achieve adequate block. We have also demonstrated that fentanyl provides the same postoperative analgesia as fentanyl and diamorphine combined, but with less pruritus.
 SOAP A31
EVALUATION OF RAPID FLUID LOADING FOR CESAREAN SECTION
Mitchell JD, Schultz JR, Spahn TE, DeBalli P, Phillips-Bute B, Reynolds JD
Duke University Medical Center, Durham, NC

Volume preloading prior to spinal anesthesia for elective cesarean section (E-CS) is commonly employed to reduce maternal hypotension, yet the effectiveness of the practice remains unclear. (1-4) The published incidence of post spinal hypotension in parturients varies between thirty and sixty-three percent. (1-5) We hypothesized the use of a rapid infuser device would result in larger and more rapid fluid boluses, resulting in a lower incidence of maternal hypotension. To test this proposal, after IRB approval, we reviewed patients presenting for E-CS between January and December 2001 who had spinal anesthesia and received fluids using a rapid infuser device (Mallinckrodt—CEOR3 IPXI). Patients received 10-12.5 mg spinal bupivacaine with narcotic. Ephedrine (mg) used was taken as a marker for maternal hypotension. Our practice is to administer ephedrine when systolic blood pressure is less than 100 mm Hg or when it decreases more than 20% below baseline values. Patients requiring blood products or vasopressors beyond ephedrine were excluded. We reviewed data from 390 patients fitting our inclusion criteria. The mean (+/- SD) fluid volume infused was 2669 cc (+/- 1629) cc or 33 (+/- 24) cc/kg body weight. This cohort also received, on average, 15 mg (+/-15) mg of ephedrine. Secondary data analysis determined there was a significant positive correlation between ephedrine use and volume of fluid infused (Spearman’s rank correlation r=0.30, p<0.0001). The data indicate that patients who received increasing volume of fluid required more ephedrine. Based on this result, our practice of aggressive fluid preloading does not appear to decrease the incidence of spinal anesthesia-induced maternal hypotension.


 SOAP A33
HEMODYNAMIC EFFECTS OF SPINAL ANESTHESIA AND SIMULTANEOUS COMBINED BOLUS INTRAVENOUS PHENYLEPHRINE AND EPHEDRINE FOR CESAREAN SECTION
Tsen LC, Loughrey JPR, Yao N, Datta S, Segal S
Brigham & Women’s Hospital, Harvard Medical School, Boston, MA

Background: Hypotension is a recognized effect of spinal anesthesia, and in the obstetric population has been noted to produce adverse effects on neonatal acid base status and unpleasant maternal symptoms. Previously, single agent prophylaxis, most notably with ephedrine, has been demonstrated to be inadequate in reliably preventing spinal induced hypotension (1). Recently, the combined prophylactic use of phenylephrine with ephedrine was demonstrated to be effective in the same population when given as an infusion (2). We hypothesized that an intravenous (iv) bolus of phenylephrine with ephedrine as a prophylactic and rescue bolus treatment could reduce the incidence and severity of hypotension following spinal anesthesia for cesarean section.

Methods: 40 women with healthy term pregnancies were randomized to receive an intravenous bolus of ephedrine 10mg (Group E) or ephedrine 10mg/phenylephrine 40 mcg (Group EP) simultaneous with spinal anesthesia. Hypotension was defined as a systolic blood pressure (SBP) reading below 100 mmHg or where a decrease to < 20% of the baseline value occurred. Rescue boluses comprised ephedrine 5mg in group E and ephedrine 5mg/phenylephrine 20mcg in group EP.

Results: The incidence of hypotension was 80% (Group E) vs 95% (Group EP) [p=.15]. Mean (± SD) lowest SBP was 95.4 ± 11.4 mmHg and 92.8 ± 12.8 mmHg for groups E and EP respectively. The number of rescue boluses required (mean ± SD) were 3.85 ± 3.7 and 3.05 ± 1.7 for Groups E and EP respectively. Mean umbilical cord arterial pH was 7.246 ± 0.081 (Group E) vs 7.244 ± 0.106 (Group EP). All comparisons were non significant. Apgar scores were similarly unremarkable in both groups.

Conclusion: We conclude that the combination of ephedrine and phenylephrine at the dose ratio selected and given as an iv bolus is not superior to ephedrine alone. Moreover, we conclude that this dose, given prophylactically, is ineffective in preventing spinal induced hypotension.

SOAP A34
DETERMINATION OF THE CORRECT DOSE OF
PHENYLEPHRINE TO TREAT MATERNAL HYPOTENSION
ASSOCIATED WITH SPINAL ANESTHESIA FOR CESAREAN
SECTION AND DEVELOPMENT OF A SAFE AUTOMATIC
DRUG DELIVERY SYSTEM FOR THE ADMINISTRATION OF
PHENYLEPHRINE

1Desjardin R, 1Kamani A, 1Kronitz N, 1Huzmezan M, 1Fung P, 1Gilhuly T
1Department of Electrical and Computer Engineering, UBC, British Columbia, Canada;
1Anesthesiology, BC Women's Hospital, British Columbia, Canada;
1Department of Electrical and Computer Engineering, UBC, British Columbia, Canada

Introduction: Recent studies have suggested that use of ephedrine compared to phenylephrine to correct maternal hypotension during spinal anesthesia for cesarean section is associated with higher incidence of fetal acidosis (1). There is increasing support for phenylephrine to treat hypotension and better fetal outcome (2). There are no studies to demonstrate the lowest effective dose of phenylephrine to correct maternal hypotension with minimal maternal side effects (hypertensive response and reflex bradycardia).

Method: Following ethic committee approval, 200 ASA II women scheduled for elective cesarean section were recruited. Patients were randomized to receive one of four doses (20, 40, 60, 80 μg) of phenylephrine to correct systolic blood pressure (SBP). Baseline SBP was established on admission. Hypotension was defined as SBP, less than 20% of base line or less than 100mmHg on two successive readings. Spinal anesthesia was standardized for all the patients for dose, position and intervertebral space. Vital signs were recorded continuously in real time on the computer to the end of the study. If the initial dose of phenylephrine did not correct SBP, subsequent doses were doubled to a maximum of 100 μg per dose. An excessive response to phenylephrine was considered to be a SBP higher than 140 mmHg or 20% greater than baseline and / or HR less than 55 bpm. HR of < 55 bpm was treated with Atropine. The estimated ED95 was extracted from the dose response curve estimate using Binomial regression methods for bioassay. As a secondary analysis, the excessive response of phenylephrine on SBP and slowing of heart rate was examined using standard linear regression models. Fetal outcome was assessed by APGAR score and cord blood gases.

Results: Preliminary statistical analysis has not been done in order to complete the study without breaking the code.

Conclusion: The purpose of this study is to determine the ED95 of phenylephrine to correct maternal hypotension induced by spinal anesthesia during elective Cesarean section with minimal side effects and normal fetal outcome.

SOAP A36
EPIDURAL ONDANSETRON IS MORE EFFECTIVE TO PREVENT POSTOPERATIVE NAUSEA & VOMITING AND PRURITUS THAN INTRAVENOUS ONDANSETRON IN CESAREAN SECTION PATIENTS
Kim K, Han D
Dept. of Anesthesiology and Pain Medicine, Yonsei University College of Medicine, Seoul, Korea

Postoperative nausea & vomiting and pruritus are common side effect of intrathecal or epidural opioids. Ondansetron, a selective serotonin type 3 receptor antagonist, is commonly used for nausea & vomiting in patients undergoing cancer chemotherapy and several studies showed that intravenous ondansetron is effective to treat intrathecal or epidural opioid-induced nausea & vomiting and pruritus. But, there is no report about epidural ondansetron. We undertook a prospective, randomized, double blind study to investigate the preventive effects of ondansetron in cesarean section patients who received spinal anesthesia and postoperative continuous epidural infusion by combined spinal-epidural technique.

In this study, we included 40 consecutive non-breast-feeding women (only ASA physical status I) who were scheduled for elective cesarean delivery. The Ethics Committee of our hospital approved this study, and informed written consents were obtained from all patients. All patients received an intrathecal injection of 10 mg heavy bupivacaine and 15 μg of fentanyl for spinal anesthesia. After baby delivery, all patients received ondansetron 4 mg intravenous injection during 1 minute. After operation, randomly allocated intravenous ondansetron group (n=20) received continuous epidural infusion with morphine 0.07 mg/ml and naropine 3 mg/ml (total volume: 100 ml) and intravenous infusion of ondansetron 80 μg/ml for 48 hours and also randomly allocated epidural ondansetron group (n=20) received continuous epidural infusion with morphine 0.07 mg/ml, naropine 3 mg/ml, and ondansetron 80 μg/ml (total volume: 100 ml) for 48 hours. Total infusion doses of ondansetron in both groups were equal (8 mg for 48 hours). The incidences and degrees of nausea & vomiting and pruritus, and side effects (headache, cardiac arrhythmia, extrapyramidal signs) were evaluated by an anesthesia research fellow who was blinded to the group during 48 hours. The x² test was used to approve differences between both groups.

The both groups were similar for demographic characteristics. The epidural ondansetron group showed 2 nausea, 0 vomiting, and 3 pruritis patients versus 7 nausea, 2 vomiting, and 6 pruritis patients in intravenous ondansetron group. Postoperative pain visual analog scale scores were not significantly different between both groups. No other side effects were observed in both groups.

Epidural ondansetron is more effective to prevent postoperative nausea & vomiting and pruritus than intravenous ondansetron in cesarean section Patients.

SOAP A37
EFFECT OF INTERIM SALINE INFUSION ON EFFICACY OF EPIDURAL ANESTHESIA FOR POSTPARTUM TUBAL LIGATION
Craft RM, Heim BS, Varner JM, Elliot LC, Snider CC
University of Tennessee Graduate School of Medicine, Knoxville, TN

Epidural catheters placed for pain relief during labor are routinely left in place in women desiring sterilization after delivery. The infusion is discontinued after delivery and bolused later to provide regional anesthesia for postpartum tubal ligation (PPTL). The failure rate of these catheters increases with the inter-time (IT) between delivery and PPTL. The purpose of this study was to determine the failure rate of regional anesthesia for PPTL using epidural catheters placed during labor with (N=18) or without (N=26) continuous infusion of saline during the IT. 44 healthy parturients were randomly recruited and their characteristics in terms of age, body mass index, gravidity, parity, and IT were not significantly different between the groups (P>0.05 by unpaired t-test or Chi-squared test for nominal data). Since the failure rate is significantly influenced by IT, the data was analyzed by quartiles. An outcomes based chi-square comparison show failure rates are significantly higher for IT >15 hours for both groups (P<0.05). Continuous saline infusion did not significantly affect the overall failure rate (19% control, 39% infused) or the failure rate for IT >15 hours (36% control, 55% infused).

Failure rates trended toward an increase with saline infusion in this study. This is in contrast to the clinical observation of epidurals used for postoperative pain control usually remaining functional during 5 to 7 days of continuous infusion. The finding that continuous infusion did not improve the failure rate may represent the presence of factors unique to parturients. These factors may be anatomic, physiologic, or social.

SOAP A38
POST-CESEAREAN SECTION ANALGESIA: A QA SURVEY
University Hospital of Geneva (HUG), Geneva

Background: Neuraxial morphine is considered effective for post-cesarean section (CS) analgesia; however, additional “rescue” medication is often required. Most studies have focused on the first 24h post-CS. We performed a QA survey to assess rescue analgesics requirements and maternal satisfaction for 72h post-CS using a standardized analgesia regimen.

Methods: Morphine (100mg spinal or 3mg epidural) was administered for all CS performed under regional anesthesia, along with 25µg spinal or 100µg epidural fentanyl. Starting in the PACU, patients received 2g/6h propacetamol & 30mg/6h ketorolac iv. Rescue analgesia (pain VAS>3), was treated with iv morphine titrated up to 10mg; iv PCA morphine (1mg/5min; max 30mg/4h) was provided if pain VAS remained >3. On post-CS day 1, po 1g/6h paracetamol & mefenacid (NSAID) 500mg/6h were given to all women, with po morphine sulfate 20mg/4-6h for rescue. Women were monitored in the PACU for at least 6h, with a 72h follow-up in the postpartum ward. Data collection included side effects, iv and po morphine requirements and satisfaction scores (VAS 0-10).

Results: Over 15 weeks, 253 CS were performed. Spinals were provided in 53% of CS (50% with 100mg epinephrine), epidurals in 25%, and CSE in 21%. Data from 9 women requiring GA at anytime was excluded.

Table: Satisfaction scores (SS) & analgesic requirements

<table>
<thead>
<tr>
<th>Indication</th>
<th>SS for labor analgesia prior to CS (n=123)</th>
<th>SS for anesthesia during CS</th>
<th>Needed intraop iv midaz/ketamine/fentanyl</th>
<th>SS for post-CS analgesia</th>
<th>Titrated with iv morphine (median 5.5mg)</th>
<th>Required subsequent iv PCA after titration</th>
<th>SS with PCA</th>
<th>Total dose of iv morphine with PCA (mg)</th>
<th>Requested po morphine (1-7 doses)</th>
<th>Duration of po morphine treatment (7-78h)</th>
<th>Respiratory depression requiring naloxone</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>9.1 ± 1.5</td>
<td>9.3 ± 1.6</td>
<td>5%</td>
<td>8.9 ± 1.5</td>
<td>75%</td>
<td>7%</td>
<td>8.1 ± 2.1</td>
<td>40 ± 22</td>
<td>52%</td>
<td>44 ± 20</td>
<td>0</td>
</tr>
</tbody>
</table>

Data expressed as mean ± SD, unless otherwise indicated.

Discussion: When given the option, 75% of women requested additional systemic opioids, after receiving neuraxial opioids, NSAIDs and paracetamol. Iv PCA did not appear to result in particularly high satisfaction scores. Approximately 50% of women received oral morphine, some up to 72h post-CS. Post-cesarean delivery pain should not be underestimated, and studies on multimodal analgesia for up to 48-72h might be of interest. Institutional and cultural differences in pain expectation, tolerance or sensitivity may well exist and explain differences in results of analgesic regimens.

### SOAP A40

**EPIDURAL NEOSTIGMINE FOR POST CESAREAN SECTION ANALGESIA**

**Eisenach JC, Owen MD, 2 Kaya N, 2 Sahin S**  
Wake Forest University Medical Center, Winston-Salem NC; 2Uludag University Medical Faculty, Bursa, Turkey

**Introduction:** Intrathecal neostigmine (neostig) produces analgesia but the clinical usefulness is limited by nausea. Epidural neostig has been shown to produce post-operative analgesia without nausea in non-pregnant patients. This study was undertaken to determine whether epidural neostig, administered during cesarean section, reduces post-operative morphine requirements without increasing nausea.

**Methods:** After institutional approval and informed consent, 80 patients for elective cesarean section were administered CSE anesthesia with hyperbaric bupivacaine (8 mg) and 10 μg fentanyl. Patients were randomized to receive either saline, 75, 150 or 300 μg neostig (n=20/group) in 10 ml saline following cord clamp. Postoperatively, a PCA device was set to deliver 1 mg morphine every 5 min as needed, without a basal infusion. Patients were monitored for pain, morphine consumption and side-effects for 24 hr.

**Results:** Patients were demographically similar. Results are summarized in the Table. Neostig was associated with lower pain scores and greater patient satisfaction at 24 hr compared to control. Nausea and morphine consumption were similar among groups. Intra-operative shivering and sedation were increased in the N300 group (p<0.05) and post-operative sedation occurred dose independently in neostig groups compared to control (p<0.05).

<table>
<thead>
<tr>
<th>24 hr VAS (0-10)</th>
<th>Morphine consumption (cumulative)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pain</strong></td>
<td><strong>SATISFACTION</strong></td>
</tr>
<tr>
<td>Saline</td>
<td>5.4 ± 1.0</td>
</tr>
<tr>
<td>N75</td>
<td>3.2 ± 1.2 *</td>
</tr>
<tr>
<td>N150</td>
<td>3.5 ± 1.2 *</td>
</tr>
<tr>
<td>N300</td>
<td>3.0 ± 1.2 *</td>
</tr>
</tbody>
</table>

Data are presented as percent or mean ± SD. (*p < 0.05 when compared to saline)

**Conclusion:** In the doses administered, epidural neostig improved 24 hr pain and satisfaction scores but did not decrease post-cesarean section morphine requirements. Nausea was similar to control; however, the incidence of sedation and shivering was increased with neostig.

**Reference:**  
1 Anesthesiology 1999; 90:1534-8.

### SOAP A41

**EPIDURAL HYDROMORPHONE PLUS EPINEPHRINE PROVIDES LONGER ANALGESIA THAN EPIDURAL MORPHINE POST C-SECTION**

**Kliffer A, Sareen S, Douglas MJ, Desjardins R, Peter E, Esler M**  
BC Women's Hospital, Vancouver, BC, Canada

**Introduction:** Epidural morphine (EM) provides 8-24 hours of effective analgesia following Cesarean Section (CS). Hydromorphone (1.5mg) plus epinephrine 50μg (HM+Ep) provides longer (24 hours) post CS pain relief when compared to HM 1.5mg. Halpern et al compared HM 0.75mg. to EM and found no difference in analgesia. This study was designed to compare pain relief of epidural HM+Ep to epidural EM. Our primary outcome was time to first dose of analgesic requested.

**Methods:** Following ethics approval, labouring women having an urgent Cesarean Section using a functional epidural were randomized to receive either epidural HM-1.5mg.+Ep50mcg. or EM 3mg. after the baby was delivered. Anesthesia for CS was provided at the discretion of the attending anesthesiologist. All patients received multimodal analgesia in the form of regular dose acetaminophen (650mg. q4h) for 24 hr and naproxyn (500mg per rectum q12h) for 3 doses. In the first 27 hr. patients were offered Acetaminophen with Codeine as rescue analgesia. After 27 hr patients were provided with a choice of Acetaminophen plus codeine, ibuprofen, or plain acetaminophen. Maternal demographic data as well as the total dose of local anesthetic and fentanyl used during labor were collected. Power analysis indicated 95 women were required. Pain, pruritis, nausea and vomiting visual analog scores were determined at time zero, 12, 18, 21, 24 and 27 hours following administration of the study drug.

**Results:** The groups are demographically similar. Interim analysis of 57 women enrolled to date shows the lower and upper 95% confidence intervals are -6.27hr. and 5.9 hr. respectively

**Conclusion:** There may be a 6 hr. difference in the duration of pain relief offered by epidural HM+Ep compared to EM. This finding is contrary to the previous study comparing epidural HM to EM. Complete data collection is necessary to confirm these observations.

**References:**  
POSTER REVIEW I

SOAP A42
POST-CESAREAN ANALGESIA WITH SPINAL MORPHINE, CLONIDINE OR THEIR COMBINATION
University of Western Australia, Subiaco, Perth, Western Australia; *King Edward Memorial Hospital for Women, Subiaco, Perth, Western Australia; *Royal Hobart Hospital, Hobart, Tasmania; *Chelsea and Westminster Hospital, London; *Royal Cornwall Hospital, Truro, Cornwall; *Women and Infants Research Foundation, Subiaco, Perth, Western Australia

Two hundred and forty women participated in a randomized, double-blinded trial to determine whether the addition of clonidine to subarachnoid morphine increases the duration and efficacy of post-cesarean analgesia. Because there was no difference between groups receiving morphine plus clonidine 60, 90 or 150 mg, this combined group (MC60-150, n=113) was compared with groups receiving morphine 100 mg (M100, n=39), clonidine 150 mg (C150, n=39) and morphine 100 mg plus clonidine 30 mg (MC30, n=41). The time to patient-controlled morphine use and cumulative morphine consumption were significantly different (longest duration and lowest dose in MC60-150 (P < 0.0001 and <0.001 respectively). Pain scores were greater for M100 (to 4 hours) and for C150 (6-12 hours) (P < 0.01). Onset of sensory block, incidence of hypotension, ephedrine dose requirement, intra-operative pain and nausea did not differ between groups, but vomiting was more common in MC60-150. All clonidine groups had greater sedation and all morphine groups more severe pruritus. Satisfaction and recovery times did not differ.

We concluded that subarachnoid clonidine (minimum effective dose 60 mg) added to morphine for post-cesarean analgesia extends and improves analgesia, but increases intraoperative vomiting and sedation.

SOAP A43
INTERACTION BETWEEN EPIDURAL CHLOROPROCAINE AND MORPHINE
Hess PE, Snowman CE, Kunze LJ, Pratt SD, Ingold VJ
Beth Israel Deaconess Medical Center, Boston, MA

Introduction: Chloroprocaine (CPC) is a frequently used epidural anesthetic in obstetrics. Epidural morphine (MS) may be less effective for post-cesarean analgesia after epidural CPC. Whether this is due to narcotic receptor antagonism, or an effect of study methodology is unclear. This study examined the effectiveness of epidural MS after a dose of epidural CPC, using a methodology that avoids a complication of previous studies.

Methods: IRB approved this prospective, randomized, placebo-controlled, double-blinded trial. Subjects for elective cesarean delivery received a combined spinal epidural anesthetic: spinal anesthesia consisted of 11.25 mg of hyperbaric bupivacaine and 25 mcg of fentanyl. Thirty minutes after spinal injection, 5 cc of study solution (CPC vs. Saline) was given via epidural catheter. 45 minutes after spinal, 3 mg epidural MS was given. Duration of spinal analgesia, postpartum pain scores, and further analgesic medications were followed. Failure of post-op analgesia was defined as oral narcotic supplementation during the first 12 hours. Data compared using chi-squared, Mann-Whitney, or Kaplan-Meier log-rank analysis as appropriate. p<0.02 significance used (correction for mid-study evaluation).

Results: 33 of 40 subjects have completed this on-going study, group assignment not broken at this time. 53% of Group I and 56% of Group 2 had complete (>18 hr) post-op analgesia. Median duration of analgesia similar 17.5 v. 16.9 hrs (see figure). 35% of Group 1 and 31% of Group 2 required early (<12 hrs) oral narcotic supplementation. Demographics, duration of spinal analgesia, post-delivery pain scores, and use of pain medications were similar.

Discussion: In this ongoing study, we have not found a decrease in epidural MS efficacy after a dose of CPC is given. This suggests that earlier results may be due to study methodology and not to receptor antagonism. The group assignment and final results will be presented at the meeting. Ref. 1.A&A 1991, p.119; 2.Anes 1990, p.860.

*Images were recreated from corrupted files.
SOAP A44
POSTOPERATIVE CONTINUOUS WOUND IRRIGATION USING ROPIVACAINE 0.1% OR 0.2% FOLLOWING CESAREAN DELIVERY: A PLACEBO CONTROLLED, RANDOMIZED STUDY
UZ Gasthuisberg Dept. Anesthesiology, Leuven, Vlaams-Brabant

Introduction: Local anesthetic wound infiltration is effective to reduce postoperative pain. Continuous wound irrigation was effective in treating post-caesarean section pain. Patient controlled wound infiltration also appeared successful. The present investigation studied the efficacy of continuous wound irrigation using ropivacaine and determined the most effective ropivacaine concentration for post-caesarean analgesia.

Methodology: Following ethical committee approval and informed consent, 90 patients, scheduled for C-section, were included. Combined spinal epidural anesthesia was performed in all patients. After closure of the fascia, a subcutaneous catheter was implanted in the wound. The catheter was connected to an elastometric pump (Painbuster®, I-flow, Lake-Forest, USA) which continuously infused 5 ml/h of the study solution for 48 h. Mothers were randomized to receive either a continuous infusion of saline (SAL-group), ropivacaine 0.1% (RLO-group) or ropivacaine 0.2% (RHI-group). If pain relief was insufficient, 5.3 ml bupivacaine 0.03% with sufentanil 11 µg/ml could be infused epidurally using patient controlled epidural analgesia (lock-out 20 minutes). Demographic and obstetric data, pain scores, satisfaction, hemodynamics, temperature, the dose of epidurally infused drugs, duration of hospitalization, length of the Pfannenstiel incision and complications were recorded. Data are presented as a mean ± SD.

Results: Demographic data were similar between the groups. Visual analogue scale scores for pain in rest were low in all groups. Pain scores during mobilization were significantly different between the groups. In the RHI-group significantly more pain relief was reported. In the RHI-group less epidural local anesthetic was requested and administered (190 ± 62 vs 179 ± 88 vs 157 ± 53 ml, in the SAL-, RLO-, and RHI-groups respectively). Maternal satisfaction was significantly higher in the RHI-group at 48 and 72 hours. Hospitalization was shorter in the RHI-group (7.3 ± 0.5 vs 6.9 ± 0.9 vs 6.8 ± 0.5, in the SAL-, RLO-, and RHI-groups respectively). More patients remained hospitalized longer than 7 days in the SAL-group as compared to the RHI-group (10 vs 2).

Discussion: Based on the present results, continuous wound irrigation with ropivacaine 0.2% appears effective in reducing postoperative pain after cesarean section.

POSTER REVIEW I

**SOAP A46**

**LACK OF THROMBOPOIETIN PLATELET POTENTIATION AS AN EARLY PREDICTOR OF PREECLAMPSIA**

Patteson SK, Owens RL, Hennessey MD, Elder RF, Craft RM, Vance MB, Snider CC, Carroll RC

*University of Tennessee Graduate School of Medicine, Department of Anesthesiology, Knoxville, TN*

Lack of thrombopoietin potentiation of platelet function in the first trimester may be an early predictive indicator of preeclampsia. 148 patients were recruited for a prospective study from a high risk pregnancy clinic. Of these patients, 42 were diagnosed as preeclamptic by ACOG criteria. Citrated whole blood samples, drawn at 1st and 3rd trimester, within 24 hours of delivery, and 4-6 weeks postpartum, were assayed in a Chronolog® instrument by impedance for platelet aggregation (Table 1) measuring activation by 0.4 µg/ml collagen with and without 10 ng/ml thrombopoietin (TPO) pretreatment to potentiate platelet function. There was no significant difference in 1st trimester un-potentiated platelet reactivity by unpaired t-test (P = 0.995). Preeclampsia patient samples at 3rd trimester are more reactive without TPO potentiation, but this was not significant by unpaired t-testing (P = 0.206). Significant (P < 0.05, paired t-test) TPO potentiation of platelet reactivity is observed in all normal patients' samples except within 24 hours of delivery (P = 0.284). In contrast, preeclampsia patients' platelets don't show significant (P>0.8, paired t-test) TPO potentiation at any time point. A potentiation difference was calculated subtracting the minus TPO data from the plus TPO data (Table 2). A significant unpaired t-test difference in TPO potentiation is seen in the 1st trimester before symptoms appear. Platelets of preeclamptic patients may be already potentiated in vivo or are refractory to in vitro TPO potentiation.

**Table 1: Impedance Mean (SEM) + 0.4 µg/ml Collagen**

<table>
<thead>
<tr>
<th>Time</th>
<th>Normal</th>
<th>Normal + TPO</th>
<th>Preecl.</th>
<th>Preecl. + TPO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Tri</td>
<td>4.0 (0.8)</td>
<td>6.6 (1.2)</td>
<td>4.0 (1.3)</td>
<td>4.0 (1.5)</td>
</tr>
<tr>
<td>3rd Tri</td>
<td>5.6 (1.2)</td>
<td>8.9 (1.6)</td>
<td>8.5 (2.1)</td>
<td>8.7 (2.1)</td>
</tr>
<tr>
<td>Delivery</td>
<td>2.1 (0.7)</td>
<td>2.5 (0.8)</td>
<td>2.0 (0.7)</td>
<td>2.0 (1.1)</td>
</tr>
<tr>
<td>Postpartum</td>
<td>5.4 (1.2)</td>
<td>6.9 (1.3)</td>
<td>5.4 (1.7)</td>
<td>5.6 (1.8)</td>
</tr>
</tbody>
</table>

**Table 2: Difference Plus/Minus TPO Impedance Mean (SEM) + 0.4 µg/ml Collagen**

<table>
<thead>
<tr>
<th>Sampling Time</th>
<th>Normal</th>
<th>Preecl.</th>
<th>Unpaired t-test P</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Tri</td>
<td>2.6 (0.6)</td>
<td>-0.02 (0.8)</td>
<td>0.019</td>
</tr>
<tr>
<td>3rd Tri</td>
<td>3.2 (1.1)</td>
<td>0.16 (1.4)</td>
<td>0.088</td>
</tr>
<tr>
<td>Delivery</td>
<td>0.5 (0.4)</td>
<td>-0.03 (0.6)</td>
<td>0.537</td>
</tr>
<tr>
<td>Postpartum</td>
<td>1.4 (0.6)</td>
<td>0.18 (1.3)</td>
<td>0.338</td>
</tr>
</tbody>
</table>

**SOAP A47**

**PLATELET COUNT TRENDS IN PRE-ECLAMPTIC PARTURIENT: WHAT IS THE PREDICTIVE VALUE OF AN INITIAL PLATELET COUNT DURING LABOR?**

Wong CA, Cho K, Patel R, McCarthy RJ

*Northwestern University, Chicago, IL*

Introduction: The admission platelet count (PC) correlated with the PC nadir in women with severe preeclampsia and HELLP syndrome. However, the natural progression of the PC has not been studied in women with mild preeclampsia. The purpose of this study was to determine the positive predictive value (PPV) of an initial PC > 150,000/mL for maintaining a PC > 80,000/mL during labor and delivery.

Methods: After approval by the IRB, all women who delivered during 2000 and 2001, with the discharge diagnosis of mild preeclampsia (M), severe preeclampsia (including HELLP and eclampsia) (S), and preeclampsia superimposed on chronic HTN (HTN) were identified. PCs for each patient, from one month prior to the delivery admission, until hospital discharge, were analyzed. The number of PC determinations per parturient was determined. For each diagnosis, the PPV of an initial PC > 150,000/mL for maintaining subsequent PC > 80,000/mL, as well as the PPV of the PC closest (prior to) initiation of neuraxial analgesia/anesthesia (NA) was calculated. The median time interval from the closest PC determination to initiation of NA was calculated.

Results: 569 patients were identified, 494 (87%) had NA and 75 (13%) had systemic analgesia/anesthesia. The number of PC determinations were [median (range)] M 2 (1,9), S 3 (1,31) and HTN 3 (1,24). 349 patients received NA, had at least two PC determinations, with at least one PC determined before the initiation of NA. The PPV and time interval from the closest PC determination to initiation of NA are listed in the Table. Conclusions: The PPV of a PC > 150,000/mL in parturients with M is very high, suggesting that a single PC determination at the time of diagnosis of mild preeclampsia is sufficient to rule out thrombocytopenia before initiation of NA, and discontinuing epidural catheters. Subsequent PC determinations are not necessary.


**Table**

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>S</th>
<th>HTN</th>
</tr>
</thead>
<tbody>
<tr>
<td>PPV (initial PC)</td>
<td>99.4</td>
<td>88.4</td>
<td>100</td>
</tr>
<tr>
<td>PPV (closest)</td>
<td>99.4</td>
<td>91.7</td>
<td>100</td>
</tr>
<tr>
<td>Initial PC=closest PC %</td>
<td>44</td>
<td>64</td>
<td>34</td>
</tr>
<tr>
<td>Closest PC to NA</td>
<td>4.0</td>
<td>2.9</td>
<td>3.9</td>
</tr>
<tr>
<td>initiation interval</td>
<td>(0.5,74)</td>
<td>(0.1,35)</td>
<td>(0.6,42)</td>
</tr>
</tbody>
</table>
SOAP A48
PREEMPTIVE EPIDURAL CATHETERS IN SEVERE PREECLAMPSIA
Ranasinghe S, Birnbach DJ, Lai MC, Pons M, Steadman JL, Toyama T
UM/Jackson Memorial Hospital Miami, FL

Introduction: Severe preeclampsia may be associated with worsening thrombocytopenia that precludes the administration of neuraxial anesthesia. The placement of epidurals in these patients early in the course of the disease may be beneficial. Standard practice at our institution is to place an epidural catheter as soon as the diagnosis of severe PIH is made, even if the patient is not experiencing labor pain. The results of a QA assessment of one year of this practice (2002) are presented.

