Anesthesia Considerations in Obstetric Hemorrhage
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Division of Obstetric Anesthesia

Common Things Being Common
Most Common Cause of Maternal Mortality Worldwide.
• In the US roughly 3% rate of PPH
• Increasing rates of transfusion Obstetrics
  – Increased Cesarean Delivery
  – Abnormal Placentation
• Atony 80% of causes of Severe PPH

WHO Analysis of Causes of Maternal Death Systematic Review

<table>
<thead>
<tr>
<th></th>
<th>Developed Countries</th>
<th>Africa</th>
<th>Asia</th>
<th>Latin Am. Caribbean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hemorrhage</td>
<td>13.4%</td>
<td>33.9%</td>
<td>30.8%</td>
<td>20.8%</td>
</tr>
<tr>
<td>Hypertensive Disorders</td>
<td>16.1%</td>
<td>9.1%</td>
<td>9.1%</td>
<td>25.7%</td>
</tr>
<tr>
<td>Infecitons</td>
<td>2.1%</td>
<td>9.7%</td>
<td>11.6%</td>
<td>7.7%</td>
</tr>
<tr>
<td>Abortion</td>
<td>8.2%</td>
<td>3.9%</td>
<td>5.7%</td>
<td>12.0%</td>
</tr>
<tr>
<td>Embolism</td>
<td>14.9%</td>
<td>2.0%</td>
<td>0.4%</td>
<td>0.6%</td>
</tr>
</tbody>
</table>

Accreta and Peripartum Hysterectomy


Massive Hemorrhage

A Report from the Anesthesia Closed Claims Project


Table 7. Clinical Lessons

<table>
<thead>
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<th>Massive hemorrhage is a rare but serious cause of malpractice claims.</th>
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<tbody>
<tr>
<td>• High mortality</td>
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<tr>
<td>• High rate of payment to plaintiff</td>
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<td>• Large payment size</td>
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</tbody>
</table>

Hemorrhage claims were most common in obstetric anesthesia and anesthesia for thoracic or lumbar spine surgery. Massive hemorrhage can also occur in low-risk procedures, e.g., minimally invasive, laparoscopic, or robotic procedures.

Common features:

• Lack of timely diagnosis
• Lack of timely transfusion
• Lack of timely return to the operating room

Anesthesia care contributed to poor outcome in most claims. Every surgical and obstetric facility should create and practice a plan to address unexpected massive hemorrhage.
Developed a Tool Kit for OB services:

- Set of Best Practices (short summaries of key aspects of OB hemorrhage)
- Checklist for managing OB hemorrhage
- Flow-Chart and Table Chart Summaries of approach
- Implementation tools such as sample policies, procedures, charting examples, implementation hints

All resources on-line at: www.cmqcc.org/ob_hemorrhage
Control of massive hemorrhage

Lessons from Iraq reach the US labor and delivery suite

Transfusion management of massive OB hemorrhage has been enlightened by military trauma care in war zones.

Volume restoration is accomplished by using thawed plasma as a primary resuscitation fluid in at least a 1:1 or 1:2 ratio with PRBCs

Crystalloid is minimized and serves mainly as a carrier

The blood bank activates the massive transfusion protocol and deliver 6 units of plasma, 6 units of PRBCs, 6 packs of platelets, and 10 units of cryoprecipitate

Recombinant FVIIa is occasionally used

Coagulopathy persisted at ICU admission

Pre-ICU resuscitation:
- 9 ± 1 L crystalloid
- 12 ± 1 units PRBC
- 5 ± 0.4 units FFP

FFP was not given until after 6 units PRBCs

In the ICU during resuscitation, patients received 10 ± 1 units FFP for coagulopathy; the ratio of FFP:PRBC was 1:1. Mean INR < 1.4 within 8 hours

Recombinant FVIIa is occasionally used

“Using the damage control resuscitation approach, the lack of intraoperative coagulopathic bleeding has been remarkable, allowing surgeons to focus on surgical bleeding.”

“Patients treated in this fashion almost always arrive in the ICU warm, euvoletic, and nonacidotic, with a normal INR and minimal edema.”
“In the majority of patients the abnormalities of the lethal triad are absent.”

“These patients appear to be easily ventilated and more quickly extubated than patients with similar blood loss treated with the standard crystalloid resuscitation volumes and blood component ratios.”


