Simulation Patient Design
Postpartum Hemorrhage in L+D
Kokila Thenuwara, MD
University of Iowa

Introduction
Postpartum hemorrhage (PPH) can complicate any pregnancy. Uterine atony is the most common cause of PPH, especially in protracted augmented labor. (1) Hemorrhage is the commonest cause of maternal death in the developing world, however it is also an important cause of maternal morbidity and mortality in the developed world. Effective management of obstetric hemorrhage is a multidisciplinary team effort.

Educational Rationale: This multidisciplinary team simulation is designed to give learners the opportunity to apply their knowledge of team skills and implementation of the PPH bundle, in managing obstetric hemorrhage. (2)

Target Audiences: Nursing, OB, Anesthesiology, and L+D support staff

Learning Objectives: As per Accreditation council for graduate medical education (ACGME) Core Competencies
Upon completion of this simulation (including the debrief) learners will be able to:

- Medical knowledge: Describe the pathophysiology of PPH
- Patient care: Resuscitate a patient with PPH
- Practice-based learning and improvement: Utilize the PPH bundle in the management of massive obstetric hemorrhage
- Interpersonal and communication skills: Effectively communicate within teams, lab and blood bank for successful resuscitation of the mother. Team members will be able to effectively communicate with family and allay their anxiety.
- Professionalism: Demonstrate mutual respect for each other’s expertise
- Systems-based practice: Identify existing barriers within the system (such as shortages of equipment, personnel, knowledge gaps, institution specific protocols) that need to be developed or modified in order to improve patient outcome

Scenario-specific learning objectives:
- Identify the 4 stages of PPH as described by the American College of Obstetricians and Gynecologists (ACOG)
- Initiate PPH management bundle
- Describe techniques to quantify blood loss
- Initiate a massive transfusion protocol (MTP)

Guided Questions:
- Which factors increase the risk of PPH?
- What is the pharmacological basis of uterotonic drugs used in the treatment of PPH?
• What contents should be included in the hemorrhage cart?
• Which factors should be considered for a PPH bundle specific for your facility?

Assessment Instruments:
1. Learner Knowledge Assessment form (Appendix1)
2. Simulation Activity Evaluation form (Appendix 2)

Simulation set-up and equipment needed:

Mannequin set-up:
- Mannequin set-up in L+D suite
- 20g IV in hand with normal saline (should contain an access port)
- Epidural catheter taped
- Atonic uterus simulated with a water-filled balloon secured to the mannequin’s abdomen
- Red dye-stained pad placed under mannequin; red stained liquid on floor beside the bed
- Mannequin should be covered with blankets so the apparent bleeding is concealed

Monitors Required:

<table>
<thead>
<tr>
<th></th>
<th>Non-invasive BP cuff</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Arterial line, set up</td>
</tr>
<tr>
<td></td>
<td>5 lead EKG</td>
</tr>
<tr>
<td></td>
<td>Temperature probe</td>
</tr>
<tr>
<td></td>
<td>Pulse oximeter</td>
</tr>
</tbody>
</table>

Other equipment required:
1) IVs: 22, 20, 18, 16, 14g
2) Fluids: Crystalloids, colloids, blood, FFP, platelets, cryoprecipitate (mock packs, which need to have the same appearance as normal packs from blood bank as the learners need to verify the patient’s name, MRN, and other institution-specific standard checks prior to administration)
3) Medications: Oxytocin, methylergonovine (Methergine), prostaglandin f2 alpha (Hemabate), misoprostol (Cytotec), TXA
4) Airway equipment: Nasal cannula, face masks, oral airways, LMAs, ETT, laryngoscopes, suction
5) Hemorrhage cart
6) Crash cart

Other supporting documents:
Patient’s history and physical exam
Lab investigations

Family member (actor)
A-V equipment
Participants
2-3 anesthesiologists (faculty/trainees of varying competencies)
2-3 obstetricians (faculty/trainees of varying competencies)
2-3 nurses/nurse midwives

Time Duration

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Set-up</td>
<td>20 min</td>
</tr>
<tr>
<td>Pre brief/consent</td>
<td>10 min</td>
</tr>
<tr>
<td>Simulation</td>
<td>20 min</td>
</tr>
<tr>
<td>Debrief</td>
<td>15-20 min</td>
</tr>
</tbody>
</table>

