Obstetrical Crisis Management

What is your Plan B?

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I will discuss the following off-label use during my presentation:
- Fentanyl
- Bupivacaine
- Atropine
- Ondansetron
- Ketorolac
Post Partum Hemorrhage

- Early cumulative EBL > 1000 ml
- OR - loss associated with s/sx of hypovolemic

Case reviews:

*Denial and delay*

Obstet Gynecol 2015;125:938-47
National Partnership for Maternal Safety: Consensus Bundle on Obstetric Hemorrhage

Elliott K. Main, MD, Dena Goffman, MD, Barbara M. Scavone, MD, Lisa Kane Low, PhD, CNM, Debra Bingham, DrPH, RN, Patricia L. Fontaine, MD, MS, Jed B. Gorlin, MD, David C. Lagrew, MD, and Barbara S. Levy, MD

Box 1. Obstetric Hemorrhage Safety Bundle From the National Partnership for Maternal Safety, Council on Patient Safety in Women’s Health Care

Readiness (Every Unit)
1. Hemorrhage cart with supplies, checklist, and instruction cards for intravenous balloons and compression stitches
2. Immediate access to hemorrhage medications (kit or equivalent)
3. Establish a response team—who to call when help is needed (blood bank, advanced gynecologic surgery, other support and tertiary services)
4. Establish massive and emergency-release transfusion protocols (type-O negative or uncrossmatched)
5. Unit education on protocols, unit-based drills (with postdrill debriefs)

Recognition and Prevention (Every Patient)
6. Assessment of hemorrhage risk (prenatal, on admission, and at other appropriate times)
7. Measurement of cumulative blood loss (formal, as quantitative as possible)
8. Active management of the 3rd stage of labor (department-wide protocol)

Response (Every Hemorrhage)
9. Unit-standard, stage-based obstetric hemorrhage emergency management plan with checklists
10. Support program for patients, families, and staff for all significant hemorrhages

Reporting and Systems Learning (Every Unit)
11. Establish a culture of huddles for high-risk patients and postevent debriefs to identify successes and opportunities
12. Multidisciplinary review of serious hemorrhages for systems issues
13. Monitor outcomes and process metrics in perinatal quality improvement committees

http://www.safehealthcareforeverywoman.org
Obstetrical Hemorrhage – Best Clinical Practice

- Hemorrhage cart
- Hemorrhage meds – immediate access
- Response team
- Transfusion protocol
- Unit based drills

Recognition and prevention

Assessment of risk
Precise measurement of EBL
Active management of 3rd stage by OB

Anesth Analg 2015;121:142-48
OB Hemorrhage - Checklist

CHECKLIST: STAGE 3
Continued bleeding with EBL >1500 mL OR >2 units RBCs given
OR Patient at risk for occult bleeding/coagulopathy OR
any patient with abnormal vital signs/labs/oliguria

INITIAL STEPS
- Mobilize additional help
- Move to OR
- Announce clinical status
  (vital signs, cumulative blood loss, etiology)
- Outline & communicate plan

MEDICATIONS
- Continue Stage 1 medications

BLOOD BANK
- Initiate massive transfusion protocol
  (If clinical coagulopathy: add cryoprecipitate, consult for additional agents)

ACTION
- Achieve hemostasis, interventions based on etiology

Safe Motherhood Initiative

Oxytocin (Pitocin)
10-40 units per 500-1000mL solution

Methylergonovine (Methergine)
0.2 milligrams IM (may repeat)

15-methyl PGF$_{2a}$ (Hemabate, Carboprost)
250 micrograms IM (may repeat in q15 minutes, maximum 8 doses)

Misoprostol (Cytotec)
800-1000 micrograms PR
600 micrograms PO or 800 micrograms PL

Cell Salvage in Obstetrics

- Risks of cell saver use in OB population parallel those in the general population
  - No definite cases of AFE reported with contemporary equipment

Waste blood and amniotic fluid prior to delivery of the placenta

Use a leukocyte depletion filter
Amniotic Fluid Embolus

- Peripartum syndrome
  - Rapid onset dyspnea, hypoxia
  - Cardiac collapse
  - Consumptive coagulopathy

Likely an anaphylactoid syndrome caused by an unknown fetal antigen
Amniotic Fluid Embolus -
Pathophysiology of any PE

- Platelet activation and degranulation
  - Thromboxane – serotonin release
    - Severe pulmonary hypertension
  - Vagal reflex
    - Bradycardia and vasodilation

