Gerard W. Ostheimer Lecture
What’s New in Obstetric Anesthesiology, 2014

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Obstetric Anaesthetists’ Association
November 2, 2015
Ostheimer Lecture: Fast and Dense
Subject

Reference

Reference

Reference
Overview

1. Labor

2. Cesarean Delivery

3. Morbidity & Mortality
Overview

1. Labor:
   - Labor pain and psychiatry
   - Labor epidurals & 2\textsuperscript{nd} stage of labor
   - Epidurals and perineal injury
   - Pharmacology of labor analgesia
Labor Pain

Do epidurals prevent postpartum depression?

Prospective, non-randomized at Chinese hospital

• N = 214
  • 107 requested/received epidural
  • 107 NO labor analgesia

• 3 day & 6 wk Edinburgh Postnatal Depression Scale
  • Epidural = Less likely depressed
    • OR 0.31, 95% CI, 0.12 - 0.82

Epidural During Childbirth Can Cut Postpartum Depression Risk

Ryan Wallace
July 23, 2014

Labor Epidurals & 2nd Stage of Labor

Does epidural analgesia lead to longer 2\textsuperscript{nd} stage?

Do more epidurals $\rightarrow$ more operative deliveries?

Do epidurals prevent perineal injury?
Second Stage of Labor

Do epidurals lead to longer second stage?

42,268 vaginal deliveries, UCSF, 1976 - 2008

95th percentile, Length of Second Stage

<table>
<thead>
<tr>
<th></th>
<th>2nd stage length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nulliparous</td>
<td></td>
</tr>
<tr>
<td>No epidural</td>
<td>197 min</td>
</tr>
<tr>
<td>Epidural</td>
<td>336 min</td>
</tr>
</tbody>
</table>

“Evidence now shows that labor actually progresses slower than we thought in the past, so many women might just need a little more time to labor and deliver vaginally instead of moving to a cesarean delivery…”

http://www.acog.org/About_ACOG/News_Room/News_Releases/2014
Second Stage of Labor

Does ↑ epidural use → ↑ operative vaginal delivery?

Perinatal Registry of the Netherlands, 2000-2009

<table>
<thead>
<tr>
<th>Nulliparous</th>
<th>Epidural Use</th>
<th>Multiparous</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = 616,063</td>
<td>↑ 284%</td>
<td>N = 762,395</td>
</tr>
</tbody>
</table>

“Epidural analgesia is not an important causal factor of operative deliveries.”

Do epidurals cause or prevent perineal injury?

61,308 Vaginal deliveries, Israeli hospital, 2006-2011
- 31,631 (51.6%) epidural
  - **Univariate** analysis: OR 1.78 (95% CI, 1.34 - 2.36)  
    *Epidurals associated with perineal injury*
  
  - **Multivariate** analysis: OR 0.95 (95% CI, 0.69 - 1.29)  
    *Epidurals NOT associated with perineal injury*

Multivariate analysis:
  - Instr. VD & prolonged 2\textsuperscript{nd} stage $\Rightarrow$ Perineal injury

Epidurals & Perineal Injury

Do epidurals cause or prevent perineal injury?

Epidurals prevent perineal injury.

<table>
<thead>
<tr>
<th>Analysis</th>
<th>Variables</th>
<th>OR Epidural</th>
<th>95% CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Univariate</td>
<td>None</td>
<td>1.12</td>
<td>1.01-1.17</td>
<td>&lt; 0.0001</td>
</tr>
</tbody>
</table>

Pharmacology of Labor Analgesia

Intrathecal local anesthetics + opioids = synergism?

Are FHR changes greater after CSE?
Labor Analgesia

Intrathecal local anesthetics + opioids = synergism?

300 nullip’s, fentanyl and/or bupivacaine CSE
- Randomized to 1 of 30 combinations:

Calculated: VAS ↓ at 15 min & 30 min

Lesser pain than predicted by additivity = Synergy
- 15 min (p<0.001) & 30 min (p=0.015)

Ngan Kee WD, et al. Anesthesiology 2014; 120: 1126
Labor Analgesia

Are FHR changes greater after CSE?

115 Laboring women randomized to:
- CSE: Bup 2.5mg + fentanyl 5mcg
- Epidural: Bup 0.1% + fentanyl 2mcg/mL, 20mL

No differences in FHR abnormalities.

Both groups: ↑ in FHR abnormalities after analgesia (p<0.0001)

Remifentanil Labor Analgesia

Is remifentanil IV PCA inferior to epidural?