Methods: As per hospital protocol, all women with the diagnosis of severe PIH and platelet counts greater than 75,000 are counseled to receive an epidural. All catheters are tested with 2% lidocaine and then infused with normal saline at 3ml/hr until the patient complains of labor pain at which time the catheters are activated with levobupivacaine.

Results: In 2002, a total of 70 parturients with the diagnosis of severe preeclampsia were given a “preemptive epidural.” Of these 70 patients, 36 (51%) subsequently underwent cesarean delivery, 35 of them (97%) being performed using the epidural catheter. At the time of cesarean delivery, 8 of these patients (22%) had profoundly depressed platelet counts that would have precluded the use of a neuraxial block. Catheters remained idle (infusion of NS only) for 6-24 hours before activation. Only 1 catheter did not function for cesarean section.

Discussion: These data strongly suggest that there is a benefit to placing “preemptive epidurals” in parturients with severe preeclampsia. The majority of these patients underwent cesarean deliveries and had we waited many would have required general anesthesia with its inherently greater risks. While it has been suggested that dormant catheters may fail when activated, this was not the case in our practice. Our practice change has decreased the use of general anesthesia for cesarean section in severe preeclampsia and thus increased the safety of our labor and delivery unit. This practice requires a collaborative approach between obstetrician and anesthesiologist and would not be possible at all hospitals.

SOAP A49
DELAYED REMOVAL OF EPIDURAL CATHETERS DUE TO THROMBOCYTOPENIA—INCIDENCE IN A CASE SERIES
Mantha VR, Ramanathan S
Dept. of Anesthesiology, Magee-Women’s Hospital University of Pittsburgh School of Medicine, Pittsburgh, PA

Background: Potential risk of epidural hematomas may preclude removal of epidural catheters in preeclamptic patients with thrombocytopenia. Frequently platelet counts reach a nadir after delivery in these patients. The catheters may need to be left in situ until the platelet counts rise to satisfactory levels (1). It is not known in what percentage of these patients the catheter may need to be retained after delivery because of thrombocytopenia. This study was done to examine the incidence of such delayed removal of catheters.

Methods: Patients with a diagnosis of preeclampsia and who had also had epidural analgesia for labor were retrieved from a computer database of patients admitted at our tertiary care maternity hospital from February 2002 through December 2002. It is a practice at our institution to perform platelet count estimation every 4-6 hours in preeclamptic patients in labor. We require platelet counts within 4 hours before insertion or removal of epidural catheters.

Results: A total of 261 patients were included. Three patients i.e 1.15% (95% Confidence interval: 0.24% to 3.32%) were identified in whom the catheters had been left in-situ following delivery, until the platelet counts rose to satisfactory levels. All three also had a diagnosis of HELLP syndrome. The trends of platelet counts in the three patients are depicted in figure 1. Time '0' on the 'x' axis denotes the time of delivery. The catheters had to be retained for 34, 68, and 48 hours in patient 1, 2, and 3 respectively. There was no epidural related morbidity in any of the above patients.

Conclusion: In our Institution, we found an incidence of 1.15% where an epidural catheter had to be left in situ 1-3 days following delivery in preeclamptic patients with HELLP syndrome, due to thrombocytopenia.

Reference:
CAESAREAN SECTION FOR SEVERE PRE-ECLAMPSIA - A SURVEY OF U.K. CONSULTANT OBSTETRICANAESTHETIC PRACTICE

Wight WJ, Bythell V
Department of Anaesthesia, Women's College Hospital, Toronto, ON, Canada; Department of Anaesthesia, Royal Victoria Infirmary, Newcastle upon Tyne, United Kingdom

Introduction: There is no accepted standard anaesthetic management of caesarean section in the severely pre-eclamptic patient. We performed a postal survey of all U.K. consultant anaesthetists identified by the Obstetric Anaesthetists Association (OAA) about their beliefs regarding this issue.

Method: A questionnaire was mailed in April 2002 to all consultant anaesthetists identified by the OAA. All non-responders were followed up with a second mailing. The questionnaire asked about the preferred anaesthetic technique for caesarean section in the severely pre-eclamptic patient, coagulation tests and results required before performing a regional technique, and the drugs chosen when performing general anaesthesia in this population.

Results: Of the 936 consultant anaesthetists surveyed, 637 replies were received (71.3%). The most frequently used anaesthetic technique for caesarean section in the severely pre-eclamptic patient was single shot spinal anaesthesia (46.1%), 26.2% choosing combined spinal and epidural anaesthesia (CSE), 15.6% epidural anaesthesia, and 7.6% general anaesthesia. The median platelet count below which respondents would not perform regional anaesthesia was 80 x 10^9/L (47.1%), with 16.5% choosing a cut-off below 70 x 10^9/L. The most popular induction agent for general anaesthesia in this population was thiopentone (86.6%). A wide range of drugs is used in the attenuation of the hypertensive response to intubation, with many using more than one agent. The most frequently used drug was alfentanil (75.2%), whilst labetalol (35.0%), magnesium sulphate (33.6%), and fentanyl (14.2%) are also popular choices; 5.8% are now using remifentanil for this purpose.

Conclusion: Despite an apparent lack of consensus in the literature regarding the superiority of one regional technique over another in severe pre-eclampsia this survey demonstrates that in practice a majority of U.K. anaesthetists use spinal or CSE in this situation. A majority of anaesthetists would perform a regional technique for caesarean section when the platelet count is 80 x 10^9/L or greater, which broadly reflects the practice represented in a similar survey performed in 1998. When general anaesthesia is performed in this population a wide range of drugs is used in the attenuation of the hypertensive response to intubation.


PERILS AND PEARLS OF PREECLAMPSIA

Wittels B
University of Chicago, Chicago, IL

Case report: A 38 year-old female, G3 P3, at 33 weeks estimated gestational age with triplets and preterm labor requiring IV magnesium tocolysis presented for elective cesarean delivery with epidural anesthesia. IV preload consisted of 2 liters Lactated Ringer's solution. Epidural lidocaine 2% was given incrementally to a T4 bilateral surgical level; delivery of triplets was uneventful; epidural morphine 4 mg and butorphanol 3 mg were given for postcesarean analgesia. A mild, transient decrease in uterine tone resulted in an estimated blood loss of 1 liter; urine output was 195 ml; and total IV fluids were 3500 ml. The epidural catheter was removed before the patient was transferred to the postanesthesia care unit (PACU).

During the first hour in the PACU, the patient developed hypertension (BP 158/108), tachycardia (HR 112), dyspnea, orthopnea, and a productive cough. The pulse oximeter failed to detect pulsations or oxygen saturation. Oxygen 100% by face mask was administered; IV hydralazine 5 mg, and IV furosemide 20 mg and 40 mg were also given. The patient became diaphoretic and voiced a sense of impending doom.

Chart review was notable for the patient’s morning complaint, “My hands feel a little puffy today” and for the serum creatinine values that had increased from 0.8 mg/dl one month prior to 1.3 mg/dl the day of surgery. Obstetricians denied that she had preeclampsia.

The patient was transported emergently to the operating room, routine monitors applied, 100% oxygen administered by bag-valve-mask (oxygen saturation was 83%); rapid sequence induction with IV sodium thiopental and succinylcholine preceded laryngoscopy, intubation and positive pressure ventilation (oxygen saturation improved to 100%). A chest radiogram and 12-lead ECG were obtained, arterial and pulmonary arterial catheters inserted, and IV furosemide 40 mg and continuous IV propofol 150 mcg/kg/hr were given (BP 105/55, PAP 20/12, PCWP 9).

After diuresis of 1400 ml over 60 minutes, frothy pink endotracheal secretions diminished, the propofol infusion was titrated off (BP 180/90, PAP 40/22, PCWP 20), and IV hydralazine 10 mg and 5 mg were given to lower SVR, BP, and PCWP. The patient was extubated to a 100% face mask with a minute ventilation of 8.0 liters and transferred to the ICU in stable condition. (See serial chest radiograms.)

Discussion: Increased capillary permeability of variable onset and severity is a critical sign of preeclampsia that may present in subtle ways, at inopportune times, making fluid restriction critical to reducing morbidity and mortality (and contradicting the generic caveat that regional anesthesia is safer than general anesthesia).
SOAP A52
INFLUENCE OF THE ISOLATED ULTRAFILTRATION ON OUTCOMES IN ECLAMPTIC COMA
Bukin VE
Faculty of Emergency Medicine, Medical Institute of Postgraduate Education, Zaporozhye

Background. Puerperas with eclamptic coma (EC) have serious neurological deficit and a high level of mortality (up to 36-50%) Isolated and expanded brain edema is noted in 70 % of deceased from the eclampsia. Isolated ultrafiltration (IUF) is effective when emergency therapy of acute extracellular and intracellular hyperhydration is treated [1]. However, IUF resources are not practically used in the eclampsia treatment.

Material and methods. This research aims to make retrospective analysis of IUF influence on clinical current and outcomes of EC, based on our own observation of 115 puerperas, treated with the use of this method in obstetrical establishments of the Zaporozhye region during the period between April 1981 and December 2002. IUF was applied 3-76 hours after delivery.

Depending on the time period between delivery and the beginning of IUF, patients were retrospectively divided into two groups: 1st group - up to 24 hours (n=73); 2nd group - more than 24 hours (n=42). Severity of the condition and neurological status dynamics were measured against APACHE-II and Glasgow Coma Scale (GCS). Statistical analysis was done comparing 1st group and 2nd group.

Results. There were no significant differences between the two groups in terms of age, type of eclampsia, number of convulsions, gestational age, mean blood pressure, and GCS. All the patients were treated in accordance with the standard protocol: magnesium sulfate therapy, anti hypertensives, analgo-sedation, mechanical ventilation and fluid balance. Removal of 1.8-5 liters of ultrafiltrate resulted in recovery of consciousness and reflexes upon the IUF session: 1st group - at 70 patients, 2nd group - at 32 patients respectively. Prompt regress of neurological deficit and a high level of mortality (up to 36-50%).

Conclusions. The use of IUF at postpartum eclampsia and eclamptic coma reduces displays of an intracranial hypertension and prevents the progress of multi-organ failure. The application of IUF in the first day after a delivery promotes a reliable decrease of maternal mortality at PE.

**SOAP A54**

**ENOXAPARIN AND REGIONAL ANESTHESIA DURING LABOR**

Finegold H, O'Hara C, Ramanathan S  
Magee-Women's Hospital, University of Pittsburgh School of Medicine,  
Pittsburgh, PA

**Introduction:** Our goal was to determine patient outcomes in parturients receiving low molecular weight heparin (LMWH) and regional analgesia at our institution.

**Methods:** With permission of the Institutional Review board, we reviewed patients’ medical records over a period from 1998-2002. Using ICD9 billing codes, we identified parturients requiring LMWH therapy, specifically Enoxaparin (EN). We entered the data into a computer database using Microsoft ACCESS™ software. Only those patients who received LMWH therapy were included with the following data: maternal diagnoses, aspirin usage, daily dosage of EN (mg), start and stop date of EN, hours between EN stoppage and insertion of regional, type of regional anesthesia, mode of delivery, apgar scores, birth weight.

**Results:** We identified 50 patients who received LMWH during their pregnancy. The most common primary diagnoses were: Factor V Leiden deficiency (22/50), Systemic Lupus (4/50), Anti-Phospholipid Syndrome (4/50), Thrombophilia (4/50). The remaining diagnoses included embolic disease and coagulation disorders. Twenty-two out of the 50 patients studied took aspirin 81 mg daily throughout their pregnancy in addition to the EN. The Obstetricians routinely discontinued the EN at 36 weeks and began unfractionated heparin therapy so patients could receive regional anesthesia during labor (Table). Factor Xa levels were not measured at any time. There were no bleeding complications nor were there any adverse maternal or fetal outcomes associated with the use of regional anesthesia (Table):

<table>
<thead>
<tr>
<th>Daily Dose EN (mg)</th>
<th>Mean 61.5</th>
<th>Min =40</th>
<th>Max=260</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week EN Start</td>
<td>13.4 ± 8.08</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week EN Stop</td>
<td>34.3 ± 5.36</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hrs EN stop and anesthesia given</td>
<td>370.68 ± 447.54</td>
<td>Min=6.75</td>
<td>Max=1782</td>
</tr>
<tr>
<td>Birthweight (g)</td>
<td>2992 ± 896.58</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apgar 1 min</td>
<td>7.91 ± 0.39</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apgar 5 min</td>
<td>8.89 ± 0.47</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CASE REPORT

A 31-year-old woman, gravida 1 para 0 at 37 5/7 weeks of gestation, was admitted to the labor and delivery unit for elective cesarean section due to a footling breech presentation and prior myometrial surgery. The past medical history was significant for beta thalassemia intermedia. Though not a Jehovah’s Witness, the patient stated that she would refuse transfusion of red blood cells. Anesthetic management proceeded with a combined spinal epidural anesthetic. In the course of the surgery, a posterior uterine floor placenta accreta was discovered complicated with profound bleeding. A COBE BRAT II cell salvage system was set up and blood processing was initiated. All fluids from the surgical field were aspirated into the reservoir. A leukocyte reduction filter (LeukoGuard RS, Pall Biomedical Products Co., East Hills, NY, USA) was used to filter the processed blood prior to readministration. In total, 2250 mL of RBCs were salvaged and readministered with an average hematocrit of 50%. It was estimated that the patient’s perioperative blood loss approached 7500 mL. In addition to the cell salvaged blood, 4800 mL of Ringer’s lactate solution and 1000 mL of hetastarch solution was administered. During the course of the surgery the patient remained awake and hemodynamically stable. The patient was discharged home on post-operative day #4 in stable condition with a hemoglobin of 6.0 gm/dl and with no elevation in post-operative creatinine levels.

Discussion

Two characteristics of this case are noteworthy. First, cell salvage in obstetrics is contraindicated by the manufacturers of this equipment; however, multiple studies and reports have been published in attempts to demonstrate cell salvage safety in obstetrics. This case adds another report of cell salvage being safely performed in obstetrics. Of more interest is that of the patient’s Beta thalassemia intermedia. No reports of cell salvage being performed in patients with hemoglobinopathies other than sickle cell anemia can be found in the literature. Reduced survival of beta thalassemic RBCs was of concern in this case. Hemolysis secondary to surgical trauma, suctioning techniques and to vacuum aspiration can be significant in the process of cell salvage. In the case presented here, excess hemolysis was noted in the effluent line and the wash volume was increased. In conclusion, this case showed that intraoperative blood salvage can be successfully applied in patients with beta thalassemia, in spite of the increased vulnerability of RBCs to trauma but that added caution needs to be applied when doing. Further study is warranted.

References:


SOAP A57

VON WILLEBRAND’S DISEASE AND REGIONAL ANESTHESIA IN THE PARTURIENT

Suddeth BH, Schmalenberger KP, Mandell GL, Golebiewsky KA
University of Pittsburgh, Pittsburgh, PA; Magee-Women’s Hospital, Pittsburgh, PA

Introduction

There is limited information in the literature pertaining to the use of regional anesthesia in parturients with von Willebrand’s Disease (vWD). The purpose of this study is to demonstrate the safety of regional anesthesia in selected patients in this population.

Methods

Following IRB approval, a chart review was conducted and data were collected on patients with VWD who delivered a viable fetus over a ten year period at Magee-Womens Hospital in Pittsburgh, PA beginning in July 1993. Along with routine demographic data and type of anesthesia, we recorded coagulation laboratory values (i.e. bleeding time, platelet count, PT, aPTT, von Willebrand factor level, factor VIII level, von Willebrand Factor Antigen level, Ristocetin Cofactor Activity, Factor VIII Coagulant Activity), antepartum and postpartum hematocrit values, blood loss during and after delivery, history of clinical hemorrhage, the use of dDAVP (desmopressin), family history of vWD, postpartum anesthetic or surgical complications (i.e. hematomas) and neonatal complications. Study groups were subsequently divided into parturients receiving regional anesthesia (RA group) for labor and delivery (epidural or spinal) and those who did not (control group). In addition to demographic and antepartum and postpartum laboratory values, hemorrhagic and neurologic complications were recorded. Data were analyzed using the t-test or chi-squared and p<0.05 was considered significant.

Results

Of the 51 deliveries, there were 34 in RA group and 17 in the control group. Patients in the RA group had significantly greater mean ages (30.0 vs 25.9 yrs), a lower incidence of clinical hemorrhage (2/34 vs 7/17), a shorter mean bleeding time (7.4 vs 10.8 min) and received dDAVP less frequently during labor and delivery (5/34 vs 7/17). No significant hemorrhagic or neurologic complications were noted in either group. Spontaneous vaginal delivery was greater in the control group (15/17 vs 18/34), and instrumented vaginal delivery greater in the RA group (8/34 vs 0). There were no 5 min APGAR scores <7 in either group.

Conclusions

Overall, our data supports the general safety of regional anesthesia for selected parturients with VWD who present during labor and delivery.

References


SOAP A56

INTRAOPERATIVE BLOOD SALVAGE DURING CESAREAN SECTION IN A PATIENT WITH BETA THALASSEmia INTERMEDIA

Lukauskiene E, Waters JH
Cleveland Clinic Foundation, Cleveland, OH

Introduction

In the case presented here, intraoperative blood salvage was used during cesarean section in a patient with beta thalassemia intermedia. There is some controversy concerning blood cell salvage in obstetrics due to a potential for amniotic fluid embolism.

Case report

A 31-year-old woman, gravida 1 para 0 at 37 5/7 weeks of gestation, was admitted to the labor and delivery unit for elective cesarean section due to a footling breech presentation and prior myometrial surgery. The past medical history was significant for beta thalassemia intermedia. There is some controversy concerning blood cell salvage in obstetrics due to a potential for amniotic fluid embolism. In addition to this, little data exists as to the safety of cell salvage in patients with hemoglobinopathies other than sickle cell disease.

Discussion

Two characteristics of this case are noteworthy. First, cell salvage in obstetrics is contraindicated by the manufacturers of this equipment; however, multiple studies and reports have been published in attempts to demonstrate cell salvage safety in obstetrics. Of more interest is that of the patient’s Beta thalassemia intermedia. No reports of cell salvage being performed in patients with hemoglobinopathies other than sickle cell anemia can be found in the literature. Reduced survival of beta thalassemic RBCs was of concern in this case. Hemolysis secondary to surgical trauma, suctioning techniques and to vacuum aspiration can be significant in the process of cell salvage. In the case presented here, excess hemolysis was noted in the effluent line and the wash volume was increased. In conclusion, this case showed that intraoperative blood salvage can be successfully applied in patients with beta thalassemia, in spite of the increased vulnerability of RBCs to trauma but that added caution needs to be applied when doing. Further study is warranted.

References

SOAP A58
PERFORMANCE OF THE PPUCII SCORE IN THE EVALUATION OF NORMAL AND ABNORMAL POSTPARTUM UTERINE CONTRACTION AND HEMORRHAGE AFTER CESAREAN SECTION
Singh H, Gei AF, Vadhera RB, Vanhook JD, Hankins GD
UTMB, Galveston, TX

Introduction: The roles of uterine contractility and postpartum bleeding are intrinsically related but remain very subjective concepts. The goal of this study was to assess the performance of a specifically designed score among pregnant patients with or without diagnosis of uterine atony or hemorrhage.

Materials and Methods: Following Institutional Review Board approval, 48 pregnant women undergoing elective or semi-elective cesarean section were consented to participate in this study. Verbal consent was obtained from all the patients before the procedure. Patients requiring urgent cesarean section or with platelet counts of less than 100,000 were excluded from the study. For all patients, the uterine contractility and the amount of bleeding were assessed by the surgeons prompted by the anesthesiology faculty or resident using a semi-quantitative score of the uterine bleeding, size of the uterus and myometrial tone. The lowest possible score was 0 and the highest score was 12. The evaluations were performed at 1, 3 and 5-min after delivery of the placenta. The subjective blood loss was estimated by the surgeons. The diagnosis of atony or hemorrhage was made intraoperatively by the surgeons.

Results: The mean age of the patients was 28 +/- 5.6 years and the mean gestational age was 38.9 +/- 1.7 weeks. The majority of the patients underwent a low uterine transverse incision (91.4%). Spinal subarachnoid block was the most frequently employed anesthesia (87.2%). The average blood loss was 957.7 +/- 215.4 ml. Four patients were diagnosed with uterine atony or intrapartum hemorrhage; their blood loss was estimated at 1450 +/- 208.1 ml (P=0.02). The median scores (and ranges) for the patients with normal bleeding (no atony or PP hemorrhage) were 5 (2-11), 4 (2-8) and 3 (0-5) at 1, 3 and 5-min respectively. The corresponding figures for the patients with diagnosis of uterine atony and/or intrapartum hemorrhage were 6 (5-9), 6.5 (5-9) and 5 (4-6). These differences were statistically significant for the scores at 3 and 5-min.

Discussion: The process of postpartum uterine involution and bleeding are interrelated phenomena difficult to assess clinically. A semi-quantitative score can effectively discriminate between patients with normal and abnormal bleeding or uterine atony during cesarean section.

SOAP A59
GOAL-DIRECTED AUTOLOGOUS BLOOD COLLECTION IN MITRAL STENOSIS
Hess P, 2 Goradia M, O'Connor J
1Beth Israel Deaconess Medical Center, Boston MA; 2The Children's Hospital, Boston MA

Mitral stenosis (MS), which is most often due to rheumatic heart disease, is the most common acquired valvular abnormality. Patients with MS are often symptomatic during pregnancy, and are likely to have life-threatening complications during labor and delivery. We present a case of MS in which an impending complication was successfully avoided using a goal-directed, autologous blood collection.

Case: KG is a 37y.o G3P1 term parturient who presented for elective cesarean delivery. Her previous delivery was complicated by an emergency cesarean for fetal distress during labor. Shortly after delivery of her live-born neonate she developed hypoxemia and acute pulmonary edema, and was transferred to the ICU in congestive heart failure. She recovered over 48 hours and was discharged in good condition. During the present pregnancy, she developed symptoms consistent with heart failure starting around 25 weeks gestation. Her echocardiogram showed a myxomatous mitral valve with severe stenosis (gradient of 8mmHg, Area of 1cm²) and regurgitation. After adequate sedation, radial arterial and pulmonary artery (PA) catheters were placed. Initial PA pressures were 27/9mmHg. An epidural catheter was placed and 20cc of 0.5% bupivacaine infused over 40 minutes. At 1 hour the anesthetic level was satisfactory with no change in hemodynamics. During surgery she had brief episodes of tachycardia (>90bpm) with elevations of the PA pressures to 40/20. These episodes were successfully treated with midazolam and reassurance. Shortly after delivery, the PA pressures rose to 75/35, and she complained of shortness of breath. Nitroglycerine was administered, without effect. An autologous blood collection bag was attached to the central line, and 35cc of blood was rapidly siphoned. Immediately after this collection, the PA pressures decreased to 44/21, and the patient reported relief of her symptoms. She had an uneventful recovery and was discharged on the fourth postpartum day. Her hematocrit remained above 30% and the collected blood was discarded.

Discussion: The physiologic changes of pregnancy (increased blood volume, tachycardia) are poorly tolerated in patients with significant MS, and are especially worse after 28 weeks. During labor, the required increase in cardiac output leads to hypoxemia and decompensation, and the uterine autotransfusion classically results in pulmonary edema. The acute and symptomatic pulmonary hypertension postpartum was likely due to autotransfusion, and was corrected with phlebotomy. Phlebotomy can be used safely in the parturient, and could be considered for the treatment of acute volume overload.

SOAP A61
REMIFENTANIL USE FOR CS IN PARTURIENTS WITH SEVERE AORTIC STENOSIS
Grange CS, Orme RLME
Nuffield Department of Anaesthetics, Oxford, Oxfordshire, UK

Choice of anesthesia for cesarean section (CS) in parturients with severe aortic stenosis (AS) remains controversial. Possible advantages of high dose opioid based general anesthesia (GA) include improved cardiovascular (CV) stability and airway protection in the event of clinical deterioration. However, major concerns with this technique in parturients include neonatal depression and delayed extubation of the mother. We report the use of remifentanil based GA for CS in 3 patients with severe AS. Aortic valve areas were 0.8, 0.6, 0.8 cm² respectively. Surgery was performed electively with full cardiothoracic surgical backup. All patients received antacid prophylaxis, antibiotic endocarditis prophylaxis and were positioned supine with left uterine displacement. Intravenous, arterial and central venous lines were inserted under local anesthesia. Following pre-oxygenation, a modified rapid sequence induction was performed using remifentanil 2-4mg·kg⁻¹, etomidate and suxamethonium. Patients were intubated and ventilated with respiration maintained using a remifentanil infusion (0.05-0.15mg·kg⁻¹·min⁻¹), vecuronium, nitrous oxide, oxygen and a volatile agent. Parturients 1 and 2 were CV stable throughout surgery, parturient 3 only became CV unstable following a 1500ml postpartum hemorrhage (due to atony) and required additional oxytocin, together with ergometrine and prostaglandin F2a. Hypotension in case 3 was combated using metaraminol, norepinephrine, calcium and atropine. Prior to the end of surgery intravenous morphine was titrated in all patients to provide satisfactory maternal analgesia. All parturients were extubated successfully ≤8 minutes after completion of surgery.

<table>
<thead>
<tr>
<th>Case</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gestation (wks)</td>
<td>38</td>
<td>38</td>
<td>37</td>
</tr>
<tr>
<td>Induction-delivery time</td>
<td>4 mins</td>
<td>3 mins</td>
<td>15 mins</td>
</tr>
<tr>
<td>Apgar 1 min</td>
<td>10</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>Apgar 5 min</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Umbilical art pH</td>
<td>7.31</td>
<td>7.32</td>
<td>7.29</td>
</tr>
</tbody>
</table>

Conclusion: Remifentanil based GA for CS in parturients with severe AS can provide maternal cardiovascular stability, minimal neonatal respiratory depression and allow rapid maternal postoperative tracheal extubation.

References:
SOAP A63

SALUTORY EFFECTS OF EPIDURAL ANESTHESIA ON THE CIRCULATION OF A PARTURIENT WITH MODIFIED FONTAN PROCEDURE DURING CESAREAN SECTION: A PHYSIOLOGICAL ANALYSIS

Koenig LF, Vasdev GM, Kamath GS
Mayo Clinic, Rochester MN

Introduction: Women with Fontan repair have a fertility rate as high as 33%. We present a case of a parturient with a modified Fontan procedure and Blalock-Taussig Shunt (BTS) who presented for a planned Cesarean section (CS).

Case Presentation: A 22-year-old G1P0 born with a common atrioventricular valve, pulmonary valve atresia and a common ventricle, presented for delivery at 25 weeks. As a neonate she underwent a RBTS and atrial septectomy. At age 11 she had a modified Fontan. The patient subsequently had frequent single and paired supraventricular premature contractions for which she was treated with digoxin and lisinopril. She had a 1st AV block with a rate of 90 beats per minute. Pre-conception cardiopulmonary tests demonstrated 76% of predicted maximal O2 consumption, maximal HR of 171 bpm and O2 saturation of 95% at maximal stress. Her transthoracic echo showed Fontan anatomy, EF 45%. MRI scan using cine loop short axis tomograms calculated an EF of 55% with wide venous pathway and both right and left pulmonary arteries. At 33 weeks the patient was admitted to the hospital for increasing fatigue. Anesthesia for CS was achieved using a lumbar epidural. Right radial arterial line was placed and epidural was loaded with 0.5% bupivacaine. One liter of Ringer’s solution was infused; her blood pressure increased from 120/70 to 140-160/80-85 and remained elevated until the end of CS. The heart rate remained in the 80s even during administration. Epidural morphine was given prior to the epidural being removed. Patient was transferred to the ICU for postoperative monitoring.

Discussion: In Fontan physiology, the component of venous return by the IVC, is approximately 60%. With venodilatation this decreases due to increased capacity. The bi-directional caval-pulmonary anastomoses are designed to decrease pulmonary congestion. Pulmonary congestion becomes more evident in parturients secondary to the physiological effects of pregnancy. Elevated afterload is inherent in Fontan physiology. Increasing the capacitance of the vascular system during regional anesthesia theoretically should improve cardiac function. This is achieved by decreasing the pulsatile and non-pulsatile components of the afterload. Positive pressure ventilation increases PVR and can significantly reduce cardiac output, hence general anesthesia is relatively contraindicated. Ventricular unloading of the Fontan procedure is associated with better ventricular function. Compensated chronotropic response is relatively limited in these patients; therefore, the use of ephedrine as a pressor is not recommended routinely. Phenytoinphrine would be the agent of choice for significant decreases in afterload.

Summary: A thorough understanding of the anatomy and physiology of the Fontan procedure is critical in determining the anesthetic management of parturients. Lumbar epidural anesthesia for CS is highly recommended.

SOAP A64

ANESTHESIA FOR CESAREAN SECTION IN A PATIENT WITH MARFAN SYNDROME, SEVERE AORTIC ROOT DILATION,KYPHOSCOLIOSIS, AND DURAL ECTASIA

Griggs RC, Muir H, Habib A, Millar S
Duke University Medical Center, Durham, NC

Introduction: Marfan Syndrome is a genetic disorder of connective tissue with significant cardiovascular and musculoskeletal complications. Case Report: A 21 year old G1P0, 56 kg, white female presented at 33 weeks gestation for elective cesarean section. She had a history of Marfan Syndrome, with aortic root dilation of 5.8cm, severe mitral valve regurgitation/prolapse, and severe thoracolumbar kyphoscoliosis. She had a normal airway exam and no evidence of pulmonary compromise. The patient continued on perioperative atenolol and digoxin. To minimize hemodynamic stress and provide post-op analgesia a continuous spinal technique was planned. The anesthesia team and interventional radiologist placed a spinal catheter at L5/S1 utilizing CT fluoroscopic guidance with an 18g pencil-point epidural needle; later review noted dural ectasia. Left radial arterial and right internal jugular venous catheters were placed. After careful positioning in the OR, isobaric bupivacaine 10mg was administered via spinal catheter. Patchy spread was noted by sensory testing. A further 7.5mg of hyperbaric bupivacaine administered over the next 30 min combined with repositioning led to only marginal improvement. General anesthesia was administered with a RSI using IV propofol, succinylcholine, and fentanyl. The patient underwent an uncomplicated primary low transverse cesarean section with delivery of a viable male, Apgars 7/8, and was extubated before transfer to the CCU. Morphine 0.15mg was administered via spinal catheter and analgesia maintained with patient-controlled spinal analgesia (bupivacaine 2.5mg, fentanyl 25ug, 45min lockout) for 18hrs post-op; the catheter was then removed. She was transferred to a regular floor day 2. With headache and neck pain noted day 3, the patient declined epidural blood patch for likely post dural-puncture headache. Therapy with cosyntropin 350ug IV, NSAIDS and oral opioids provided some relief. The patient was discharged day 5, and the headache had resolved by day 9.

Discussion: Women with Marfan Syndrome are at significant risk of aortic dissection in pregnancy; aortic root dilation may be a predictor of risk (2). In the setting of severe aortic root dilation, anesthetic management focuses on decreasing contractility with beta blockade and avoiding stress to the aortic root (3). In this patient, severe kyphoscoliosis and dural ectasia likely limited the efficacy of neuraxial anesthesia (4). We are unaware of prior reports of failed spinal anesthesia in patients with dural ectasia.

