# ISIS CURRICULUM

## Obstetric Bleeding Curriculum

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# Curriculum Outline

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# 2. Description of Curriculum

**Course Overview:**

One out of ten deliveries are complicated by post-partum hemorrhage (PPH) with an associated maternal mortality rate as high as 17%. The most common cause of PPH is uterine atony. Uterine atony, or failure of the myometrial muscle fibers to contract following delivery, can lead to rapid and severe hemorrhage and hypovolemic shock. The effective management of major PPH relies on an organized multidisciplinary approach involving the obstetrician, anesthesiologist, hematologist, nursing staff, laboratory and blood bank personnel. This simulation based curriculum has been designed to provide an opportunity for anesthesia and OB/GYN residents to practice the diagnosis and management of an obstetric bleeding emergency in a real but risk free environment.

**Educational Rationale:**

Anesthesiologists are regularly involved in medical management of PPH, often delivering medications that are not a standard part of their clinical repertoire. In addition, a true obstetrical bleeding emergency requires familiarity with the hospital's obstetrical (OB) bleeding emergency protocol; the steps involved to initiate it and the steps to terminate it. Effective communication with the obstetricians, supporting staff, and blood services are critical to successful management.

**Duration of training:** 2 hours

**Frequency of courses:** 6-10 times per year

**Number of Trainees per Session**: 3-5

# 3. Target Trainees

**Target Trainees:**

***Primary:*** Senior Anesthesia Residents
Anesthesia Fellows
CRNA's (Nurse Anesthetists)

***Secondary:*** OB/GYN Residents and Fellows
OB & Anesthesia Personnel

# 4. Prerequisite Knowledge and Skills

Required background knowledge and skills expected in trainees prior to receiving training in the target course are as follows are as follows:

**Medical knowledge**

a. Understand the basic principles of physiology, pharmacology, anesthetic equipment and monitoring in the obstetrical population
b. Able to perform an immediate pre-operative evaluation in the obstetric patient
c. Know the anesthetic options for a C-section
d. Recognize the signs and symptoms of acute hemorrhage
e. Know the principles and goals of basic resuscitation (ABC: Airway, Breathing, Circulation)
f. Know the most common risk factors for uterine atony
g. Know the steps to manage acute hemorrhage and its complications

**Technical Skills**

a. Demonstrate technical skill in placing a spinal anesthetic
b. Demonstrate the ability to set up an anesthetic work station, infusion pumps, IV infusion and blood warming equipment, an arterial line and other equipment to deal with major bleeding
c. Demonstrate skills to perform an emergent rapid sequence induction

**Behavioral Skills**

a. Recognize and declare emergency with no delay
b. Assume adequate responsibility and initiative within limits of training
c. Show familiarity with the basic concepts of crisis management, including: situational awareness, problem-solving, and decision making in critical situations
d. Identify, utilize, and coordinate all available resources
e. Consistently communicate in an organized and complete manner

# 5. Goals and Objectives

**Learning Objectives**

***Long-Term Goal:*** To improve clinical outcome and to reduce patient safety incidents in real life

***Primary Goal:*** To achieve competency in responding to an obstetrical bleeding emergency with emphasis on teamwork, communication, and resource management.

*Note: these goals have been designed in sound correlation with the core competencies developed by the Accreditation Council for Graduate Medical Education (ACGME) as part of outcome project. Core competencies are as follows:*

1. Patient care
2. Medical knowledge
3. Practice-based learning and improvement
4. Interpersonal and communication skills
5. Professionalism
6. System-based practice

Each goal covers specific competencies as requested by the ACGME

**Goal 1:** To initiate a sequence of medical and resuscitative interventions for control of PPH and promptly assess the success and failure of each measure (1, 2, 4, 5, 6).

***Key learning objectives:***

1. Recognize active PPH- confirm uterine atony with OB team
2. Demonstrate structured approach to deploying medications to stop or moderate PPH
3. Provide oxygenation/ventilation and circulatory support
4. Initiate without delay bleeding emergency protocol
5. Prevent, recognize and treat complications related to major transfusion

**Goal 2:** To gain competency in the concept of crisis resource management (1, 3, 4, 5, 6).

***Key learning objectives:***

1. Situational awareness: recognize the peril of major bleeding at an early stage and employ actions to prevent and treat its consequences
2. Decision-making: call for help, declare emergency situation, etc
3. Take leadership: set priorities, assign roles, distribute workload, re-evaluate situation
4. Utilize all available resources
5. Communicate effectively within the team and support staff
6. Demonstrate professional behavior and empathy

**Goal 3:** To become proficient in advanced clinical and technical skills in delivering anesthetics for obstetrics and managing major OB bleeding (1, 2, 5, 6).