Systematic review of 5 RCTs (n=886)
- Lower VAS pain scores with epidurals
- No differences in secondary outcomes


- Remifentanil provides worse analgesia as labor progresses


Remifentanil IV PCA is inferior labor analgesia.
Overview

1. Labor

2. Cesarean Delivery

3. Morbidity & Mortality
Cesarean Delivery

Preventing Spinal Hypotension

Anesthetic & Analgesic Requirements

Intraoperative Awareness

Postcesarean Analgesia

General anesthesia and the fetal brain
Cesarean Delivery

Is the fluid bolus harmful?

N=30, prior to elective Cesarean

- Administered 750mL warm LR bolus
  - Endothelial glycocalyx biomarkers
    - Heparan sulfate
    - Syndecan-1

Levels of biomarkers increased after bolus

Fluid bolus disrupts glycocalyx

Powell M, et al. IJOA 2014; 23: 330-4
Prophylactic Phenylephrine Infusion

*How well does it prevent spinal hypotension?*

Systematic review of CD under spinal bupivacaine

- 21 RCTs, n = 1504
- Primary outcome: SBP < 80% baseline

<table>
<thead>
<tr>
<th>Comparison Infusion</th>
<th>Phenylephrine’s Relative Risk for Hypotension</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Placebo</td>
<td>0.36</td>
<td>0.004</td>
</tr>
<tr>
<td>Ephedrine</td>
<td>0.58</td>
<td>0.009</td>
</tr>
<tr>
<td>Phenylephrine + Ephedrine</td>
<td>0.73</td>
<td>0.02</td>
</tr>
</tbody>
</table>

Phenylephrine

Which is better: Prophylactic infusion or rescue bolus?

“One shoe will never fit all… [because practices, patients, clinical scenarios and providers are all different]… anesthesia providers should be able to develop a phenylephrine regimen based on their local experience that provides an acceptable balance between the elimination of maternal symptoms and the risks of hypertension and bradycardia.” – Warwick Ngan Kee

Progesterone decreases anesthesia & analgesia requirements?

Greater progesterone

Lesser anesthesia & analgesia requirements

Lee J, Ko S. Anesthesia and analgesia 2014; 119: 901
Obstetric Intraoperative Awareness

- 5th National Audit Project (NAP5)

- Prospective study:
  - 269 study coordinators in 329 UK hospitals
  - 41 coordinators in 46 Irish hospitals
    - Reported accidental awareness under GA at their hospitals
    - Reports reviewed by NAP5 panel

- Denominator: **2,800,000 general anesthetics in UK & Ireland**
Obstetric Intraoperative Awareness

Incidence of awareness: 1 in 19,000 anesthetics

Obstetrics: *The most over-represented surgical speciality*
- 12 cases out of 8000 CDs under GA
- **Incidence: 1 in 670 CD under GA (95% CI, 380 – 1,300)**

Risk factors identified elsewhere in NAP5:
- RSI
- Omission of opioids at induction
- Difficult airway management
- Obesity
- Brief period between induction & incision
- High incidence of emergent surgery
- High rates of off-hours surgery (higher rates of non-consultant care)

Pandit JJ et al. British journal of anaesthesia 2014; 113: 549-59
Could Bispectril Index monitoring prevent awareness?

N = 61, Isolated Forearm Technique + BIS Monitor

- Thiopental 4-5mg/kg & Succinylcholine 1-2mg/kg
- 50% nitrous & 1.8-2.2% sevoflurane

Positive IFT:
- 41% Laryngoscopy
- 46% Intubation
- 23% Skin Incision

BIS could not differentiate positive vs negative tests

No patients experienced recall

Pain After Cesarean Delivery

What’s the incidence of chronic pain after Cesarean?

- Prospective observational, N = 300
  - 6 months = 3%
  - 12 months = 0.6%
- Acute postoperative pain → chronic pain

Are TAP blocks safe after Cesarean?

- TAP blocks add no benefit to intrathecal morphine
- TAP blocks after Cesarean: high risk of seizure?

Ortner CM, et al. RAPM 2014; 39: 478-86

Weiss E, et al. RAPM 2014; 39:248-51
General Anesthesia and the Fetal and Neonatal Brain

Nonhuman primate brain:
- Isoflurane’s apoptosis from 3rd trimester - neonate

Sevoflurane + hydrogen = neuronal apoptosis
- Fetal mouse brain

Isoflurane + carbon monoxide = neuronal apoptosis
- Neonatal mouse brain

Ketamine + dexmedetomidine = neuronal apoptosis
- 2 month-old rat brain

Creeley CE et al. Anesthesiology 2014; 120: 626-38
Overview

1. Labor

2. Cesarean Delivery

3. Morbidity & Mortality
Obstetric Morbidity and Mortality

The SCORE project
Cardiac arrest
Postpartum hemorrhage
Sepsis
Maternal early warning systems
Worldwide maternal mortality
What’s the incidence of OB anesthesia complications?