References:
INTRODUCTION: Pregnancy complicated by primary pulmonary hypertension (PPH) has a 35-56% maternal mortality rate [1,2].

Case Report: A 32 year old G2PO with an asymptomatic, congenital membranous VSD (inoperable) was diagnosed with severe PPH (pulmonary artery pressure [PAP] was 129/66 mmHg), detected on a routine follow-up echocardiogram at 24 weeks gestation. Eisenmenger’s syndrome was ruled out due to the small size of the VSD and no shunt reversal. Therapy was started with prostacyclin, digoxin, enoxaparin, and aldactone, which resulted in a decrease in PAP (85/50 mmHg). A cardiology, maternal-fetal medicine, neonatology, and anesthesiology multidisciplinary team opted for a vaginal delivery with epidural analgesia. However, at 31 weeks, fetal presentation was breech, and external cephalic version was attempted. A pulmonary artery catheter (PAC), arterial line and lumbar epidural were placed. Version with epidural anesthesia (0.125% bupivacaine, 15cc) failed despite 60mcg nitroglycerin IV. A cesarean section was planned for the next day, with cardiopulmonary bypass standby. The epidural was dosed with 100mcg fentanyl and 20cc of 2% lidocaine over 35 minutes to achieve a T4 level. Nitric oxide (NO) was administered at 20-40ppm via nasal cannula (with 4L O2). A cardiac output of 6-7 L/min and CVP of 4mmHg were maintained. No pressors were given. The patient remained hemodynamically stable, and the intra-operative course was uneventful. NO was tapered off within 24 hours and the epidural maintained for 2 days of pain management. The patient was discharged from the ICU on postoperative day 3. Over the next 24 hours, the patient became increasingly tachycardic, dyspneic and diaphoretic which acutely worsened following a bowel movement. She was transferred back to the ICU, where she was intubated and subsequently suffered cardiac arrest. She was placed on ECMO until declared brain dead a day later. Echocardiogram on ECMO showed severe RV dilation and hypokinesis, mild-moderate TR, VSD with L>R shunt, and marked inter-ventricular septal flattening. Autopsy report revealed no signs of pulmonary embolus.

Conclusion: Valsalva maneuver is known to increase right heart pressures and could have exacerbated right heart failure in an already compromised patient. Most deaths involving PPH occur in the immediate postpartum period up to 10 days post-delivery. This suggests that it may be reasonable to continue monitoring with a PAC for at least one week in an intensive care setting, regardless of how stable the patient appears.

References:

INTRODUCTION: Primary pulmonary hypertension (PPH) during pregnancy is a rare but serious disease with 50% mortality. Death usually occurs immediately postpartum due to right ventricular (RV) failure and cardiovascular collapse. Peripartum therapy should maximize RV performance by avoiding atelectasis, hypoxemia, hypercarbia, and arrhythmias.

Case Report: A 36 yo G4P3 was admitted at 30 weeks gestation with newly diagnosed PPH. Pulmonary artery (PA) systolic pressures >90 mmHg were estimated by echocardiography, with a mean PA pressure of 42. Treatment with nifedipine did not lower PA pressures. The patient was heparinized and started on IV prostacyclin titrated up to 11.78 ng/kg/min. At 35 weeks gestation, she was transferred to the ICU, heparin was discontinued, a PA catheter was placed, and she was converted from IV to inhaled prostacyclin. Inhaled prostacyclin is administered at Washington University under an FDA approved investigational new drug license via a continuous nebulizer containing a solution of 20,000 ng/ml at 8 ml/hr. PA pressures decreased from 83/36 (52) to 62/28 (40) within one hour of starting inhaled prostacyclin. During this time, SvO2 increased from 54% to 64%. An epidural was placed and labor was induced with oxytocin. Within 4 hrs the cervix was completely dilated. A healthy infant was delivered by forceps. During the course of labor PA pressures ranged from 64/12 (29) to 91/31 (51) with SvO2 ranging from 59% to 76%. Postpartum, IV prostacyclin was restarted and titrated up to her predelivery dose without changing PA pressures or SvO2. Inhaled prostacyclin was discontinued 8 hours postpartum. She was discharged on day 4 on IV prostacyclin and coumadin.

Discussion: PPH in pregnancy is difficult to manage. Current modes of therapy include calcium channel blockers, nitric oxide, and IV prostacyclin. This is the first reported case of PPH in which inhaled prostacyclin was used during delivery. Inhalation is not currently an approved route of administration of prostacyclin, so the drug was administered under an investigational protocol. The outcome was successful and we believe that this approach may have advantages over other therapies. Calcium channel blockers did not lower pulmonary pressures in our patient. IV prostacyclin can inhibit platelet aggregation, which could increase the risk of epidural hematoma during neuraxial anesthesia. Nitric oxide has toxicity issues, is expensive, and is difficult to titrate in non-intubated patients. Inhaled prostacyclin therapy should be considered in future parturients with PPH.
POSTER REVIEW I

SOAP A67
CENTRAL VENOUS CATHETER PLACEMENT ASSISTED BY OBSTETRICAL ULTRASOUND-A CASE REPORT
Furs, CM, Muir HA, Habib A, DeBalli P, Schultz JR
Duke University Medical Center, Durham, NC

Obtaining venous access in parturients is usually uncomplicated. We report a case of a parturient with unusually difficult access secondary to her morbid obesity and coexisting disease. A 32 y/o G1P0 presented to labor and delivery with a singleton pregnancy at 26 weeks gestation. Past medical history was significant for hypothyroidism, chronic hypertension, and acute congestive heart failure, with an LVEF <30% by echocardiogram. The patient was morbidly obese with poor intravenous access. Deterioration in the patient's condition prompted the decision to obtain central venous access. At the bedside, several attempts at right internal jugular vein (IJV) and subclavian vein puncture were unsuccessful. A chest radiograph was negative for pneumothorax. Based on non-reassuring fetal heart tracing, the patient was taken the operating room for cesarean section. After optimal positioning on the operating table, another attempt at percutaneous right IJV cannulation was unsuccessful. At this time, in order to improve visualization of the vasculature, a standard obstetrical ultrasound system (Aloka SSD-1700 Dynaview II) was brought into the OR. The 3.5 mHz curvilinear probe was used to produce a two-dimensional image of the right IJV and carotid artery, and successful cannulation ensued. The patient had an uneventful cesarean delivery under spinal anesthesia with arterial and central venous pressure monitoring. Of note, the IJV was considerably more medial than expected, and success without visualization would likely have been very difficult. Furthermore, neither of the anesthesia staff involved in the case had any formal ultrasound training. In conclusion, when obtaining central venous access in pregnant patients, the obstetric ultrasound system is an often overlooked resource which can provide crucial information and improve patient safety.

SOAP A68
A CLUSTER ANALYSIS MODEL FOR LABOR PROGRESS AND OUTCOME
Sullivan JT, McCarthy RJ, Fitzgerald PC, Scavone BM, Wong CA
Northwestern University Feinberg School of Medicine, Chicago, IL

Introduction: We have developed a model of labor progress with the goal of facilitating the study of labor pathophysiology. Severe labor pain has been associated with an increased incidence of cesarean delivery and has been identified as an increasingly important marker of dysfunctional labor.1,2 Evidence of dysfunctional labor may be more readily identified when pain intensity is evaluated in conjunction with speed of cervical dilation.

Methods: From our perinatal database we identified 120 consecutive parturients who presented in spontaneous labor for a pilot study. From their medical records we collected data on the cervical dilation and pain verbal rating score. Method of delivery was recorded as spontaneous or assisted vaginal delivery or cesarean section. Cluster models were developed based on 2-step cluster analysis using Schwartz's Bayesian criteria. Model 1 incorporated parity, gestational age and cervical dilation at the time of admission to labor and delivery and at first request for analgesia. In Model 2, pain scores at admission and at analgesia request were added to the previous variables in Model 1.

Results: Model 1 identified 2 clusters of patients primarily characterized by parity and admission cervical dilation. The area under the receiver operator (ROC) curve was 0.383 (95% confidence interval (CI) of 0.237-0.529). Model 2 identified 3 clusters of patients primarily characterized by parity, admission cervical dilation and admission pain. The area under the ROC curve was increased to 0.552 (95% CI: 0.393-0.712).

Discussion: Dysfunctional labor remains a poorly understood phenomenon. Modeling developed to predict labor outcome from early clinical variables should include progression of pain in addition to the progression of cervical dilation. The development of cluster analysis modeling may aid in the further understanding of labor pathophysiology.

SOAP A69
EFFECTS OF EPIDURAL ANALGESIA IN EARLY LABOR ON CESAREAN DELIVERY
Sharma SK, Alexander JM, Wiley J, McIntire DD, Leveno KJ
UT Southwestern Medical Center, Dallas, TX

Introduction: It has been recommended that epidural analgesia should be delayed until cervical dilation reaches 4-5 cm so as not to interfere with labor and cause unnecessary cesarean delivery (1). Our purpose was to determine whether administration of epidural analgesia during early labor (£3 cm cervical dilation) affects the cesarean rate when compared to early labor IV meperidine.

Methods: This study is a analysis of data previously reported from 5 randomized trials where the effects of epidural analgesia on the cesarean rate were compared to IV meperidine (2-6). A total of 2703 nulliparous women who requested analgesia for labor pain relief were randomized in these 5 studies.

Results: 1339 women were randomized to epidural analgesia, and 1099 actually received epidural analgesia. Similarly, of 1364 women allocated to IV meperidine analgesia, 1017 received IV meperidine. A total of 587 women did not receive their allocated analgesia and were excluded from this analysis. Demographic factors including maternal age, weight, height, gestational age, and cervix dilation at initiation of analgesia were similar in both study groups. There was no significant difference in the incidence of cesarean delivery due to dystocia between the epidural and meperidine groups when analgesia was initiated at £3 cm compared to £4 cm cervical dilation. However, the cesarean rate was significantly increased when analgesia was administered at £3 cm versus £4 cm cervical dilation in both the epidural and meperidine groups.

Conclusion: Women requiring analgesia early in labor are at increased risk for cesarean delivery but this risk is independent of the type of analgesia used suggesting that epidural analgesia should not be withheld in early labor.

Table: Cesarean delivery for dystocia

<table>
<thead>
<tr>
<th>Timing of Analgesia</th>
<th>Epidural (n=1099)</th>
<th>Meperidine (n=1077)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>£3 cm cervical dilation</td>
<td>40 / 258 (16)*</td>
<td>38 / 246 (15)*</td>
<td>0.99</td>
</tr>
<tr>
<td>£4 cm cervical dilation</td>
<td>56 / 785 (7)</td>
<td>44 / 727 (6)</td>
<td>0.43</td>
</tr>
</tbody>
</table>

P* < 0.001 compared to £4 cm cervical dilation

Reference:
1. ACOG. Washington DC; August 2000.
3. Anesthesiology 1997;87:487.

SOAP A70
ELECTIVE INDUCTION VS. AUGMENTATION: THE IMPACT OF PATIENT DEMOGRAPHICS ON CESAREAN SECTION UNDER EPIDURAL ANALGESIA
Kaul B, Vallejo MC, Mandell GL, Ramanathan S, Daftari AR
Anesthesiology, University of Pittsburgh and Magee Women's Hospital, Pittsburgh, PA

Introduction: In a previous study, we found the incidence of cesarean section (C/S) was higher in parturients when oxytocin was used for elective induction compared to oxytocin augmentation (1). The purpose of this study is to determine if there is a relationship between C/S and patient demographics in parturients who receive oxytocin for elective induction vs. labor augmentation under epidural analgesia.

Methods: A total of 1671 healthy, nulliparous women with uncomplicated pregnancies who received labor epidural analgesia (LEA), were identified from a CQI database. All parturients received oxytocin during labor (as per hospital standard protocol), either for elective induction or augmentation of labor. All parturients received a continuous infusion of bupivacaine (0.125%) or ropivacaine (0.1%) with fentanyl (2 mg/ml) for LEA. Measured variables included patient demographics (height, weight, age) and neonatal weight. Logistic regression was used to determine the possible association of C/S with the variables in the two groups. Odds Ratio (OR) was calculated wherever statistically possible.

Results: Maternal demographics (height, age, weight) had a higher OR for C/S in the oxytocin induction group compared to the oxytocin-augmented group (Table). In the induction group, height had an inverse relationship with C/S (increasing height being associated with lower probability of C/S), while increasing maternal age and weight increased the odds of having C/S. In the augmented group only maternal age influenced the chance of C/S. Increasing neonatal weight was also significantly associated with increased odds for C/S in both the induced as well as the augmented group.

<table>
<thead>
<tr>
<th></th>
<th>Induction (n=675)</th>
<th>Augmented (n=996)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal Demographics</td>
<td>p&lt;0.000; OR 6.2</td>
<td>p&lt; 0.05</td>
</tr>
<tr>
<td>height</td>
<td>p&lt;0.01</td>
<td>p=0.217</td>
</tr>
<tr>
<td>age</td>
<td>p&lt;0.000</td>
<td>p=0.01</td>
</tr>
<tr>
<td>weight</td>
<td>p=0.001</td>
<td>p=0.363</td>
</tr>
<tr>
<td>Neonatal Weight</td>
<td>p&lt;0.000; O.R. 12.2</td>
<td>p&lt;0.000</td>
</tr>
</tbody>
</table>

Conclusion: When studying the effects of patient demographics on the C/S rate under labor epidural analgesia, it is important to distinguish between labor induction vs. labor augmentation.

Reference:
COMBINED-SPINAL EPIDURAL WITH PATIENT-CONTROLLED EPIDURAL ANALGESIA: A QA SURVEY OF MATERNAL SATISFACTION AND COMPLICATIONS

Landau R, Giraud R, Kern CG
University Hospital of Geneva (HUG), Geneva

Background: Combined-spinal epidural (CSE) and patient-controlled epidural analgesia (PCEA) are popular methods for initiation and maintenance of labor analgesia. As part of a quality assurance (QA) program, we assessed anesthetic complications, obstetrical and neonatal outcomes, and maternal satisfaction, using standardized analgesia regimens with PCEA.

Methods: With IRB approval, data was gathered from all parturients delivering with neuraxial analgesia from July 2001. Choice of epidural (EPID) or CSE was made by anesthesiologist. CSE consisted of spinal 2.5mg bupivacaine (BUP) & 25mg fentanyl (F), followed immediately by PCEA BUP 0.0625% & F 2mg/cc (10cc infusion, 5cc bolus/15'). For EPID, BUP 0.125% 10cc & 50mg F was given after a 3cc BUP 0.25% (test dose), with same PCEA settings. QA form, started in the Labor Room, was completed 24-72 hours postpartum with a follow-up of complications and maternal satisfaction.

Results: We recorded 2597 cases (71% CSE, 29% EPID) over 18 months. Unpaired t-tests were used, p<.05 significant, relative risk (RR) presented with 95% CI.

Table: Complications and maternal satisfaction

<table>
<thead>
<tr>
<th>Complication</th>
<th>EPID (n=761)</th>
<th>CSE (n=1836)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uterine hypertonus→fetal brady</td>
<td>2.3%</td>
<td>3.4%</td>
</tr>
<tr>
<td>Paresthesia during procedure</td>
<td>14%</td>
<td>16%</td>
</tr>
<tr>
<td>No CSF during CSE</td>
<td>-</td>
<td>6%</td>
</tr>
<tr>
<td>Wet tap (18G)+ epid cath placed</td>
<td>0.4%</td>
<td>0.4%</td>
</tr>
<tr>
<td>Unexpected spinal catheter</td>
<td>0.4%</td>
<td>0.4%</td>
</tr>
<tr>
<td>Failed analgesia→ cath replaced</td>
<td>6.2%</td>
<td>3.1%</td>
</tr>
<tr>
<td>Failed analgesia→ GA for CS</td>
<td>1.8%</td>
<td>0.9%</td>
</tr>
<tr>
<td>Postdural puncture headache (n)</td>
<td>0.5% (4)</td>
<td>0.7% (13)</td>
</tr>
<tr>
<td>PDPH requiring blood patch (n)</td>
<td>4/4</td>
<td>10/13</td>
</tr>
<tr>
<td>Neurol deficits (% due to anesth)</td>
<td>1% (0)</td>
<td>1% (0)</td>
</tr>
<tr>
<td>Pruritus</td>
<td>22%</td>
<td>23%</td>
</tr>
<tr>
<td>Insufficient 1st stage analgesia</td>
<td>8.2%</td>
<td>4.1%</td>
</tr>
<tr>
<td>Insufficient 2nd stage analgesia</td>
<td>14.9%</td>
<td>12.2%</td>
</tr>
<tr>
<td>Motor block</td>
<td>3.7%</td>
<td>2.4%</td>
</tr>
<tr>
<td>Satisfaction (VAS 0-10, ±SD)</td>
<td>8.8± 2.1*</td>
<td>9.4±1.9</td>
</tr>
</tbody>
</table>

*p<.01, RR 1.6 (1.2;2.1), *p<.01, RR 1.5 (1.2;1.9), *p<.01

Discussion: While introducing new anesthetic techniques, QA surveys offer important tools to monitor outcome parameters. Our data suggests that CSE might provide better labor analgesia than epidurals, with a trend for less motor block. Overall, CSE with PCEA resulted in excellent labor analgesia and maternal satisfaction, with few complications.


SURVEY OF PATIENT SATISFACTION FROM EPIDURAL ANALGESIA FOR LABOR

Weiniger CF, Avidan A
Department of Anesthesiology & ICU, Hadassah Hebrew University School of Medicine, Hadassah Ein Kerem, Israel

Introduction: Epidural analgesia is the standard method of providing analgesia to the parturient. Maintenance of the epidural analgesia is provided by top up boluses or infusion methods, and differs between institutions. Rarely is patient satisfaction with epidural analgesia provided as the primary study outcome. In the current study we surveyed parturients who requested epidural analgesia in order to assess their satisfaction with the maintenance of the epidural analgesia.

Methods: This audit survey was performed in a labor room where an on-demand epidural analgesia service is provided. Patients are offered either on demand top ups from the gynecologist, or PCA (patient controlled analgesia) according to the whim of the anesthesiologist. A questionnaire was completed by the midwife attending during labor, after epidural analgesia was requested. The questionnaire contained demographic details, the parturient's stage of labor when the request for epidural analgesia was made, the waiting time for epidural analgesia, and the stage of labor prior to the placement of the epidural. At each stage of labor the efficacy of the analgesia (VAS pain scores and requests for additional analgesia) were noted. After labor the maternal satisfaction with the epidural analgesia was recorded.

Results: The preliminary results are presented here from 79 questionnaires. Waiting times for the epidural analgesia were higher during the day shift (although this was not statistically significant). Use of continuous epidural infusions facilitated better pain scores (low pain) in the second stage of labor. Women who were given PCA continuous infusions for their epidural maintenance protocol were less likely to request additional analgesia from the medical staff (p=0.017). Patient satisfaction with epidural analgesia was high for all patients.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Day Shift (n=33)</th>
<th>Evening Shift (n=12)</th>
<th>Night Shift (n=13)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women waiting at least 15 minutes for epidural analgesia once the anesthesiologist was requested</td>
<td>25%</td>
<td>17%</td>
<td>11%</td>
<td>NS</td>
</tr>
<tr>
<td>Percentage of women who were in pain when 2nd stage of labor was diagnosed</td>
<td>51.5%</td>
<td>59%</td>
<td>73%</td>
<td>0.029</td>
</tr>
<tr>
<td>Use of continuous infusions (PCA)</td>
<td>23%</td>
<td>23%</td>
<td>13%</td>
<td>NS</td>
</tr>
<tr>
<td>Average Satisfaction score (VAS score: 0-low 10 = high)</td>
<td>9.0</td>
<td>9.1</td>
<td>9.2</td>
<td>NS</td>
</tr>
</tbody>
</table>

(VAS = visual analogue scale, PCA = Patient Controlled Analgesia, * = significant result)

Discussion: The initial analgesia after the induction of epidural analgesia was good, yet more than 50% of women were in pain in the second stage of labor. Maintenance of epidural analgesia can be improved by the use of PCA continuous infusions. Despite this objective failure to provide adequate analgesia throughout labor, overall maternal satisfaction with epidural analgesia is high.

Reference
2. This audit was possible due to the assistance of the midwives in Hadassah Mt. Scopus, Jerusalem, Israel.
POSTER REVIEW II

SOAP A73
SPONTANEOUS VAGINAL DELIVERY AND AMBULATION AFTER "MOBILE" EPIDURAL ANALGESIA IN LABOR. THE COMPARATIVE OBSTETRIC MOBILE EPIDURAL TRIAL
COMET STUDY GROUP UK
Wilson MJ A
University of Washington, Seattle, WA

Introduction: We recently demonstrated that Combined Spinal Epidural (CSE) and Low Dose Infusion (LDI) epidural techniques, for analgesia in labor, are associated with a reduced instrumental vaginal delivery rate, relative to traditional epidurals. It is unclear whether this increase in spontaneous vaginal delivery rate results from factors associated with maternal ambulation in labor per se or the enhanced perineal sensation afforded by "mobile" epidural analgesia, assisting active and passive expulsion of the fetus. We have undertaken a secondary analysis of the association between walking in labor, with a mobile epidural in situ and subsequent delivery mode.

Method: From a total of 1054 nulliparous women recruited to the COMET study, 701 women were randomized in labor, to receive CSE or LDI, each utilising a low-dose mixture of 0.1% bupivacaine with 2 μg fentanyl/ml. A modified "Bromage" score of lower limb power was recorded at 30 minutes after epidural insertion and hourly thereafter, until delivery. A record was made each hour of whether women had remained in bed, stood out of bed or walked. Those women who stood out of bed or walked, at any time in labour, were labelled "ambulatory", those who remained in bed throughout labour were labelled "sedentary". Subgroup analysis of ambulatory and sedentary women was performed for delivery mode.

Results: A similar proportion of women in each "mobile" epidural group were ambulatory during labour: CSE (37.9%) and LDI (36.6%). There was no difference in the incidence of spontaneous vaginal delivery, instrumental vaginal delivery or caesarean section between ambulatory and sedentary groups.

<table>
<thead>
<tr>
<th>Delivery mode</th>
<th>Ambulatory N = 261</th>
<th>Sedentary N = 440</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSE</td>
<td>LDI</td>
<td>CSE</td>
</tr>
<tr>
<td>n=133</td>
<td>n=128</td>
<td>n=218</td>
</tr>
<tr>
<td>Spontaneous Vaginal</td>
<td>61 (46%)</td>
<td>54 (42%)</td>
</tr>
<tr>
<td>Instrumental†</td>
<td>36 (27%)</td>
<td>37 (29%)</td>
</tr>
<tr>
<td>Caesarean</td>
<td>36 (27%)</td>
<td>37 (29%)</td>
</tr>
</tbody>
</table>

† Includes forceps and ventouse (suction) delivery

Conclusion: Within the limitations of subgroup analysis, there was no association between ambulation after "mobile" epidural analgesia and delivery mode.

References

SOAP A74
THE COMPARATIVE OBSTETRIC MOBILE EPIDURAL TRIAL (COMET): LONG-TERM OUTCOMES
Moore P, MacArthur C, Shennan A, Cooper GM
Birmingham Women’s Hospital, Birmingham West Midlands; Guys, King’s & St. Thomas’ School of Medicine, London

Introduction: 1054 primiparous women, requesting epidural analgesia, were randomised to receive traditional (Trad) intermittent boluses of 0.25% bupivacaine, combined spinal epidural (CSE) or low-dose infusion (LDI), both using 0.1% bupivacaine with fentanyl 2mcg/ml. Analysis of intrapartum data demonstrated that both CSE and LDI were associated with increased spontaneous vaginal delivery, relative to traditional epidurals. We now present the long term outcomes.

Method: The primary long term study outcome measure was backache which had occurred within three months of the birth and persisted for longer than six weeks. This was assessed by postal questionnaire completed by the women at twelve months postpartum. The secondary long term outcome measures were headache, neck ache and paraesthesiae in the buttocks and legs, assessed in the same manner.

In addition to the women included in the trial, the questionnaire was sent to a matched comparison (Comp) group of women who did not receive epidural analgesia.

Results: There was no significant difference in the incidence of backache, neck ache or paraesthesiae reported in either of the mobile groups compared with traditional. There was significantly less headache found in the mobile groups compared with the non-randomised comparison group who had not received epidural analgesia.

<table>
<thead>
<tr>
<th></th>
<th>Trad</th>
<th>CSE</th>
<th>LDI</th>
<th>Comp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recruited</td>
<td>n=353</td>
<td>n=351</td>
<td>n=350</td>
<td>n=351</td>
</tr>
<tr>
<td>Questionnaire returned (%)</td>
<td>262(78.0)</td>
<td>266(78.0)</td>
<td>262(78.4)</td>
<td>251(73.2)</td>
</tr>
<tr>
<td>Backache (%)</td>
<td>123 (46.9)</td>
<td>111 (41.7)</td>
<td>120 (45.8)</td>
<td>97* (38.6)</td>
</tr>
<tr>
<td>Headache (%)</td>
<td>52 (19.8)</td>
<td>33* (12.4)</td>
<td>38 (14.5)</td>
<td>36 (14.3)</td>
</tr>
<tr>
<td>Neck ache (%)</td>
<td>23 (8.8)</td>
<td>17 (6.4)</td>
<td>23 (8.8)</td>
<td>21 (8.4)</td>
</tr>
<tr>
<td>Paraesthesia (%)</td>
<td>15 (5.7)</td>
<td>11 (4.1)</td>
<td>12 (4.6)</td>
<td>9 (3.6)</td>
</tr>
</tbody>
</table>

* P<0.05

Conclusion: Neither CSE nor LDI epidurals were associated with any increase in the incidence of long term side effects compared with traditional epidural. Importantly these data confirm the conclusion that the continued routine use of high dose traditional epidural analgesia for labour can no longer be justified.

(Footnotes)
1 Comparative Obstetric Mobile Epidural Trial (COMET) Study Group UK: Effect of low-dose mobile versus traditional epidural techniques on mode of delivery. Lancet 2001; 358: 2
POSTER REVIEW II

SOAP A75
THE COMPARATIVE OBSTETRIC MOBILE EPIDURAL TRIAL (COMET): WOMEN'S PERCEPTIONS OF CONTROL DURING LABOUR
Cooper GM, MacArthur C
University of Birmingham, Birmingham, West Midlands

Introduction: Retaining control is viewed as an important criterion in satisfaction with childbirth. In the COMET study women requesting epidural analgesia were randomized to a traditional (trad) epidural or one of two 'mobile' techniques, combined spinal epidural (CSE) or low-dose infusion (LDI). A matched comparison group who did not have epidural analgesia (no epid) was identified.

Method: Visual analogue scores (VAS, 0 = complete control and 100 = no control at all) for feeling of control in labour were obtained the day after delivery from women who had a vaginal delivery. Complete control was defined as a VAS of 0. Since the non-epidural group contained more spontaneous deliveries, this could skew the results. Spontaneous and assisted deliveries were therefore examined separately.

Results: For spontaneous delivery, the level of control felt during labor (table), expressed as median value and the proportion (%) who felt in complete control was significantly greater for CSE, and proportionately greater for LDI, relative to traditional epidural: the non-epidural group however, did not differ. The table illustrates that control is generally greater in spontaneous compared with assisted vaginal deliveries, with almost a two fold difference in median VAS. Among assisted deliveries, the type of pain relief did not seem to make much difference.

<table>
<thead>
<tr>
<th>Delivery Type</th>
<th>Trad</th>
<th>CSE</th>
<th>LDI</th>
<th>no epid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spontaneous</td>
<td>122</td>
<td>147</td>
<td>147</td>
<td>249</td>
</tr>
<tr>
<td>Median VAS</td>
<td>24</td>
<td>19*</td>
<td>15</td>
<td>21</td>
</tr>
<tr>
<td>% complete control</td>
<td>17</td>
<td>30</td>
<td>22</td>
<td>15</td>
</tr>
<tr>
<td>Assisted</td>
<td>129</td>
<td>102</td>
<td>96</td>
<td>51</td>
</tr>
<tr>
<td>Median VAS</td>
<td>42</td>
<td>29</td>
<td>29</td>
<td>31</td>
</tr>
<tr>
<td>% complete control</td>
<td>13</td>
<td>15</td>
<td>17</td>
<td>12</td>
</tr>
</tbody>
</table>

* p<0.05

Conclusion: Women experienced a pattern of greater feeling of control with mobile epidurals compared to those who received a Traditional technique. However it is of note that non-epidural births were not associated with any greater feeling of control than traditional epidurals.

(footnotes)
1 Comparative Obstetric Mobile Epidural Trial (COMET) Study Group UK: Effect of low-dose mobile versus traditional epidural techniques on mode of delivery. Lancet 2001; 358: 2

SOAP A76
IS IT SAFE TO USE INTRATHECAL CATHETERS IN OBSTETRIC PRACTICE?
Ranasinghe S, Takeko T, Pons M, Steadman J, Lai M
University of Miami, Jackson Memorial Medical Center, Miami, FL

Introduction: Our obstetric unit, which is a tertiary care center, manages many high-risk obstetric patients. We have chosen to utilize continuous spinal anesthesia which has many positive characteristics of an ideal regional anesthetic technique. These intrathecal catheters were placed both intentionally and after accidental dural punctures. We present our review of fifty continuous spinal catheters placed during the last two years.

Method: After obtaining the institutional review board approval, charts of all the patients who received continuous spinal anesthesia or analgesia (CSA) from November 2000 to October 2002 were reviewed. In these patients 20G epidural catheters were inserted through 17G epidural needles intentionally or following an accidental dural puncture especially when it was a difficult epidural placement requiring multiple attempts.

Results: The majority (56%) of the patients were noted to have BMI >30. Intrathecal catheters were placed intentionally in 10 patients (20%) who had BMI >35 using extra long (15 cm) epidural needles. Transient parasthesias were noted during the placement of the catheters in 20 patients (40%). Most of the intrathecal catheters (47 of 50) were placed for cesarean delivery and 39 (83%) of these patients received 0.75% hyperbaric bupivacaine injected in increments of 0.25 cc through the catheter. The total bupivacaine volume required to achieve the initial thoracic 4 dermatomal level block was 0.5 cc to 1 cc with fentanyl 20 ug in 60% of the cases. Lidocaine 2% (2-3 cc) with fentanyl 20ug was used in 8 (17%) patients. In case of labor analgesia, bupivacaine 2.5 mg with fentanyl 25ug was injected intermittently through the catheter.

Although the overall incidence of post dural puncture headache was 15 (28.8%), only 4 (8%) patients required blood patch. The others responded to NSAID. In most cases (47/50), the intrathecal catheter was removed immediately after the cesarean or vaginal delivery. Although there was a high incidence of transient parasthesia, none of the patients developed neurological complications.

Discussion: Continuous spinal anesthesia has several advantages over both single dose spinal and continuous epidural techniques including the reliability, titratability and higher success rate with smaller local anesthetic requirement. There were no catheter failures in this review. The total dose that was required to achieve an adequate block level for cesarean delivery was smaller than normally used in traditional single dose spinal anesthesia in most of the patients. This emphasizes the importance of injecting small incremental doses of local anesthetic through the intrathecal catheter to avoid high block, especially in morbidly obese patient with difficult airway. Intrathecal catheters3 as well as high BMI (>30) has shown to be associated with reduced incidence of postdural puncture headache (PDPH).

In this review most patients complained of mild headache consistent with PDPh and needed NSAID only. In conclusion, we found continuous spinal anesthesia and analgesia using 20G catheter to be safe and reliable, especially in high-risk obstetric patients.