***Key learning objectives:***

1. Demonstrate the ability to provide a regional anesthetic for cesarean section
2. Safely convert to general anesthesia in a hypovolemic bleeding obstetric population
3. Provide appropriate settings for resuscitation including venous access, devices for rapid blood transfusion, check appropriate labs, call for ICU bed, etc
4. Keep accurate records

# 6. Instructor Notes

**1. Make the scenario and environment realistic**

a. Ensure the room is set up exactly the same as the hospital setting that the learners are used to. All routinely used equipment should be in an expected location.

b. Transform SimMan into SimMama: wig, bra, gown, and abdominal cover to artificially simulate a womb (i.e. a foam pad or a pillow).

c. A simulated blood collection should be constructed through the use of a laparotomy drape, a pan filled with blood, and a Yankauer suctioning tool. The pan is placed between the legs of SimMama and covered with the drape. A slip is cut in the drape so that the Yankauer suctioning tool can access the pan.

# 6. Instructor Notes

**2. Briefing prior to simulation session**

The instructor shall explain:

i. The clinical functionality of SimMama (e.g. where pulses can be felt, where to listen to breath sounds, etc.)
ii. How to operate the touch-screen simulated patient monitor
iii. How to perform advanced monitoring, including vital signs and setting the alarm-limits
iv. The location and availability of additional resources (e.g.: emergency phone, resuscitation cart, laboratory and radiology services on demand)

Learners should be advised:

i. To assume that all unexpected events are "intended" events during the simulation
ii. To act as they would in a real-life situation
iii. To communicate clearly (e.g.: call out drug names and dosages loudly)

Learners shall sign a consent form:

i. Agreeing not to discuss performance of team members outside of the simulation environment
ii. Agreeing and signing that the recorded videotapes (used to aid the debriefing process) may be retained for research or other educational process

**3. Debriefing**

a. Please refer to Appendix A for detailed debriefing notes.
b. Participants are accompanied to the debriefing room. A video recording is available to review key parts of the simulation.

***Key points for the debriefing:***

- Facilitate the discussion rather than giving a lecture.
- Learners should discuss why they chose certain courses of action and discuss the consequences. Ask what they would do the same or differently if they did the same scenario again.
- Engage everyone in the discussion and create an atmosphere of reciprocal trust

***Key topics for discussion should include:***

- Avoiding the pitfalls of spinal anesthesia in pregnancy
- Pharmacological management of uterine atony (see Appendix B)
- Strategies to recognize and manage acute obstetric hemorrhage
- Principles of teamwork and communication in crisis management (see Appendix C)
- Brief review of the bleeding emergency OB protocol specific to institution. Every participant receives a copy of the current guidelines.

# 7. Common Errors and Prevention Strategies

**Description of common errors observed in trainees' actions and debriefing strategies to help address the errors**

| *Error Type* | *Common Errors Observed* | *Solutions (Teaching Points)* |
|---|---|---|
| **Cognitive and Clinical Skills** | Underestimate bleeding | Identify strategies to improve estimation of maternal blood loss:<br>► hemodynamic status<br>► amount of blood in suction container/ floor, surgical pads and drapes<br>► lab results |
| | Insufficient knowledge of appropriate dosage and side-effects of uterotonic drugs | Provide didactic material (Appendix B) |
| | Delayed or suboptimal resuscitation<br>► Airway control in hypotensive patient (e.g., failure to convert to GA) | Discuss RSI in OB patients |
| | Circulatory support (e.g., start second large-bore IV; use pressurized devices for rapid infusion, turn off volatile agent) | Review ACLS protocols |
| | Lack of familiarity with bleeding emergency algorithm (e.g., does not declare emergency, does not infuse O (-) blood) | Reinforce OB Bleeding Emergency Protocol and provide practical implementation tips (Appendix E) |
| **Crisis Management Behaviors (Teamwork)** | Poor workload distribution, (e.g., leader fails to assign tasks to team members and performs routine tasks such as intubation, ventilation, or drug administration) | Introduce basic principles of teamwork and discuss what is expected of the team leader/members prior to simulation |
| | Deficient mobilization of all available resources resulting in slow and inefficient volume resuscitation | Emphasize the importance of ancillary staff: RN can help checking the blood, anesthesia tech can squeeze the bag or set up lines |
| | Communication breakdowns<br>►Failure of closed loop communication<br>►Unspecified requests (e.g. "give some ephedrine"; "I need a bag of epinephrine", etc.) | Follow the Crew Resource Management (CRM) template (Appendix C) to discuss the principles of teamwork and communication |