- TEE
  - Profound RV dilation and failure
Amniotic Fluid Embolus – AOK protocol – proposed mechanism

- Platelet activation in pulmonary vasculature
- Vagal reflex
- Bradycardia and peripheral vasodilation
- Thromboxane
- Serotonin
- Pulmonary vasoconstriction
Amniotic Fluid Embolus – AOK protocol – proposed mechanism

- Platelet activation in pulmonary vasculature
- Vagal reflex
- KETOROLAC
- THROMBOXANE
- SEROTONIN
- Pulmonary vasoconstriction
- Bradycardia and peripheral vasodilation
- ATROPINE
- ONDANSETRON

Leighton, B. 2014 41st Annual Virginia Apgar Seminar Digest
AOK Protocol (off-label uses)

CPR, delivery, call for CPB

- **Atropine** 1 mg
  - vagolysis

- **Ondansetron** 8 mg
  - block serotonin receptors

- **Ketorolac** 30 mg
  - block thromboxane release

Leighton, B. 2014 41st Annual Virginia Apgar Seminar Digest
Preeclampsia

■ 5-7% of pregnancies
  ▸ Preeclampsia (HTN after 20 wks, renal or liver sx)
  ▸ Eclampsia (CNS involvement – seizures)
  ▸ HELLP
    ■ Hemolysis
    ■ Elevated liver enzymes
    ■ Low platelets
PIH - Implications for anesthesia

- ↓ plasma volume
- ↑ upper airway edema
- ↓ renal function – renal arteriolar vasoconstriction
- ↑ liver enzymes – splanchnic vasoconstriction
- CNS irritability – hyperreflexia
PIH therapy

- Magnesium sulfate (anticonvulsant, tocolytic, vasodilator)

- Plasma levels
  - Normal: 1.5-2.0 mg/dl
  - Therapeutic range: 4.0-8.0 mg/dl
  - Loss of deep tendon reflex: 10 mg/dl

↑ potency and duration of nondepolarizing muscle relaxants

No need to pretreat prior to succinylcholine
Traumatic macroglossia
C/S in severe preeclampsia – Evidence Based Best Practice

SAB for C/S –

- Preeclamptic is 6x less likely to develop ↓ BP than a healthy parturient
- No bolus needed

If – platelets are > 80,000 and PT/PTT are normal

499 women with plt counts < 100k/mm$^3$

- GETA 41%
- SAB 36%
- EPI 23%

GETA morbidity rate - 6.5%

Hematoma cases - 0
Preeclampsia – GETA and CVA

- 2002-2007
- 304,000 CS deliveries
- 8500 had preeclampsia

*Risk of stroke 2.38 x greater in GA group v neuraxial group*
Leading Cause of Maternal Death?

Table 5. Causes of Maternal Death/Permanent Brain Damage (n = 69) 1990 or Later

<table>
<thead>
<tr>
<th>Condition</th>
<th>Overall (n = 69), %</th>
<th>General Anesthesia (n = 28), %</th>
<th>Regional Anesthesia (n = 41), %</th>
</tr>
</thead>
<tbody>
<tr>
<td>High neuraxial block</td>
<td>15 (22)</td>
<td>0 (0)</td>
<td>15 (37)</td>
</tr>
<tr>
<td>Maternal hemorrhage</td>
<td>11 (16)</td>
<td>8 (29)</td>
<td>3 (7)</td>
</tr>
<tr>
<td>Embolic events</td>
<td>8 (12)</td>
<td>2 (7)</td>
<td>6 (15)</td>
</tr>
<tr>
<td>Difficult intubation</td>
<td>7 (10)</td>
<td>7 (25)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Preeclampsia/HELLP syndrome</td>
<td>5 (7)</td>
<td>3 (11)</td>
<td>2 (5)</td>
</tr>
<tr>
<td>Medication</td>
<td>5 (7)</td>
<td>0 (0)</td>
<td>5 (12)</td>
</tr>
<tr>
<td>Inadequate oxygenation/ventilation</td>
<td>3 (4)</td>
<td>1 (4)</td>
<td>2 (5)</td>
</tr>
<tr>
<td>Aspiration of gastric contents</td>
<td>2 (3)</td>
<td>1 (4)</td>
<td>1 (2)</td>
</tr>
<tr>
<td>Neuraxial cardiac arrest</td>
<td>2 (3)</td>
<td>0 (0)</td>
<td>2 (5)</td>
</tr>
<tr>
<td>Hypertensive intracranial hemorrhage</td>
<td>2 (3)</td>
<td>1 (4)</td>
<td>1 (2)</td>
</tr>
<tr>
<td>Central venous catheter</td>
<td>1 (1)</td>
<td>1 (4)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Chorioamnionitis/ARDS</td>
<td>1 (1)</td>
<td>1 (4)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Airway obstruction</td>
<td>1 (1)</td>
<td>1 (4)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Other/unknown</td>
<td>6 (9)</td>
<td>2 (7)</td>
<td>4 (10)</td>
</tr>
</tbody>
</table>

