CURRENT CONCEPTS IN POSTPARTUM HEMORRHAGE

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Maternal Mortality in the U.S.A.

- 1930’s - 670 per 100,000
- 1990’s - 7.7 per 100,000


Has the trend in mortality continued to decrease after 1996?

1. Yes
2. No

Hemorrhage remains a major cause of obstetric morbidity and mortality

- Rate of maternal deaths has nearly tripled from 6 per 100,000 in 1996 to 17 per 100,000 annual births in 2006. (1)
- Rate for African American women has risen from 28.7 to 54.9 per 100,000 live births between 1999 and 2006. (1)
- Obstetric hemorrhage is one of the leading causes for maternal death and is a major cause of maternal morbidity.
- In 1997, 2.4% of all live births in California were complicated by postpartum hemorrhage. (2)
- Nationwide, blood transfusions increased 92% during delivery hospitalizations between 1997 and 2005. (3)

Definition

- Volume
  - Greater than 1000cc following a cesarean section
  - Greater than 500cc following a vaginal delivery

- Average blood loss
  - 400-600ml vaginal
  - 1000ml cesarean section

- Visual estimates inaccurate by 30-50%

Definition

- Volume
  - Greater than 1000cc following a cesarean section
  - Greater than 500cc following a vaginal delivery

- Average blood loss
  - 400-600ml vaginal
  - 1000ml cesarean section

- Visual estimates inaccurate by 30-50%

Andolina K et al. Objective measurement of blood loss at delivery: is it more than a guess? AJOG 1999; 180

Clinically Based Classification

- Clinical symptoms definition

<table>
<thead>
<tr>
<th>Class</th>
<th>Blood Loss</th>
<th>Blood Pressure</th>
<th>Signs and Symptoms</th>
<th>Degree of Shock</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>500-1000</td>
<td>Normal</td>
<td>Palpitations, diziness, tachycardia</td>
<td>Compensated</td>
</tr>
<tr>
<td>II</td>
<td>1000-1500</td>
<td>Slightly low</td>
<td>Weakness, sweating, tachycardia</td>
<td>Mild</td>
</tr>
<tr>
<td>III</td>
<td>1500-2000</td>
<td>70-80</td>
<td>Restlessness, pallor, oliguria</td>
<td>Moderate</td>
</tr>
<tr>
<td>IV</td>
<td>2000-3000</td>
<td>50-70</td>
<td>Collapse, air hunger, anuria</td>
<td>Severe</td>
</tr>
</tbody>
</table>

Vital Sign Triggers

- Triggers identify patients that need attention based on vital sign thresholds
- Prevents potentially ill patients from being ignored
- Useful for all OB emergencies
- Improves communication and allows implementation of action that might otherwise be delayed (labs)

NHS Trigger Tool for Obstetrics

Graphical display of vital signs: “Contact doctor if one red or two yellows”

Prevention with the Active Management of the 3rd Stage of labor

- Passive management
  - Placental delivery occurs naturally without cord traction
- Active management
  - Oxytocin
  - Cord traction
  - Uterine massage


Meta Analysis of Active vs. Expectant 3rd Stage

<table>
<thead>
<tr>
<th>Study</th>
<th>Treatment (n)</th>
<th>Control (n)</th>
<th>RR (95% CI)</th>
<th>Weight (kg)</th>
<th>RR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abu Dhabi 1997</td>
<td>499-2741</td>
<td>499-2741</td>
<td>21.2</td>
<td>0.53 (0.36, 0.74)</td>
<td></td>
</tr>
<tr>
<td>Dublin 1998</td>
<td>1475-705</td>
<td>1475-705</td>
<td>23.6</td>
<td>0.53 (0.34, 0.82)</td>
<td></td>
</tr>
<tr>
<td>Hoxton 1998</td>
<td>117-500</td>
<td>117-500</td>
<td>13.9</td>
<td>0.54 (0.14, 0.44)</td>
<td></td>
</tr>
<tr>
<td>Total (n)</td>
<td>1134</td>
<td>1134</td>
<td>10.01</td>
<td>0.98 (0.48, 1.06)</td>
<td></td>
</tr>
</tbody>
</table>

~62% fewer PPH in Active Management group versus Expectant Management


Sometimes, I allow the placenta to deliver on its own because I support the concept of natural childbirth.