# 7. Common Errors and Prevention Strategies

| | | |
|---|---|---|
| **Crisis Management Behaviors (Teamwork) Cont'd** | Does not convey concerns assertively to the OB surgeon and staff. | Introduce the TeamSTEPPS Conflict Resolution principles known as the "Two Challenge Rule"<br>► If the surgeon's request is improper (e.g. IV methylergonovine), the learners should express their concerns at least 2-times. If this is unsuccessful, the learners should state: "This is a safety issue!" |
| | Non-Cohesive Team (e.g., disconnection between communication and actions; conflicts between OB and anesthesia team remain unresolved) | Playback video during the debriefing session and stop to focus on 3or 4 key behavioral points<br>Provide examples from real life and share your experience |

# 8. Cognitive Training

**Methods for delivering cognitive training include the following:**

1. Short interactive discussion containing theoretical aspects of PPH (etiology, pharmacologic and surgical treatment, complications of uterine atony, etc), (see Appendix D)
2. Video playback for cognitive skills debriefing including: the process of decision-making, anticipation, situation re-evaluation, etc.
3. Material for distribution:
    - Step-wise use of pharmacologic agents for uterine atony
    - OB anesthesia protocol for CS for bleeding emergency
    - Bleeding Emergency protocol (Appendix E)
    - Review article of PPH: Oyelese Y, Scorza WE: Postpartum Hemorrhage. Obstet Gynecol Clin N Am 34(2007), 421 - 441
4. Evaluation of simulation training (Appendices F & G)

# 9. Simulator Set-up

**Room Set-Up:**

The simulation room is prepared to reflect a real operating room environment.

- SimMama (Laerdal SimMan with wig, breasts, and belly) on OR table, awake & breathing spontaneously
- Anesthesia machine at head end of bed checked but turned off
- Anesthesia circuit connected with mask
- Anesthesia cart with airway equipment and drugs
- Anesthesia preoperative assessment sheet on the cart
- Standard ASA monitors in situ not connected to the patient
- Peripheral IV-line present and attached to a fluid bag

**Equipment:**

- Spinal Simulator
- Spinal tray with drugs
- Surgery equipment incl. drapes, suction container, and surgical instruments
- Fetal monitoring and fetal heart rate strip available
- Fake blood and blood products in bags and labeled
- Bag with fake blood hidden between patient's legs
- Arterial and central line

*Please refer to Appendix I for detailed list of items required.*

# 10. Skill Training

**Participants**

| | |
|---|---|
| *Doctor #1* | Attending anesthesiologist (senior resident) |
| *Doctor #2* | Anesthesia resident (junior resident) |
| *Doctor #3* | Available anesthesiologist |
| | |
| *Instructor #1* | Obstetrician |
| *Instructor #2* | Anesthesia Tech |
| *Instructor #3* | OR nurse, midwife (optional) |

**Case narrative** (case vignette)

Chris is 38 years old, 90Kg G6P4 at 40 weeks gestation presenting to the L&D onset of regular uterine contractions spaced 5 minutes apart. Physical exam demonstrates a 3 cm dilated cervix. Leopolds estimates fetal weight of 8-9 lbs. Fetal heart tracings are reassuring.

The obstetrician decides to perform a cesarean delivery right now. The patient is transferred to the operating room and she is waiting for the anesthesiologist to arrive. She has been already pre-assessed and an anesthesia pre-op format filled out. The patient wishes to have a regional anesthetic.

*This is the information that should be given to the participants before meeting the patient.*

**Past Medical History**
Asthma

**Past Obstetrical History**
Normal spontaneous vaginal deliveries x2
C-Sections x 2 secondary to failure to progress

**Past Surgical History**
C-section x 2
Appendectomy

**Medications**
Prenatal vitamins
Albuterol frequently

**Airway Exam**
Mallampati III
Thyromental distance >6 cm
Full neck extension/flexion
>4 cm mouth opening

**Labs**

Hct 31mg/dl
Plts 212,000μl
INR 1.1
Na 141mEq/l
K 3.9mEq/l
Glucose 110mg/dl
Creat 0.8mg/dl
Blood type: B negative

**Simulation flow**

**Act # I: Spinal Anesthesia**

Scenario description: Nurse (instructor #3) enters the operating room followed by the anesthesiology team (doctors #1 & #2; doctor #3 will be available if help is requested). The patient lies comfortable on the operating table. An 18G IV is in place connected to Lactated Ringer's solution. Monitors are not attached yet. Drugs and airway equipment are available and ready to use. The anesthesia tech just finished to check out the ventilator. (For a detailed simulation algorithm, please see Appendix H).