High block – 22%
Identification of subarachnoid placement

- Lidocaine 1.5% 1:200,000 epi 3 ml (45 mg)

*perform a careful assessment of sympathetic, motor and sensory function 3-5 min after injection*

However:

SABs fail for many reasons

Undiagnosed intrathecal catheters are rare – false positive TDs are not

LA TD for intrathecal catheters not been extensively studied
Cardinal Rules – Neuraxial Anesthesia

- Assess for gravity dependent flow of CSF
- Gentle aspiration with 5 ml glass or 3 ml plastic
- Appropriate test dose – intravascular marker
- Incremental dosing – never > 5 ml
- Stay with the patient and observe – 30 min
- Lipids and resuscitation equipment available
Treatment of total spinal

- Airway, ventilation and cardiovascular support

- Consider undiagnosed medical problems:
  - cardiomyopathy
  - anaphylactic shock
  - eclampsia
  - *amniotic fluid embolus*
The Society for Obstetric Anesthesia and Perinatology Consensus Statement on the Management of Cardiac Arrest in Pregnancy

Steven Lipman, MD,* Sheila Cohen, MB, ChB, FRCA,* Sharon Einav, MD,† Farida Jeejeebhoy, MD, FRCP, FACC,† Jill M. Mhyre, MD,§ Laurie J. Morrison, MD, MSc, FRCP|| Vern Katz, MD,¶ Lawrence C. Tsen, MD,# Kay Daniels, MD,** Louis P. Halamek, MD, FAAP†† Maya S. Suresh, MD,†† Julie Arafeh, RN, MSN, §§ Dodi Gauthier, M.Ed, RNC-OB, C-EFM,|||| Jose C. A. Carvalho, MD, PhD, FANZCA, FRCPC,¶¶ Maurice Druzin, MB, BCh,** and Brendan Carvalho, MBBCCh, FRCA*

Table 1. Checklist of Key Tasks During the First Minutes of In-House Maternal Cardiac Arrest

<table>
<thead>
<tr>
<th>Category</th>
<th>Task</th>
</tr>
</thead>
<tbody>
<tr>
<td>Call for help!</td>
<td>Call &quot;OB Code&quot;</td>
</tr>
<tr>
<td></td>
<td>Call neonatal team</td>
</tr>
<tr>
<td></td>
<td>AED/defibrillator</td>
</tr>
<tr>
<td></td>
<td>IMMEDIATE BLS</td>
</tr>
<tr>
<td></td>
<td>Adult code cart</td>
</tr>
<tr>
<td></td>
<td>Adult airway equipment</td>
</tr>
<tr>
<td></td>
<td>Backboard</td>
</tr>
<tr>
<td></td>
<td>Scalpel/Cesarean pack</td>
</tr>
<tr>
<td></td>
<td>Assign timer/documenter</td>
</tr>
<tr>
<td>Start CPR</td>
<td>Left uterine displacement (manual)</td>
</tr>
<tr>
<td></td>
<td>Hands mid-sternum</td>
</tr>
<tr>
<td></td>
<td>100 compressions/min</td>
</tr>
<tr>
<td></td>
<td>PUSH HARD! PUSH FAST!</td>
</tr>
<tr>
<td></td>
<td>Change compressors every 2 min</td>
</tr>
<tr>
<td></td>
<td>Obtain IV access above diaphragm</td>
</tr>
<tr>
<td></td>
<td>Chin lift/jaw thrust</td>
</tr>
<tr>
<td></td>
<td>100% O₂ at 10-15 L/min</td>
</tr>
<tr>
<td></td>
<td>Use self-inflating bag mask</td>
</tr>
<tr>
<td></td>
<td>Oral airway or</td>
</tr>
<tr>
<td></td>
<td>Experienced personnel: Intubation with 6-7.0 ETT or</td>
</tr>
<tr>
<td></td>
<td>Supraglottic airway (e.g., LMA)</td>
</tr>
<tr>
<td></td>
<td>Do not interrupt chest compressions!</td>
</tr>
<tr>
<td>C Circulation</td>
<td>If not intubated: 30 compressions to 2 breaths</td>
</tr>
<tr>
<td></td>
<td>If intubated: 10 breaths per min</td>
</tr>
<tr>
<td></td>
<td>(500-700 mL per breath)</td>
</tr>
<tr>
<td></td>
<td>Administer each breath over 1 s</td>
</tr>
<tr>
<td></td>
<td>Peds front and back</td>
</tr>
<tr>
<td>Chest compressions</td>
<td>Use AED or Analyze/defibrillate every 2 min</td>
</tr>
<tr>
<td></td>
<td>Immediately resume CPR for 2 min</td>
</tr>
<tr>
<td></td>
<td>Prepare for delivery</td>
</tr>
<tr>
<td></td>
<td>Aim for incision by 4 min</td>
</tr>
<tr>
<td></td>
<td>Aim for fetal delivery by 5 min</td>
</tr>
</tbody>
</table>