1. True
2. False
Uterine atony

- 80% of all postpartum hemorrhage

Risk Factors
- High parity
- Chorioamnionitis, sepsis
- Fibroids
- Uterine overdistention
- Precipitous delivery, protracted delivery
- Magnesium sulfate
- General anesthesia/ Nitroglycerin
- Placental abruption
- Hypothermia

Medical Treatment

- Fundal massage
- Bimanual compression
- Decompress bladder
- Oxytocin
- Methergine (Methylergonovine)
  - 0.2 mg IM q 2-4 hours
  - Half life 3 hours
- Hemabate (prostaglandin F2-alpha)
  - 0.25 mg IM up to 6 doses, each being 15 to 90 minutes
- Cytotec (Misoprostol) 1000mcg per rectum one time†

Medical Treatment continued

- Magnesium sulfate
- General anesthesia/ Nitroglycerin
- Placental abruption
- Hypothermia

Your patient has just delivered and has uterine atony and is hemorrhaging. What is the maximum amount of oxytocin you order for her IV solution

1. 10 units
2. 30 units
3. 50 units
4. 60 units
5. 80 units

Oxytocin after delivery

<table>
<thead>
<tr>
<th></th>
<th>10 U * (n=163)</th>
<th>80 U * (n=198)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Additional uterotonic</td>
<td>39%</td>
<td>19%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Methylene or Hemabate</td>
<td>9%</td>
<td>2%</td>
<td>0.005</td>
</tr>
<tr>
<td>Hypotension treatment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>By fluid bolus</td>
<td>19%</td>
<td>17%</td>
<td>0.55</td>
</tr>
<tr>
<td>EBL</td>
<td>957±148cc</td>
<td>937±159</td>
<td>0.55</td>
</tr>
</tbody>
</table>

*Diluted in 500cc NS over 30 minutes

I have used a brace suture (e.g. B-lynch) for the treatment of PPH?

1. Yes
2. No

Steadily Moving Up the Protocol

- In general, if there has been little/no response to Methergine, do not give the second dose but MOVE ON to the prostaglandin second medication.
- Second medication is often Hemabate (carboprost: 15-methyl PGF2α) one amp (0-25mg) IM or intramyometrial but some centers prefer misoprostol (800-1,000ug PR).
- If Hemabate has had little/no effect MOVE ON to non-pharmacologic methods after the 2nd dose, if some effect, may give up to 8 doses, at Q15-20min intervals
- Most authors do NOT see value in giving BOTH Hemabate AND misoprostol as the mechanism of action is the same. In that setting, perhaps misoprostol may be given while the non-pharmacologic steps are being set up. MOVE ON.
Brace Suture

- Must be responsive to bimanual compression
- Number 2 chromic 70 cm long

B-Lynch Compression Suture

"Belt and Suspenders"

B-Lynch Suture

- Every Obstetrician should know how to do this
- Quick (<2 minutes)
- Ideal at time of Cesarean birth for atony
- Diagram can be placed in each OR

Variations of the uterine brace suture

- Cho Square suture
- Approximates anterior and posterior uterine walls
- Successful in 23 patients with PPH at time of cesarean and avoided hysterectomy in all cases

My L+D unit has balloon tamponade devices?