SOAP A77
ARE LABOR EPIDURALS LESS SAFE WITHOUT AN IN HOUSE TWENTY-FOUR HOUR ANESTHESIA SERVICE?
Black IH, Holbrook H, 2Weesner K
Department of Anesthesia, Irwin Community Hospital, Fort Riley, KS; 2Department of Anesthesia, Wilford Hall Medical Center, TX

Objective: With new techniques in labor epidural analgesia (patient controlled epidural analgesia (PCEA), dilute concentrations of local anesthetics), and data from acute pain services without in house coverage, there is a convincing argument that labor epidurals may be safe without a dedicated in house twenty four hour anesthesia service (off site). As there is no data in the literature about this practice we hoped to provide descriptive statistics of neonatal outcomes (Apgars and weight), operative deliveries, and a description of one institution's experience with this practice.

Methods: A retrospective chart review of labor epidurals from an army community hospital. Medical records were cross checked with the birthing log. All epidurals that were in place at least one hour before birth, operational after the duty day (07:00-15:00), or on the weekend, were considered off site epidurals.

Results: There were a total of 718 live births in 2001. Of those 21 % (n=150) were by cesarean section, 9% were operative vaginal deliveries (n=67) and the rest 70% (n=501) were spontaneous vaginal deliveries. If scheduled cesarean deliveries were removed from the denominator approximately 70% of the women had labor epidural analgesia. The charts of the first consecutive 200 births were examined. Of these approximately 80% (n=158) were off site epidurals by our definition. The reported outcomes for off site epidurals were: Apgars (7.7 SD±1.3, 8.8 SD±0.6), fetal weight (3525 gr. SD±504), a cesarean section rate of 15% (n=24), and an operative vaginal delivery rate of 8% (n=13)

Conclusion: Off site labor epidurals appear to have outcomes no different from national averages. A prospective randomized study is needed to definitely answer the question of how, if any, off site epidurals are different from epidurals with a dedicated in house anesthesia provider.

SOAP A78
COMPARISON BETWEEN INTRATHECAL RACEMIC BUPIVACAINE AND LEVOBUPIVACAINE FOR CSE FOR ANALGESIA DURING LABOR
Sah NB, Ramanathan S, Manuel VC, Golebiewski KA
Magee Women's Hospital, Pittsburgh, PA

Background: Combined spinal epidural (CSE) for labor analgesia is commonly performed with a combination of racemic bupivacaine and an opioid. A human study compared racemic bupivacaine and levobupivacaine in combination with sufentanil for labor analgesia and showed a similar sensory block with less intense motor block twenty minutes after administration.1 An animal study showed a motor block of shorter duration with levobupivacaine but a longer lasting sensory block when compared to racemic bupivacaine.2 The purpose of this study was to compare the intensity and duration of motor block and the duration of sensory block with racemic bupivacaine and levobupivacaine.

Method: Patients were randomized into two groups. Group-1 received intrathecal racemic bupivacaine 2.5mg and fentanyl 25mcg and Group-2 received intrathecal levobupivacaine 2.5 mg and fentanyl 25mcg. Pain VAS scores (0-10) and motor block using Modified Bromage Score (MBS) were recorded by a blinded observer at 5,15, 30 and every 30 minutes until pain VAS was >3 at which time the epidural was activated. Baseline vital signs and fetal heart rate were recorded and every 5 minutes for 30 minutes after block initiation. Results are expressed as mean ± SD or median and analyzed using t-test or Mann-Whitney. P < 0.05 is significant.

Results: None of the patients in either group had any noticeable motor block (MBS = 0). The mean duration of sensory block, before epidural activation in Group 1 was 115.6 ± 28.82 mins and Group 2 was 110.9 ± 42.76 mins. (P = 0.715). Group 1 Median VAS at 5 minutes was 3 and Group 2 median VAS was 5 (P = 0.075). At 15 minutes the median VAS was 0 in both groups. Heart rate, blood pressure and fetal heart rate were comparable in both groups.

Discussion: Both racemic bupivacaine and levobupivacaine are similar with respect to pain VAS and motor block, in terms of duration and intensity for CSE. Since the dose of local anesthetic is minimal for CSE, the advantage of less toxicity associated with levobupivacaine does not justify the increased drug cost.
Intrathecal levobupivacaine for labor analgesia using the combined spinal-epidural technique: A comparison with bupivacaine

Balestrieri PJ, Ascari CM, Parker BB
Department of Anesthesiology, University of Virginia Medical System, Charlottesville, VA

Introduction: Levobupivacaine is the pure S(-)-enantiomer of racemic bupivacaine but is has less potential for central nervous system and cardiovascular toxicity than racemic bupivacaine. Although recently introduced for routine use in obstetric anesthesia, comparative clinical studies of its intrathecal use in combined spinal-epidurals for labor are lacking. The aim of this study was to compare the efficacy, duration and side-effect profiles of intrathecal levobupivacaine/fentanyl versus intrathecal bupivacaine/fentanyl for labor analgesia administered through a combined spinal-epidural technique.

Methods: After IRB approval and written informed consent, a prospective, randomized, double-blind study of 19 patients requesting labor analgesia was performed. Patients were all ASA physical status I or II term parturients in active labor <1 cm cervical dilation with singleton gestation who were between the ages of 18 and 44 years. Patients were randomly assigned to one of two groups. Group 1 received a combined spinal-epidural with 1ml of 0.25% PF bupivacaine and 20 micrograms fentanyl intrathecally. Group 2 received a combined spinal-epidural with 1ml of 0.25% levobupivacaine and 20 micrograms fentanyl intrathecally. A continuous epidural infusion was not started until the patient requested additional pain relief.

Results:

<table>
<thead>
<tr>
<th></th>
<th>VAS* Pain Score</th>
<th>Bromage Score</th>
<th>Time to Rescue</th>
<th>Incidence of Pruritus</th>
<th>Percent of Patients Undergoing Vaginal Delivery</th>
<th>Time to Delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td>LevoBupivacaine</td>
<td>0.84 (0.42)</td>
<td>4.0 (0)</td>
<td>95.70 min</td>
<td>85.70%</td>
<td>100%</td>
<td>224.6 min (34.17)</td>
</tr>
<tr>
<td></td>
<td>(n=10)</td>
<td></td>
<td>(7.56)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bupivacaine</td>
<td>1.09 (0.55)</td>
<td>3.75 (0.27)</td>
<td>110.30 min</td>
<td>87.50%</td>
<td>87.5%</td>
<td>534.4 min (118)</td>
</tr>
<tr>
<td></td>
<td>(n=9)</td>
<td></td>
<td>(15.56)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Conclusion: Although none of the differences between the two groups reached statistical significance due to the limited number of patients, the trends suggest that levobupivacaine and bupivacaine do not differ in terms of duration, analgesic efficacy or side effects such as pruritus and motor block when used in the context of combined spinal-epidural for labor. This appears to contradict a prior study which suggested less motor block with levobupivacaine1. Larger studies will hopefully confirm our results.

*All values are either mean, mean with standard error of the mean (SEM) or percentages.

SOAP A81
A COMPARISON OF 0.125% BUPIVACINE, 0.1% ROPIVACAINE AND 0.125% LEVOBUPIVACAINE WITH FENTANYL FOR EPIDURAL LABOR ANALGESIA
Vallejo MC, Darwich AA, Mandell GL, Ramanathan S
University of Pittsburgh, Department of Anesthesia and CCM, Magee-Women's Hospital, Pittsburgh, PA

Background: Racemic bupivacaine (RS-B) is a 50/50 mixture of enantiomers, R (+) and S (-) bupivacaine. Levobupivacaine (S-B) is the pure S (-) enantiomer of bupivacaine. An equipotent dose of S-B is less cardiotoxic compared to RS-B.1 Ropivacaine (R) is also a pure S (-) enantiomer and may produce less motor block than RS-B.2 The present study compares the affect of epidural infusions of RS-B, S-B and R combined with fentanyl on motor block in laboring parturients.

Methods: Following IRB approval, 65 healthy primigravid patients requesting epidural labor analgesia consented to participate in the study. Five patients were eliminated due to protocol violations. Patients were randomized into one of three treatment groups. After administering an epidural test dose of 3 ml of 1.5% lidocaine + 5µg/ml epinephrine, patients received an 8ml epidural bolus of either 0.125% RS-B(n=19) or S-B(n=19), or 0.2% R(n=22) + 100 µg of fentanyl followed by a continuous infusion of the same medication. Concentrations of 0.125% RS-B and S-B, and 0.1% R + 2µg/ml fentanyl at 12ml/hr were used. Visual Analog Scale (VAS) pain scores and the degree of motor block (using the Bromage score, [BS], where a BS=1 indicates complete motor block and a BS=4 indicates no motor block) were determined prior to epidural analgesia and then at hourly intervals until complete cervical dilation was achieved. In addition, demographic data, vital signs and method of delivery were recorded. Data were analyzed using ANOVA and appropriate tests; P<0.05 was statistically significant.

Results: BS and VAS pain scores did not differ between the groups, before the initial bolus, at hourly intervals, or at 10cm cervical dilation. Mean BS at 10cm was 4 in all groups. There was no difference between the total mean volume infused in each group (RS-B=65.1±34.2ml, R=87.3±50.1ml, S-B=84.1±37.4ml)

Conclusions: The concentrations of R, RS-B and S-B used in this study produced effective labor analgesia with no motor block. This makes RS-B more cost-effective than R or RS-B.

References:

SOAP A82
EFFICIENCY OF EPIDURAL NEOSTIGMINE COMBINED WITH SUFENTANIL TO INITIATE LABOR ANALGESIA
Lavandhomme PM, Roelants F, Schreiner M
Anesthesiology Department - St Luc Hospital – UCL, Brussels

Background: During the first stage of labor, a major goal is to provide rapid and profound analgesia without motor blockade, by example using epidural opioids like sufentanil (S) (1). Epidural neostigmine (N), a cholinesterase inibitor, is analgesic and potentiates opioids in postoperative conditions without major side effects (2). The study examines the efficacy of epidural sufentanil-neostigmine combination to initiate labor analgesia.

Material and Methods: After informed consent, at the begin of labor, lumbar epidural catheter was inserted at L3-L4 level in healthy parturients. When VAS (value 0-100) was >30/100, after a test dose, parturients were randomly allocated to receive: S 10µg (S 10; n=24), S 20µg (S20; n=22), S 10µg and N 250µg (SN250; n=20), S 10µg and N 500 µg (SN500; n=25) in a total volume of 12 mL. Pain score at 5, 10, 15, 30 min as well as the time until request for supplemental epidural dose (when VAS >30/100), i.e. duration of analgesia, were assessed. Maternal and fetal vital parameters were monitored. Motor blockade and maternal side effects were also recorded. Statistical analysis used ANOVA and appropriate tests; P<0.05 was significant (* with S10 and SN250).

Results: Parturients did not differ concerning demographic data (% nuliparous, cervical dilatation) and initial VAS (VAS 0; mean±SD). Maternal and fetal parameters remained stable. Analgesia efficiency (AE) = % parturients with VAS <30/100 at 5, 10, 15 and 30 min post injection and duration (min; mean±SD) are expressed in the table. No motor block was recorded in any group.

<table>
<thead>
<tr>
<th>S10</th>
<th>S20</th>
<th>SN250</th>
<th>SN500</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAS 0</td>
<td>53±19</td>
<td>56±15</td>
<td>59±21</td>
</tr>
<tr>
<td>AE 5</td>
<td>42 %</td>
<td>67%*</td>
<td>45 %</td>
</tr>
<tr>
<td>AE 10</td>
<td>58 %</td>
<td>82%*</td>
<td>50 %</td>
</tr>
<tr>
<td>AE 15</td>
<td>58 %</td>
<td>79%*</td>
<td>57 %</td>
</tr>
<tr>
<td>AE 30</td>
<td>67 %</td>
<td>95%*</td>
<td>60 %</td>
</tr>
<tr>
<td>Duration (min)</td>
<td>71±37</td>
<td>109±53*</td>
<td>64±29</td>
</tr>
</tbody>
</table>

Epidural S 20 µg induced prurit (23%) and nausea (14%).

Discussion: To initiate labor analgesia, epidural N 500 µg (e.g. 6-7 µg/kg) combined with S 10 µg is as effective as S 20 µg (potency and duration) but devoid of bothersome side effects.

SOAP A83
THE EFFECT OF EPIDURAL SUFENTANIL IN NULLIPAROUS PATIENTS IN EARLY LABOR ON THE MINIMAL LOCAL ANESTHETIC CONCENTRATION (MLAC) OF EPIDURAL ROPIVACAINE

Buyse I, Vandermeersch E, Van de Velde M, Stockman W, Columbo MO
UZ Gasthuisberg Dept Anesthesiology, Leuven, Vlaams-Brabant; Hellig Hart Ziekenhuis Roeselaere, Roeselaere, West-Vlaanderen; South Manchester University Hospital, Wilthington

Introduction: Previously it was demonstrated that opioids, added to the labor analgesic epidural mixture, increase the potency of ropivacaine (ROP). To evaluate the effect of sufentanil on the potency of ropivacaine (ROP) during labor, a randomized trial using the MLAC methodology was designed.

Methodology: Following ethical committee approval and patient informed consent, 50 term, vertex-presenting, healthy parturients in early labor, were randomized to 2 groups. The first patient in each group received 10 ml of ROP 0.13% combined with either SUF 7.5 μg (SUF-group) or no additives (PLAIN-group). If the first patient of each group satisfactory analgesia was achieved (visual analogue scale (VAS) for pain < 20 min within 30 minutes and lasting for 60 minutes after the epidural injection), the next patient received a 10 ml dose of a 0.01% less concentrated ROP. If however pain relief was insufficient, the next patient received a 10 ml dose of a 0.01% more concentrated ROP. From this up-and-down sequential allocation technique the MLAC of epidural ROP with and without SUF was then calculated using the Dixon method.

Results: There were no significant differences in patient or obstetric characteristics between the two groups. The MLAC of ROP in the PLAIN group was 0.184 %/vol (95% CI 0.141 – 0.227) and the MLAC in the SUF-group was 0.060 %/vol (95% CI 0.0034-0.086). This difference was statistically significant. Hemodynamic data were comparable between the two groups.

Discussion: We conclude that epidural sufentanil in a dose of 7.5 μg significantly reduces the MLAC of ROP in nulliparous parturients in active but early labor. This is in line with previous studies.

SOAP A85
DILUENT VOLUME FOR EPIDURAL FENTANYL AND ITS EFFECT ON ANALGESIA IN EARLY LABOR
Baystate Medical Center, Springfield, MA

Introduction: Epidural fentanyl after a lidocaine-epinephrine test dose, provides approximately 2h of analgesia. It has previously been shown that the volume of injectate affects the onset and duration of analgesia of epidural fentanyl in the setting of postoperative pain (a low volume slowed the onset and shortened the analgesic duration). We thus undertook this study to determine the influence of volume on the duration of analgesia and side effects when administered in labor.

Methods: Following IRB approval, 60 primigravid patients, >36 weeks of gestation, <5 cm cervical dilation were enrolled. A lumbar epidural catheter was inserted and the patients received a 3 mL epidural test dose of lidocaine with epinephrine, then received a fentanyl 100 mg bolus, in either a 2ml, 10ml or 20ml volume. VAS scores and side effects were recorded. The time at which each patient requested additional analgesia was recorded. Data were analyzed by ANOVA, Mann-Whitney U, and by contingency testing. Significance: p<0.05 level.

Results: There were no significant differences in demographic variables, nausea, or pruritus. The onset of analgesia was similar in all three groups. There was no significant difference in pain scores between the groups at any of the time points, except for 90 minutes, at which time the 2 ml group had higher pain scores (p<0.03). The duration until re-dose was not significantly different between the 2ml (108 ± 40 min), the 10ml (126 ± 36 min), and the 20ml groups (127 ± 41 min). Thirty-three patients (55%) ambulated at least once during their labor.

Discussion: The effect of varying the diluent volume of epidural fentanyl on the quality and duration of labor analgesia, based on our study, does not affect the onset of analgesia nor does it prolong the analgesic duration. When performing an ambulatory epidural in early labor, after a lidocaine and epinephrine test dose, we found no advantage in varying the volume from our standard 10 ml injectate volume.

SOAP A87
THE EFFECTS OF AGE ON ANALGESIA REQUIREMENTS FOR PRIMIPAROUS PARTURIENTS WITH LABOR EPIDURALS
Melnick AH, Schultz JR, Muir HA, Phillips-Bute BG
Duke University Medical Center, Durham, NC

Purpose: To determine if there are differences in epidural analgesia requirements as defined by the number of anesthesia interventions required to establish patient comfort in primiparous women of different ages with labor epidurals.

Methods: After IRB approval, we performed a chart review on all anesthetic records for a four month period from the obstetrics department of this tertiary care, university based medical center with 3500 deliveries a year. All primiparous patients receiving a labor epidural and going on to vaginal delivery were identified. Those with a history of recreational drug use or preterm labor (<36 weeks) were excluded. All patients were managed with patient controlled epidural analgesia. The end point was anesthesia intervention including bolusing of the epidural, changing the concentration of the infusion, or increasing the infusion pump settings. All patients who required repositioning of the epidural were excluded. Two hundred and fourteen patients were identified and assigned to age groups <18, 18-20, 21-25, 26-30, 31-35, or >35. A multivariate logistic regression analysis was performed to evaluate the relationship between age and anesthesia intervention as well as age and interventions per epidural hour.

Results: No correlation between patient age and requirement of anesthesia intervention was found (p=38). There was no relationship between age and interventions per epidural hour (p=.77). There was a positive correlation between epidural time (placement to delivery) and requirement of anesthesia interventions (p=.0012).

Conclusions: we found no relationship between age and analgesia requirements as measured by anesthesia interventions.

Requirement for Intervention and Age

Intervention per Epidural Hour and Age

*Images were recreated from corrupted files.*
POTER REVIEW II

SOAP A88
HANDS AND KNEES POSITIONING DURING LABOUR WITH EPIDURAL ANALGESIA
Halpern S,1 Hodnett E, Yee J,2 Stremler R
1Department of Anesthesia, Sunnybrook & Women’s College Health Sciences Centre, Toronto, Ontario, Canada; 2 Faculty of Nursing, University of Toronto, Toronto, Ontario, Canada

Background: Hands and knees (HK) position has shown promise as an intervention to improve labor and birth outcomes, but no reports exist that examine its use with women laboring with an epidural. A RCT of maternal HK positioning (Stremler et al.) for women laboring with a fetus in occipitoposterior (OP) position found consistent trends toward benefit of use with respect to fetal head rotation following use of the position, fetal head position at delivery, operative delivery, 1-minute Apgar score and time from randomization to delivery.

Objective: To describe the safety, effects on analgesia, and acceptability to women of HK positioning during labor with an epidural.

Design: Retrospective case series drawn from a larger RCT of 147 women in the first stage of labor.

Sample: All women who had an epidural in place at the time of randomization and were randomized to the intervention group (HK positioning for at least 30 minutes over a 1-hour period) of the RCT (n=13). Women were assessed for ability to use HK prior to randomization.

Outcome variables: Safety of HK positioning as evidenced by: catheter dislodgements; falls; and cardiovascular instability (>20% change from baseline for heart rate or blood pressure). Effects of HK positioning on analgesia as evidenced by: women’s pre- and post-intervention back pain scores (measured using the Short Form-McGill Pain Questionnaire and a vertical, Color Analogue Scale (CAS)). Acceptability of HK positioning to women as evidenced by: time spent in HK position; willingness to use HK position in a future labor; and women’s comments about using HK position.

Results: There were no falls, no catheter dislodgements, no maternal hypotension, and no maternal bradycardia. One woman experienced a heart rate increase of 24% above baseline. One woman had a higher pain score after using HK position (0 pre-intervention, 1.75 post-intervention on CAS). 12/13 women spent at least 30 minutes in HK position (median 33 minutes, IQR 31, 55). One woman was not able to continue in HK position due to fetal heart decelerations, which resolved when HK position was discontinued. 12/13 women who responded stated they would use HK position in a future labor.

Conclusions: This study provides limited evidence that HK position is safe, does not limit analgesic efficacy and is acceptable to women laboring with an epidural. Given the small sample size of this case series, more research is needed to determine if HK positioning can be routinely recommended for women laboring with an epidural.

References: Stremler R, Hodnett E, Petryshen P, Stevens B, Willan A
The Labour Position Trial (manuscript in preparation).

SOAP A89
DOES ETHNICITY DELAY EPIDURAL ANALGESIA IN LABORING WOMEN?
Boone MD, Schultz JR, Pan H, White WD, Spahn TE, Olufolabi Y
Duke University Medical Center, Durham, NC

Introduction: A recent meta-analysis demonstrated the negative impact of cultural and language barriers on quality of care (1). It remains unclear if these barriers affect the delivery of anesthesia care in our population of Hispanic parturients (2-3). We investigated whether ethnicity delays the placement of an epidural for pain control in laboring Hispanic parturients.

Methods: Following IRB approval, a retrospective analysis of the obstetric data base was performed for consecutive admissions to labor and delivery over a 3 month period. We included women who received epidurals for labor and noted cervical dilation in triage and during epidural placement. Demographics included age, gravity, parity, and ethnicity. Excluded were epidurals placed for cesarean section. Standard statistical methods were used.

Results: Our results reveal a statistically similar percentage of women chose epidural analgesia: African American (AA) 54%, n=185; Caucasian (Cauc) 60%, n=180; and Hispanic (Hisp) 51%, n=113 (P=0.2972). There was no statistical difference in either cervical dilation in triage or epidural placement for any ethnic group (Table 1).

Conclusion: The data did not support our hypothesis that Hispanic women receive epidurals at a more advanced period of labor. Despite cultural differences and language barriers, Hispanic women present to labor triage and receive epidural analgesia at cervical dilations similar to Caucasian and African-American women.

Table 1. Mean cervical dilation at triage and epidural

<table>
<thead>
<tr>
<th>Race</th>
<th>Cervical dilation (triage)</th>
<th>Cervical dilation (epidural)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA</td>
<td>3.2 (1.8)</td>
<td>4.8 (1.7)</td>
</tr>
<tr>
<td>Cauc</td>
<td>3.5 (1.8)</td>
<td>5.0 (2.1)</td>
</tr>
<tr>
<td>Hisp</td>
<td>3.9 (2.0)</td>
<td>5.7 (1.9)</td>
</tr>
</tbody>
</table>

1. J Midwifery Women’s Health. 47(2); 80-96, 2002
SOAP A90
URINARY CATHETERIZATION REQUIREMENT OF WOMEN WITH LABOR EPIDURAL ANESTHESIA
Chong E, Ramanathan S, Kaul B, Goliewski K
1University of Pittsburgh School of Medicine, Pittsburgh, PA, 2Magee-Womens Hospital; University of Pittsburgh, Pittsburgh, PA

Introduction: More than 80% of women delivering vaginally at our institution receive epidural anesthesia. During pregnancy, physiologic and structural changes increase a woman’s susceptibility to urosepsis. Urinary retention and diminished bladder tone often result from the labor process and the use of labor analgesia. (1) The role of epidural anesthesia in contributing to urinary retention has been studied previously. (2,3) We obtained data on the urinary catheterization rate of parturients in our institution over a 4-month period. Most women received epidural anesthesia with 0.125% bupivacaine with fentanyl 2mcg/cc infusions and loading doses.

Methods: Ongoing data is collected as part of an existing labor and delivery anesthesia database. The data sheets are entered with each patient encounter as to patient characteristics, labor course, and anesthetic drugs, and then placed in a database. The database was then queried as to the incidence of urinary catheterization during labor.

Results: Data from 279 patients receiving labor epidurals were analyzed out of which 203 women received urinary catheterization at least once during labor. (74%+)

No immediate post-partum urinary tract infections have been found to date in a subset of these women (56 patients) where such data was obtainable. To date the control population that delivered without epidural anesthesia is too few in number to be statistically meaningful.

Conclusions: Previous studies have investigated the ability of parturients to void while receiving epidural anesthesia with conflicting results. (4,5,6) The influence of peripartum urinary catheterization on postpartum urinary tract infections continues to be under surveillance in our institution. A larger randomized trial is needed to determine whether the administration of more dilute local anesthetic solutions (walking epidurals) would decrease the incidence urinary catheterization during labor.

References:

SOAP A91
THE EFFECT OF LABOR ANALGESIA ON BREASTFEEDING SUCCESS
Ellinas EH, Uhrich TD, Maitra-D’Cruze AM
Medical College of Wisconsin, Milwaukee, WI

The effect of labor analgesia on breastfeeding success remains controversial. As it becomes increasingly apparent that “breast is best,” giving new mothers and babies the greatest chance at success becomes more and more important. Although several studies have suggested that overall breastfeeding rates at 1-2 months postpartum are similar regardless of intrapartum medication choice, none have looked at the dose of epidural fentanyl used versus breastfeeding success, nor have they used the number of days to successful feeding as an outcome.

In this retrospective study, we surveyed 189 healthy, uncomplicated vaginal deliveries of healthy infants. A chart review then revealed the type and quantity of labor analgesia that the mother received.

We divided the groups into epidural analgesia and non-epidural, and then reconfigured the groups into narcotic (IV or epidural) and no narcotic. We looked at success from multiple angles, and in no case could we find a significant effect on breastfeeding success. There was no difference in overall success at four weeks, no difference in number of days until successful feeding, and no difference in patients experiencing early success (defined as less than 2 days). Particularly, the amount of fentanyl given was not correlated with the number of days until breast feeding success. There was a trend toward more overall success in the non-narcotic group, but it was not statistically significant.

We conclude that epidural analgesia affects neither overall success nor early success in breast feeding.
SOC A92
RECRUITMENT RATES OF PARTURIENTS TO PARTICIPATE IN OB ANESTHESIA RESEARCH PROJECTS
Golebiewski KA, Finegold H, Vallejo MC, Ramanathan S
Magee Womens Hospital, Pittsburgh, PA

Background: There is an increased public awareness of clinical research mishaps, this apparently has not decreased parturients’ decision to participate in clinical research studies. We report our experience of recruitment of subjects for obstetric anesthesia research.

Methods: Over a six-month period, parturients were approached for one of four IRB approved studies. Data were obtained from monthly reports prepared by the Clinical Research Coordinator (CRC) who used to be a labor and delivery nurse.

Study 1: Comparison of Circulating Oxytocin Levels With CSE and Epidural Anesthesia for Labor Analgesia
Study 2: Double Blind Randomized Comparison Of Ropivacaine, RS-Bupivacaine, and Levobupivacaine for labor analgesia.
Study 3: The Biological Relationship Between Periodontal Disease and Preterm Low Birth Weight
Study 4: Comparison Between Intrathecal RS-Bupivacaine and Levobupivacaine for Labor Analgesia

Results: Our overall recruitment rate was 83% (Table). We tabulated the rate of enrollment, study completion and decline rate for each study (Table). We had the least success with Study 1 because it required a second intravenous line for blood sampling. Study 2 had the highest recruitment rate because it did not deviate from standard care. No patient withdrew from any of the four studies after recruitment. Incomplete studies were due to protocol violation or prolonged labor (Table)

Discussion: Obstetric anesthesia projects are dependent upon patient cooperation. Our data show that we had a high recruitment rate probably due to the involvement of a CRC with an obstetric background and lack of significant deviation from standard practices in our studies.

<table>
<thead>
<tr>
<th>Study No.</th>
<th># Patients consented</th>
<th># Studies incomplete</th>
<th># Declined enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>21/31 (68%)</td>
<td>2/21 (10%)</td>
<td>10/31 (32%)</td>
</tr>
<tr>
<td>2</td>
<td>7/179 (90%)</td>
<td>23/71 (32%)</td>
<td>8/79 (10%)</td>
</tr>
<tr>
<td>3</td>
<td>31/39 (79%)</td>
<td>1/31 (3%)</td>
<td>8/39 (21%)</td>
</tr>
<tr>
<td>4</td>
<td>38/44 (86%)</td>
<td>2/38 (5%)</td>
<td>6/44 (14%)</td>
</tr>
<tr>
<td>Totals</td>
<td>161/193 (83%)</td>
<td>28/161 (17%)</td>
<td>32/193 (17%)</td>
</tr>
</tbody>
</table>

SOC A93
UTERINE RUPTURE AND NEURAXIAL ANALGESIA
Goldner JD, Scavone BM
Northwestern University Feinberg School of Medicine, Chicago, IL

Introduction: There is a theoretical risk that symptoms of uterine rupture may be masked by neuraxial analgesia.\(^1\) We report several cases of uterine rupture in patients with neuraxial labor analgesia.

Case 1: 35yo G2P1 h/o one CS admitted for labor. The patient had an epidural infusion of bupivacaine 0.0625% with fentanyl 2 μg/ml at 15 ml/hr with T7 level and good labor analgesia. She suddenly developed severe constant abdominal pain and bilateral shoulder pain. Epidural dosing for surgery with 3% 2-chloroprocaine provided relief from abdominal pain, but shoulder pain persisted. The patient underwent CS that revealed uterine scar dehiscence.

Case 2: 33yo G2P1 h/o one CS admitted for labor. Epidural (same infusion) provided adequate analgesia with T8 level. Pt experienced severe bilateral shoulder pain at the same time fetal heart rate tracing became non-reassuring. Emergent CS revealed uterine rupture.

Case 3: 36yo G3P1 h/o one CS admitted for labor. Pt experienced severe lower abdominal pain, hypotension and tachycardia several hours into labor, despite previous adequate epidural analgesia at T7 level. Emergency CS revealed uterine scar rupture.

Discussion: Despite theoretical concerns that neuraxial analgesia may mask signs and symptoms of uterine rupture it remains common practice in our hospital to provide epidural labor analgesia to women undergoing a trial of labor after CS. Analgesia provided by low concentration LA/opioid does not mask uterine rupture pain. Diaphragmatic irritation, referred to the shoulder, is carried by C4 afferents and spared during epidural labor analgesia. Sudden onset shoulder pain may be a good clinical marker for uterine rupture in these patients.

POSTER REVIEW II

SOAP A94
MATERNAL AND FETAL OUTCOMES AFTER UTERINE RUPTURE
Stack KE
Emory University School of Medicine, Atlanta, GA

Our institution is a large, tertiary care, inner city hospital serving the indigent with poor prenatal care, as well as a large Hispanic population who frequently present with unknown scars from cesarean sections performed outside of the US. Over a one-year period (November 2001 through November 2002), 14 cases of uterine rupture or dehiscence were recorded. Retrospective chart reviews for maternal and fetal outcomes were performed on all cases of partial or complete uterine rupture or uterine dehiscence. The diagnosis was confirmed at cesarean delivery in all 14 patients.

Maternal outcomes: There were no maternal deaths. There was one cesarean hysterectomy performed and thirteen uterine repairs. One of the patients who underwent a uterine repair also required uterine artery embolization to control bleeding. Three patients required blood transfusions, with no more than 2 units per patient required. Nine patients received regional anesthesia, four patients received general endotracheal anesthesia (one refused regional anesthesia), and one epidural required conversion to general endotracheal anesthesia at incision due to inadequate block.

Fetal outcomes: There were no fetal deaths. Ten neonates had apgar scores of eight or greater at five minutes of life. Thirteen neonates had apgar scores of seven or greater at fifteen minutes of life, and by fifty minutes of life, all fourteen neonates had apgar scores of seven or greater. Currently, there are no known permanent neonatal sequelae.