**Expected interventions:**

- Verify patient identity
- Review patient history and physical (focus on asthma, airway, labs)
- Discuss the risks and benefits of regional anesthesia vs. general anesthesia
- Attach standard ASA monitors (HR 80/bpm; BP 120/80; SpO2 97%)
- Surveys anesthesia set-up including airway equipment, anesthetic, OB specific, and emergency drugs; prepares spinal tray
- Administers 30 ml of sodium citrate (Bicitra) PO
- Performs spinal anesthesia (anatomy, drugs, dosage)

  *Note. This will be done using the spinal simulator. The learner should describe the steps he/she will complete, as in the real life.*

Progression: As soon as the patient is laid down after the successful completion of spinal anesthesia,she complains of nausea and dizziness.

| | |
|---|---|
| Rhythm | sinus |
| HR | 110 bpm |
| BP | 85/55 |
| SpO2 | 96% |

**Expected interventions:**

- O2 by face mask
- Left uterine displacement
- Rapid fluid infusion
- Vasopressors: ephedrine, phenylephrine

Progression: Once the BP is corrected and level of block checked (should be T4), surgery commences.

**Act # II: Uterine atony**

Case progression

Patient prepped and draped. Surgery starts. Four minutes after skin incision, uterine incision is made and within 2 minutes a 4.4 kg baby boy is delivered.

The obstetrician checks if pitocin (oxytocin) is being administered. Soon, he will state that uterine contraction is poor and requests oxytocin in **IV push**, methylergonovine (methergine) 0.2 mg **IV**, and then hemabate (carboprost or 15 methyl PGF2 alpha).

**Expected interventions:**

- Administer pitocin (20-40U diluted in 1L saline)
- Know the correct dose, route of administration, and side-effects of uterotonic drugs and administer accordingly
- Treat bronchospasm (if occurs)

*Instructor notes*: *The surgeon becomes increasingly anxious and demanding; if the participants fail to notice, then the nurse will need to point out the caveats of **IV** pitocin and methergine, as well as comment on the side-effects of hemabate in patients with a history of asthma; she, or the surgeon may suggest misoprostol as alternative.*

Case progression

Patient begins to complain of feeling nauseous and "not well". Her BP and O2 saturation drop progressively. She becomes agitated and then unresponsive to verbal commands. The surgeon is aware of "some" bleeding but does not believe that this could be the main cause of the severe hypotension.

**START TIMER**

**Time: 0-4 min**

| | | |
|---|---|---|
| Rhythm | sinus tachycardia | |
| HR | 100 | → ramp up to 140 bpm |
| BP | 90/55 | → ramp down to 65/35 |
| $O_2$ Sat | 96% | → ramp to 90% over 3 min |

**Expected interventions:**

- Re-check and confirm BP drop; inform surgeon of the problem
- Consider differential diagnosis: sympatectomy, vaso-vagal reaction, anaphylaxis, pulmonary or amniotic fluid embolism, etc
- Support the circulation: rapid fluid/colloid infusion, boluses of vasopressors
- Call for help; communicate your concerns and presumptive diagnosis to the OB team
- Oxygenate with 100% O2. Convert to general anesthesia. Recognize potential for difficult airway and aspiration.

- Perform a RSI with cricoid pressure; use etomidate or ketamine and succiniylcholine for induction.
- Confirm the correct position of the tracheal tube.

**Act # III: Recognition of bleeding emergency**

Case progression

Significant hypotension continues despite fluid/vasopressor therapy.