1. Yes
2. No

Balloon tamponade

- Compression device to apply pressure to the interior of the uterus
Cook “Bakri” Intrauterine Balloon

- FDA approved for uterine atony
- Double lumen
- Silicone (non-latex)
- Uterine contour shape
- Good filling capacity
- Easy to use

Successful Applications of the Intrauterine Balloon

- Atony
- Low-lying placental implantation site, esp with placenta previa
- Poorly contracting lower uterine segment
- Placenta accreta / percreta
- Cervical implantation
- DIC at term or after 2nd trimester loss
- Vaginal sidewall lacerations
- In combination with Compression Suture at hysterotomy ("Sandwich technique")

“Intrauterine Balloon Should be First Step after Failure of Medical Therapy”

- Tamponades uterine bleeding
- Allows the OB to mobilize other resources
- Low-tech, fast, easy to utilize
- Least morbidity of any “next step”

Issues for Bakri Balloon

- There is some user learning—
  - How much to fill? (150-500ml is a big range). We recommend estimating the uterine volume bimanually -- usually 250-300ml is sufficient unless the uterus is very atonic.
  - There can be “hour-glassing” of the balloon thru the cervix into the vagina. We recommend using vaginal packing if the cervix is more than 1-2cm dilated)
Hysterectomy

- Primary surgical conservative procedure does not work
- Life threatening hemorrhage

The primary diagnosis for the last cesarean hysterectomy I performed was for....?

1. Uterine atony
2. Uterine rupture
3. Abnormal placentation
4. Other

Emergency Postpartum Hysterectomy for Uncontrolled Postpartum Bleeding
A Systematic Review
A. Cristina Ross, MD, Richard H. Lee, MD, and Roman H. Chou, MD

| Table 2. Indications for Emergency Postpartum Hysterectomy |
|----------------------------------|------------------|
| Factors Leading to EPH | Incidence |
| Abnormal placental adhesion | 377 (38) |
| Uterine atony | 203 (29) |
| Uterine rupture | 123 (12) |
| Uterine myometrial laceration | 83 (9) |
| Placenta previa | 69 (7) |
| Abruption placentae | 17 (2) |
| Myoma | 13 (1) |
| Hematoma | 4 (less than 1) |
| Other* | 10 (1) |

EPH, emergency postpartum hysterectomy.  Data are n (%). * Includes endometritis, pelvic abscess, and sepsis.

Risk of accreta with prior CD and placenta previa

<table>
<thead>
<tr>
<th>Number of prior c-section</th>
<th>MFMU (n=723)</th>
<th>Clark (n=29)</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>3.3%</td>
<td>5%</td>
</tr>
<tr>
<td>1</td>
<td>11%</td>
<td>24%</td>
</tr>
<tr>
<td>2</td>
<td>40%</td>
<td>47%</td>
</tr>
<tr>
<td>3</td>
<td>61%</td>
<td>40%</td>
</tr>
<tr>
<td>4</td>
<td>67%</td>
<td>67%</td>
</tr>
</tbody>
</table>


- 2009- 32.9% cesarean delivery rate
- Decision analysis
- 2020 – cesarean delivery rate 56.2%
- 6,236 additional placenta previas
- 4,504 additional placenta accretas
- 130 additional maternal deaths annually


Prenatal diagnosis of Accreta

- Ultrasound
  - Sensitivity 80% Specificity 95%
  - Placenta previa
  - Lacunar lakes
- Increased vascular flow under placenta
- Decreased myometrial thickness
- MRI with gadolinium (Warshak and Hull)
- Sensitivity 88%, Specificity 100%
Placenta previa normal

Placenta previa abnormal

Hysterectomy

Team approach

- Gynecologic Oncology
- Anesthesia
- Nurses
- Surgical technicians
- NICU
- Cell-Saver
- ICU
- Blood Bank
Hysterectomy

Complications from Cesarean Hysterectomy

<table>
<thead>
<tr>
<th>Study</th>
<th>Blood transfusion (%)</th>
<th>Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>USC (n=127)</td>
<td>55</td>
<td>0</td>
</tr>
<tr>
<td>New Orleans</td>
<td>32</td>
<td>0</td>
</tr>
<tr>
<td>LSU (n=1417)</td>
<td>61</td>
<td>8</td>
</tr>
<tr>
<td>Harvard (n=117)</td>
<td>87</td>
<td>0</td>
</tr>
<tr>
<td>Turkey (n=67)</td>
<td>97</td>
<td>3</td>
</tr>
</tbody>
</table>


