Postpartum Hemorrhage

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Case Presentation

• MH, 39 year-old, G1 P0
• IVF singleton pregnancy, uncomplicated PNC
• Presented to L&D in labor, 4 cm dilated
• US confirmed breech presentation
• Spinal anesthesia given
• Cesarean delivery started at 08:40

Case Presentation

• Delivered at 08:49, female newborn with Apgars 8 / 9
• Uterine atony noted
• Received oxytocin IV
• Uterine massage
• Cesarean section completed at 09:18

Case Presentation

• Bleeding noted prior to moving patient from OR bed to stretcher
• Uterine massage done again

Case Presentation

• 09:29: Methergin 0.2 mg IM
• 09:35: Hemabate 250 mcg IM
• 09:44: Methergin 0.2 mg IM
• 09:56: Transferred to ICU
• 10:10: In ICU – BP: 88/50, P: 110
• 10:20: Unit #1 PRBC started
• 10:20: BP: 77/45, Dopamine started

Case Presentation

• 10:50: Unit #2 PRBC started, BP: 66/32
• 10:55: A-Line placed, Levophed / Neosynephrine started
• 11:20: Unit #3 PRBC started, BP: 68/45, P: 114
• 11:20: Continues to bleed profusely
• 11:40: Maxed on Dopamine, Levophed, Neosynephrine
• 11:45: Unit #4 PRBC started, BP obtained by Doppler 60/dop
• 12:20: Sent for uterine embolization
Case Presentation

- 13:10: Unit #5 PRBC given
- 13:45: Unit #6 PRBC given, BP: 77/45, P: 120
- 14:10: Returns from radiology, profuse bleeding, unit #7 PRBC given
- 14:10: BP: 60/40, P: 90
- 14:25: To OR for hysterectomy
- 14:30: Unit #1&2 of FFP given
- 16:40: Returns from hysterectomy

Case Presentation

- Over course of next 24 hours:
  - 11 units PRBC
  - 9 units FFP
  - 4 units Cryo
  - 3 units Platelets

Case Presentation

- Pronounced dead 32 hours post delivery

Postpartum Hemorrhage

- Leading cause of pregnancy-related death worldwide
- 300,000 women die annually
- 88% of deaths occur within 4 hours of delivery


Average Interval to Maternal Death

<table>
<thead>
<tr>
<th>Untreated Obstetric Condition</th>
<th>Time in hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ruptured uterus</td>
<td>24</td>
</tr>
<tr>
<td>Antepartum hemorrhage</td>
<td>12</td>
</tr>
<tr>
<td>Postpartum hemorrhage</td>
<td>2</td>
</tr>
</tbody>
</table>


Postpartum Hemorrhage

Is there room for improvement in clinical management?
Maternal Death
North Carolina; 1990-1999

Postpartum Hemorrhage
Definition
• Blood loss in excess of 500 mL after a vaginal delivery
• Blood loss in excess of 1000 mL after a cesarean delivery

Postpartum Hemorrhage
Incidence
• Blood loss > 1000 mL
• Need for transfusion
• Hemodynamic instability
  5.2 %

Postpartum Hemorrhage
Recurrence
• PPH in 5.8% in first delivery
• PPH in 14.8% in second delivery
• PPH in 21.7% with 2 prior PPH
• PPH in 10.2% in 3rd delivery if PPH in 1st and not in 2nd

Postpartum Hemorrhage
Causes
• Uterine Atony (70%)
• Placental abnormalities
• Genital tract trauma
• Retained placenta / clots
• Coagulation disorders
• Uterine inversion
Postpartum Hemorrhage

What are risk Factors for postpartum hemorrhage?