Case Stem
Patient is a 35-year-old G5P5, who has had a protracted labor that was augmented with oxytocin and culminated in the delivery of a 3.9 kg male infant. She had an epidural for labor analgesia, which functioned well. Her 4 prior deliveries were vaginal.
After delivery, oxytocin was administered and the patient’s quantified blood loss was 500 mL. The 3rd stage of labor was uncomplicated.
1 hour after delivery she is still in the L+D suite, and a large amount of blood has been noted on the floor by the patient’s family member who has called for the nurse.

The patient is previously healthy with no past surgical history.
Current medications and allergies:
   NKDA
   Pre-natal vitamins

Physical examination:
   General: Ill appearing female
   Weight, height: 110 Kg, 5’3” (BMI 42)
   Vital signs: HR 82/min, BP 110/74 mm Hg, Sat 99%, RR 18/min
   Airway: MP I
   Lungs: Clear
   Heart: Normal

Laboratory, radiology, and other relevant studies:
   HB 8 mg/dL
   Blood group is 0 positive
## Scenario

<table>
<thead>
<tr>
<th>Trigger</th>
<th>Patient’s condition</th>
<th>Action</th>
<th>Done</th>
<th>Time</th>
<th>Comments</th>
</tr>
</thead>
</table>
| **Stage I** | Call by the patient’s family member that there is blood on the floor | 1. Recognize and assess ongoing risk for PPH, quantify blood loss/assess stage of hemorrhage  
2. Call for help/designate leader/delineate work  
3. Repeat fundal massage, increase oxytocin rate  
4. Vital signs measuring frequency?  
5. Obtain 2nd large-bore IV access, fluid resuscitation, place Foley catheter  
6. 2nd-line uterotonic(s)  
7. Send labs – which tests?  
8. Bring in hemorrhage cart  
9. Use PPH checklist  
10. Communicate with blood bank  
11. Communicate and reassure family members | | | |
| | Confederate verbalizes QBL of 1000 mL | | | | |
| | Patient’s VS:  
HR 110 bpm  
BP 100/70 mm Hg  
Sat 98%  
RR 18 bpm | | | | |
| **Stage II** | Confederate verbalizes further blood loss (500 mL) | 1. Recognize worsening PPH Stage II  
2. 100% oxygen via face mask  
3. Multidisciplinary team discussion - differential diagnosis of etiology of PPH, surgical bleed, DIC  
4. Repeat labs - which tests (role of lactate)?  
5. Additional uterotonic(s), tranexamic acid  
6. Order MTP  
7. Consider moving to the OR  
8. Active patient warming – monitor temperature  
9. Assess urine output | | | |
| Hypotension and tachycardia | Patient’s VS:  
HR 115 bpm  
BP 80/40 mm Hg  
Sat 95%  
RR 18 bpm | | | | |
| **Stage III** | Confederate verbalizes further blood loss (500 mL) | 1. MTP arrived?  
2. Invasive monitors, cell saver, rapid transfusion set-up  
3. Transfuse and optimize ratio of blood products  
4. Fibrinogen replacement (human-derived fibrinogen concentrate or | | | |
| Worsening hypotension | Patient’s VS:  
HR 120 bpm, faint pulse | | | | |
<table>
<thead>
<tr>
<th>BP 60/23 mm Hg</th>
<th>Patient unresponsive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sat 90%</td>
<td>HB 6.0 g/dL</td>
</tr>
<tr>
<td>RR 22 bpm</td>
<td>HCT 26%</td>
</tr>
<tr>
<td>Patient should be transported to OR/hybrid room</td>
<td>Platelets 150K (verbalized by facilitator)</td>
</tr>
</tbody>
</table>

- 5. Order 2\textsuperscript{nd}/3\textsuperscript{rd} MTP?
- 6. Repeat labs – which tests?
- 7. Evaluate acid-base balance and electrolytes (e.g. calcium)
- 8. Consider calling Gyn-onc, vascular, interventional radiology, ICU
- 10. Consideration for general anesthesia or dose the epidural catheter?