Table 2. Checklist of Potential Contributing Factors to Maternal Cardiac Arrest

A Anesthetic complications (high neuraxial block, loss of airway, aspiration, respiratory depression, hypotension, local anesthetic systemic toxicity)
B Bleeding* (coagulopathy, uterine atony, placenta accreta, placental abruption, placenta previa, uterine rupture, trauma, surgical, transfusion reaction)
C Cardiovascular causes (cardiomyopathy, myocardial infarction, aortic dissection, arrhythmias)
D Drugs (anaphylaxis; illicit; drug error; magnesium, opioid, insulin, or oxytocin overdose)
E Embolic (pulmonary embolus, amniotic fluid [AFE], air)
F Fever* (infection, sepsis)
G General nonobstetric causes of cardiac arrest (H’s and T’s)†
H Hypertension* (preeclampsia/eclampsia/HELLP, intracranial bleed)
Cardiac arrest – What’s the Difference?

- Compressions – hand position slightly higher
- Manual LUD (if uterus is visible)
- Intubate – ventilate 100% oxygen
- ACLS Drugs per guidelines – none contraindicated
- If on MgSO₄ at time of arrest – consider CaCl
- **PMCD** – promptly (within 5 min) to restore maternal circulation/oxygenate fetus
Maternal Cardiac Arrest

First Responder
- Activate maternal cardiac arrest team
- Document time of onset of maternal cardiac arrest
- Place the patient supine
- Start chest compressions as per BLS algorithm; place hands slightly higher on sternum than usual

Subsequent Responders

Maternal Interventions
Treat per BLS and ACLS Algorithms
- Do not delay defibrillation
- Give typical ACLS drugs and doses
- Ventilate with 100% oxygen
- Monitor waveform capnography and CPR quality
- Provide post-cardiac arrest care as appropriate

Maternal Modifications
- Start IV above the diaphragm
- Assess for hypovolemia and give fluid bolus when required
- Anticipate difficult airway; experienced provider preferred for advanced airway placement
- If patient receiving IV/IO magnesium prearrest, stop magnesium and give IV/IO calcium chloride 10 mL in 10% solution, or calcium gluconate 30 mL in 10% solution
- Continue all maternal resuscitative interventions (CPR, positioning, defibrillation, drugs, and fluids) during and after cesarean section

Obstetric Interventions for Patient With an Obviously Gravid Uterus*
- Perform manual left uterine displacement (LUD) — displace uterus to the patient’s left to relieve aortocaval compression
- Remove both internal and external fetal monitors if present

Obstetric and neonatal teams should immediately prepare for possible emergency cesarean section
- If no ROSC by 4 minutes of resuscitative efforts, consider performing immediate emergency cesarean section
- Aim for delivery within 5 minutes of onset of resuscitative efforts

*An obviously gravid uterus is a uterus that is deemed clinically to be sufficiently large to cause aortocaval compression

Search for and Treat Possible Contributing Factors (BEAUCHOPS)
- Bleeding/DIC
- Embolism: coronary/pulmonary/amniotic fluid embolism
- Anesthetic complications
- Uterine atony
- Cardiac disease (MI/ischemia/aortic dissection/cardiomyopathy)
- Hypertension/preeclampsia/ eclampsia
- Other: differential diagnosis of standard ACLS guidelines
- Placenta abruptio/previa
- Sepsis
15 multi-disciplinary teams