Postpartum Hemorrhage

Labor Induction

Clinical Obstet Gynecol. 2010;53:147

Postpartum Hemorrhage

Fetal Macrosomia

Clinical Obstet Gynecol. 2010;53:147

Postpartum Hemorrhage

Perineal Trauma

Clinical Obstet Gynecol. 2010;53:147

Postpartum Hemorrhage

Prolonged third stage/retained placenta

Clinical Obstet Gynecol. 2010;53:147

Third Stage of Labor

• Active management of the third stage of labor (AMTSL) is the single best strategy to prevent postpartum hemorrhage.
Third Stage of Labor

- Active management
  - Use of uterotonic within 1 min of delivery
  - Delivery of placenta with controlled cord traction
  - Massage of the uterus after delivery of placenta


Is there evidence that standardization of protocols, training and simulation improves outcome?

Impact of Safety Initiatives

- Ob rapid response team
- Mock drills
- Clinical pathways & protocols
- Involvement of senior members early
- Staff education – stages of hemorrhage
- Trauma team involvement

Obstet Gynecol 2006;107:977

Postpartum Hemorrhage

Impact of Safety Initiatives

<table>
<thead>
<tr>
<th>Outcome</th>
<th>2000-2001</th>
<th>2002-2005</th>
<th>( P )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death</td>
<td>16.7 %</td>
<td>0 %</td>
<td>0.036</td>
</tr>
<tr>
<td>Lowest pH</td>
<td>7.23</td>
<td>7.34</td>
<td>0.004</td>
</tr>
<tr>
<td>Lowest T</td>
<td>35.2</td>
<td>36.1</td>
<td>0.001</td>
</tr>
<tr>
<td>Hysterectomy</td>
<td>50 %</td>
<td>37 %</td>
<td>0.51</td>
</tr>
<tr>
<td>Transfusion</td>
<td>1,313</td>
<td>1,194</td>
<td>0.80</td>
</tr>
</tbody>
</table>

Obstet Gynecol 2006;107:977
Management of PPH

• Early aggressive therapy
  – Recognition & Resuscitation
  – Medical & surgical therapies
  – Blood products replacement

Key to improved outcome

Management of PPH

Poor outcome

Commonly related to delay

Hypovolemic Shock

Postpartum Hemorrhage

Lethal Triad
• Acidosis
• Hypothermia
• Coagulopathy

Options for Management

• Aggressive resuscitation
• Uterotonics
• Early transfusion
• Balloon tamponade
• Compression & ligation sutures
• rFactor VII
• Hysterectomy
• Interventional radiology (if stable)

Fluid Resuscitation

Resuscitation of uncontrolled hemorrhage

<table>
<thead>
<tr>
<th>Normal Saline</th>
<th>Lactated Ringer's Solution</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium (mEq/L)</td>
<td>140 ± 3.0</td>
<td>138 ± 1.6</td>
</tr>
<tr>
<td>Chloride (mEq/L)</td>
<td>119 ± 5.3</td>
<td>105 ± 2.9</td>
</tr>
<tr>
<td>pH</td>
<td>7.35 ± 0.12</td>
<td>7.45 ± 0.06</td>
</tr>
<tr>
<td>Base excess (mM/L)</td>
<td>-4.6 ± 7.9</td>
<td>7.2 ± 4.2</td>
</tr>
<tr>
<td>Lactate (mg/dL)</td>
<td>1.7 ± 1.7</td>
<td>4.7 ± 2.2</td>
</tr>
<tr>
<td>Fibrinogen (mg/dL)</td>
<td>99 ± 21</td>
<td>123 ± 20</td>
</tr>
</tbody>
</table>

LR is superior to NS solutions

J Trauma. 2007;62(3):636
Uterotonics

Transfusion

• Start early, do not await lab results
• Stay ahead of bleeding
• With profuse, heavy bleeding, initiate massive transfusion protocol

Massive Transfusion

• Defined as > 10 units PRBC
• Improved outcomes with 1:1 - 2:1 ratio of PRBC to FFP
  – 52% lower mortality
  – Reduction in organ failure
  – Increased in ARDS (1.93X)

Massive Transfusion

• Recommend a 1:1 ratio of PRBC to FFP
Balloon Tamponade

Bakri Balloon Catheter

Balloon Tamponade

Helpful Tips

- Use ultrasound for balloon guidance
- During CS, close incision first then place balloon
- Vaginal pack may be helpful with advanced cervical dilation
- Consider antibiotic prophylaxis
- Deflate within 24-48 hours