Subtotal vs. Total Hysterectomy

<table>
<thead>
<tr>
<th>Study</th>
<th>Operative time (minutes)</th>
<th>Blood loss (mL)</th>
<th>Transfusions</th>
<th>Bladder injuries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yucel et al. 2006</td>
<td>127.7 (60-300)</td>
<td>1481 (600-3600)</td>
<td>4.4 (2-9)</td>
<td>-</td>
</tr>
<tr>
<td>Kastner et al. 2002</td>
<td>100 (45-130)</td>
<td>2056 (1300-2800)</td>
<td>5 (3-8)</td>
<td>-</td>
</tr>
<tr>
<td>Castaneda et al. 2000</td>
<td>130±54 (45-130)</td>
<td>2.4 drop in Hgb</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>135±44 (45-130)</td>
<td>3.5 drop in Hgb</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>161±59 (45-130)</td>
<td>&gt;2000 cc (19%)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>185±60 (45-130)</td>
<td>&gt;2000 cc (68%)</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Prophylactic occlusion of the internal iliac arteries for accreta/percreta

<table>
<thead>
<tr>
<th>Study</th>
<th>EBL</th>
<th>Transfusion (units)</th>
<th>Inpatient days</th>
<th>OR time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bodner et al. 2006</td>
<td>2800</td>
<td>6.5</td>
<td>23</td>
<td>338 minutes</td>
</tr>
<tr>
<td>Control n=22</td>
<td>2600</td>
<td>6.3</td>
<td>8.8</td>
<td>228 minutes</td>
</tr>
</tbody>
</table>

Prophylactic embolization n=6     Control P


Arterial embolization

- Radiologic assisted insertion of hemostatic material into bleeding vessel
  - Uterine artery or anterior branch of int. iliac artery
- Disadvantages
  - Specialist equipment
  - Time consuming
  - Patient should be stable
- Complication 6-7%:
  - Nausea
  - Buttock claudication
  - Bladder irritation
  - Bladder paresis
  - Lower extremity paresis
  - Vaginal necrosis
  - Septicemia
  - Hematoma
  - Endometritis
  - Pulmonary emboli

Prophylactic internal iliac balloon occlusion for accreta

Subjects | EBL
--- | ---
Shrivastava et al. 2007 | 69 NO DIFFERENCE
Levine et al. 1999 | 5 NO DIFFERENCE

Staged Procedure (balloon>delivery>emb>hyst)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Staged procedure</th>
<th>Cesarean hysterectomy</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood loss, mL</td>
<td>553 ± 119 (205–1200)</td>
<td>4517 ± 711 (705–11,000)</td>
<td>.0001</td>
</tr>
<tr>
<td>Units transfused, n</td>
<td>0.5 ± 0.38 (0–3)</td>
<td>7.9 ± 1.68 (2–32)</td>
<td>.0013</td>
</tr>
<tr>
<td>Required transfusion, n</td>
<td>2</td>
<td>16</td>
<td>.0001</td>
</tr>
<tr>
<td>Intensive care unit, n</td>
<td>1</td>
<td>7</td>
<td>.16</td>
</tr>
<tr>
<td>Postoperative stay, d</td>
<td>6.0 ± 0.8 (4–10)</td>
<td>8.2 ± 0.8 (5–13)</td>
<td>.107</td>
</tr>
<tr>
<td>Preoperative radiology, h</td>
<td>0.59 ± 0.09</td>
<td>0.59 ± 0.09</td>
<td></td>
</tr>
<tr>
<td>Total operative time, h</td>
<td>2.91 ± 0.37</td>
<td>2.67 ± 0.26</td>
<td></td>
</tr>
<tr>
<td>Total anesthetic time, h</td>
<td>6.59 ± 0.35</td>
<td>2.67 ± 0.26</td>
<td></td>
</tr>
</tbody>
</table>