2003-2005 Retrospective Data From Iraq War

Plasma:RBC product transfusion ratios effect on patient survival

Survival versus ratio. (Dark Gray) 24-hour survival; (Light Gray) 30-day survival

Volume 50, February 2010 TRANSFUSION

PLT:RBC product transfusion ratios effect on patient survival

Survival versus ratio. (Dark Gray) 24-hour survival; (Light Gray) 30-day survival

Volume 50, February 2010 TRANSFUSION
Principles to Reducing Maternal Hemorrhage

- Screen and identify patients at high risk
- Active management of 3rd stage
- Ongoing quantification of blood loss
- Ongoing evaluation of patient’s vital signs
- Sequential use of medications & procedures
- Timely request for blood products
- Massive transfusion protocol and team
- Periodic hemorrhage drills and simulations

Adapted from CMQCC California Maternal Quality Care Collaborative – OB Hemorrhage Task Force
Multisite, RCT, 12 Level 1 Trauma Centers
680 Severely Injured Patients
August 2012 – December 2013
Outcomes 24-hour and 30-day mortality
Considerations in Massive Transfusion Protocol - Continued

• Prepare for general anesthesia
• Vasopressors immediately available
• All uterotonic immediately available
• Supply of calcium chloride to prevent low ionized calcium levels from rapid transfusion
• Foley to measure urine & SCDs
• Reserve ICU bed

Consideration of Cell Salvage

• Cell salvage in obstetrics should be considered in cases at risk for severe hemorrhage or for individuals in whom allogenic blood can not be used...
  - Placenta accreta / increta / percreta
  - Massive uterine fibroids
  - Jehovah’s Witnesses
  - Difficult cross-matching

Opinion Statements

• “If the diagnosis or strong suspicion of placenta accreta is formed before delivery...Cell saver technology should be considered if available as well as the appropriate location and timing for delivery…”

  (American College of Obstetricians and Gynecologists (ACOG), Practice Bulletin, No. 76, October 2006, Postpartum Hemorrhage)
Opinion Statements

- “Cell salvage is recommended for women in whom an intraoperative blood loss of more than 1500 ml is anticipated. Cell salvage should only be used by healthcare teams who use it regularly and have the necessary expertise and experience. Consent should be obtained and its use in obstetric patients should be subject to audit and monitoring.”

(RCOG Guideline No. 27, October 2005 – Placenta Previa and Placenta Accreta)

TOOLS TO HELP? SOME NEW AND SOME OLD

Role of Interventional Radiology

Uterine Artery Catheterization

Embolization Agents

- Slurry
- n-Butyl Cyanoacrylate
- Pledgets
- Coils
## IR for Atony Clinical Success

<table>
<thead>
<tr>
<th>Study</th>
<th>Year</th>
<th>n</th>
<th>Success %</th>
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</thead>
<tbody>
<tr>
<td>Ornan D et al., Obstet Gynecol</td>
<td>2003</td>
<td>28</td>
<td>96%</td>
</tr>
<tr>
<td>Boulleret C et al., CVIR</td>
<td>2004</td>
<td>35</td>
<td>100%</td>
</tr>
<tr>
<td>Zwart JJ et al., Am J Obstet Gynecol</td>
<td>2009</td>
<td>114</td>
<td>85%</td>
</tr>
<tr>
<td>Kirby JM et al., JVIR</td>
<td>2009</td>
<td>43</td>
<td>79%</td>
</tr>
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</table>

### Menstrual and fertility outcomes following the surgical management of postpartum haemorrhage: a systematic review

- 28 studies were included in the systematic review
- 460 out of 503 (91.45%) women resumed menstruation
- 168 women desired another pregnancy
  - 126 (75%) achieved conception following embolization

**Conclusion:** Uterine-sparing radiological techniques do not appear to adversely affect the menstrual and fertility outcomes in most women; however, the number and quality of the available evidence is of concern.