**Time: 4-14 min**

| | |
|---|---|
| Rhythm | sinus tachycardia |
| HR | 120-140 |
| BP | 70/45-90/55 |
| $O_2$ Sat | 98% |
| RR | 12/min |
| $ETCO_2$ | 22-30 mmHg |

Labs #1: Hct 18, pH 7.24, PCO2 37, PO2 240, Bicarb 16, glucose, electrolytes normal

#2: Hct 21, pH 7.26, PCO2 40, PO2 120, Bicarb 17, $Ca^{2+}$ 0.87, INR 2.8, Plt 70

**Expected interventions:**

- Continue supportive care
- Place a second large-bore IV. Insert an arterial-line.
- Send blood samples urgently
- Check the field and suction containers for ongoing bleeding
- Discontinue volatile anesthetics; consider midazolam for amnesia

*Instructor notes: The surgeon recognizes bleeding is coming from uterus; alternatively, the OR nurse may call out that there is a large amount of blood between the patient's legs. Blood is suctioned continuously from the operating field.*

*****During this act the simulator vital sign software should be programmed to demonstrate overt hemodynamic instability with very little and temporary response to fluids, blood, and vasopressor therapy. (SBP <100>70)***

**Expected interventions:**

Initiate bleeding emergency protocol (Plan communicated with team).

- Summon additional help.
- Infuse immediately O negative blood as available through fluid warmer.
- Prepare for massive transfusion (ask for rapid transfusion device or cell saver)
- Continue to support BP by infusing vasoactive drugs; give IV calcium gluconate if ionized calcium is low.
- Monitor labs frequently: Hct, ABG, coagulation panel.

# 10. Skill Training

**Act # IV and # V: Hemorrhagic Shock/DIC**

Case progression

The resuscitative efforts continue; the vital signs remain unstable and the surgeon complains of oozing from the surgical field

**Time: 15-25 min** or until hysterectomy is performed

| | |
|---|---|
| Rhythm | sinus tachycardia |
| HR | 140-150 |
| BP | 70/45-90/55 |
| $O_2$ Sat | 93%-98% |
| RR | 12-18/min |
| $ETCO_2$ | 22-30 mmHg |

**Expected interventions:**

- Re-evaluate the situation; follow up with the surgeon
- Recognize the persistence of profuse bleeding
- Suspect coagulopathy (DIC) and infuse blood products
- Consider alternative options to halt bleeding, such as administration of recombinant factor VII (Novoseven)
- Express your concerns-communicate with the obstetrician by suggesting definite surgical intervention (hysterectomy)

***Case scenario ends with the initiation of hysterectomy.***

**END TIMER**

# 11. Assessment Methods

Type(s) of Assessment Methods Used in This Course:

- ☐ Pre-test Only
- ☐ Pre-test & Post-test
- ☐ Post-test Only
- ☐ Individual Evaluation Form
- ☑ Team Performance Checklist *(see Appendix J)*
- ☑ Team Debriefing
- ☑ Simulation Session Evaluation

# 12. Appendices

| | |
|---|---|
| **Appendix A** | Debriefing Information |
| **Appendix B** | Drugs for Uterine Atony |
| **Appendix C** | Crew Resource Management |
| **Appendix D** | Guided Study Questions |
| **Appendix E** | Bleeding Emergency Protocol |
| **Appendix F** | Team Evaluation Form |
| **Appendix G** | Simulation Evaluation Form |
| **Appendix H** | Scenario Algorithm |
| **Appendix I** | Equipment Set-up |
| **Appendix J** | Performance Checklist |
| **Appendix K** | References |

# Appendix A: Debriefing Information

**Debriefing Strategy**

The basic assumption for the debriefing is:
"We believe that everyone participating in the simulation scenario is intelligent, well-trained, cares about doing their best, and wants to improve".

Method of debriefing should be based on learning objectives and targeted to analyze critical actions and the impact of experience on the participants

Tips for Small Group Debriefing

a. Establish ground rules for debriefing in terms of demonstrating respectful listening of each other's opinions, avoiding assigning blames to one another for what happened during simulation, highlighting key take home message as a result of the simulation
b. Open the debriefing session by going around the room inquiring the trainees what went well and what could be improved in future sessions. This is one way to engage all participants.
c. If a particular resident monopolizes the session, acknowledge the trainee's contribution and mention that someone else's viewpoints may be helpful for the group to hear.
d. Invite trainees to share specific ways in which they will change their practice as a result of the simulation session. This is one way to link training with real- life practice.
e. Do not use the debriefing session for providing didactic lectures. Use the forum for trainees to re-visit every major aspect of simulation learning under your guided discussion.
f. Be respectful of the trainees' time.