Emergent vs. Elective Hysterectomy

<table>
<thead>
<tr>
<th>Turkey: EMERGENT n=34</th>
<th>Plachet al. ELECTIVE n=189</th>
<th>Gonzaudil et al.</th>
</tr>
</thead>
<tbody>
<tr>
<td>EBL</td>
<td>1555 mL</td>
<td>1091±344</td>
</tr>
<tr>
<td>Operating time</td>
<td>116±27 min</td>
<td>105±28</td>
</tr>
<tr>
<td>Blood transfusion</td>
<td>40%</td>
<td>18%</td>
</tr>
<tr>
<td>Hospital Stay (days)</td>
<td>9.6</td>
<td>4±1.1</td>
</tr>
<tr>
<td>Cystotomy</td>
<td>3.8%</td>
<td>3.1%</td>
</tr>
</tbody>
</table>

The gestational age at which I deliver my patient with a placenta previa and suspected accreta is...

1. 32 weeks
2. 34 weeks
3. 36 weeks
4. 37 weeks
5. 38 weeks
6. 39 weeks

Timing of delivery for accreta

- “The results of the present decision analysis should support the concept that planned delivery at 34 weeks of gestation may be warranted under many circumstances and that there is little reason to believe that awaiting labor beyond 37 weeks of gestation is a beneficial strategy.”
- “Furthermore, this analysis should support the concept that for any given gestational age at which delivery is planned for women with a previa and suspected accreta, there seems little reason to use amniocentesis for confirmation of fetal lung maturity.”
Anti-Shock Garment

Non-pneumatic anti-shock garment

-Mourad Youssif et al. Reproductive Health 2010 7:24

My hospital has an OB hemorrhage protocol....
1. Yes
2. No

Hospitals in California and their approach to reducing hemorrhage related morbidity and mortality

-Total Number of Hospitals that responded to the Survey
-By Hospital Size relative to All California Hospitals
-with Birth Facilities >50 births

<table>
<thead>
<tr>
<th>Hospital Size</th>
<th># Responded</th>
<th>% by Row: Hospital Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>50-1000 (76)</td>
<td>39</td>
<td>51%</td>
</tr>
<tr>
<td>1001-3000 (123)</td>
<td>86</td>
<td>70%</td>
</tr>
<tr>
<td>&gt;3000 (62)</td>
<td>48</td>
<td>77%</td>
</tr>
<tr>
<td>Total (261)</td>
<td>173</td>
<td>66%</td>
</tr>
</tbody>
</table>

Summary: Key Survey Findings

- 40% of hospitals DO NOT have a hemorrhage protocol
- Inconsistent definitions
- 70% of hospitals DO NOT perform drills
- Most have access to all 4 uterotonics
- Many hospital report they do not have access to alternative treatment methods, e.g., Balloons

California Pregnancy-related Mortality Review
QI Opportunities and Learning Points
How to reduce Mortality and Morbidity from OB Hemorrhage?

- Need a medical indication for induction
- Disorganized and sub-optimal treatments
- No documentation of actual blood loss
- Underestimation of blood loss
- Delay in administration of blood
- Lack of working equipment
- Delay in response from other team members
- Delays in adequate resuscitation
- Lack of an organized approach

Postpartum Hemorrhage ABC's:

- Serial vital signs (normal range vital signs do not necessarily assure stability)
- Airway
  - Provide adequate ventilation
  - Assist airway protection
  - Call anesthesia
  - Intubate if necessary
- Breathing
  - Oxygen 5-8 L/min by tight face mask or non-rebreather
- Circulation
  - Skin color (pallor), delayed capillary refill, decreased urine output can indicate compromised blood volume without changes seen in BP or HR
  - Decreased urine output, decreased BP, and tachycardia may be late signs of compromise

Infusions

- 2 large bore IV's (16 gauge or larger)
- RL or NS replaced at a 3:1 ratio for blood loss
- Transfusion (In massive hemorrhage consider 6 prbc/4 ffp/1 apheresis plt pack)
- Coagulation factors (1 unit per 15 kg)
- Warm infusions to prevent hypothermia, coagulopathy, and arrhythmias