### Interventional Radiology Invasive Placenta

- Different disease process than uterine atony
- Requires a multidisciplinary team
  - Maternal fetal medicine (OB team)
  - Surgical gynecology (gyn onc)
  - Interventional radiology
  - Diagnostic radiology (antenatal MRI)
  - Scheduled deliveries
  - Use of multidisciplinary team is associated with a significant reduction in morbidity (p=0.005)

**Conclusion:** Uterine-sparing radiological techniques do not appear to adversely affect the menstrual and fertility outcomes in most women; however, the number and quality of the available evidence is of concern.
rFVIIa

Cost: ~ $5000.00

- A review of the FDA’s Reporting System from 1999 to 2004
- A total of 431 AE reports for rFVIIa were found, of which 168 reports described 185 thromboembolic events
- Unlabeled indications accounted for 151 of the reports, most with active bleeding (n=115)
- In 36 (72%) of 50 reported deaths, the probable cause of death was the thromboembolic event
- Conclusion: RCTs are needed to establish the safety and efficacy of rFVIIa in patients without hemophilia

Review of Factor VIIa in Severe Obstetric PPH

- A 2008 review noted 118 cases of massive postpartum hemorrhage treated with rFVIIa.
- Median dose was 71.6 mcg/kg
- rFVIIa was reported to be effective in stopping or reducing bleeding in 90% of reported cases
- Caution in interpreting results as they are from uncontrolled studies
- RCTs needed to determine efficacy, dose, & safety

Table 2. Data on fibrinogen levels in nonpregnant women and in pregnant women during the first, second, and third trimesters

<table>
<thead>
<tr>
<th>Fibrinogen concentration (g/L)</th>
<th>Nonpregnant controls</th>
<th>First trimester</th>
<th>Second trimester</th>
<th>Third trimester</th>
</tr>
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<tbody>
<tr>
<td></td>
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<td></td>
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<tr>
<td>Haussold et al. [41]</td>
<td>3.3 (1.1–4.6)</td>
<td>4.0 (3.7–4.3)</td>
<td>4.6 (4.3–4.8)</td>
<td>5 (4.4–5.6)</td>
</tr>
<tr>
<td>Adner et al. [42]</td>
<td>2.2 (0.4)</td>
<td>NA</td>
<td>NA</td>
<td>3.7 (0.7)</td>
</tr>
<tr>
<td>Ubachs and Adner [41]</td>
<td>2.4 (0.4)</td>
<td>NA</td>
<td>NA</td>
<td>4.7 (0.7)</td>
</tr>
<tr>
<td>Caracci et al. [44]</td>
<td>3.7 (0.9)</td>
<td>4.1 (0.7)</td>
<td>4.6 (0.9)</td>
<td>5.6 (1.1)</td>
</tr>
<tr>
<td>Schrier et al. [45]</td>
<td>NA</td>
<td>2.6 (0.3)</td>
<td>3.0 (0.2)</td>
<td>3.3 (0.3)</td>
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<tr>
<td>Marks et al. [46]</td>
<td>NA</td>
<td>3.3 (0.3)</td>
<td>3.7 (0.3)</td>
<td>5.1 (0.5)</td>
</tr>
<tr>
<td>Choi and Park [47]</td>
<td>3.3 (2.1)</td>
<td>3.3 (2.0)</td>
<td>3.8 (2.1)</td>
<td>4.4 (0.9)</td>
</tr>
</tbody>
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Butwick et al. Curr Opin Anesthesiol 2015; 28:275-84

Fibrinogen
Thromboelastography

ROTEM- Thromboelastometry (Germany)

Fig. 3. ROC curve of fibrinogen plasma concentration at H0 for the diagnosis of severe postpartum hemorrhage.
PROTOCOL SUMMARY

FULL TITLE OF STUDY: Tranexamic acid for the treatment of postpartum haemorrhage: An international, randomised, double blind, placebo controlled trial

SHORT TITLE: WORLDMATERNAL ANTI-FIBRINOLYTIC TRIAL

TRIAL ACRONYM: THE WOMAN TRIAL

PROTOCOL NUMBER: ISRCTN76912190

EUDRACT NUMBER: 2008-008441-38

CLINICAL PHASE: 3

PLANNED TRIAL START: May 2009

PLANNED DATE OF LAST PATIENT ENROLMENT: 31 March 2016

PLANNED DATE OF LAST OUTCOME: 12 May 2016

Butwick et al. Curr Opin Anesthesiol 2015; 28;275-84
Summary

• Recognition and Preparedness
• Multidisciplinary Team
• Good Communication and Team Work
• Massive Transfusion Protocols
• Role of Cell Salvage in Predictable Hemorrhage
• Potential Role of Devices and Pharmacologic Interventions