<table>
<thead>
<tr>
<th>Resolution</th>
<th>Patient’s VS:</th>
</tr>
</thead>
<tbody>
<tr>
<td>HR 95 bpm</td>
<td>HR 95 bpm</td>
</tr>
<tr>
<td>BP 98/60 mm Hg</td>
<td>BP 98/60 mm Hg</td>
</tr>
<tr>
<td>Sat 95%</td>
<td>Sat 95%</td>
</tr>
<tr>
<td>RR 20 bpm</td>
<td>RR 20 bpm</td>
</tr>
</tbody>
</table>

- 1. Importance of continuing uterotonics
- 2. Monitoring bleeding
- 3. Concern of progression to DIC
- 4. When to remove epidural catheter?
- 5. Disposition - where to?
Appendix 1

Obstetric Interdisciplinary Team Simulation

Name of simulation: _______________  Date: ___________

OB  Nursing  Anes  Consult  PG Yr 1234  Med st  staff

Each item has two components. The “Before the simulation” column (left side) examines your perspective at the beginning of the simulation. The “End of Simulation” column (right side) is to evaluate your perspective at the completion of the simulation. Think carefully about your responses and mark them accordingly.

1. How would you rate your knowledge of the clinical stages of PPH?

<table>
<thead>
<tr>
<th>BEFORE THE SIMULATION</th>
<th>END OF SIMULATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Little/none</td>
<td>Knowledgeable</td>
</tr>
</tbody>
</table>

2. How would you rate your knowledge of the uterotonic pharmacology?

<table>
<thead>
<tr>
<th>BEFORE THE SIMULATION</th>
<th>END OF SIMULATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Little/none</td>
<td>Knowledgeable</td>
</tr>
</tbody>
</table>

3. How would you rate your ability to access emergency resuscitation equipment and hemorrhage carts during a PPH?

<table>
<thead>
<tr>
<th>BEFORE THE SIMULATION</th>
<th>END OF SIMULATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
<td>Excellent</td>
</tr>
</tbody>
</table>

4. How would you rate your knowledge of labs that need to be ordered in a PPH?

<table>
<thead>
<tr>
<th>BEFORE THE SIMULATION</th>
<th>END OF SIMULATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Little/none</td>
<td>Knowledgeable</td>
</tr>
</tbody>
</table>

5. How would you rate your knowledge of the massive transfusion protocol used in obstetrics?

<table>
<thead>
<tr>
<th>BEFORE THE SIMULATION</th>
<th>END OF SIMULATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Little/none</td>
<td>Knowledgeable</td>
</tr>
</tbody>
</table>
Appendix 2

SIMULATION ACTIVITY EVALUATION FORM

DATE OF SIMULATION: ____________________________

YOUR OCCUPATION: Consultant  PG Yr1234  STUDENT  NURSE  MIDWIFE  OTHER
SPECIALTY: ___________________  YEARS IN PRACTICE: ___________________

Please rate the following aspects of this training program using the scale listed below:

1 = poor  2 = suboptimal  3 = adequate  4 = good  5 = excellent
Use “N/A” if you did not experience or otherwise cannot rate an item.

### INTRODUCTORY MATERIALS
| Orientation to the simulation | 1 | 2 | 3 | 4 | 5 | N/A |

### PHYSICAL SPACE
| Realism of the simulation space | 1 | 2 | 3 | 4 | 5 | N/A |

### EQUIPMENT
| Satisfaction with the mannequin | 1 | 2 | 3 | 4 | 5 | N/A |

### SCENARIOS
| Realism of the scenarios | 1 | 2 | 3 | 4 | 5 | N/A |
| Ability of the scenarios to test technical skills | 1 | 2 | 3 | 4 | 5 | N/A |
| Ability of the scenarios to test behavioral skills | 1 | 2 | 3 | 4 | 5 | N/A |
| Overall quality of the debriefings | 1 | 2 | 3 | 4 | 5 | N/A |

### FACULTY
| Quality of instructors | 1 | 2 | 3 | 4 | 5 | N/A |
| Simulation as a teaching method | 1 | 2 | 3 | 4 | 5 | N/A |

### COMMENTS
References