Medications for uterine atony

- Oxytocin
  - 40 units in 1 liter NS or RL IV rapid infusion
- Methylergonovine (Methergine)
  - 0.2 milligrams IM q 2-4 hours up to 5 doses
  - Avoid in hypertension, preeclampsia
- Prostaglandin F2 Alpha (hemabate)
  - 250 micrograms intramuscular, intramyometrial, repeat q 15-90 minutes
  - Max 8 doses
  - Avoid in asthma
- Misoprostol (Cytotec)
  - 800-1000 micrograms per rectum, 3rd line agent
- Prostaglandin E2 suppositories (Prostin E2)
  - May cause hypotension and avoid if already hypotensive, 3rd line agent

Interventions for Uterine atony

- Bimanual massage
- Bimanual compression
- Examine for lacerations (repair if present and is the source of hemorrhage)
- Examine placenta for retained products (D+C)
- Bakri Balloon (for uterine bleeding responsive to bimanual compression)
- Uterine artery ligation
- Utero-ovarian artery ligation
- B-Lynch (for uterine bleeding responsive to bimanual compression)
- Hysterectomy
Your patient has lost an estimated 2 liters of blood from uterine atony and is still bleeding and becoming tachycardic and hypotensive - after beginning crystalloid and 2 units of PRBC what is your next order for blood product replacement?

1. Nothing
2. Await input from anesthesiologist
3. 2 more units PRBC, no FFP, no platelets…transfuse per lab results
4. 4 units PRBC, no FFP, no platelets…draw labs
5. 4 units PRBC, 4 units FFP, 1 unit platelets
Whole blood” is good for OB hemorrhage
- After 2u PRBCs, start FFP
- Massive transfusion protocol: 1:1 ratio FFP/RBC
  - 6 RBC + 4 FFP + 1plt pack
  - 4 RBC + 4 FFP, plt and cryo on request
- Think ahead and Keep up!

How much to transfuse and the Persian Gulf War experience
- Retrospective military review
- 252 patients
- Massive transfusion (MT) defined as ≥ 10 units PRBC/24 hours

<table>
<thead>
<tr>
<th>Plasma: RBC ratio</th>
<th>Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:8</td>
<td>65%</td>
</tr>
<tr>
<td>1:2.5</td>
<td>34%</td>
</tr>
<tr>
<td>1:1.4</td>
<td>19%</td>
</tr>
</tbody>
</table>

Persian Gulf War experience
- 65% Mortality:
  - 1:8
  - 34% Mortality:
  - 1:2.5
  - 19% Mortality:
  - 1:1.4

Civilian Trauma Centers
- 467 patients requiring MT, Level 1 Trauma centers

<table>
<thead>
<tr>
<th>Plasma:RBC ratio</th>
<th>30 day survival</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥ 1:2</td>
<td>59.6%</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>&lt; 1:2</td>
<td>40.6%</td>
<td></td>
</tr>
</tbody>
</table>

- Suggested a 1:1:1 ratio of PRBC:Plasma:Platelets

Massive transfusion in OB
- In pregnant patients with life threatening PPH start with:
  - 6 units RBCs
  - 4 units FFP
  - 1 apheresis unit of platelets
- Provides approximately:
  - 70% total RBC volume
  - 60% total circulating plasma volume
  - Mimics whole blood with hematocrit of 40%
  - And prevents dilutional coagulopathy
- Reassess based on laboratory values and continuation of bleeding


In conclusion, can we lower the frequency and morbidity/mortality of OB Hemorrhage?
- Lower the incidence:
  - Reduce the cesarean birth rate (both primary and repeat)
  - Reduce chorioamnionitis
  - Fewer multiple gestations
  - Reduce long inductions of labor
  - Reduce long second stages
- Respond rapidly to OB hemorrhage:
  - Use the new techniques and respond in an organized, well-executed, timely fashion
  - Prevent a small hemorrhage from evolving into a massive hemorrhage

- http://www.cmqcc.org/ob_hemorrhage