The Serious Complication Repository Project for Obstetric Anesthesia

- 30 U.S. institutions, 5 years
- 257,000 obstetric anesthetics

- 157 total serious complications
  - 1:1,959 (95% CI 1,675-2,294)

- 85 anesthesia-related complications
  - 1:3,021 (95% CI 2,443 - 3,782)

D'Angelo R, Smiley RM, Riley ET, Segal S. Anesthesiology 2014;120:1505-12
<table>
<thead>
<tr>
<th>Event</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal death</td>
<td>1: 10,250</td>
</tr>
<tr>
<td>Cardiac arrest</td>
<td>1: 7,151</td>
</tr>
<tr>
<td>Serious neurologic injury</td>
<td>1: 11,389</td>
</tr>
<tr>
<td>Respiratory arrest in LR</td>
<td>1: 8,455</td>
</tr>
<tr>
<td>Failed intubation</td>
<td>1: 533</td>
</tr>
<tr>
<td>High neuraxial block</td>
<td>1: 4,336</td>
</tr>
<tr>
<td>Unrecognized spinal catheter</td>
<td>1: 15,435</td>
</tr>
</tbody>
</table>

D'Angelo R, Smiley RM, Riley ET, Segal S. Anesthesiology 2014;120:1505-12
Cardiac Arrest

*Incidence and causes of maternal cardiac arrest?*

**National Inpatient Sample (U.S.):**
- 56,900,512 deliveries, 1998-2011
- 4,843 cardiac arrests
  - 8.5 per 100,000 → 1 in 12,000

Survived to Discharge (59%)

<table>
<thead>
<tr>
<th>Lowest survival</th>
<th>Highest survival</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aortic dissection 0%</td>
<td>Anaphylaxis 100%</td>
</tr>
<tr>
<td>Trauma 23%</td>
<td>Mag toxicity 86%</td>
</tr>
<tr>
<td></td>
<td>Aspiration 83%</td>
</tr>
<tr>
<td></td>
<td>Anes. complications 82%</td>
</tr>
</tbody>
</table>

Mhyre JM, Tsen LC, et al. Anesthesiology 2014; 120: 810-8
Cardiac Arrest

- Postpartum hemorrhage 28%
- Antepartum hemorrhage 17%
- Heart failure 13%
- Amniotic fluid embolism 13%
- Sepsis 11%
- Anesthesia complications 8%
- Aspiration pneumonitis 7%
- Venous thromboembolism 7%
- Eclampsia 6%

Mhyre JM, Tsen LC, et al. Anesthesiology 2014; 120: 810-8
## Cardiac Arrest

<table>
<thead>
<tr>
<th>Medical condition</th>
<th>adjusted OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulmonary hypertension</td>
<td>13.3</td>
</tr>
<tr>
<td>Malignancy</td>
<td>12.5</td>
</tr>
<tr>
<td>Ischemic heart disease</td>
<td>7.6</td>
</tr>
<tr>
<td>Liver disease</td>
<td>5.5</td>
</tr>
<tr>
<td>Congenital heart disease</td>
<td>4.2</td>
</tr>
<tr>
<td>Systemic lupus</td>
<td>4.1</td>
</tr>
<tr>
<td>Cardiac valvular disease</td>
<td>3.8</td>
</tr>
</tbody>
</table>

Mhyre JM, Tsen LC, et al. Anesthesiology 2014; 120: 810-8
Cardiac Arrest

The society for obstetric anesthesia and perinatology consensus statement on the management of cardiac arrest in pregnancy

Commissioned by Board of Directors of SOAP

• Highlights:
  • Educational strategies
  • Communication strategies
  • Periodic systems testing
  • Point of care checklists

Manual left uterine displacement

Maternal Mortality in the US

Can bundled practice changes prevent maternal mortality?

Hospital Corporation of America

• 2000-2006, baseline maternal mortality
  • Intervened with 3 protocols
• 2007-2012: 81 deaths / 1,256,020 deliveries (1 in 15,600)

• 3 protocols:
  • Universal SCDs during & after Cesarean → significant \( p = 0.038 \)
  • HTN crisis & pulmonary edema → significant \( p = 0.02 \)
  • PPH protocol → trend toward in deaths, \( p = 0.07 \)

PPH Recognition

Is there a tool to facilitate PPH recognition?

Obstetric Shock Index = HR ÷ SBP

N=100, both CD and VD
Massive PPH (>30% loss of blood volume) vs controls

10 minutes after onset of bleeding

<table>
<thead>
<tr>
<th>OSI</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Obstetric shock index > 1, think PPH

30 minutes after onset of bleeding

<table>
<thead>
<tr>
<th>OSI</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>0.76</td>
</tr>
<tr>
<td>PPH</td>
<td>0.90</td>
</tr>
</tbody>
</table>

PPH Prevention

Prophylactic tranexamic acid?