Conclusion: While a uterine rupture may have catastrophic consequences, maternal and fetal outcomes at our institution have been favorable. Five of our ruptures cannot be associated with a specific event or time, but nine were associated with acute fetal heart rate changes in association with other physical findings. In these cases, the time from decision to section and delivery of the fetus was under thirty minutes (mean twenty-five minutes). While all fourteen cases of rupture or dehiscence were confirmed at cesarean section, it is possible, however, that our rupture rate may be higher since there may have been women who successfully delivered vaginally that may have had an undiagnosed rupture. We believe that twenty-four hour in-house obstetric, anesthesiology, and neonatology services were essential for good outcomes.

SOAP A95
THROMBOEMBOLISM RISK ASSESSMENT OF MOTHERS IN LABOUR
Abdel-Hafiz M, O’Hare T, Sashidharan R
The Royal London Hospital, London

Introduction: Thromboembolism remains the leading direct cause of maternal death in the UK. Following the introduction of the RCOG guidelines on thromboprophylaxis, deaths after LSCS have fallen dramatically. An audit in our department also reflected this. The most recent CEMD reports that deaths from thromboembolism after vaginal deliveries have unfortunately not improved.

Methods: For a period of 6 weeks, we prospectively audited the presence or absence of risk factors and the use of thromboprophylaxis in women admitted to labour in our unit. The mothers were classified as moderate or high risk as per RCOG risk assessment profile. Staff caring for the mothers was not aware of the audit.

Results
A total of 290 women were reviewed during this period.

<table>
<thead>
<tr>
<th></th>
<th>Thromboprophylaxis</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mod risk (n=58)</td>
<td>0</td>
<td>58 (100%)</td>
</tr>
<tr>
<td>High risk (n=21)</td>
<td>8 (38%)</td>
<td>13 (62%)</td>
</tr>
</tbody>
</table>

Conclusion and Discussion: Except for 8(38%), none of the mothers at risk had any form of thromboprophylaxis. On the other hand none of the women in the audit developed DVT or PE. Interestingly, the 8 who received prophylaxis did so because they were delivered by emergency LSCS.

Following this audit, we have established protocols for risk assessment and thromboprophylaxis in women delivering vaginally on our unit. The last two CEMD reports recommended that all women with risk factors should be carefully screened and consideration given to a wider use of thromboprophylaxis during vaginal deliveries. Despite this there is still a lack of awareness of risk factors and the need for thromboprophylaxis. We reiterate the CEMD recommendations suggesting that each unit develop guidelines, which can be applied within the requirements of their own units.

References
2) RCOG Working Party on Prophylaxis against Thromboembolism 1995
SOAP A96
THE ASSOCIATION OF PREVOTELLA INTERMEDIA AND FUSOBACTERIUM NUCLEATUM WITH PRETERM LABOR
Vallejo MC, Miller J, Golebiewski K, Phelps AL, Kaul B, Ramanathan S
Magee-Womens Hospital, Pittsburgh, PA; Duquesne University, Pittsburgh, PA

Objectives: Determine oral pathogens associated with preterm labor.

Methods: After IRB approval, 53 parturients received a periodontal examination using Periodontal Screening and Recording (PSR score) on labor suite admission. Patients were separated into three groups: Group 1 – periodontitis (PSR ≥ 3) at term, Group 2 – periodontitis and preterm (< 37 weeks gestation), Group 3 – no periodontitis (PSR < 3) at term. In all groups, gingival sulcus samples were obtained and DNA tested (MicroDenteX®) for periodontal pathogens. Pathogens screened: Actinobacillus actinomycetemcomitans (Aa), Eikenella corrodens (Ec), Porphyromonas gingivalis (Pg), Campylobacter rectus (Cr), Prevotella intermedia (Pi), Fusobacterium nucleatum (Fn), Bacteriodes forsythus (Bf), and Treponema denticola (Td). Results expressed as mean ± SD or median. Analyzed using ANOVA, Kruskall-Wallis, or Chi-square. P < 0.05 is significant.

Results: Results in Table. Gestational age was less in group 2. Median PSR score was higher in groups 1 and 2, with a higher pathogen detection frequency (pathogen +) compared to group 3. Fusobacterium nucleatum alone, or in combination with Prevotella intermedia had a higher detection rate in the preterm group.

Conclusion: Fusobacterium nucleatum alone, or in combination with Prevotella intermedia is associated with preterm labor in parturients with periodontitis (PSR ≥ 3).

Table

<table>
<thead>
<tr>
<th></th>
<th>Group 1 (n=19)</th>
<th>Group 2 (n=10)</th>
<th>Group 3 (n=24)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yrs)</td>
<td>30.3±5.4</td>
<td>28.8±6.1</td>
<td>31.0±5.1</td>
<td>0.67</td>
</tr>
<tr>
<td>Gestation (wks)</td>
<td>39.3±0.7</td>
<td>35.3±1.7</td>
<td>39.0±0.9</td>
<td>0.00</td>
</tr>
<tr>
<td>PSR (median)</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>Pathogen + (%)</td>
<td>57.9</td>
<td>60.00</td>
<td>33.3</td>
<td>0.18</td>
</tr>
<tr>
<td>Aa (%)</td>
<td>81.8</td>
<td>83.3</td>
<td>62.5</td>
<td>0.55</td>
</tr>
<tr>
<td>Pi (%)</td>
<td>69.2</td>
<td>100</td>
<td>50.0</td>
<td>0.13</td>
</tr>
<tr>
<td>Pg (%)</td>
<td>45.5</td>
<td>83.3</td>
<td>62.5</td>
<td>0.89</td>
</tr>
<tr>
<td>Ec (%)</td>
<td>72.7</td>
<td>66.7</td>
<td>62.5</td>
<td>0.89</td>
</tr>
<tr>
<td>Cr (%)</td>
<td>54.5</td>
<td>50.0</td>
<td>37.5</td>
<td>0.76</td>
</tr>
<tr>
<td>Br (%)</td>
<td>72.7</td>
<td>50.0</td>
<td>50.0</td>
<td>0.52</td>
</tr>
<tr>
<td>Td (%)</td>
<td>72.7</td>
<td>50.0</td>
<td>25.0</td>
<td>0.42</td>
</tr>
<tr>
<td>Fn (%)</td>
<td>69.2</td>
<td>83.3</td>
<td>25.0</td>
<td>0.05</td>
</tr>
<tr>
<td>Pi + Fn (%)</td>
<td>53.8</td>
<td>83.3</td>
<td>12.5</td>
<td>0.03</td>
</tr>
</tbody>
</table>

Conclusion: Fusobacterium nucleatum alone, or in combination with Prevotella intermedia is associated with preterm labor in parturients with periodontitis (PSR ≥ 3).
SOAP A98
DOES OBESITY IMPACT ON MOVEMENT OF UNSECURED EPIDURAL CATHETERS AS THE PARTURIENT MOVES FROM THE SITTING FLEXED TO THE LATERAL DECUBITUS POSITION?

Toyama TM, Siddiqui MN, Sudha RJ, Steadman JL, Lai M
University of Miami/Jackson memorial Hospital, Department of Anesthesiology, Miami FL

Introduction: Epidural analgesia is a popular method of pain control during labor. An earlier study and anecdotal reports showed that unsecured epidural catheters can move inward, disappearing, from the skin exit site, when the patient moved from the sitting flexed to the lateral decubitus position (1, 2, 3). We observed the catheter movement associated with change in the patient’s position in 486 parturients who requested epidural analgesia during the six-month period from July to December 1999.

Method: Age, height, weight, the distance from the skin to the epidural space (D-ES, cm), and the length of unsecured epidural catheter movement as the patient moved from the sitting flexed to the lateral decubitus position before the catheter was secured to the skin were recorded. The 486 records were chosen and retrospectively reviewed after approval by the Internal Review Board. Epidurals were performed by anesthesiology residents supervised by attending anesthesiologists. Patients were in the sitting position with the legs resting on a chair in maximal flexion. An Arrow epidural kit (#WJ-05401, Reading, PA) was used. A midline approach at the L3-4 ± 1 interspace with loss of resistance to air was employed. The bevel of the epidural needle was directed cephalad. D-ES was estimated to the nearest 0.5 cm by viewing the calibrated Tuohy needle. Following identification of the epidural space (ES), a catheter was inserted 4 cm into the ES. If, after the needle removal, the catheter was estimated to be more than 4 cm into the ES, it was withdrawn in the sitting flexed position until the appropriate marking was seen at the skin. Before securing the epidural catheter, the position of the epidural catheter relative to the skin was measured with the patient in the sitting flexed position. The patient was then assisted into the lateral decubitus position. During this time the unsecured epidural catheter was held at the distal end of the catheter, while sterility was maintained and free movement relative to the skin was allowed and observed. Epidural catheters were either judged to have moved inward, not moved, or moved outward at the end of patient movement. The length of catheter movement was calculated by comparing the length in the sitting flexed position from the length in the lateral decubitus position. After measurement the epidural catheter was firmly secured to the skin using an adhesive sterile dressing (Tegaderm, 3M Health Care, St. Paul, MN). The epidural catheter was looped to prevent direct traction on the exit site under the transparent dressing, and was taped up the patient’s back. Patients were then allowed to assume a comfortable supine position with either right or left uterine displacement. Based on body mass index (BMI, kg/m2), patients were divided into two groups: group A consisted of BMI < 30 and group B, BMI > 30. BMI of 30 was chosen because after taking into account an estimated weight gain of 16 kg at term the parturient with a BMI greater than 30 is considered to be obese (4,5). Data was analyzed with Student’s t test or Chi-Square analysis as appropriate.

Results: Of the 486 patients evaluated, group A had 199 patients and group B, 287 patients. Median weight was 70.7 kg in group A and 114.0 kg in group B (p < 0.01). There were no differences in patient age or height among the groups. D-ES was significantly greater in group B than in group A. There was no significant difference in the number of the catheters pulled outward between two groups. There were significant differences, however, in the percentage of the patients whose catheters did not move and whose catheters moved inward from the skin between two groups. A greater percentage of the catheters did not move in group A than in group B, and more percentage of the catheters moved inward in group B than in group A. In addition, there were significant differences in the percentage of the patients whose catheter moved 1.5 cm or more. All the data is in table.

Table 1

| BMI <30 | 162±20 | 0±7±21.8 | 5.7±2.25 | 11±5.5% | 0±40.2% | 80±40.2% | 108±40.2% | 5±2.5% |
| BMI >30 | 158±24 | 114±52.4 | 8±4.5 | 25±8.7% | 39±13.6% | 39±13.6% | 59±20.5% |

P value | NS | <0.01 | <0.01 | NS | <0.01 | <0.01 | <0.01

Conclusion: We found that unsecured epidural catheters often move inwards as the patient moves from the sitting flexed to the lateral decubitus position. This catheter movement occurs more frequently and more extensively in the obese than in the non obese. This suggests that the D-ES is expandable. Many obstetric anesthesiologists prefer to perform epidurals in the sitting flexed position. We advise securing the catheter in order to avoid catheter displacement after the patient moves into the lateral decubitus position, particularly in the obese.

SOAP A99  
**THE RELATIONSHIP BETWEEN BODY MASS INDEX AND POSTDURAL HEADACHE IN PARTURIENTS**  
Spielman FJ, Mayer DC, Criswell HE  
*Dept of Anesthesiology, University of North Carolina, Chapel Hill, NC*

**Introduction:** Unintentional dural puncture while performing an epidural is sometimes unavoidable. The most common outcome of this problem is severe headache. Patient characteristics which increase the incidence of postdural puncture headache (PDPHA) include being of childbearing age, female, and pregnant. Some evidence suggests that morbidly obese (MO) parturients are less susceptible to PDPHA. A postulation has been made that the augmented intra-abdominal pressure caused by the obesity increases pressure in the epidural space and minimizes cerebro-spinal fluid outflow. Our study investigates the relationship between the incidence of PDPHA in parturients over a wide range of BMI (kg/m²), not just in patients who are MO.

**Methods:** At our institution all parturients who have an accidental dural puncture (17 gauge) are seen and evaluated every day until discharge, and then we communicate with them via telephone, if necessary, for at least five days. Quality assurance forms are completed that include the intensity of the PDPHA, medications and treatments administered, and level of mobility. Patients who received a prophylactic epidural blood patch or a continuous spinal anesthetic were excluded from the study. Two groups of patients’ BMIs were compared, Group I (no headache or headache no more than one day in duration requiring no narcotics, patient ambulatory), and Group II (headache of several days duration requiring a combination of narcotics, bed rest, or epidural blood patch).

**Results:** 192 patients were included in the study; 93 (49%) in Group I and 98 (51%) in Group II. We found a strong relationship between BMI and incidence of PDPHA; the higher the BMI, the lower the incidence of headache (Figure 1). Those patients with a BMI greater than 50 did not experience a PDPHA.

**Discussion:** Being able to determine the chance that a parturient will have a PDPHA is crucial for patient education, and the decision to perform a continuous spinal or prophylactic epidural blood patch. Etiologies other than PDPHA should be considered in patients who are MO if they experience headache after dural puncture.

**References:**  

---

SOAP A100  
**EXTREME MORBID OBESITY: A CHALLENGE TO THE ANESTHETIC PLAN**  
Mhyre JM, Polley LS  
*Department of Anesthesiology University of Michigan, Ann Arbor MI*

**Introduction:** We are presenting the delivery of a woman weighing 628#, who is, to our knowledge, the largest parturient in the literature.

**Case Report:** A 28 yo woman, G2P0, presented at 41 weeks gestation for post-date induction. Her past medical history was significant for hypertension and extreme morbid obesity (5'9" 286 kg BMI 93). The airway exam was normal. To construct a delivery plan, the obstetricians verified sufficient thigh mobility to permit a vaginal exam, and vaginal delivery was planned. After consultation with the anesthesiologist, the patient agreed to epidural analgesia, forgoing a desired natural childbirth. At 10 am, the epidural was placed using standard technique, with the epidural space located at 10 cm. The epidural catheter was threaded to 17 cm and dosed to a level of T9 bilaterally with 0.05% bupivicaine and 3 mcg/cc fentanyl, and the infusion was adjusted throughout the day to maintain patient comfort. At 2230, after an arrest of dilation at 5 cm, a decision was made to proceed with cesarean section. An arterial line was placed electively to ensure accurate blood pressure measurements. The epidural was extended to a T3 level using 15 cc of 2% lidocaine with 0.08 mEq/cc sodium bicarbonate, 1:200,000 epinephrine and 5mcg/cc fentanyl. The surgeons proceeded with a classical cesarean section through a supraumbilical midline incision, and delivered a live female infant 16 minutes after skin incision, 4360gm, Apgars of 7 and 8. The post-operative course was uneventful.

**Discussion:** Morbidly obese parturients demonstrate an increased rate of both urgent and emergent cesarean section, a decreased rate of successful vaginal delivery, and an increased risk of failed intubation. The anesthetic team anticipated a possible cesarean section and ensured early placement and ongoing function of the epidural catheter. With careful coordination between the obstetrical and anesthetic care teams, this 286 kg woman was successfully delivered with an uncomplicated outcome for both neonate and mother.

**References:**  
1. Submission to SOAP 2003  
**SOAP A101**

**ANESTHETIC MANAGEMENT OF A PARTURIENT WITH A C5-C6 SPINAL CORD INJURY**

**Prasad M, Ebeele R, DeSimone CA**

**Albany Medical College, Albany, NY.**

**Introduction:** Autonomic hyperreflexia (AH) is a severe life-threatening complication seen in patients after spinal cord injury. We report a case of a successful management of a quadriplegic parturient in labor with a history of autonomic hyperreflexia.

**Case:** A 30 year old white female G2P1 0-10 C5-C6 quadriplegic since age 16 was seen by our department in consultation at 32 weeks of gestation because of a history of AH. Past medical history was significant for cervical fusion, recurrent urinary tract infection and a limited diaphragmatic function of 40%. Patient was 130 lbs and 5'6". Airway exam revealed a Mallampati class II with minimal range of motion of her neck. Patient had some pressure sensation to pinprick in the upper and lower extremity. At 36 weeks gestation, the patient was admitted in early labor (1 cm/50%/2), with a temperature of 101°F and evidence of a urinary tract infection. Prior to the augmentation of her labor, epidural analgesia was instituted. An epidural catheter was placed, a test dose with 3cc of 1.5% lidocaine with 1:200,000 epinephrine was given. The test dose was negative. Eight cc of 0.125% bupivacaine with 2 mcg/cc of fentanyl was administered in fractionated doses. A T8T9 level was obtained (patient could no longer detect pressure sensation with pinprick). A continuous epidural infusion with 0.1% bupivacaine plus fentanyl 2 mcg/ml at 12 cc/hr was started. Foley catheter insertion, vaginal exam, AROM and augmentation of labor with pitocin were uneventful. Epidural infusion rate was decreased to 8cc/hr because the patient became symptomatic. Labor progressed uneventfully for 6 hrs until patient complained of sweating, facial flushing with hypertension. Five cc of 0.125% bupivacaine was administered without any relief, 5cc of 0.5% ropivacaine was given and the patient's symptoms subsided. Vaginal exam revealed the cervix to be fully dilated and the fetus at +2 station. A live female infant was delivered by outlet forceps, with spontaneous delivery of the placenta. Epidural infusion was continued 6 hrs postpartum and then discontinued. She was monitored on labor and delivery floor for 24 hrs postpartum and discharged on the 4th postpartum day.

**Discussion:** Labor is a potent stimulator and perineal stretching has been found to be a maximal noxious stimuli for AH. Regional anesthesia is the best method for prevention or treatment of autonomic hyperreflexia during labor and delivery.

1Gambling, Obst Anes and Uncommon Dis 1998: 247-251
2Chestnut. Obstetric Anes 1999: 966-968

**SOAP A102**

**EPIDURAL ANALGESIA IN NEUROFIBROMATOSIS TYPE 2**

**Spiegel JE, Hahn C, Hess PE**

**Beth Israel Deaconess Medical Center, Boston, MA**

Neurofibromatosis type 2 (NF2) is a very rare condition that has recently been described. Patients with NF2 have central nervous system tumors that may significantly affect the safety of neuraxial anesthesia. We present a case describing the preoperative management and use of epidural anesthesia in NF2. Case: A 33 year-old term G2P1 with a history of NF2 presented for repeat elective cesarean delivery. Her previous delivery was complicated by high frequency hearing loss and severe shoulder, back and neck pain starting during the 5th month gestation. Postoperative MRI revealed a cervical spine ependymoma, 2 cranial meningiomas, a CNVII schwannoma and 2 distal lumbar spinal tumors, confirming a diagnosis of NF2. She underwent a posterior cervical laminectomy (C3-C6) for removal of the ependymoma, and complete resection of a left-sided CNVIII schwannoma. One month prior to this admission, a MRI revealed multiple extramedullary intradural lesions from L1 to S1, the largest measuring 7mm x 8mm in size; however, these lesions were contained in the thecal sac, and the epidural space was noted to be clear. Epidural analgesia was used for cesarean delivery, without complication. The patient was discharged in good condition.

**Discussion:** Similar to NF1, a disease encountered more frequently, NF2 is an autosomal dominant condition with a predisposition to potentially severe complications. A sine qua non of NF2 is the presence of acoustic neuromas, and the disease is commonly associated with cranial nerve VIII schwannomas, ependymomas, and meningiomas. Because of the rarity of this condition, the precise hormonal effect of pregnancy on the growth of NF2 lesions is not well described; however, most reports describe an increase in the size of lesions during pregnancy, with complete or partial resolution of symptoms in the postpartum period. This patient had a history consistent with these reports. The potential complication of enlargement of neurofibromas within the spinal cord and nerve roots is illustrated in NF1 patients where epidural hematomas have resulted from rupture of the tumors during spinal and epidural placement. Because ependymomas or meningiomas arise in and around the spinal cord, parturients with NF2 must receive lumbosacral spine imaging prior to administration of regional labor analgesia. This is the first case report emphasizing the potential risks of regional analgesia for labor in a patient with NF2 in the English literature, and the first to report the safe use of epidural anesthesia for cesarean delivery.

Case Report: This case illustrates the care of a parturient with chronic upper airway inflammation and subglottic stenosis.

Case Report: A 24-year-old primiparous woman presented for pre-pregnancy consult with a history of a chronic upper airway inflammatory condition. Recurrent inflammation and severe sinus headaches had required sinus surgery on three occasions, as well as multiple antibiotic and steroid treatments. Stridor and shortness of breath led to the determination of subglottic stenosis on MRI, which was treated with dilatation and laser therapy to improve tracheal diameter from 4mm to 8-9mm. The chronic presentation had led to postulation of limited Wegener’s granulomatosis, although histology had been inconclusive. Blood tests were positive for antinuclear antibody, but antineutrophil cytoplasmic antibody, rheumatoid factor and anticardiolipin antibodies were negative. There were no distal pulmonary or renal manifestations. During pregnancy she continued to have relapses of her sinus inflammation requiring steroid suppression, and noted an intensification of her symptoms of dyspnea with exercise. She was admitted for a planned induction of labor before term. An IV line was established and early placement of a low dose, low concentration lumbar patient controlled epidural. An effective epidural allowed fetal descent during second stage, culminating in an uncomplicated instrumental delivery, minimizing workload and respiratory demands. In the immediate post delivery period there was increasing stridor and respiratory effort. Our patient became quite distressed, supplemental oxygen was already in place, and racemic epinephrine was nebulized for inhalation. Although there was an initial improvement, a further dose of epinephrine was required before her symptoms stabilized.

Discussion: The clinical picture of chronic upper airway inflammation and tracheal stenosis can be seen in limited Wegener’s granulomatosis. In our patient pregnancy had increased symptoms, but not to the point of surgical intervention. Effective regional analgesia reduced the metabolic and respiratory demands of labor and delivery. It may be that delivery, with increased effort and fluid shifts, created sufficient change in airway diameter to severely restrict airflow. Had she deteriorated further, a microlaryngeal tube of sufficient length to exceed the stenosis may have been required. A surgical approach may have been challenging as the lesion extended from C7 to T1 level. The physiological perturbations of labor and delivery should not be underestimated.


Anaphylactic reactions follow exposure to an allergen in susceptible patients. Here we report two cases of anaphylaxis where the inciting agent was not obvious.

Case A: A 26 y/o parturient with PMH significant for asthma and multiple environmental allergies presented for a repeat cesarean section under spinal anesthesia. Following delivery and cord clamp, cefazolin (1gm) and oxytocin were administered. The patient vomited, developed severe bronchospasm, hypoxia, bradycardia and hypotension. Epinephrine (100 mcg) and atropine, followed by diphenhydramine cimetidine and hydrocortisone were administered. An additional 200 mcg of epinephrine did improve the scenario. Following intubation, blood pressure was maintained with an epinephrine infusion and volume resuscitation. Hemodynamic stability and extubation were achieved 10 hours later. Tryptase level was elevated. Skin testing to cefazolin was negative, however RAST for latex was highly positive (class 4).

Case B: A 32 year old parturient presented for repeat cesarean section. Cefazolin (1gm) was administered preoperatively. Spinal anesthesia was induced. After delivery of the placenta, IM methylergonovine was administered for uterine atony. The patient complained of chest pressure, difficulty breathing and swallowing. A low blood pressure was treated with ephedrine. The patient developed severe wheezing, diffuse erythema and facial swelling. Epinephrine (70 mcg) restored blood pressure but did not improve breathing. Ventilation was assisted with positive pressure, while administering diphenhydramine, hydrocortisone and additional epinephrine (80 mcg). Latex gloves were replaced. Ventilation improved even though wheezing and airway edema persisted. Nebulized racemic epinephrine improved airway edema and wheezing. RAST testing for latex was moderately positive (class 3).

Discussion: Here we describe two cases of anaphylaxis to latex with no known history of latex sensitivity. Both reactions were temporally related to parenteral drugs, but in each case, latex proved to be the inciting agent. Even if the suspected allergen is not latex, we recommend that during an allergic reaction latex be removed from the field.
SOAP ABSTRACTS

POSTER REVIEW II

SOAP A105

CESAREAN SECTION IN THE SETTING OF PREGNANCY-INDUCED DIABETES INSIPIDUS

Millar S, DeBalli III P, Habib A, Muir HA
Duke University Medical Center, Durham NC

Introduction: We discuss the anesthetic management of severe transient diabetes insipidus (DI) in a parturient.

Case Report: A 25 year old African American woman at 30 weeks gestation, G2P1, had presented to a community hospital with nausea, vomiting and polyuria increasing over some weeks. Medical history included asthma and a family history positive for myotonic dystrophy. Initial treatment for hyperemesis included fluids and antiemetics, however continued polyuria and increasing hypernatremia with clinical decline led to transfer. Of note, her tongue remained markedly swollen following a possible antibiotic reaction. She had started to contract prior to departure and tocolysis was attempted with magnesium and terbutaline for transfer. Our initial investigations revealed Na174mmol/l, urine osmolality 133mOsm/kg, serum osmolality 360mOsm/kg. She was drowsy but rousable and appropriate, with no localizing neurological signs. The oral cavity was largely occupied by tongue, although there was no tracheal stridor. Fetal cardiograph lacked variability with late decelerations of sufficient concern to require operative delivery. Careful resuscitation of DI was commenced with dextrose and 2mg IV DDAVP. FFP added to correct PT15 (INR1.2), though aPTT normal. Arterial and central venous monitoring was instituted to guide therapy. An epidural was placed for cesarean section. Careful dosing allowed gradual onset with vigilance for change in clinical state. She was delivered of a male infant with Apgars 1145, cord blood gas pH7.30, Na172mmol/l. The sodium concentration had been corrected by 48hrs post-delivery in the ICU, although it was some days before homeostasis was unsupported. Mental state lagged behind metabolic restoration, a CT scan was normal. Cholelithiasis and acute pancreatitis complicated recovery.

Discussion: The challenge was to balance fetal well being, with attendant perioperative risks, against the desire to resuscitate a severe metabolic derangement. Subsequent normalization of her sodium handling supported the diagnosis of pregnancy-induced DI, cured by removal of the placental vasopressinase activity.1 Faced with a difficult airway, altered conscious level and the desire to normalize her metabolic state within the time limit imposed by an intolerant fetus, we initiated resuscitation and chose a gradual onset surgical epidural to allow minimal CNS and CVS impact. Although hypernatremia leads to increase in MAC2, there is no data as to alteration of local anesthesia pharmacodynamics.


SOAP A106

THE PARTURIENT WITH TERMINAL CANCER: OBSTETRIC AND ANESTHETIC MANAGEMENT

Dolak JA, Lababidi TG
The Cleveland Clinic Foundation, Cleveland, OH

Background: Cancer in pregnancy occurs in approximately .1% of all pregnancies, which makes it not a relatively uncommon event. However, the literature is nearly silent with respect to management of pregnant women with cancer from both an obstetric as well as an anesthetic perspective especially with regard to the parturient with terminal cancer. While it has been well documented in cases of acute cardiac arrest that a perimortem c-section can result in positive maternal and fetal outcomes, its role in the rapidly deteriorating cancer patient is not well examined.

Case: A woman at 15 weeks gestation was diagnosed with metastatic adenocarcinoma, which was deemed to be terminal. The patient elected to continue the pregnancy, as she was asymptomatic at the time; however the patient’s condition continued to deteriorate over the next few weeks with ensuing spread of bony metastases and pain. The patient was placed on morphine PCA and sent home with the PCA after adequate pain control had been established. A semi-elective c-section was performed at 34 weeks and 5 days under general anesthesia secondary to respiratory compromise, malignant hypercalcemia, and hemodynamic instability pointing to a possible terminal event. General anesthesia was elected secondary to notable volume contraction and mental status changes. General endotracheal anesthesia was performed using etomidate and succinylcholine for induction. 0.4% Isoflurane with 100% O2 was used for maintenance. Once the baby was delivered, maintenance was switched to nitrous oxide/02 and narcotics. A total of 1mg of Versed and 2 mg Dilaudid were used. Patient was extubated without complications once her respirations resumed spontaneously and with adequate effort. The baby was delivered healthy with Apgars of 9 and 9 however the mother died two weeks post surgery from complications of cancer.

Conclusion: When a patient is diagnosed with cancer, a team approach to treatment must be formulated keeping in mind the many complications of cancer and the possibility of rapid deterioration of the mother. With a rapidly deteriorating cancer patient, a perimortem c-section should be planned for as it has been proven to have positive outcomes. Anesthetic options must be carefully considered, although regional anesthesia may be the preferred method to ensure maternal-baby bonding. Factors such as patient preference, maternal bonding, metastatic spread, hemodynamic state, and metabolic state must be weighed when choosing regional versus general anesthesia.
SOAP A107
INABILITY TO ABDUCT LEGS: A NEW INDICATION FOR CESAREAN SECTION
Mhyre JM, Polley LS
Department of Anesthesiology, University of Michigan, Ann Arbor, MI

Introduction: Numerous risks have been associated with morbid obesity in parturients, including a higher incidence of failed epidurals, difficult intubation, and prolonged cesarean section times. Extreme morbid obesity (BMI>80), may present additional challenges, such as the inability to abduct the legs.

Case Report: A 28 yo woman, G3P1, presented at 38 weeks gestation for right lower extremity (RLE) lymphedema and cellulitis. Her past medical history was significant for gestational diabetes and extreme morbid obesity (5'7" 245 kg BMI 85). She had a prior cesarean section under epidural anesthesia at a weight of 105 kg. A decision was made to induce labor, and to deliver her vaginally using epidural analgesia. The airway examination was normal. Initial bimanual examination was not successful due to limited mobility of her hip joints, obesity, venous stasis, lymphedema, and tenderness of the RLE. Lacking sufficient thigh abduction to permit vaginal delivery of the fetus, the delivery plan was changed to cesarean section under epidural anesthesia.

Intravenous and arterial access was obtained. Using a long Tuohy needle for epidural catheter placement, the epidural space was located at 14 cm and the catheter was threaded to 20 cm. The epidural was dosed to a T6 level using 25 cc of 2% lidocaine, 0.8 mEq/cc sodium bicarbonate, 5 mcg/cc epinephrine and 5 mcg/cc fentanyl. Despite supplemental local anesthetic the block was inadequate for surgery and the anesthetic was converted successfully to general with a 7.0 ETT. The surgeons proceeded with a classical cesarean section through a supraumbilical midline incision, and delivered a live female infant nine minutes after skin incision, 5350gm, Apgars of 6 and 8. At the end of the case, the patient was extubated and recovered uneventfully. She was discharged eight days post-operatively with a PICC line for long-term intravenous antibiotics.

Discussion: Although the rate of spontaneous vaginal delivery is reduced among the obese, vaginal delivery has been shown to be associated with fewer peripartum complications, and should be attempted whenever possible. However, as this case demonstrates, a vaginal examination demonstrating sufficient leg abduction to permit the vaginal passage of the fetus should be documented prior to planning a vaginal delivery.

References:

SOAP A108
AMNIOTIC FLUID EMBOLISM SYNDROME: CASE REPORT OF AN ATYPICAL PRESENTATION
Mitchell JD, Schultz JR, Spahn TE, DeBalli P, Phillips-Bute B, Reynolds JD
Duke University Medical Center, Durham, NC

Amniotic fluid embolism (AFE) is a very serious, life threatening complication of pregnancy, accounting for 12% of maternal deaths. Classically, it presents with abrupt dyspnea and hypotension followed quickly by cardiopulmonary collapse, however, not all cases of AFE follow this scenario. There can be varied presentations of AFE. We present a case of a 37 year-old woman, status-post vaginal birth after cesarean (VBAC), who experienced a profound postpartum hemorrhage and subsequently developed disseminated intravascular coagulation (DIC). After a massive resuscitation spanning 5 hours in the operating room and including infusions of large amounts of crystalloid, colloid, and blood products, the patient was stabilized, admitted to the surgical intensive care unit (SICU), and eventually made a full recovery. We believe this case represents an atypical presentation of an amniotic fluid embolism.
EPIDURAL NEEDLES
Hustead RF, Froelich MA, Caton D
University of Kansas Medical Center, Wichita, KS; University of Florida College of Medicine, Gainesville, FL

Introduction: Advances in material and needle design have facilitated the integration of epidural anesthesia (EA) into routine anesthesiology care.