Ligation & Compression Sutures

Modified O’Leary Procedure

Uterine Devascularization
1) Place patient in stirrups
   - Allows assessment of bleeding
   - Access to lower genital tract
     • Repair of lacerations
     • Balloon placement
     • Rectal Misoprostol placement

2) Exteriorize the uterus
3) Compress uterus with hands
   - Assess success of suture

4) Incise lower uterine segment
   - Explore uterine cavity
   - Remove retained products
   - Guide in placement of suture
   - Minimizes risk of entrapment
B-Lynch Suture

5) Apply B-Lynch suture
   - Monocryl #1 or Chromic catgut
   - Follow illustrated technique

- Success rate ~ 85-90% (> 1600 cases reported)
- Side effects (rare):
  - Erosion of suture (more common with delayed absorbable)
  - Uterine necrosis
  - Uterine adhesions / pyometra

Uterine Sandwich Technique

- Place B-Lynch suture
- Close uterine incision
- Place Bakri balloon
- Tie B-Lynch suture
- Inflate balloon

Recombinant Factor VIIa

- NovoSeven® - Novo Nordisk, Bagsvaerd, Denmark
- Augment intrinsic clotting pathway
- Converts prothrombin into thrombin
- Most common dose is 90 microgram/Kg IV bolus over 3-5 min

- No randomized controlled trials
- A total of 272 women with PPH collected
- Effectiveness reported in 85% for stopping or reducing bleeding

Clinical Obstet Gynecol 2010;53:219
**r Factor VIIa**

**Recommendations**
- Use after failure of medical and conservative surgical therapies
- Dose at 90 microgram/kg IV over 3-5 min
- Correct acidosis, hypothermia and coagulation before FVIIa injection
- Consider after ~ 10 units of PRBC and ~ 8-10 units of FFP
- May repeat once in 20 min if no response

**Side Effects**
- Thrombotic events
  - Cerebrovascular accidents
  - Myocardial infarction
  - Pulmonary embolism
  - Clotting of indwelling devices

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**Hysterectomy**

**Helpful Tips**
- Consider supracervical
- Leave placenta in-situ if accreta
- Pack vagina which elevates the lower segment
- Consider cystoscopy / ureteral stents
- Consider instillation of indigo carmine for bladder integrity

**Interventional Radiology**
Interventional Radiology
• Selective arterial embolization
• Pre-op occlusive balloon catheters

Interventional Radiology
Arterial Embolization
• Reserved for stable patients
• Literature review:
  – failure rate of 23%
  – complication rate of 11%
    • Ischemia
    • Neuropathy
    • Thrombosis
    • Necrosis
    • Vessel aneurysm

Interventional Radiology
Pre-op occlusive balloon catheters
• Placed in internal iliac arteries
• Can be inflated intra-op

Interventional Radiology
Pre-op occlusive balloon catheters
• Case-control study of 69 patients
• No difference in
  • blood loss
  • transfused products
  • operative time
  • hospital stay

Blue Towel Closure

PPH Equipment Box
• Surgical instruments
• Vaginal packing
• Bakri balloon
• Diagrams for Bakri balloon placement
• Diagrams for suture placement (O’Leary / B-Lynch)
• Instructions for rFactor VII administration
• Mass transfusion protocol
• Ob Right care guidelines for PPH
• Long right angle retractors (2)
• Briesky vaginal retractor (1)
• Long tongued weighted speculum (1)
• Regular large metal speculum (1)

PPH Equipment Box

• Foerster sponge forceps (2)
• Hunter large uterine curette (2)
• Heaney curved needle holder (2)
• Bozeman uterine forceps (2)
• Fletcher Van Doren uterine forceps (1)
• Randall stone forceps (2)

PPH Equipment Box

Take Home Message

Early diagnosis and rapid / aggressive management are key to success

• Stay in control
• Transfuse early
• Call for help
• Know treatment options including conservative approaches
• Consider return to OR early