Systematic review, 7 trials (n=1760)

- Bld tx ↓ after tranexamic acid:
  - RR 0.34 (95% CI 0.20-0.60)

- Eliminate 2 trials with ↑ tx rates:
  - RR 0.35 (95% CI 0.12-1.04)

PPH Treatment

Can we conserve blood in stable, anemic postpartum pts?

RCT, Non-blinded, Non-inferiority (n = 521)
• 12-24 hrs after PPH, Hgb 4.8-7.9 g/dL, stable

Randomized to:
• Intervention arm: transfuse → 8.9 g/dL
• Non intervention arm: transfuse only if severe symptoms

Primary outcome, physical fatigue at 3 days

Intervention group: 2 units pRBC (IQ 2-2) Hgb 9.0 (8.5-9.5)
Non-intervention grp: 0 units pRBC (IQ 0-0) Hgb 7.4 (6.8-7.7)

Non-inferiority not demonstrated
• Very small difference in fatigue
• No difference in secondary outcomes:
  • Breastfeeding, infection, thrombosis

Prick BW, et al. BJOG 2014; 121: 1005
Maternal Mortality in the UK

2009-2012 Triennial report:

- 10.12 deaths per 100,000 maternities
  - Compared to 2006-2008: 11 per 100,000
- 2/3 died from indirect causes
- 3/4 women who died had **co-existing medical conditions**

**Emphasis:**

- Management of preexisting medical conditions
- Provision of critical care support
- *Think sepsis*

Sepsis

What’s the cause of peripartum sepsis?

UK OB Surveillance System

- 2011-2012, 780,537 maternities, 365 severe sepsis
- Severe sepsis 4.7 per 10,000 maternities
  - 20% (n = 71) Septic Shock
  - 1.4% (n = 5) Died

Antepartum

<table>
<thead>
<tr>
<th>Bacterium</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>E. coli</td>
<td>33</td>
<td>24.6%</td>
</tr>
<tr>
<td>Group B Strep</td>
<td>13</td>
<td>9.7%</td>
</tr>
</tbody>
</table>

Postpartum

<table>
<thead>
<tr>
<th>Bacterium</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>E.coli</td>
<td>44</td>
<td>19.1%</td>
</tr>
<tr>
<td>Group A strep</td>
<td>30</td>
<td>13.0%</td>
</tr>
<tr>
<td>Staph</td>
<td>21</td>
<td>9.1%</td>
</tr>
<tr>
<td>Group B strep</td>
<td>17</td>
<td>7.4%</td>
</tr>
</tbody>
</table>

50% SIRS to septic shock < 2 hrs
75% SIRS to septic shock < 9 hrs

Maternal early warning systems

• 2012 Surveys to all lead OB Anaesthetists:
  • 130/205 responded (63%)
  • 130/130 used MEOWS (100%)


“Maternal Early Warning Criteria”

<table>
<thead>
<tr>
<th>Vital Sign</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart rate</td>
<td>50</td>
<td>120</td>
</tr>
<tr>
<td>SBP</td>
<td>90</td>
<td>160</td>
</tr>
<tr>
<td>DBP</td>
<td>--</td>
<td>100</td>
</tr>
<tr>
<td>Resp Rate</td>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td>O₂ Sat on RA</td>
<td>95%</td>
<td>--</td>
</tr>
<tr>
<td>UOP, 2 hrs</td>
<td>35mL/hr</td>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Symptoms</th>
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<tbody>
<tr>
<td>Agitation</td>
</tr>
<tr>
<td>Confusion</td>
</tr>
<tr>
<td>Unresponsiveness</td>
</tr>
<tr>
<td>Shortness of breath</td>
</tr>
<tr>
<td>Non-remitting headache</td>
</tr>
</tbody>
</table>

World Wide Maternal Mortality

• WHO Millennium Development Goal:
  • Decrease maternal mortality by $\frac{3}{4}$ by 2015

• Themes:
  • Near-miss & maternal death reviews
  • Evidence-based guideline adherence
  • Postpartum hemorrhage reduction & treatment
  • Preventing abortion and especially unsafe abortion

• In 2014 there were:
  • 289,000 maternal mortalities
  • 2.6 million stillborn babies
  • 3.0 million babies dying within one month of birth

Br J Obstet Gynaecol 2014; 121 Supplement #4
Int J Gynaecol Obstet 2014; 126 Supplement #1
Int J Gynaecol Obstet 2014; 127 Supplement #1
Thank You

Hans Sviggum, M.D.

Rebecca Johnson, M.D.

Nuala Lucas and Roshan Fernando
Thank You