Methods: We present a historical overview of the epidural needle design changes and the rationale behind those changes.

Discussion: Edward B. Tuohy popularized continuous spinal anesthesia (SA) in the 1950s. He adopted a technique from Barker to insert a urethral catheter into the subarachnoid space using a Quincke type bevel. He then modified the needle into a Huber point needle to give a "directional" tip. This Tuohy® needle has seen many modifications to enhance its use in SA and EA. Hustead in 1954 modified the sharp Tuohy needle for EA, using difference in resistance technique (Fig. 1). The Hustead modification had an opening that would not exceed 2.7 mm, an angle of 12 to 15°, a blunt tip, and rounded heel (2); the blunt needle would not penetrate the skin, requiring a sharp needle skin introducer. It was not until 1965 that a manufacturer (Monoject) could be found willing to produce the needle to his un-patentable specifications. Crawford in Springfield, Mo and Jess Weiss in Boston preferred a short-beveled, straight epidural needle. Weiss used the hanging drop technique and added wings to the needle to allow him to advance it with both hands. Currently, most manufacturers produce an epidural needle with a directional tip that incorporates a short opening as did Hustead, but the round-heeled, blunt “Hustead” needle has now become sharp, like a “Tuohy.” We believe that changes in material design have significantly contributed to the success of EA.

References:
1. Anesthesiology 1944; 5:142-8.

Figure 1:
Legend: from left to right - 18 ga Tuohy, 16 ga Hustead, 18 ga Hustead, and 16 ga Tuohy needle.
POSTER REVIEW III

SOAP A111
THE EFFECT OF NEEDLE DESIGN AND LENGTH ON INJECTION PRESSURE
Holland DA, Kassapidis DT, Marenco JE, Ciliberto CF, Stein DJ
Department of Anesthesiology, St. Luke's-Roosevelt Hospital Center, New York, NY

Introduction: Neurological injury has been reported to occur following spinal anesthesia using atraumatic needles (1). Although the etiology is unclear, high pressure and pain on injection may alert to possible placement of a needle in the conus medullaris. Many anesthesiologists rely on their subjective evaluation of resistance to injection ("feel") in order to alert them to the potential for intraneural injection. However, this may be influenced by needle design. The purpose of this study was to determine pressure characteristics of needles with different designs and lengths.

Methods: The pressures required to inject through commonly used spinal needles were measured at injection speeds of 5, 10, 15, 20 and 30 ml/min. The needles were connected to an automated programmable infusion pump. The data were acquired using a digital manometer coupled to a computer. Student's t-test for unpaired data was used to detect if there were differences in injection pressure.

Results: Pressure required to inject varied among the needles.

<table>
<thead>
<tr>
<th>Needle Length</th>
<th>Pressure (psi) at 5 ml/min (Mean ± SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>90mm</td>
<td>1.07±0.006</td>
</tr>
<tr>
<td>120mm</td>
<td>1.40±0.000*</td>
</tr>
<tr>
<td>22-Gauge Sprotte</td>
<td>3.20±0.010*</td>
</tr>
<tr>
<td>24-Gauge Sprotte</td>
<td>4.37±0.006†</td>
</tr>
</tbody>
</table>

1 = Significantly greater than 90mm needle.
2 = Significantly greater than 22-gauge needle.

Discussion: The pressure required to inject through a needle was related to the rate of injection and differences in needle design and length. With a 25 gauge needle commonly used in obstetric anesthesia, the atraumatic needle tested resulted in lower injection pressure compared to the Quincke point needle. Anesthesiologists should be aware of such differences and may want to become familiar with the resistance to injection with a specific needle.

References
1. Reynolds F. Anaesthesia 2001; 56:238.

SOAP 112
ANESTHESIOLOGISTS PERCEPTION OF INJECTION PRESSURE
Bulceva S, Ciliberto CF, Marenco JE, Kassapidis DT, Stein DJ
Department of Anesthesiology, St. Luke's-Roosevelt Hospital Center, New York, NY

Introduction: Forceful injection may carry a risk of neurological injury and may influence the disposition of intrathecally injected local anesthetic. Most anesthesiologists rely on their perception of the "feel" of injection pressure to control the force of intrathecal injection. In this study we measured the pressure and speed of injection that clinicians exert during a simulated spinal injection.

Methods: Sixteen attending anesthesiologists were asked to inject 3 ml of solution during simulated intrathecal injection. The anesthesiologists, blinded to the purpose of the study and to the needle gauge, were asked to use the same speed and force of injection that they do in their practice. The injections were made, in random order, through 127 mm 25 and 27 gauge commonly used atraumatic spinal needles for CSE using 3 and 5 ml syringes. The pressure and time data were acquired using a manometer coupled to a computer via an analog-to-digital conversion board. Data were analyzed using a data analysis software package (BioBench 1.2, National Instruments, Austin, TX).

Results: The time required to inject solution varied from 10 to 56 secs (median 27 secs) with the 25 gauge and 60 to 169 secs (median 32 secs) with the 27 gauge needle using the 3 ml syringe. The number of times the pressure exceeded 10 and 20 psi for at least 1 sec during an injection of 3 ml of solution is shown in Figure 1. Higher injection pressures occurred with the 27 as compared to the 25 gauge needle particularly with the 5 ml syringe (ANOVA, p<0.05).

Discussion: Our data suggest that individual anesthesiologists vary with respect to their perception of "safe" pressure and appropriate speed of intrathecal injection. This disparity appears to be much greater with needles of a smaller gauge (e.g., a 27 gauge vs. a 25 gauge) and with a larger syringe. Further studies are required to determine whether the extremes of force and speed of injection may affect safety or the sensory level of spinal anesthesia.

Reference
1. Reynolds F. Anaesthesia 2001; 56:238.
SOAP A113
THE INSERTION ANGLE OF THE EPIDURAL NEEDLE AFFECTS THE SUCCESS OF THE BLOCKADE
Landa SE, Pal K, Winikoff SP
St. Joseph’s Regional Medical Center, Paterson, NJ

Introduction: There are very few recommendations in the anesthetic literature regarding how steep an angle to use when approaching the epidural space. We studied the effect of the angle of insertion of the epidural needle on complications and the overall success of the blockade.

Methods: In 102 laboring women the epidural space was identified using a 17g Tuohy needle (B. Braun, mfg.). With a sterile protractor, we measured the angle formed by the epidural needle and the patient’s back (range 90° - 125°). A 20g catheter with lateral holes was inserted 4-5cm into the epidural space. After aspiration and test dosing, a total of 10ml of 0.25% bupivacaine was administered. Dividing the patients into two groups with a lesser angle of insertion (90° - 107°) and a greater angle (108° - 125°), we determined: 1) the ease of catheter insertion (graded as minimal to no resistance on insertion vs. moderate to extreme resistance), 2) the incidence of paresthesias, 3) the incidence of intravascular cannulation requiring removal and re-insertion, and 4) the percentage of patients with complete analgesia after 20 minutes in each group.

Results: The group with the greater angle of insertion had easier catheter placement (75% vs. 62%), less paresthesias (21% vs. 46%), less intravascular cannulations (6% vs. 16%) and more satisfactory analgesia (86% vs. 62%).

Conclusion: When administering epidural analgesia, the needle should be inserted with significant cephalad angulation when possible in order to facilitate uncomplicated catheter insertion and successful analgesia.

SOAP A114
A RETROSPECTIVE STUDY ON THE DISTANCE TO THE EPIDURAL SPACE IN PARTURIENTS
Jaklitsch PM, Schultz JR, Muir MA, White WD, Reynolds JD
Duke University Medical Center, Durham, NC

Epidural infusion of anesthetic agents is one of the most common forms of analgesia available to laboring patients. There have been several studies published reporting that the average distance to the epidural space is less than 4.9 cm. However, we do not believe that this number accurately reflects our clinical experience. In addition, we hypothesize that there are differences in the distance to the epidural space amongst various ethnic groups and that the distance increases proportionally with increasing Body Mass Index (BMI). To test these proposals, we conducted a retrospective chart review of all parturients who received an epidural catheter at our institution in 2001. We collected information on the recorded distance to the epidural space, demographic data (height and weight), and patient ethnicity. Each patient’s BMI was calculated using the standard equation (weight (kg)/height (m2)). The data were evaluated using standard and descriptive statistical techniques. The effects of BMI, race, and their interactions were tested with multiple linear regression.

Our principle ethnic groups were African American, Hispanic and Caucasian. Mean epidural distances for all three ethnic groups were significantly greater than 4.9 cm. Furthermore, epidural distances increased significantly with increasing BMI; this effect was strongest amongst African Americans in comparison to the other racial groups.

The results confirm our hypothesis the mean distances to the epidural space in our obstetric patients is larger than documented in the literature. This increase correlates with an increase in BMI in our obstetric population. This information may be clinically helpful in planning or executing epidurals and/or spinals in those patients expected to have, or that have evolved into, difficult placements.

<table>
<thead>
<tr>
<th>N</th>
<th>Race</th>
<th>B* slope</th>
<th>P</th>
<th>R²</th>
<th>Dist. mean</th>
<th>BMI mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>436</td>
<td>AA</td>
<td>.126</td>
<td>&lt;1*</td>
<td>.407</td>
<td>6.2</td>
<td>32.8</td>
</tr>
<tr>
<td>167</td>
<td>Hisp</td>
<td>.077</td>
<td>&lt;1*</td>
<td>.165</td>
<td>5.3</td>
<td>29.2</td>
</tr>
<tr>
<td>421</td>
<td>Cau</td>
<td>.116</td>
<td>&lt;1*</td>
<td>.316</td>
<td>5.6</td>
<td>30.7</td>
</tr>
</tbody>
</table>

*p=.0177 (slopes differ)
SOAP A115
AIR OR SALINE FOR IDENTIFICATION OF THE EPIDURAL SPACE: A META-ANALYSIS
Morgan PJ, Tarshis J
Department of Anesthesia, Sunnybrook & Women's College Health Sciences Centre, Toronto, Ontario, Canada

Introduction: Controversy exists as to the preferred method of identification of the epidural space. The purpose of this meta-analysis was to compare outcomes using the loss of resistance to air and saline techniques.

Methods: We searched PubMed (1966-2002), Cochrane Central Register of Controlled Trials, Database of Abstracts of Reviews of Effectiveness (DARE) and International Journal of Obstetric Anesthesia for articles, using text terms “loss of resistance” “air” “saline” and “epidural technique”. The last search was conducted in October 2002. Review articles and abstracts from major scientific meetings (American Society of Anesthesiologists (ASA), Canadian Anesthesiologists’ Society (CAS) and the Society for Obstetric Anesthesia and Perinatology (SOAP)) were reviewed for the past 3 years. Studies were included if they were randomized, controlled trials (RCT) comparing loss of resistance to air or saline for epidural space identification. Two authors independently assigned a quality score. Discrepancies were resolved by consensus. Outcome measures included adequacy of analgesia, occurrence of paresthesiae, incidence of unintentional dural puncture and postdural puncture headache (PDPH).

Results: Sixty articles were retrieved of which 4 were randomized, controlled trials. Quality scores ranged from 2-4. The largest study involved non-pregnant patients; the remaining three studies involved a mixed obstetric population. Studies ranged in size from 50-3730. All four studies reported on the incidence of unintentional dural puncture and PDPH; three reported on adequacy of analgesia and 2 reported on the incidence of paresthesiae. There were no statistically significant differences in the incidence of unintentional dural puncture and postdural puncture headache (PDPH). Results: Sixty articles were retrieved of which 4 were randomized, controlled trials. Quality scores ranged from 2-4. The largest study involved non-pregnant patients; the remaining three studies involved a mixed obstetric population. Studies ranged in size from 50-3730. All four studies reported on the incidence of unintentional dural puncture and PDPH; three reported on adequacy of analgesia and 2 reported on the incidence of paresthesiae. There were no statistically significant differences in the incidence of unintentional dural puncture (Relative Risk (RR), 1.00, 95% CI, 0.68, 1.48) but there was a significantly lower risk of developing a headache when the loss or resistance to saline was used. (RR, 0.15, 95% CI, 0.06, 0.38) The risk of inadequate analgesia was significantly less when saline was used (RR 0.51, 95% CI 0.31, 0.84) but the incidence of paresthesiae did not differ (RR 1.14, 95% CI, 0.88, 1.49).

Discussion: A limitation of this analysis is the lack of large, good quality RCT comparing these techniques. Although a statistically higher incidence of PDPH was demonstrated when air was used, the volume of air was larger than many obstetrical anesthesiologists would routinely use in practice.

References

SOAP A116
SURVEY OF THE EPIDURAL TECHNIQUE AMONG OBSTETRIC ANESTHESIOLOGISTS IN THE USA
Adsumelli RSN, Schabel JE, Glass PSA
Department Of Anesthesiology, School of Medicine, SUNY @ Stony Brook, Stony Brook, NY

The technique of loss of resistance to air (LORA) or saline with or without a bubble (LORS) is the most commonly used method to locate the epidural space. Recently, publications implicate the use of air in producing pneumocephalus (pneumo) following dural puncture (DP) and immediate headache, patchy blocks (PB), venous air embolism and nerve compression especially when multiple attempts were made.

Aims: 1) To survey the practice of technique used to locate the epidural space and the rationale for their choice. 2) To survey the impact of the information in medical journals in changing clinical practice.

Methods: The study population included all American members of the Society of Obstetric Anesthesiologists and Perinatalogists (SOAP). The questionnaire was piloted, coded and distributed at 2002 SOAP meeting and also mailed. Statistical significance (p<0.05) was checked with chi square test.

Results: 938 surveys were sent. 50% were returned. Analysis revealed the current primary technique as: LORA 56%, LORS 41% and other 3%. 69% learned LORA as the first technique and 30% of them practice LORS now (p<0.0001). During the last 7 years, 9% changed from LORA®S and 3% LORS®A. Change was based on literature (29% LORA®S, 14% LORS®A) and clinical experience (60% LORA®S, 86%LORS®A). Responses to the rationale for their practice are expressed in Table 1.

Table 1: Rationale for practice of epidural technique

<table>
<thead>
<tr>
<th>Groups</th>
<th>Easy</th>
<th>Sensitive</th>
<th>↓ PB</th>
<th>↓ Pneumo</th>
<th>↓ DP</th>
<th>NT-1 DP</th>
</tr>
</thead>
<tbody>
<tr>
<td>LORA</td>
<td>71</td>
<td>41</td>
<td>2</td>
<td>1</td>
<td>18</td>
<td>19</td>
</tr>
<tr>
<td>LORS</td>
<td>43*</td>
<td>50</td>
<td>36*</td>
<td>58*</td>
<td>30*</td>
<td>3*</td>
</tr>
<tr>
<td>LORA→S</td>
<td>58*</td>
<td>32*</td>
<td>47*</td>
<td>29*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LORS→A</td>
<td>36</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

Data expressed as %. * p<0.01

Conclusion: LORA remains the commonest technique. Based on literature and their clinical observation of fewer complications with LORS, more providers are changing to LORS. Those not changing are concerned about DP when learning a new technique (NT).

EVALUATING THE PAIN OF EPIDURAL PLACEMENT IN
PARTURIENTS
Bell DJ, Schultz JR, White WD, Muir HA
Duke University Medical Center, Durham, NC

Anesthesia providers often tell patients that local anesthetic (LA) infiltration is “the worst part” of receiving epidural anesthesia (i.e. the most painful), but the validity of such statements has not been tested. To address this, we designed a randomized, prospective study to test the hypothesis that LA infiltration during the epidural procedure is the most painful portion of the procedure. The study was approved by our institution’s IRB. After providing informed consent, laboring women received an elective epidural using a PERIFIX Custom Epidural Anesthesia Tray (Product Code CESK). A 3 cc volume of 1.5% Lidocaine with 1:200,000 epinephrine (at room temperature) was used for LA infiltration with a 25 Ga. x 5/8 inch needle. Infiltration lasted five seconds. Anesthesia providers did not use the phrase “this is the worst part” at anytime.

Data collection included Verbal Rating Scores (VRS) at three distinct intervals during the epidural procedure: LA infiltration; epidural needle placement; and epidural catheter placement. Other data, including patient demographics, prior neuraxial block, use of intravenous analgesics, cervical dilation, lumbar spine pathology, anesthesia provider experience, number of epidural attempts, and VRS with the most recent contraction were also collected. To date, 20 patients have been recruited into this ongoing study.

The results show a mean VRS score of 8.4 for contractions, 4.5 for LA infiltrate, 4.2 for epidural needle placement, and 3.6 for catheter placement. VRS for mean, high, and low values are shown. Mean VRS scores for LA infiltration, epidural needle and catheter placement were similar, corresponding to mild-moderate pain in contrast to the severe pain of 8.4 reported with contractions. Our results indicate LA infiltration may not be “the worst” portion of the epidural procedure. It may be more accurate to explain to parturients receiving elective epidurals the procedure will produce some pain but usually less than their contractions.

COMBINED SPINAL-EPIDURAL ANALGESIA (CSEA) FOR CAESAREAN SECTION (CS): INJECTION OF LIDOCAINE VIA EPIDURAL NEEDLE REDUCES SUBSEQUENT SPINAL NEEDLE DURAL PUNCTURE PAIN.
van den Berg AA, Sadek M*, Swanson S*
Department’s of Anesthesiology, University of Texas at Houston, Texas, USA, and King Edward Memorial Hospital, Perth, Western Australia*

Method: With Institutional approval and patient consent 43 women undergoing CS under CSEA were randomized to receive either 3ml lidocaine 2% plus epinephrine 1:200,000(group lidocaine) or 3ml normal saline (group saline) injected into the L2-L5 lumbar epidural space through a 16 gauge epidural needle followed by dual puncture with a 27g spinal needle. One-minute thereafter dual puncture with a 27g spinal needle was performed, during which patients were asked to report any discomfort. Analysis used Chi-Tests (P<0.05).

Results: Of 43 women, 22 and 21 received lidocaine and saline respectively. No response to dural puncture was observed in 20 (91%) women given lidocaine and 4 (19%) given saline (P<0.0005) respectively. Two (9%) women given lidocaine and 17 (81%) given saline responded adversely to dural puncture (P<0.0005).

Comment: Minimizing needle stick discomfort in patients of all ages is a modality of good patient care. These data reveal that epidural injection of lidocaine before dural puncture is largely effective in reducing dural puncture discomfort during CSEA. Such injection, plus the judicious use of EMLA cream and infiltration of local analgesic is recommended to reduce needling discomfort in these and other, patients during CSEA.
POSTER REVIEW III

SOAP A119
MECHANISM OF EPIDURAL PARESTHESIA: IS IT THE CATHETER OR NEEDLE?
Allen MA, Vasdev GM, Burkle CM, MacKenzie RA, Southorn PA
Mayo Clinic, Rochester MN

Introduction: The incidence of paraesthesia with epidural catheter placement in the obstetric population is reported as high as 44%. Clinically, such paresthesia mostly occur as the catheter tip initially emerges from the needle. We hypothesized that the stiffness of the catheter and the angle of the epidural needle tip determine the force an epidural catheter exerts on surrounding tissues as it exits the needle. To test this hypothesis, we constructed a model to test in vitro the force exerted when a variety of epidural catheters is passed through different epidural needles.

Methods: Force measurements were made with a compression gauge and protractor. The maximum force acting on the compression plate with catheter advancement was measured 10 times for each catheter/needle combination. Catheters studied were: 20g Kendall SafeTrak® bullet tip epidural catheter (kbt) (copolymer), 20g Kendall SafeTrak® open tip epidural catheter (Teflon®) (kut), 20g Portex bullet tip epidural catheter (nylon) (pbt), and the 19g Arrow® FlexTip Plus™ epidural catheter (wire spiral polyurethane) (s) and needles were 18g Husted® epidural needle (h), 18g winged Weiss® epidural needle (w), 18g winged Espocan® Tuohy epidural needle (e), and 17g Tuohy (winged) epidural needle (t). The mean and standard error were determined for each catheter/needle combination and compared by the analysis of variance and Dunnett's Multiple Comparison Test with p<0.05 as significant (JMP 4.04 software).

Results: The angle of needle tip was e=22°, h = 2°0, t = 25°, w = 18°. One way analysis of variance force vs catheter-needle combination

Discussion: Our study demonstrated that there is an association between needle type and catheter combination and the force exerted on tissues with catheter advancement. The Kendall Bullet tip catheter pushed through an Espocan needle and Portex Bullet tip catheter advanced through Husted needle combinations were significantly better than the other polyamide catheter/needle combinations. When compared with the Arrow/Tuohy, only the Kendall Bullet Tip/Espocan combinations were similar. This in vitro study implies that both the needle and catheter chosen are important determinants in reducing the risk of paraesthesia.

SOAP A120
LABOR EPIDURAL CATHETER INDUCED PARESTHESIA ACCOMPANIED BY LOCALIZED SYMPATHETIC RESPONSE
Zhang R, Caton D
Department of Anesthesiology, University of Florida College of Medicine, Gainesville, FL

Introduction: Paresthesia during epidural catheter placement is typically characterized by a poorly localized burning sensation radiating to the hip or leg. It is usually transient, and most clinicians consider it a minor problem. In this report, we describe a patient who had persistent paresthesia in her foot, which was associated with localized changes in skin color and temperature, a situation not previously reported.

Clinical Course: A healthy 28-year-old, nulliparous woman in active labor at term requested analgesia. An epidural catheter was placed at the L3-4 inter-space with the midline approach without technical difficulties. However, the patient noticed a "pins and needles" sensation on the lateral aspect of her right foot as the epidural catheter was inserted 5-cm into the epidural space. A bolus dose of 10-ml 0.1% ropivacaine provided excellent relief of her labor pain, but the paresthesia in her right foot remained and was difficult to tolerate. Examination showed her right foot to be pale and very cold compared to the left. The catheter was pulled back 2-cm, leaving 3-cm in the epidural space. This provided immediate relief of the paresthesia. The temperature and color of her right foot also returned to normal. The epidural infusion continued at 6 ml/hr with 0.1% ropivacaine and 2 µg/ml fentanyl. The patient had excellent labor analgesia and no further paresthesias. Four hours later the patient vaginally delivered a healthy infant. On follow up interviews, the patient reported some slight numbness in her right foot, which completely resolved by the third day postpartum. No other neurologic complications appeared in the next year.

Discussion: Few neurologic complications occur following neuraxial blocks. However, two thirds of serious complications have been associated with paresthesia during the procedures. Severe and prolonged irritation of nerve fibers is likely the cause. In our patient, the persistent paresthesia was associated with localized changes in skin color and temperature at the same topographic area. This prompted us to act quickly, which resulted in a favorable outcome. This localized response due to sympathetic discharge associated with epidural catheter placement has not been previously described. It is likely that this is an overlooked phenomenon that, if noticed, may help us in our clinical decision making.
CATHETER DISPLACEMENT IN LABOR EPIDURALS—ARE THEY MOVING?
Gunn CG, Schultz JR, Muir HA, Phillips-Bute B, Reynolds JD
Duke University Medical Center, Durham, NC

A large percentage of cesarean sections (C/S) at our institution are performed using epidural anesthesia, most of which are placed for labor analgesia and later converted to a surgical block. A certain percentage of these epidurals “fail” to provide sufficient surgical anesthesia. Catheter displacement can occur during labor and delivery: a serial assessment of 294 parturients at our institution determined that in >50% of these patients the epidural catheter moved 1 cm or more. The focus of this analysis is to determine if change in catheter position is related to epidural failure. Data were reviewed prospectively over a 3-month period in patients who received an epidural for labor analgesia and underwent a C/S. The catheter length at the skin at time of placement and removal was recorded and the difference calculated. Failure of the epidural catheter was defined as conversion to general anesthesia or supplementation with systemic anesthetic agents. During our study period, 38 patients had epidurals converted to surgical block. The epidurals which failed migrated an average of 1.33 cm (SD = 2.4, N = 8) compared to successful epidurals which moved an average of 0.61 cm (SD = 1.11, N = 30). At this point the study is under-powered to detect a significant difference and requires a sample size of 221 surgical epidurals. However, the observed trend supports the proposal that failure of surgical blocks may correlate to the distance an epidural catheter is displaced. Currently, it is our practice to place the catheter 5 cm into the epidural space and secure it to the skin using compound benzoin tincture and adhesive dressing. Whether this practice needs to be modified remains to be determined.

DIFFICULT EPIDURAL PLACEMENT: USE OF BACK X-RAYS AS A GUIDE TO SUCCESS
Ross VH, Thomas J
Wake Forest University School of Medicine, Winston-Salem, NC

A 38 yo female parturient G1P0 with a hx of mental retardation presented for delivery. The patient’s hx was also significant for severe scoliosis for which she had numerous surgeries including Harrington Rod placement, subsequent removal and multiple lumbar laminectomies. On PE she was 5’2” and weighed 120 lbs. VS BP 120/84 P 72 R 14 T 37. Her airway revealed a receding chin <2FB, decreased extension of her neck and poor mouth opening classified as a mallampatti 4. Her back revealed a severe curvature to the spine with a scar traversing its length from the cervical through lumbar region. The OB team felt that because of her contracted frame she might have a difficult delivery. With a non-favorable airway it was decided to place an epidural early. Two anesthesiologists (a senior resident and an attending) had two unsuccessful attempts at epidural placement. It was then decided with consultation with OB that an x-ray of the back would be advantageous. X-rays were obtained, and revealed obliteration of all interspaces above L4. A space was identified at L4-L5 and with cm measurement from the x-ray and then the patient’s back an epidural was placed at that interspace, with little difficulty. The epidural was injected with a local anesthetic and worked successfully throughout labor and a subsequent vaginal delivery. X-ray films are rarely utilized even in patients with a hx of skeletal disease or surgery. This case demonstrates that under certain circumstances x-rays may alter the approach to and improve success of regional anesthesia in certain obstetric patients.
A "truly" failed spinal is defined as an absent or limited sensory or motor deficit following administration of local anesthetic into the CSF. While nearly all spinal anesthetic failures can be explained on technical grounds alone, there are a handful of truly failed spinals reported, for which the etiology remains elusive. Although physiologic resistance to local anesthetics has been postulated to explain past cases of truly failed spinals, a more likely explanation is anatomic maldistribution of local anesthetic within the CSF. Case Report: A 37 year-old G2P2 presented for tubal ligation on post-partum day #1. She had never received regional analgesia, and reported no failures of local anesthetic during previous dental procedures. In the sitting position, 2.2 cc of 2% mepivacaine (44mg) with 10mcg fentanyl and 1cc 10% glucose was injected into the CSF at the L4-L5 interspace via a 25-gauge Sprotte needle. A right-sided, single (S1) sensory deficit was noted after 10 minutes. A second dose (40mg) using 2 cc of 2% mepivacaine and 1cc 10% glucose, with 10mcg fentanyl was injected into the CSF at the L3-L4 level, however, no further appreciable level of anesthesia was detected. A third spinal anesthetic was attempted using 1.25cc of hyperbaric 5% lidocaine into the L4-L5 intrathecal space. Again, no appreciable sensory level was obtained above S1 after 10 minutes. The patient subsequently underwent an uneventful general anesthetic, and reported no neurologic deficits postoperatively. MRI of the lumbar sacral spine revealed a considerably enlarged thecal sac (approximately 1.5-2X larger than normal) on sagittal views. Although unproven, a large thecal volume may be an important contributor to insufficient distribution of the local anesthetic within CSF, and indeed, past studies and case reports have identified both larger volumes of CSF and localized pooling of intrathecal anesthetics as a possible cause of maldistribution, and hence, truly failed spinals. Maldistribution results from the complex interactions of the multiple determinants of distribution of local anesthetic within the CSF, including, but not limited to, dose, concentration, volume, and baricity. The alternative possibility of an inert local anesthetic as a cause of the failed spinals is remote, but should always be a consideration when a spinal anesthetic fails. In this patient, mepivacaine was drawn from 2 different batch numbers, and failure of a second amide spinal anesthetic in this patient renders the "inert local anesthetic" theory doubtful. In conclusion, the simultaneous operative roles of dose, concentration, and volume make it ultimately impossible to determine which is the exact cause of "true" spinal anesthetic failure. Ultimately, however, it is a failure of the distribution of the local anesthetic within the CSF, and patients who fail to respond to an intrathecal dose of local anesthetic should not be assumed physicochemically resistant. Epidural or general anesthesia may be a preferable solution after an initial failed spinal anesthetic, as multiple, repeated attempts with large doses of intrathecal local anesthetics should be avoided to eliminate the risk of permanent neurologic damage. 1. Greene NM: Distribution of local anesthetic solutions within the subarachnoid space. Anesthesiology 1985; 64:715-30. 2. Schmidt et al.: A series of truly failed spinal anesthetics. J Clin Anesth 1990; vol 2, 336-338. 3. Rigler ML and Drasner K: Distribution of catheter-injected local anesthetic in a model of the subarachnoid space. Anesthesiology, 1991; 75:684-692.
INTRODUCTION: Incidences and characteristics of failures in regional labor analgesia have not been well reported or defined.

Method: We retrospectively reviewed the quality assurance (QA) data in 19,053 deliveries from yr. 2000 to 2002 at our teaching institution. The QA data were obtained in 3 steps: self-reported QA complication forms daily; a physician reviewed all anesthetic records daily to identify problems not reported; then all complications were summarized, tabulated and tracked monthly. We reviewed and analyzed the QA data from the past 3 years on a spreadsheet and presented here the results concerning the failure characteristics of regional analgesia during labor.

Results: For the 3 years, the rate of regional labor analgesia had been increasing consecutively from 70% to 74% to 84% respectively, with an average of 75%.