• Simulated AFE with maternal cardiac arrest
• Randomization: Delivery in OR vs. LDR

Time to incision 4.25 LDR v 7.53 min OR
Transport Decreases the Quality of Cardiopulmonary Resuscitation During Simulated Maternal Cardiac Arrest

Steven S. Lipman, MD, Jocelyn Y. Wong, BA, Julie Arafeh, RN, MSN, Sheila E. Cohen, MBChB, FRCA, and Brendan Carvalho, MBChB, FRCA

26 two-provider multi-disciplinary teams

Randomized to CPR during transport or while stationary

- Stationary group – 92% correct
- Transport group - 7% correct
Obstetrical Predictors of Failed Neuraxial Labor Analgesia

- Nulliparity, ↑ fetal wt, ↓ cervical dil at placement
- Pain within 30 min of insertion
- Abnormal fetal presentation
- More than one episode of breakthrough pain
Inadequate EPI – *During Labor*

- Use adjuvants – Fentanyl/Epinephrine
- Attempt to Rx with ↑ *volume*
- Replace/Resite

*Do not waste time convincing yourself a block exists when it is inadequate!*

*Communicate with LDRN and OB!*
**EPI Volume Matters (*a lot*)**

<table>
<thead>
<tr>
<th>Bup 20 mg</th>
<th>4 ml 0.5% n=19</th>
<th>10 ml 0.2% n=19</th>
<th>20 ml 0.1% n=20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain (VAS)</td>
<td>4.37</td>
<td>0.88</td>
<td>0.25</td>
</tr>
<tr>
<td>Mean duration</td>
<td>43 min</td>
<td>100 min</td>
<td>120 min</td>
</tr>
<tr>
<td>Motor block</td>
<td>+</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>Complete relief</td>
<td>5.26%</td>
<td>57.8%</td>
<td>75%</td>
</tr>
</tbody>
</table>

Converting labor EPI to C/S EPI
Converting a labor EPI to a C/S EPI

- Lido 2% 1:200,000 epinephrine
- +/- Bicarb 1 meq/10 ml
- In the presence of a well functioning epidural-10-15ml – *in divided doses*
Factors Thought to be Associated with Epidural Conversion Failure

- Duration of labor analgesia
- Tall v short stature
- CSE v EPI only
- OB specialist v non-specialist
- Number of boluses for breakthrough pain
- Urgency of CS

IJOA 2012;21:294-309
BJA 2003;91:532-535
Reported as high as 21%

**Why not GETA?**

- Higher incidence of maternal mortality
- Pulmonary aspiration
- Difficult intubation
- Neonatal depression
- Intraoperative awareness
- Uterine relaxation – volatile agents
- Postop pain, sedation
# EPI Conversion Failure – Now What?

<table>
<thead>
<tr>
<th>EPI catheter replacement</th>
<th>Single-shot spinal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Takes time – titrate correctly</td>
<td>Increased risk of high/total spinal</td>
</tr>
<tr>
<td>Total LA dose? – LAST</td>
<td>UK - 50% of high spinals followed failed EPI</td>
</tr>
<tr>
<td></td>
<td>Reduce spinal dose</td>
</tr>
<tr>
<td></td>
<td>Wait 30 min</td>
</tr>
</tbody>
</table>

Anesth 2014;120:1505-1512
Inadequate EPI level for C/S = CSE

- In failed top-up for C/S
  - Repeat using a CSE
  - Reduce spinal dose
  - Augment block using the (new) EPI cath

Minimizing the chance for a high/total spinal
Combined spinal-epidural (CSE)

Advantages of a CSE:

- Speed of onset
- Confirms placement of EPI needle
- Augment prn using EPI cath
Dural Puncture Epidural (DPE)

- Similar to CSE – dura is punctured with a small needle prior to placement of epi cath

- *No* drug is administered in the intrathecal space

- Improves sacral spread, onset, and bilateral pain relief without altering cephalad spread of LA administered in the EPI space with 25g (not 27g)

AA 2008;107:1646
GETA for Cesarean Delivery

Sometimes the best choice

- Intra-op awareness remains high – 0.26%
- **USE a GA** – 0.7 MAC (or more)
  - Uterine relaxation
  - Neonatal depression
- Fetal compromise? Fi02 = 1.0
  - Otherwise N20 is OK
- Propofol is OK
Questions?

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