<table>
<thead>
<tr>
<th>3-yr Outcomes</th>
<th>EPID</th>
<th>CSE</th>
<th>BOTH</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of Labor pts</td>
<td>47%</td>
<td>28%</td>
<td>75%</td>
<td></td>
</tr>
<tr>
<td>% Labor pts del vag</td>
<td>87%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% Labor pts del C/S</td>
<td>13%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall % Failure</td>
<td>14%</td>
<td>10%</td>
<td>12%</td>
<td>.000001*</td>
</tr>
<tr>
<td>% Initial IV cath</td>
<td>7%</td>
<td>5%</td>
<td>6.4%</td>
<td>&lt;.0003*</td>
</tr>
<tr>
<td>cleared</td>
<td>46%</td>
<td>48%</td>
<td>46%</td>
<td>NS*</td>
</tr>
<tr>
<td>% Migrate IV cath</td>
<td>0.24%</td>
<td>0.25%</td>
<td>0.25%</td>
<td>NS*</td>
</tr>
<tr>
<td>% cleared</td>
<td>21%</td>
<td>8%</td>
<td>16%</td>
<td>NS*</td>
</tr>
<tr>
<td>% Known WTAP</td>
<td>1.4%</td>
<td>0.8%</td>
<td>1.2%</td>
<td>&lt;.002*</td>
</tr>
<tr>
<td>Of above %EBP</td>
<td>31%</td>
<td>28%</td>
<td>30%</td>
<td>NS*</td>
</tr>
<tr>
<td>% Occult WTAP</td>
<td>0.45%</td>
<td>0.4%</td>
<td>0.43%</td>
<td>NS*</td>
</tr>
<tr>
<td>Of above % EPB</td>
<td>83%</td>
<td>79%</td>
<td>82%</td>
<td>NS*</td>
</tr>
<tr>
<td>% of CSE: No CSF</td>
<td>1.8%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% CSE: No SAB Analg</td>
<td>0.6%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>InadeqAnesReplaced</td>
<td>7.1%</td>
<td>3.2%</td>
<td>5.6%</td>
<td>&lt;.000001*</td>
</tr>
<tr>
<td>Did Not Replaced</td>
<td>1.3%</td>
<td>3.4%</td>
<td>2.1%</td>
<td>&lt;.000001*</td>
</tr>
<tr>
<td>Inadeq+Not Replaced</td>
<td>8.4%</td>
<td>6.6%</td>
<td>7.7%</td>
<td>&lt;.0003*</td>
</tr>
<tr>
<td>% pts Multi Replaced</td>
<td>1.9%</td>
<td>0.65%</td>
<td>1.5%</td>
<td>&lt;.000001*</td>
</tr>
<tr>
<td>% EPID/CSE failed at C/S</td>
<td>7.1%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% failed from SAB at C/S</td>
<td>2.7%</td>
<td></td>
<td></td>
<td>&lt;.000001*</td>
</tr>
<tr>
<td>% EPID/CSE convert to GA at C/S</td>
<td>4.3%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% SAB converted to GA at C/S</td>
<td>1.1%</td>
<td></td>
<td></td>
<td>&lt;.000001*</td>
</tr>
</tbody>
</table>

*EPID vs CSE; +EPID/CSE vs SAB; Above Data for 3 yrs total

Discussion: It is of interest that half of the initial epidural IV catheters could be corrected to provide good epidural analgesia by manipulation such as flushing or pulling catheter back. 13% of pts with labor epidural proceeded to C/S, but 7.1% of them failed at C/S in contrast to 2.7% failed when a spinal block was performed in OR for C/S. Some of the outcome differences between groups might be due to differences in patient populations. This large retrospective review also identifies areas for prospective studies to further isolate risk factors associated with different failures to improve outcomes and clinical care.
Anesthesiology
2003;98, Supp 1

POSTER REVIEW III

SOAP A127
PROLONGED SPINAL ANESTHESIA IN A PARTURIENT FOLLOWING ADMINISTRATION OF A STANDARD EPIDURAL TEST DOSE WITH LIDOCAINE AND EPINEPHRINE
Kuczkowski KM, Bellars R University of California, San Diego, CA

Introduction: The safety and efficacy of an epidural test dose with lidocaine and epinephrine to rule out intravascular or subarachnoid epidural catheter placement is well established. We herein report a case of a healthy parturient who developed a sudden onset, prolonged duration T2 sensory level of spinal anesthesia following administration of a standard epidural test dose with lidocaine and epinephrine.

Report of case: A 36 y/o 165 cm, 67 kg, G1P0 healthy female at 37 weeks gestation was in labor and consented to epidural labor analgesia. An 18-GA Tuohy-Schliff epidural needle was introduced with the loss of resistance to saline technique and the epidural space was identified on the first attempt. A 20-GA multi-orifice epidural catheter was inserted 5 cm into the epidural space. Aspiration from the epidural catheter was negative for blood and CSF. An epidural test dose consisting of 3 ml of 1.5 % lidocaine (45 mg) with epinephrine 1:200,000 (15 1/4g) was administered over 30 seconds in-between uterine contractions and in approximately 3-5 minutes resulted in a T2 sensory level of spinal anesthesia. The patient remained calm and hemodynamically stable. The respiratory rate was 20 breaths/min and hemoglobin oxygen saturation was 100%. FHR was reactive and 140 beats/min. No additional analgesia was required for an uneventful vaginal delivery of a healthy newborn (Appar scores of 9 and 10, after one and five minutes, respectively), which was accomplished 125 minutes after the onset of spinal block. The patient did not require any treatment and spinal block totally receded over 197 minutes.

Discussion: Although it is tempting to assume that the catheter might have been initially positioned in the subdural space (what may explain the negative aspiration test), the time of onset of spinal anesthesia described in this report seems consistent with subarachnoid injection of lidocaine and epinephrine. Palkar et al. reported a case of an obstetric patient who developed a sudden onset, short duration (5 minutes) total spinal block after receiving epidural test dose with 45 mg of lidocaine and 15 1/4g of epinephrine (1). However, the authors of this report are not aware of any reports documenting a sudden onset, prolonged duration (197 minutes) sensory level of spinal anesthesia following administration of a standard epidural test dose with lidocaine (45 mg) and epinephrine (15 1/4g). In conclusion, this case report demonstrates that in obstetric anesthesia practice great vigilance is required even when routine "gold standard" procedures with a good record of safety are conducted.


SOAP A128
SEVERE PERSISTENT FETAL BRADYCARDIA FOLLOWING SUBARACHNOID ADMINISTRATION OF FENTANYL AND BUPIVACAINE FOR INDUCTION OF A COMBINED SPINAL-EPIDURAL ANALGESIA FOR LABOR PAIN
Kuczkowski KM University of California, San Diego, CA

Introduction: Several researchers have recently described uncommon maternal and fetal complications following induction of combined spinal epidural analgesia (CSEA) during labor. I herein report a case of a severe prolonged fetal bradycardia following subarachnoid injection of 5 1/4g of fentanyl in combination with 2.5 mg of bupivacaine for induction of a CSEA technique for labor pain.

Report of case: A 21 y/o G1P0, laboring female at 39 weeks gestation received a CSEA, which was performed in a standard manner with an 18-GA Tuohy-Schliff epidural needle and 27GA Pencan needle. After the appearance of CSF at the hub of the spinal needle, 5 1/4g of fentanyl combined with 2.5 mg of bupivacaine was injected into the subarachnoid space. A 20-GA multi-orifice epidural catheter was inserted 6 cm into the epidural space. Aspiration from the catheter was negative for CSF and blood. Approximately 5 minutes after the subarachnoid injection, severe fetal bradycardia (FHR of 50 beats/min) was reported. Maternal vital signs remained stable. The pinprick sensory level of analgesia was a T8. There was no evidence of uterine hypertonicity. The FHR did not increase in response to maternal oxygen administration, change in maternal position (knees-elbows position), direct fetal scalp stimulation and administration of subcutaneous terbutaline. An emergency C-section under general anesthesia was performed and an uneventful delivery of a female fetus, who had Appar scores of 4 and 8, after one and five minutes, respectively was promptly accomplished.

Discussion: D'Angelo and Eisenach reported a case of a severe maternal hypotension and transient fetal bradycardia after a CSEA with 7.5 1/4g of sufentanil and 2.5 mg of bupivacaine (1), and concluded that fetal bradycardia was secondary to maternal hypotension. Friedlander et al. described a case of a parturient who developed uterine hyperactivity and fetal bradycardia after subarachnoid administration of fentanyl during labor (2). The authors postulated that uterine hypertonus and resulting decrease in uteroplacental perfusion, may explain the fetal bradycardia after subarachnoid opioid administration. However, the author of this report is not aware of any other reports documenting emergent, intrapartum obstetric and anesthetic management of a severe persistent fetal bradycardia with maternal vital signs (specifically no hypotension) and normal uterine tone (specifically no hypertonus) following induction of CSEA with subarachnoid fentanyl and bupivacaine for labor pain.

References:
1. Anesthesiology 1997; 87: 166-168.
SOAP A129
PROPHYLACTIC ONDANSETRON FOR PRURITUS ASSOCIATED WITH THE USE OF INTRATHECAL FENTANYL FOR ANALGESIA LABOR
Harnett MJP, Walsh ME, Segal S
Brigham and Women's Hospital, Boston, MA

Introduction: Pruritus occurs in 60-80% of parturients who receive intrathecal opioids for labor analgesia (1,2). To date there has been no dose-response study evaluating the prophylactic effect of ondansetron for intrathecal induced pruritus in the setting of labor analgesia. We performed a prospective, randomized, double-blinded clinical study to test the hypothesis that ondansetron 2mg is as effective as 4mg or 8mg and more effective than placebo in decreasing the incidence of pruritus associated with the use of intrathecal fentanyl in Ces for labor analgesia.

Methods: With IRB approval, 40 parturients planning neuraxial analgesia for labor were recruited and randomized to one of 4 groups. Group 1 received saline IV, group 2 received ondansetron 2mg IV, group 3 received 4mg ondansetron IV and group 4 received 8mg ondansetron IV at the time of injection of spinal medication (25mg fentanyl and 2.5mg bupivacaine). Both pruritus and pain were assessed using a 100mm VAS. Assessments were made at time 0 (time of injection of spinal medication) and times 5, 15, 30, 60 and 90 minutes. Patients had the option of receiving nalbuphine 5mg IV as a rescue medication for pruritus at any time during the study period.

Results: In all groups, pruritus significantly increased after intrathecal fentanyl, peaking at 30 minutes after injection. This variation over time was highly significant (repeated measures ANOVA, p<0.0001). Ondansetron significantly affected the incidence of pruritus (repeated measures ANOVA for ondansetron*time interaction, p=0.0075). Comparing individual time points, the degree of pruritus was significantly lower in the 8mg group as compared to the control group at 30, 60 and 90 minutes (Fischers PLSD, p<0.05). Analgesia was indistinguishable between the groups.

Conclusion: We found a clear relationship between ondansetron and the pattern of itch. Pruritus increased over the first 30 minutes in all groups, thereafter the intensity of the itch decreased but the pattern was preserved.

References:

SOAP A130
ITCHING FOR AN ANSWER: THE EFFECTIVENESS OF 5-HT3 RECEPTOR ANTAGONISTS IN TREATING NEURAXIAL OPIOID-INDUCED PRURITUS IN OBSTETRIC PATIENTS
Councilman-Gonzales LM, Fritcher MH
Scott & White Memorial Hospital, Dept. of Anesthesiology, Texas A&M Health Science Center, Temple, TX

Introduction: The use of regional anesthesia for operative delivery has become a widespread practice in the area of obstetrics. A popular adjunct to regional anesthesia techniques is the use of neuraxial opioids. Pruritus is a common side effect of neuraxial opioids that is particularly bothersome in the obstetric population. Recently it has been suggested that serotonin, mediated by 5-HT3 receptors, might be involved in the production or sensation of pruritus. A few studies have focused on the use of ondansetron, a 5-HT3 receptor antagonist, in treating neuraxial opioid-induced pruritus with favorable results. However, dolasetron, another 5-HT3 receptor antagonist, has never been studied as a potential treatment modality in this setting according to our literature review. This study will determine the effectiveness of dolasetron and ondansetron in the treatment of moderate to severe pruritus in patients undergoing labor analgesia or non-emergent cesarean delivery utilizing neuraxial opioids for pain control.

Methods: We are conducting a prospective, randomized, double-blind study on consenting patients complaining of moderate to severe pruritus at any point after receiving neuraxial opioids. A total of 104 patients complaining of moderate to severe pruritus will receive a study drug randomized by pharmacy into 2 treatment groups (52 patients per group). Treatment modalities include: ondansetron 4 mg and dolasetron 12.5 mg. Repeat treatment will be offered if no relief (Pruritus score < 2) after 20 minutes. After treatment, vital signs (blood pressure, heart rate), pruritus scores, sedation scores, and side effect profiles will be monitored for 24 hours. Success is defined as a reduction of pruritus to mild or none within 1 hour after treatment. Failure is defined as continued moderate to severe pruritus for 1 hour after treatment is administered. If failure occurs, naloxone 40 mcg is used as a rescue medication. If patients complain of recurrence of moderate to severe pruritus at any point within the 24 hour observance period, they will be treated with naloxone as a rescue medication. Once naloxone is administered, the study is automatically terminated. Patients will fill out satisfaction surveys upon conclusion of the study. All data will be collected by the research nurse and submitted to the Biostatistics Department for statistical analysis at six-month intervals.

Statistical Analysis: The percentage of treatment successes in each group (a decrease in pruritus score to < 2 within 1 hour of treatment) will be compared using the chi-square test. The time required to achieve successful treatment will be analyzed using life-table methods (Kaplan-Meier survival curves). The percentage of patients with any drowsiness (Sedation score >1) in the first hour of treatment will be analyzed using the chi-square test. The time required to achieve successful treatment success will be analyzed using life-table methods. The Biostatistics Department will perform interim analyses at six-month intervals, and the findings will be reviewed with a physician not associated with the study.

Results: This study is ongoing. At the time of submission of this abstract we have consented 29 patients, 12 of whom were subsequently enrolled in the study. Of the 12 patients enrolled, 10 were considered a success, their pruritus reduced to < 2 within one hour of treatment. Of the 12 patients, 7 required a repeat dose of the study drug and 3 required the rescue medication. Two patients required rescue medication within the first hour after treatment and were considered failures. One patient was successfully treated, however required rescue medication three hours after treatment. So far, the results appear promising for the utilization of 5-HT3 receptors for the treatment of opioid-induced pruritus, confirming the results of prior studies. If dolasetron is shown to be as effective as ondansetron for treating opioid-induced pruritus, we will have a more cost-effective therapy available in our armamentarium.
POSTER REVIEW III

SOAP A131
BACK PAIN AND EPIDURAL ANALGESIA FOR LABOR AND DELIVERY-A SYSTEMATIC REVIEW
Wight WJ, Halpern SH
Department of Anaesthesia, Sunnybrook and Women’s Health Sciences Centre, Toronto, ON, Canada

Introduction: Numerous studies have been published to determine whether or not epidural analgesia for labor and delivery causes long-term back pain. Retrospective studies provide unreliable results. We therefore performed this systematic review of prospective studies and randomized controlled trials to determine this relationship.

Methods: The search strategy for relevant studies included the use of electronic databases, manual searches of major anesthetic journals and reference listings using appropriate MESH terms and text words. We included in the review studies that were either randomized controlled trials or prospective cohort studies. The search was carried out independently by the two authors and any disagreement regarding eligibility of the studies was resolved by consensus.

Results: Eight studies were identified as fitting the search criteria. These included three randomized controlled trials and five prospective cohort studies. The main findings are presented in Table 1. The total number of patients was 4400, with similar numbers in each group. The timing of assessment of patient’s back pain ranged from 6 weeks to 12 months. No study found a statistically significant increase in the prevalence of long term back pain in the epidural group compared with the control group. The absolute difference between the epidural and control groups ranged from -0% to +8% (figure 1). Four studies specifically looked for the incidence of new back pain (defined as a new onset of back pain not present before or during the pregnancy), but none found a significant relationship between this and epidural analgesia (absolute difference +1% to +7%).

Discussion: The available data does not support the association between the use of epidural analgesia for labour and delivery and the development of long-term back pain. Among all demographic, obstetric, and epidural variables the only factors that have been found to be significantly associated with postpartum back pain are backache before and during pregnancy. The main findings are presented in table 1. The total number of patients was 4400, with similar numbers in each group. The timing of assessment of patient’s back pain ranged from 6 weeks to 12 months. No study found a statistically significant increase in the prevalence of long term back pain in the epidural group compared with the control group. The absolute difference between the epidural and control groups ranged from -0% to +8% (figure 1). Four studies specifically looked for the incidence of new back pain (defined as a new onset of back pain not present before or during the pregnancy), but none found a significant relationship between this and epidural analgesia (absolute difference +1% to +7%).


Figure 1

Table 1: Outlined results of included studies

<table>
<thead>
<tr>
<th>Study</th>
<th>Time of Assessment</th>
<th>Back Pain and Epidural (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loughnan</td>
<td>6 weeks</td>
<td>-0% to +5%</td>
</tr>
<tr>
<td>Jougasaki</td>
<td>1 week</td>
<td>-0% to +7%</td>
</tr>
<tr>
<td>Jougasaki</td>
<td>3 weeks</td>
<td>-0% to +7%</td>
</tr>
<tr>
<td>Macarthur</td>
<td>3 weeks</td>
<td>-0% to +7%</td>
</tr>
<tr>
<td>Russell</td>
<td>4 weeks</td>
<td>-0% to +7%</td>
</tr>
<tr>
<td>Patel</td>
<td>4 weeks</td>
<td>-0% to +7%</td>
</tr>
</tbody>
</table>

SOAP A133
DEATH FOLLOWING CESAREAN DELIVERY: MASSIVE OBESITY, CONTINUOUS SPINAL ANESTHESIA, AND SUBDURAL HEMORRHAGE
Beland JE, Bell EA, Spielman FJ
University of North Carolina, Dept. of Anesthesiology, Chapel Hill, NC

Anesthetic management of the massively obese parturient is challenging. We present a case of a 288 kilogram (633 pound) parturient delivered by elective cesarean section. The patient was a 30-year-old, gravida 2, para 1 at term with body mass index of 99.4. Past medical history was significant for deep vein thrombosis, pulmonary embolism (PE), and chronic anticoagulation. Risks and benefits of general and regional anesthesia were discussed in detail, after which we planned a continuous spinal anesthetic. Anticoagulation was stopped one day prior to surgery and coagulation studies were normal the day of surgery. After successful placement of a spinal catheter, intermittent doses of bupivacaine were administered to obtain a sensory blockade. During the ninety-minute operative procedure, the patient received 15mg bupivicaine and moderate amounts of ephedrine and phenylephrine for maintenance of hemodynamic stability. The surgery resulted in a viable male infant with Apgar scores of 3 and 5 at one and five minutes, respectively. The immediate postoperative course was uneventful. The patient was started on intravenous patient-controlled analgesia with fentanyl. The spinal catheter was discontinued prior to full anticoagulation, which resumed twelve hours postoperatively. On postoperative day (POD) one, the patient complained of neck pain and headache. These symptoms were treated with intravenous fluids, demerol, morphine, and intravenous caffeine. On postoperative days two and three the patient had mild improvement of her nonpostural headache, but did complain of tinnitus and decreased hearing. Cosyntropin and sumatriptan were given on POD three and four respectively, without resolution of headache or neck pain. On POD five she developed mental status changes requiring endotracheal intubation, mechanical ventilation and transfer to the ICU. Differential diagnosis included intracranial hemorrhage, CNS infection and PE; however, her obesity created technical difficulties, which prevented radiological evaluation via CT or MRI. On POD seven, neurology and ophthalmology consults were obtained to evaluate possible elevation of intracranial pressure and CSF analysis. Reversal of anticoagulation was initiated. On POD eight, the patient was declared brain dead and life support was withdrawn. Post mortem examination revealed a lethal sized posterior-fossa subdural hemorrhage. This case report emphasizes the need for aggressive assessment of headache in morbidly obese parturients following regional anesthesia. The safety of full anticoagulation in the immediate postoperative period requires reevaluation.

SOAP A134
NOT ALL PERIPARTUM HEADACHES ARE POST DURAL PUNCTURE HEADACHES: A CASE OF RUPTURED AVM
Velickovic IA, Yang M, Leicht CH
Ohio Valley Medical Center, Wheeling WV and Western Pennsylvania Hospital, Pittsburgh, PA

A 32-year-old female developed a severe headache six days after CSE for an uncomplicated vaginal delivery. A large ruptured arteriovenous malformation (AVM) of the brain was found during emergency craniotomy. The patient never regained consciousness and died several days later. The medical literature does not reveal a connection between AVM rupture and CSE but does indicate that women with an AVM are at increased risk for rupture in the peripartum period. In evaluating the postpartum patient with a headache, this case illustrates the need for physicians to maintain a high index of suspicion for those rare, but potentially fatal conditions that may masquerade as a PDPH.
Despite continuing advances in prenatal care, delivery at experienced tertiary care centers, improved neonatal resuscitation and the ready use of extracorporeal membrane oxygenation (ECMO), the postnatal mortality due to resultant pulmonary hypoplasia and secondary pulmonary hypertension is still disturbingly high. Prenatally diagnosed CDH is associated with a much higher mortality than postnatally diagnosed CDH. The clinical severity varies from those with a relatively “good” prognosis who will do well with aggressive postnatal care to those with a “grim” prognosis who may benefit from prenatal intervention. Currently, the most reliable indicators for poor outcomes for left CDH are position of the fetal liver and the LHR (right lung-to-head ratio). Those fetuses with liver herniation into the hemithorax have about a 50% chance of survival. Furthermore, fetuses with a LHR of less than 1.4 have a 38% chance of survival with no survivors with an LHR of less than 1. Furthermore, it is assumed that with other severe congenital anomalies (i.e. congenital heart disease), survival would be dismal.

From November 2000 until October 2002, nine fetuses with “liver up” CDH and low LHR presented to the Advanced Fetal Care Center at Children’s Hospital, Boston. Two of these fetuses also had a prenatal diagnosis of congenital heart disease. All but one fetus presented with a left sided CDH. Following preoperative evaluations with fetal ultrafast MRI, fetal ultrasonography, fetal echocardiography and extensive maternal counseling, the EXIT (ex utero intrapartum treatment) procedure was planned. The average gestational age at the time of intervention was 37 2/7 weeks. Because of poor oxygenation following a trial of ventilation with partial delivery, 6 out of 9 fetuses required ECMO prior to clamping of the umbilical cord. Two patients required ECMO cannulation several hours later secondary to respiratory failure and the remaining patient required only standard mechanical ventilation following delivery. The average duration needed for ECMO was 7.6 days. Mechanical ventilatory support averaged 43.1 days with a average ICU stay of 56.7 days. Two deaths. One baby died at 3 1/2 months of age from respiratory failure and the other died at 6 1/2 months from presumed sepsis. Survival rates in this high risk population was 78%.

Conclusion: The EXIT-ECMO procedure may be offered in a select group of fetuses with CDH and poor prognostic indicators with significantly higher survival rates when compared with conventional medical therapy.

Objective: Intrauterine cardiac intervention for fetuses with aortic stenosis, pulmonary stenosis, and intact atrial septum has yielded promising preliminary outcomes. Intra-operative balloon dilation of stenotic valves often results in critical fetal bradycardia. Methods of fetal resuscitation during these procedures and outcomes are presented.

Study Design: After IRB approval, we retrospectively reviewed the anesthetic records, surgeon’s operative reports, and delivery records in 9 consecutive women undergoing percutaneous intrauterine cardiac intervention from 9/99 to 9/02. Records were reviewed for type of intervention performed, incidence of bradycardia during procedure, method of resuscitation during the procedure, gestational age of fetus, delivery age, and post-natal cardiac intervention (if any).

Results: Seven balloon aortic valve dilations, one pulmonary valve dilation, and one atrial balloon septostomy were performed. All fetuses were between 21 and 29 weeks gestation. 63% of fetuses required intramuscular or intracardiac epinephrine (2 mcg/kg) for bradycardia (HR<60 bpm). Two fetuses required multiple epinephrine doses. Intracardiac epinephrine had a faster onset of action than intramuscular epinephrine. No intra-operative deaths occurred. Two fetuses required no cardiac intervention after delivery, two required Stage 1 procedures, one was non-viable, and four fetuses are yet to be delivered.

Conclusions: Procedure-related fetal bradycardia can be treated with small doses (2mcg/kg) of epinephrine. Intracardiac administration of epinephrine is preferred over intramuscular epinephrine administration. Initial results of intrauterine cardiac intervention are promising, but further studies are warranted.
SOAP A137
COMPLEMENTARY AND ALTERNATIVE MEDICINE USE IN PATIENTS UNDERGOING ASSISTED REPRODUCTIVE TECHNOLOGIES
Tsen LC, Levin M, Hepner D, Kodali B, Martin R Ginsberg E, Segal S
Brigham & Women's Hospital, Harvard Medical School, Boston MA

Background: A dramatic increase in the use of complementary and alternative medicines (CAM) has been observed (1). Anecdotal reports note that individuals frequently take CAM therapies with hopes of improving assisted reproductive technologies (ART) outcomes. This study was undertaken to quantify the use and evaluate the impact on CAM on hemostatic and reproductive outcomes in couples undergoing ART at a large, teaching hospital.

Methods: A two-page questionnaire was distributed to all patients presenting for IVF-oocyte retrieval over an 8 month period. Patients answered questions on basic demographic information and the use of prescription and non-prescription medications, herbal remedies and alternative "healing" therapies.

Results: A total of 1038 participants, representing approximately 510 couples, returned the survey (>99% response rate). In women undergoing ART, 18% used herbal therapies with megadose vitamins, echinacea and primrose being the most popular. In the 33% of women using healing therapies, acupuncture (34%) and relaxation therapies (26%) were the most popular. Factors correlated with herbal therapy use included graduate school education (p <.01), and healing therapy use (p<0.001). Age, marriage status, and race were not associated. Factors correlated with healing therapies included an age between 31-40 (p<.05), Caucasian race (p<.001), graduate school education (p <.0001) and herbal therapy use (p< .0001).

Discussion: Recent clinical and laboratory evidence suggests that some of these therapies may have a negative effect on reproductive outcomes. Ondrizek et al. (2) noted in an animal model that St. John's wort, echinacea and ginkgo had adverse effects on oocytes, and St. John's wort was mutagenic to sperm cells. Analysis of hemostatic and reproductive outcomes is currently being done. The use of such remedies in the ART population has implications for the patient and anesthesiologist, due to the potential for drug interactions, side effects, and medical liability.


SOAP A138
SOAP OBSTETRIC ANESTHESIA WORKFORCE SURVEY: PRELIMINARY WORK
Bucklin BA, Hawkins JL, Anderson JR
1University of Colorado Health Sciences Center, Denver, CO; 2University of Nebraska Medical Center, Omaha, NE

Introduction: Since 1962, obstetric anesthesia surveys have become important research tools to detect changes in obstetric anesthesia practice. The purpose of this survey is to define current obstetric anesthesia practice patterns. It differs from previous surveys (1, 2) by: 1) using focus groups to refine the design and content of the survey; 2) directing specific sets of questions to target groups; 3) adding new questions to define contemporary practice patterns.

Methods: Following IRB approval, a stratified random sample frame of 1300 hospitals was obtained from the American Hospital Association survey database. Hospitals were stratified based on geographic region (East North Central, East South Central, Mid-Atlantic, West North Central, and West South Central) and number of births (<500, 500-1499, and >1500). Institutions with fewer than 100 births/year were excluded. In the initial pre-survey, letters were sent to each hospital administrator in the sample asking them to identify and provide contact information for the three key personnel in obstetric anesthesia at their institution: Chiefs of Obstetrics and Anesthesiology, as well as Labor and Delivery Nurse Manager. A second mailing was sent to non-responders in early January. Responses to the second mailing are currently being entered into the study database system. By mid February, an assessment of second-mailing responses will be completed and the first wave of survey questionnaires will be sent to target clinical personnel.

Results: From the "first wave" of pre-survey inquiries a total of 305 responses were received, including 12 refusals and 58 notifications of closed institution, inadequate/inappropriate address, or other mailing difficulties. The overall rate of response was approximately 23%.

Sample size: 1300 'Affirmative' responses: 235 Returned refused: 12 Address problems, etc. 58

Conclusions: Our strategy for this survey is to maximize the return rate of the questionnaires in excess of that observed in previous surveys and define current obstetric practice patterns.

STATUS OF OBSTETRIC ANESTHESIA IN ARGENTINA AT THE BEGINNING OF THE XXI CENTURY

Celesia MC, Fernández CL
Hospital Materno Infantil Ramón Sardá' Buenos Aires Capital Federal

Introduction: The goal of this study is to identify the behavior, preferences and accessibility of equipment of Argentine anesthesiologists regarding Obstetric Anesthesia. An anonymous survey was designed for such purpose with 18 questions related to labour analgesia and c-section.

Method: 150 surveys were distributed to a group of anesthesiologists attending an oral presentation on Obstetric Anesthesia during the 30th Argentine Congress of Anesthesiology, of which 53 were turned in. The data was entered into a computer for further statistic analysis.

Results: Most of the anesthesiologists who completed the survey work in medical centers receiving 1000-3000 deliveries/year (41,51%) or even more than 3000 (24,53%). This proves they are experienced professionals both in the private (37,7%) and the public (43,4%) scene. It is important to notice that in many institutions the practice of labour analgesia has increased, lumbar epidural being the most popular (87,5%), bolus injection (67,3%) or continuous-infusion techniques. Bupivacaine 0.125mg% (40,6%) and Ropivacaine 0,2mg % (26,6%) are the preferred LA. The adding of epinephrine to LA is not quite used (27,5%), but 71,2% of the anesthesiologists add opioids to the LA. The c-section rate has increased significantly, as noticed worldwide: only 19,5% of the surveyed report c-section rates under 20 %, as a 52,94% report rates between 20 and 40 %. Lumbar epidural technique is also preferred for c-sections, although spinal is raising amongst the choices: 33% report that more than 80% of the c-sections are performed with spinal technique. General anesthesia is still being used often by most surveyed professionals, as 58,49% of them count with alternative elements for difficult airway management.

Conclusion: No previous literature allows us to compare differences. However, great changes have developed in the last years in argentine obstetric anesthesia: labour analgesia is taking a significant place, with techniques similar to the employed in other countries, and c-section is safely performed using the results of international scientific research. It will be interesting and revealing to repeat this survey in order to analyze changes and to identify where instruction and equipment need to be improved.

References:
INTRODUCTION OF SPINAL ANESTHESIA AT KHOROUGH OBLAST GENERAL HOSPITAL, Khorough, Tajikistan THROUGH INTERNATIONAL CLINICAL PARTNERSHIP

Kamani AAS, Bahromov M, Hussein N
British Columbia Women’s Hospital, Vancouver, BC, Canada and Khorough Oblast General Hospital, Khorough, Tajikistan

Introduction: Tajikistan is one of the Central Asian countries, that shares common border with Northern Afghanistan. The Anesthesiologists chose to establish a practice of spinal anesthesia at KOGH. At KOGH, nearly 1000 anesthetics per year are performed. All the surgeries are performed under general anesthesia, with few intravenous anesthetic agents (TIVA). There are no anesthetic machines or inhalation anesthetics available at KOGH. There is constant shortage of both, oxygen and electricity. It was agreed by all parties to establish spinal anesthesia at KOGH: very low technology, easy to teach and high safety margin. A three week program was planned for each year for a three year period (2000-2002) and was sponsored by the Aga Khan Foundation and Swiss Development Agency. The principal goal is to train all the anesthesiologists at KOGH in performing spinal anesthesia and to be the teaching site for Tajikistan.

Method: During the first visit, we established trusting, collegial and working relationships through discussions of Common Medical Conditions and developing solutions that would be practical for Tajikistan. We collectively developed a spinal anesthesia teaching module in Russian and English. This module included basic science (anatomy, physiology and pharmacology), absolute contraindications, management of side effects and complications and understanding the difference between pregnant and non-pregnant patients. A quiz was created to ensure understanding of the concepts and its correct application. During the second visit, the spinal anesthesia module was revisited. Two anesthesiologists were trained hands-on with the intention that they, in turn, would train the other anesthesiologists at KOGH. During the third and final visit, the department was well trained and included a number of district anesthesiologists.

Results: The department was trained in providing spinal anesthesia, continuing medical education via e-mail was established and a teaching centre was developed at KOGH. Thus a sustainable educational environment was formed for KOGH and Tajikistan. To date nearly 20% of all the anesthesias are performed under spinal anesthesia.

Conclusion: International clinical partnership with developing countries, forms formidable bridges between people and cultures around the world. Distant learning preventing professional isolation, was formed.
SOAP A143
WHERE DO OUR PATIENTS OBTAIN INFORMATION ABOUT LABOR PAIN RELIEF?
Maddipati L, Armstrong B, Tsen L, Camann W
Brigham and Women's Hospital, Boston, MA

Patient education is an important component of obstetric anesthesia, and adequate information should be provided, if possible, before the onset of labor. (1) Women who were given adequate information about labor and delivery are more likely to be satisfied with their childbirth management, than those who did not receive enough explanation; (2) there is substantial negative information about obstetric anesthesia provided to the pregnant women by a variety of sources; (3) women already in painful labor may be unable to comprehend and process this information. This study was undertaken to determine where our clients obtain information about pain relief so that our educational efforts can be directed to strengthen those resources.

Methods: Questionnaires were distributed to parturients on arrival to the labor and delivery floor and were asked to answer the questions after the completion of delivery. Questions were predominantly directed to obtain answers to when, how and where they obtained information about childbirth and pain relief methods.

Results: 126 patients participated in the survey. 56 multipara and 70 primipara. 88% women desired pain relief during this delivery. 65% obtained information during first trimester. Major source of information was childbirth classes (40%), friends (46%) and others (24% - MD's, midwives). 94% women felt the information to be adequate. 65% did not consider the necessity of meeting the anesthesiologist prior to the labor. Best source of information as suggested by the parturients were childbirth classes (40%), friends (46%) and others (24% - MD's, midwives). 94% women felt the information to be adequate. 65% did not consider the necessity of meeting the anesthesiologist prior to the labor. Best source of information as suggested by the parturients were childbirth classes (40%), friends (46%) and others (24% - MD's, midwives). 94% women felt the information to be adequate. 65% did not consider the necessity of meeting the anesthesiologist prior to the labor. Best source of information as suggested by the parturients were childbirth classes (40%), friends (46%) and others (24% - MD's, midwives). 94% women felt the information to be adequate. 65% did not consider the necessity of meeting the anesthesiologist prior to the labor. Best source of information as suggested by the parturients were childbirth classes (40%), friends (46%) and others (24% - MD's, midwives). 94% women felt the information to be adequate. 65% did not consider the necessity of meeting the anesthesiologist prior to the labor. Best source of information as suggested by the parturients were childbirth classes (40%), friends (46%) and others (24% - MD's, midwives). 94% women felt the information to be adequate. 65% did not consider the necessity of meeting the anesthesiologist prior to the labor.

Conclusion: Women obtain information early in pregnancy. Information is mostly obtained from childbirth classes, friends and others such as MD's and midwives. There is no single factor that is worrisome to all. Efforts should be directed at strengthening obstetric anesthesia education at childbirth classes, and the use media to disseminate information via friends, MDs and midwives of parturients.

SOAP A145
SHOULD OBSTETRIC PATIENTS UNDERGO PRENATAL ANESTHESIA EVALUATION?
Rung GW, Neidinger DK, Wise NJ
Lancaster General Hospital, Hershey, PA

Antenatal patients are often not evaluated by an anesthesiologist until just prior to inserting an epidural catheter. This practice is usually satisfactory because parturients are generally young and healthy – it is rare to discover problems at the last minute that could affect safe anesthetic management. However, medical conditions, medication allergies, body habitus, and patient misconceptions or unrealistic expectations may pose unforeseen problems when the patient presents in labor. These problems are intensified by the perceived urgency of inserting the epidural catheter to provide pain relief and the difficulties related to obtaining truly informed consent when the patient is in pain.

The construction of a new free-standing Women and Babies Hospital at our institution provided the opportunity to re-evaluate all of our processes and we decided to pro-actively address the above problem by screening prenatal patients in a manner similar to pre-surgical patients. All patients registered for admission to the Women’s Hospital are contacted by telephone and a short medical questionnaire is completed and filed. Protocols are used to evaluate common medical conditions, and “flagged” charts undergo physician review. The anesthesiologist, patient, or obstetric care provider may request an outpatient visit with an anesthesiologist. Patient education begins with a locally produced videotape shown in hospital prenatal classes. This education is reinforced during the medical screening telephone call and patients are invited to visit the anesthesia clinic for further education.

Objective analysis of the success of this approach is difficult due to much non-uniform data. The Table shows some data from 1998 and 2002, time periods approximately 18 months prior to, and after, the opening of our Women and Babies Hospital. An independent patient survey company (Press Ganey) measured patient satisfaction regarding anesthesia services.

<table>
<thead>
<tr>
<th></th>
<th>1998</th>
<th>2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of vaginal deliveries</td>
<td>2396</td>
<td>3203</td>
</tr>
<tr>
<td>c sections ( sched./after labor)</td>
<td>161/309</td>
<td>528/413</td>
</tr>
<tr>
<td>Epidural for vaginal delivery</td>
<td>722</td>
<td>1709</td>
</tr>
<tr>
<td>Patient Satisfaction</td>
<td>88.9%</td>
<td>92.8%</td>
</tr>
</tbody>
</table>

We feel that everyone benefits from prenatal patient education and evaluation for anesthesia risk factors. Local institutional processes for screening patients prior to outpatient surgery may be used to simplify startup and ensure uniform quality of care.

SOAP A146
THE LABOR OF INFORMED CONSENT
Saunders TA, Stein DJ, Dilger JP
1SUNY Stony Brook University Hospital & Medical Center, Stony Brook NY; 2St. Luke’s-Roosevelt Hospital Center, New York, NY

Ethicists tend to agree that informed consent is a process rather than just signing a form. The process of obtaining informed consent from women in active labor is dubious at best. The purpose of this study was to determine current practices and opinions regarding informed consent for parturients. We surveyed the 88S active US anesthesiologists members of SOAP as of May 2002. The questionnaire contained 13 questions about type of institution/practice, presence of an OB anesthesia team, use of a separate anesthesia consent form, antenatal OB anesthesia consult capability, and opinions about obtaining informed consent in laboring parturients.

Results: There were 451 completed surveys; 46% from academic practice, 47% from private practice. 45% of respondents practiced as part of an OB anesthesia team and 51% performed more than 3000 deliveries per year.

Patient consent and education (7 questions): Many respondents used consent forms for basic anesthesia services (56%), for parturients getting anesthesia services (53%) and specifically for labor epidurals (59%). 67% agreed that "parturients in active labor are able to give informed consent for labor epidural analgesia". 83% perform pre-anesthetic consultations for pregnant women. However, only 13% recommend antenatal anesthesia consults for pregnant women who might want a labor epidural. 41% of the respondents' departments participate in childbirth education classes. Most of the answers to these 7 questions did not differ with the type of practice (academic versus private, OB team versus no team, or the number of annual deliveries). The exception was that OB team practices were 1.8 times more likely to participate in childbirth education classes (54% vs 30%, p<0.001, c2 analysis).

Discussion: Our study population consisted of physicians having a particular interest and expertise in the clinical care and management of parturients. Comparing our data to similar data, there has been a 7% increase since 1995 in US OB anesthesiologists who obtain separate written informed consent for epidural analgesia during labor. It is interesting that despite the difficulties inherent in obtaining informed consent from parturients, 67% of the respondents thought that consent was possible. This view is supported by prospective studies of parturients in labor. Some suggest that obtaining informed consent for labor epidurals should be a two part process: while pain-free for the risks and during labor for the benefits. Participation in childbirth education may provide an ideal opportunity for OB anesthesiologists.

SOAP A147
HURDLES IN DOCUMENTING LABOR ANALGESIA: RECORD FORMAT OR PROVIDER EDUCATION
Singh H, Vadhera RB, Abouleish A
UTMB, Galveston TX

Introduction: Documenting the anesthesia care for labor is challenging for several reasons. First, the record traditionally uses a graphic form that has been adopted from the anesthesia record for surgery. In contrast to surgical anesthesia, anesthesia care for labor is intermittent and not continuous. Therefore, this graphic format may not be as amenable to documenting intermittent care. Second, the nature of intermittent care may lead to providers not documenting all encounters with the patient. The purpose of this study is to evaluate the reasons for difficulty in documenting patient care — the format of the anesthesia record or education of the provider.

Methods: Following IRB approval, data was collected from the 100 anesthesia records for two groups — Old Form (graphic record) and New Form (tabular anesthesia record). Consecutive patients who received epidural analgesia and delivered vaginally were included. For the Old Form, the time period of data collection was in October 2002. For new form, introduced in November 2002, the time period was started 2-weeks after the new form was introduced. Time period for the third group (New/Educate) will begin March 2003 following meetings with faculty and resident educating the importance of documenting and presentation of initial results. Total time care provided was documented, and epidural placement to catheter removal interval, and epidural placement to delivery interval were calculated. A certified billing coder determined the time documented using the Texas Medicaid definition of “face-to-face” time (1). In addition, overall completeness of documentation for twenty items (e.g. fetal heart rate, test dose, local anesthetic infusion, preload, level of block and end time etc.) was reviewed.

Results: At the time of this abstract, the data collected for the first two groups was complete. For the first two groups, there was no difference in age, gravid, or primip. There was a significant difference in the anesthesia duration (epidural placement to delivery of baby), but no difference in amount of time care was documented.

Discussion: Tabular charting did not increase the face to face time as compared to the graphical charting. Further, there was no difference in documented time between the categories of duration of analgesia. Therefore, the format of the anesthesia record alone does not explain the difficulty in documentation. The third group (after education of providers) will be completed to evaluate if education can make a difference.

References: Texas Medicaid. 2002 Texas Medicaid Provider Procedure Manual Section 34.432. Anesthesia for Labor and Delivery

SOAP A148
A TIME TO BE BORN—A LOOK AT DISCREPANCIES BETWEEN HOSPITAL CLOCKS
Okumura MT, Schultz JR, Phillips-Bute B, 2Thompson ME, 2Neumann MM
Duke University Medical Center, Durham, NC; 2Loma Linda University, Loma Linda, CA

The record of time is a legal marker used as evidence for the occurrence, duration, or chronological order of events. In the average operating room or labor and delivery suite, there are multiple timepieces. As a result, any given event, such as birth, can appear to take place at several different times. Furthermore, the presence of inaccurate timepieces has the potential to fictitiously add minutes to life-threatening events such as maternal or fetal hypoxia. Our study sought to assess the accuracy and synchronization of clocks in the operating suite and labor and delivery suite at two major teaching institutions (on opposite coasts). Standard time was determined in accordance with http://www.time.gov/ (a service of the United States Government to provide Coordinated Universal Time). For our study, a digital watch was set to the nearest second and used as a standard to compare all the clocks in each labor and delivery suite and operating room. One observer recorded the hour and minute from the control timepiece while a second observer simultaneously recorded the hour and minute from the subject timepiece. The difference in recorded time was listed to the nearest minute. Out of a total of 345 timepieces, we found 83% (n=287) of the clocks to be inaccurate by 1 minute of more. One-third of the clocks, 33% (n=113) were inaccurate by 5 minutes or more.

As the record of time is the foundation of the medical record and a legal marker, steps should be taken to ensure the accuracy and synchronization of all timepieces used to chronicle medical events.
SOAP A149
ETHICAL DILEMNAS OF COURT-ORDERED CESAREAN SECTION
Gaunt G, Ramin K, Vasdev G
Department of Obstetrics and Gynecology; Department of Anesthesiology, Mayo Clinic, Rochester, MN

Introduction: We present a case of a parturient with uncontrolled diabetes, documented fetal cardiac anomalies, late prenatal care, and prior cesarean section with a strong desire for non-intervention and attempt at Vaginal Birth After C-section (VBAC).

Report of a case: A 28 y/o G3P2 presented in active labor. In spite of scant attendance at prenatal clinics, fetal anomalies were documented in the patients record. These included complete situs inversus, atrial septal defect, ventricular septal defect, and early fetal cardiac failure. The patient insisted that there could be no fetal anomaly since she was experiencing adequate kick counts and good fetal movement. The indication for her prior cesarean section was malpresentation; because her current fetus was in a vertex position she would under no circumstances consider repeat c-section. Labor was allowed to progress under continuous monitoring. An epidural was placed per patient request. After arrest of cervical dilatation in spite of adequate contractions, the patient refused advice to undergo repeat C-section. Persistent attempts at patient education were unsuccessful. Ultimately, the appearance of non-reassuring fetal heart tones led to an urgent need for prompt delivery of the child. In protest, the patient attempted to leave the labor suite with epidural in place and was stopped only when security guards were summoned. In lieu of patient consent, a court order was issued to force the patient to undergo C-section citing child protection in the environment of concerns over non-reassuring heart tones and known cardiac anomalies.

Discussion: The current concerns over VBAC revolve around immediate availability of anesthesia coverage. However, issues of patient consent can further complicate well known risks. An increasing trend of patients with strong desire for no medical intervention continues to challenge caregivers with responsibility for avoidance of adverse outcome. The balance between patient autonomy and the principle of nonmaleficence becomes increasingly complex as more patients elect to customize their care plan.

Conclusion: This case serves as a warning that VBAC candidates with unrealistic demands may be forced to undergo C-section for purposes of child protection. Further, this underlines the need for continued patient education focused on possible VBAC outcomes.
<table>
<thead>
<tr>
<th>Author</th>
<th>SOAP Abstracts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abel-Hafiz M</td>
<td>A95</td>
</tr>
<tr>
<td>Abouleish A</td>
<td>A147</td>
</tr>
<tr>
<td>Abramovitz SE</td>
<td>A35</td>
</tr>
<tr>
<td>Adsumelli RSN</td>
<td>A116</td>
</tr>
<tr>
<td>Ahearn GS</td>
<td>A24</td>
</tr>
<tr>
<td>Ahmed S</td>
<td>A84</td>
</tr>
<tr>
<td>Ahuja D</td>
<td>A84</td>
</tr>
<tr>
<td>Alexander JM</td>
<td>A69</td>
</tr>
<tr>
<td>Ali GS</td>
<td>A144</td>
</tr>
<tr>
<td>Allen MA</td>
<td>A119</td>
</tr>
<tr>
<td>Anderson JR</td>
<td>A138</td>
</tr>
<tr>
<td>Antonarakis SE</td>
<td>A20, A22</td>
</tr>
<tr>
<td>Arango JA</td>
<td>A28</td>
</tr>
<tr>
<td>Arifeen Z</td>
<td>A30</td>
</tr>
<tr>
<td>Arkoosh VA</td>
<td>A17</td>
</tr>
<tr>
<td>Armstrong B</td>
<td>A143</td>
</tr>
<tr>
<td>Ascari CM</td>
<td>A79</td>
</tr>
<tr>
<td>Avidan A</td>
<td>A72</td>
</tr>
<tr>
<td>Avram MJ</td>
<td>A23</td>
</tr>
<tr>
<td>Ayers C</td>
<td>A84</td>
</tr>
<tr>
<td>Backman SB</td>
<td>A11</td>
</tr>
<tr>
<td>Bahromov M</td>
<td>A141</td>
</tr>
<tr>
<td>Balestrieri PJ</td>
<td>A79</td>
</tr>
<tr>
<td>Banks SL</td>
<td>A42</td>
</tr>
<tr>
<td>Bansinath M</td>
<td>A9</td>
</tr>
<tr>
<td>Barbara P</td>
<td>A2</td>
</tr>
<tr>
<td>Barenholz Y</td>
<td>A9</td>
</tr>
<tr>
<td>Barsoum S</td>
<td>A84</td>
</tr>
<tr>
<td>Beland JE</td>
<td>A133</td>
</tr>
<tr>
<td>Belinski F</td>
<td>A24</td>
</tr>
<tr>
<td>Bell DJ</td>
<td>A117</td>
</tr>
<tr>
<td>Bell EA</td>
<td>A15, A133</td>
</tr>
<tr>
<td>Bellars R</td>
<td>A127</td>
</tr>
<tr>
<td>Benni P</td>
<td>A1</td>
</tr>
<tr>
<td>Bhavsar V</td>
<td>A84</td>
</tr>
<tr>
<td>Birnbach DJ</td>
<td>A17, A48</td>
</tr>
<tr>
<td>Black III</td>
<td>A77</td>
</tr>
<tr>
<td>Blouin JL</td>
<td>A20, A22</td>
</tr>
<tr>
<td>Bogard TD</td>
<td>A125</td>
</tr>
<tr>
<td>Booc MD</td>
<td>A89</td>
</tr>
<tr>
<td>Booth JV</td>
<td>A1</td>
</tr>
<tr>
<td>Bral E</td>
<td>A44</td>
</tr>
<tr>
<td>Bray JK</td>
<td>A6</td>
</tr>
<tr>
<td>Browne IM</td>
<td>A17</td>
</tr>
<tr>
<td>Bucklin BA</td>
<td>A138</td>
</tr>
<tr>
<td>Bukin VE</td>
<td>A52</td>
</tr>
<tr>
<td>Bulich LA</td>
<td>A135, A136</td>
</tr>
<tr>
<td>Bulleova S</td>
<td>A112</td>
</tr>
<tr>
<td>Burkle CM</td>
<td>A119</td>
</tr>
<tr>
<td>Buyse I</td>
<td>A83</td>
</tr>
<tr>
<td>Bythell V</td>
<td>A50</td>
</tr>
<tr>
<td>Cabrol D</td>
<td>A26</td>
</tr>
<tr>
<td>Camann W</td>
<td>A55, A143</td>
</tr>
<tr>
<td>Campbell KA</td>
<td>A1, A24</td>
</tr>
<tr>
<td>Carroll RC</td>
<td>A46</td>
</tr>
<tr>
<td>Carvalhalo B</td>
<td>A3, A4</td>
</tr>
<tr>
<td>Caton D</td>
<td>A109, A120</td>
</tr>
<tr>
<td>Celesia MC</td>
<td>A140</td>
</tr>
<tr>
<td>Chao J</td>
<td>A18</td>
</tr>
<tr>
<td>Chartrand DDC</td>
<td>A11</td>
</tr>
<tr>
<td>Chaudhry N</td>
<td>A84</td>
</tr>
<tr>
<td>Chen PP</td>
<td>A139</td>
</tr>
<tr>
<td>Cho K</td>
<td>A47</td>
</tr>
<tr>
<td>Chong E</td>
<td>A90</td>
</tr>
<tr>
<td>Choudhry FM</td>
<td>A110</td>
</tr>
<tr>
<td>Ciliberto CF</td>
<td>A111, A112</td>
</tr>
<tr>
<td>Cohen SE</td>
<td>A3, A4, A17</td>
</tr>
<tr>
<td>Colomb MO</td>
<td>A6, A13, A83</td>
</tr>
<tr>
<td>Comerford MD</td>
<td>A35</td>
</tr>
<tr>
<td>Connelly NR</td>
<td>A85</td>
</tr>
<tr>
<td>Cooper GM</td>
<td>A74, A75</td>
</tr>
<tr>
<td>Gonzales LM</td>
<td>A130</td>
</tr>
<tr>
<td>Craft RM</td>
<td>A37, A46</td>
</tr>
<tr>
<td>Criswell HE</td>
<td>A99</td>
</tr>
<tr>
<td>Daftari AR</td>
<td>A70</td>
</tr>
<tr>
<td>D'Angelo R</td>
<td>A17</td>
</tr>
<tr>
<td>Daniel D</td>
<td>A8</td>
</tr>
<tr>
<td>Darwin AA</td>
<td>A81</td>
</tr>
<tr>
<td>Datta S</td>
<td>A33</td>
</tr>
<tr>
<td>Davidson EM</td>
<td>A9</td>
</tr>
<tr>
<td>de la Fuente SG</td>
<td>A1, A24</td>
</tr>
<tr>
<td>de Wet CJ</td>
<td>A66</td>
</tr>
<tr>
<td>DeBaili III P</td>
<td>A2, A31, A67, A103, A105, A108</td>
</tr>
<tr>
<td>Deschamps AAD</td>
<td>A11</td>
</tr>
<tr>
<td>Desimone CA</td>
<td>A101, A104</td>
</tr>
<tr>
<td>Desjardins R</td>
<td>A34, A41</td>
</tr>
<tr>
<td>Diaz N</td>
<td>A10</td>
</tr>
<tr>
<td>Dilger JP</td>
<td>A146</td>
</tr>
<tr>
<td>Dolak JA</td>
<td>A106</td>
</tr>
<tr>
<td>Douglas MJ</td>
<td>A41</td>
</tr>
<tr>
<td>Du D</td>
<td>A7</td>
</tr>
<tr>
<td>Dubois S</td>
<td>A85</td>
</tr>
<tr>
<td>Durbin M</td>
<td>A4</td>
</tr>
<tr>
<td>Eberle R</td>
<td>A101, A104</td>
</tr>
<tr>
<td>Ecker J</td>
<td>A14</td>
</tr>
<tr>
<td>Eisenach JY</td>
<td>A7, A40</td>
</tr>
<tr>
<td>Elder RF</td>
<td>A46</td>
</tr>
<tr>
<td>Ellinas EH</td>
<td>A91</td>
</tr>
<tr>
<td>Elliot LC</td>
<td>A37</td>
</tr>
<tr>
<td>El-Mansouri M</td>
<td>A85</td>
</tr>
<tr>
<td>Esler M</td>
<td>A41</td>
</tr>
<tr>
<td>Eubanks S</td>
<td>A1, A24</td>
</tr>
<tr>
<td>Evans P</td>
<td>A30</td>
</tr>
<tr>
<td>Evans SF</td>
<td>A42</td>
</tr>
<tr>
<td>Fernandez CL</td>
<td>A140</td>
</tr>
<tr>
<td>Fernado RA</td>
<td>A6, A13, A16</td>
</tr>
<tr>
<td>Finegold H</td>
<td>A18, A54, A92, A142</td>
</tr>
<tr>
<td>Fiset PF</td>
<td>A11</td>
</tr>
<tr>
<td>Fitzgerald P</td>
<td>A23</td>
</tr>
<tr>
<td>Fitzgerald PC</td>
<td>A68</td>
</tr>
<tr>
<td>Flood P</td>
<td>A8, A25</td>
</tr>
<tr>
<td>Fougere H</td>
<td>A38</td>
</tr>
<tr>
<td>Frek V</td>
<td>A55</td>
</tr>
<tr>
<td>Fritcher MH</td>
<td>A130</td>
</tr>
<tr>
<td>Froehlich MA</td>
<td>A109</td>
</tr>
<tr>
<td>Fung P</td>
<td>A34</td>
</tr>
<tr>
<td>Furs CM</td>
<td>A67</td>
</tr>
<tr>
<td>Gadalla F</td>
<td>A35</td>
</tr>
<tr>
<td>Gambling DR</td>
<td>A3</td>
</tr>
<tr>
<td>Gaunt G</td>
<td>A149</td>
</tr>
<tr>
<td>Gei AF</td>
<td>A58</td>
</tr>
<tr>
<td>Giarrusso K</td>
<td>A4</td>
</tr>
<tr>
<td>Gibson C</td>
<td>A85</td>
</tr>
<tr>
<td>Gilhaly T</td>
<td>A34</td>
</tr>
<tr>
<td>Ginsberg E</td>
<td>A137</td>
</tr>
<tr>
<td>Giraud R</td>
<td>A38, A71</td>
</tr>
<tr>
<td>Glass PSA</td>
<td>A116</td>
</tr>
<tr>
<td>Glassenberg R</td>
<td>A19</td>
</tr>
<tr>
<td>Glassenberg SZ</td>
<td>A93</td>
</tr>
<tr>
<td>Goffinet F</td>
<td>A126</td>
</tr>
<tr>
<td>Goldner JD</td>
<td>A57, A78, A92, A96, A97</td>
</tr>
<tr>
<td>Goldsworthy M</td>
<td>A90</td>
</tr>
<tr>
<td>Golebiewski KA</td>
<td>A59</td>
</tr>
<tr>
<td>Golciewski K</td>
<td>A12</td>
</tr>
<tr>
<td>Goradia M</td>
<td>A61</td>
</tr>
<tr>
<td>Graham EF</td>
<td>A9</td>
</tr>
</tbody>
</table>
Griggs RC  SOAP A64  Lukauskienė E  SOAP A56
Grosu V  SOAP A84  Lyons GR  SOAP A13
Groysman R  SOAP A84  MacArthur C  SOAP A74, A75
Gutierrez LF  SOAP A121  MacKenzie RA  SOAP A119
Habib A  SOAP A28  Maddipati L  SOAP A143
Hahn C  SOAP A102  Maïtra-D’Cruze AM  SOAP A91
Halpern SH  SOAP A88, A131  Malek S  SOAP A21
Han D  SOAP A35, A36  Mandell G  SOAP A18, A142
Hankins GD  SOAP A129  Mandell GL  SOAP A57, A70, A81, A97
Harnett MJP  SOAP A110  Manikantan T  SOAP A85
Harrison BA  SOAP A138  Manson R  SOAP A24
Hawkins JL  SOAP A138  Mantha VR  SOAP A49
Henderson J  SOAP A37  Manuel VC  SOAP A78
Hennessey MD  SOAP A42  Manvelian G  SOAP A3
Hepner D  SOAP A142  Maratea A  SOAP A14
Hess PE  SOAP A103, A105  Marenco JE  SOAP A27
Hessabi M  SOAP A64, A67, A103  MacArthur C  SOAP A21
Hohenkamp E  SOAP A143  MacKenzie RA  SOAP A119
Holbrook H  SOAP A66  Maddipati L  SOAP A143
Holcroft CJ  SOAP A12  Manikantan T  SOAP A85
Holland DA  SOAP A111  Manson R  SOAP A24
Huffnagle HJ  SOAP A3  Mantha VR  SOAP A49
Hussein N  SOAP A141  Manuel VC  SOAP A78
Hustead RF  SOAP A109  Manvelian G  SOAP A3
Huzmezan M  SOAP A34  Maratea A  SOAP A14
Inglod VJ  SOAP A43  Mason RR  SOAP A27
Jacobsohn B  SOAP A66  Mather DC  SOAP A99
Jaklitsch PM  SOAP A114  McCarty RJ  SOAP A10, A47, A68
Jarreau PH  SOAP A26  McClune DD  SOAP A137
Je H  SOAP A21  McEwen L  SOAP A27
Jennings RW  SOAP A135  Mcintyre DD  SOAP A99
Kamani AAS  SOAP A34, A141  McNeil AH  SOAP A47, A68
Kamath GS  SOAP A63  McCaine RJ  SOAP A1
Kassapidis DT  SOAP A111, A112  McIndoe DD  SOAP A69
Kaufman IJK  SOAP A11  McNeil AH  SOAP A87
Kaul B  SOAP A70, A90, A96  Mignot AF  SOAP A100, A107
Kaya N  SOAP A40  Mikhail KA  SOAP A35
Kermoglu B  SOAP A17  Millar S  SOAP A96
Kern CG  SOAP A38, A71  Miller J  SOAP A17
Kett AG  SOAP A9  Mirikiti E  SOAP A30
Kim K  SOAP A35, A36  Missa U  SOAP A31, A108
Kjær K  SOAP A35  Mitchell JD  SOAP A74
Kliffer A  SOAP A41  Moore P  SOAP A27
Kodali B  SOAP A137  Moosikerwan MN  SOAP A26, A39
Koenig LF  SOAP A63  Morales MA  SOAP A35
Kronitz N  SOAP A34  Morgan JK  SOAP A64, A103, A105
Kuczewski KM  SOAP A126, A127, A128  Morgan PJ  SOAP A96
Kunze LJ  SOAP A43  Mognier B  SOAP A17
Lababidi LG  SOAP A106  Muir HA  SOAP A30
Lai MC  SOAP A48, A76, A98  Myers LB  SOAP A31, A108
Landa SE  SOAP A113  Navratil JE  SOAP A74
Landau R  SOAP A5, A20, A22, A38, A71  Negron MA  SOAP A27
Lange S  SOAP A30  Neidinger DK  SOAP A20
Lauren DJ  SOAP A35  Nelson KE  SOAP A21
Lavan d’Homme PM  SOAP A135  Nemes L  SOAP A115
Lawrence P  SOAP A139  Neuman GG  SOAP A138
Lee BB  SOAP A82  Ngan KWD  SOAP A139
Leffert L  SOAP A14  Nieva A  SOAP A144
Leicht CH  SOAP A134  Ocampo CE  SOAP A80
Leighton BL  SOAP A35, A66  O’Connor J  SOAP A59
Leventhal BL  SOAP A69  O’Hara C  SOAP A54
Levin M  SOAP A137  Okumura MT  SOAP A95
Li Y  SOAP A80  Oliverson TJ  SOAP A148
Lim Y  SOAP A21  O’Hare T  SOAP A45
Lipman S  SOAP A4  Ong Y  SOAP A27
Loughrey JPR  SOAP A33  Orlowski EC  SOAP A61
Lucas T  SOAP A85  Owen MD  SOAP A40

Anesthesiology  2003;98, Supp I
AUTHOR INDEX

Parker RK  
Patel N  
Patel R  
Patteson SK  
Pavy TJ  
Pedersen T  
Penning DH  
Pertuz CA  
Peter B  
Pexters A  
Phelps AL  
Phillips-Bute B  
Plan-Smith MCM  
Plorede GGP  
Polley LS  
Pons M  
Prasad M  
Pratt SD  
Raikoff K  
Ramanathan SA  
Ramin K  
Ranasinghe S  
Rauk P  
Razeghi M  
Redai I  
Restrepo CE  
Reyes M  
Reynolds JD  
Riley ET  
Rizvi A  
Robson S  
Roelants F  
Rohlf S  
Ross LA  
Ross VH  
Rung GW  
Sadek M  
Sah NB  
Sahin S  
Santos D  
Sareen S  
Sashidharan R  
Saunders TA  
Scavone BM  
Schabel JE  
Schmalenberger KP  
Schreiner M  
Schultz JR  
Scot J  
Scott JA  
Scott KP  
Segal S  
Serban S  
Sharma SK  
Shennan A  
Shook PR  
Sia AT  
Siddiqui MN  
Singh H  
Smiley RM  
Smith A  
Smith Q  
Snider CC  
Snowman CE  
Socha NJ  
Southern PA  
Spahn TE  
Spiegel JE  
Spilman FJ  
Spite B  
Stack KE  
Stamler JS  
Steadman JL  
Stein DJ  
Stockman W  
Stremler R  
Suddeth BH  
Sudha RJ  
Sullivan JT  
Swamidoss CP  
Takeko T  
Tarsis J  
Teunakens A  
Thomas J  
Thompson ME  
Tong C  
Torres JE  
Toyama TM  
Tsen LC  
Uhrich TD  
Vadhera RB  
Vallejo MC  
Van de Velde M  
Vance MB  
vanden Berg AA  
Vandermeersch E  
Vanhook JD  
Varner JM  
Vasdev GM  
Velickovic IA  
Walsh ME  
Waters JH  
Weesner K  
Weiniger CF  
White WD  
Wight WJ  
Wiley J  
Wilson DC  
Wilson MJA  
Winikoff SP  
Wise NJ  
Wittels B  
Wong CA  
Yang M  
Yao N  
Yee J  
Yeo ST  
Zapata CJ  
Zhaku B  
Zhang R  

SOAP ABSTRACTS - 77
BENEFITS OF MEMBERSHIP

- An annual educational program with reduced registration fees for members, that includes Scientific Papers and Posters, Research Forums, What's New in Obstetric Anesthesia, What's New in Perinatology, and Industrial Exhibits;

- Research Funding - Obstetric Anesthesia & Perinatology Endowment Fund (OAPEF)/FAER

- SOAP Newsletters containing current review articles, meeting summaries, Pro-Con submissions on controversial issues, and updates on political matters of relevance to obstetric anesthesia;

- Accepted abstracts published in Anesthesiology supplement;

- Website for current Society information
  - Online Membership Directory
  - Meeting Registrations
  - Abstract Submissions

- Plus lots more!
FUTURE MEETINGS

May 12-16, 2004
36th Annual Meeting
Sanibel Harbor Resort and Spa
Ft. Myers, FL

May 5-8, 2005
37th Annual Meeting
Marriott Palm Desert
Palm Desert, CA

Society for Obstetric Anesthesia and Perinatology
P.O. Box 11086, Richmond, VA 23230-1086
Phone (804) 282-5051 / Fax (804) 282-0090
Email: soap@societyhq.com

Program and registration material can be accessed online at:

www.soap.org