Framework for debriefing:

**A. Reactions**

- Clear the air and set the stage for discussion
- Facts

1) What happened?
   - Participants often want to know "the answer"
   - Stick to the facts

2) How did you feel about that?
   - Accept expressions of feelings
     - Acknowledge is not the same as agree
     - Try to mirror feelings rather then evaluate them
     - Don't tell participants "that's OK" when it may not be
   - Give perspective if participant feelings are hurt. e.g.:
     - I've seen this a dozen times and that happens nearly every time ... or
     - I've made the same mistake ... or
     - We all make mistakes and this is a good place to learn from them or ...
     - Remind them of the Basic Assumption and say that we'll work together to figure out what happened ... or ...

# Appendix A: Debriefing Information

**B. Understanding**

*Remember to use Advocacy-Inquiry: Be curious!*

- *Exploring*
- *Applying*
- *Generalizing*

***1) Exploring***

- What were you thinking at the time and how did you explain that?
- What was your differential at that point?
- What facts aid you in diagnosis and which one did not?
- It looked to me like …..
  *(Use this to discuss some error you observed and would like to find out why the student chose a particular course of action)*
- What led to it? What will you do next to solve the problems?
- Why did that happen?

***2) Applying***

- What drug or procedure or behavior might be best?
- Have you ever done this clinically?
- How might this be reflected in your clinical practice?

***3) Generalizing***

- Have you ever seen anything similar to this in your practice?
- Are there analogies to the clinical world?
- What can be done in a similar situation?

**C. Summary**

*Review what was learned and ensure the single scenario is put into a larger context.*

1) Relate this experience to higher-level principles, e.g., principles of teamwork, circulation and respiration, patient safety, etc.
2) What did you do well?
3) What would you do differently?

# Appendix B: Drugs for Uterine Atony

**UTERINE ATONY THERAPY**

| Drug | Dose | Dosing | CV effects | Other effects |
|---|---|---|---|---|
| Oxytocin | 20-40 U/1L NS or RL | Continuous gtt | ↓SVR, ↓MAP, ↑HR | ADH effect |
| Methergine | 0.2 mg IM (IMM) | 2-4 hrs | ↑ SVR, ↑MAP→stroke, seizure, coronary vasospasm | Increase BP<br>Rare: Bronchospasm |
| Hemabate (15-methyl PGF 2$\alpha$ | 0.25 mg IM (IMM) | 15-90 min (max 8 doses) | ↑CO, ↑PVR<br>avoid in severe cardiac disease | Bronchospasm,Diarrhea |
| Dinoprostone (PGE2) | 20 mg (PR) | 2 hrs | ↓SVR,↓MAP<br>↑CO,↑HR | Bronchodilation |
| Misoprostol (PGE1) | 200-800 mcg PR (generally give 600) | Once | No data available | Diarrhea (if given orally)<br>Shivering<br>Pyrexia |

IM = intramuscular; IMM = intramyometrial; PR = per rectum; MAP = mean arterial pressure; CO = cardiac output; SVR = systemic vascular resistance; PVR = pulmonary vascular resistance; HR = heart rate

# Appendix C: Crew Resource Management

***Specific Crew Resource Management (CRM) topics to discuss using this template:***

1. Team leader's performance:
    - Was a team leader clearly identified?
    - Were team members assigned to do specific tasks assigned appropriately?
    - Did he/she maintain awareness of the big picture? i.e. not sidetracked
    - Did the most life threatening issues get dealt with first?
      A → B → C
    - Did he/she allow team members to participate in the decision making process?
    - Were there any communication problems? i.e. not addressing specific person, no parroting, miscommunication
    - Did he/she use other resources appropriately i.e. non-anesthesia personnel?

2. Team members:
    - Did he/she clearly communicate critical information to the team leader & other team members?
    - Did he/she request assistance if unable to complete task/during task overload?
    - Good communication: closed loop communication/parrot back, clarify instructions, verbalize activities

3. Group performance:
    - Was everyone involved in the crises?
    - Were there any fixation errors?
    - Were there any conflicts? If so, was it resolved?
    - Did the team address new emergent events effectively?
    - What communication problems did we see?
        - Get person's attention
        - Make eye contact
        - Use names if possible
        - Parrot requests and responses

          Use cross-checks and 'call-outs'

**Additional topics:**

1. What would your further management of the patient have been? (e.g., talk to family, ICU care, extubation, etc.).
2. Did it feel real? How can we improve this scenario?
3. Review importance of accurate record keeping, review the record – lapses in vital signs, drugs administered.

# Appendix D: Guided Study Questions

**Guided Study Questions**

1. What is the definition and etiology of PPH?
2. Can you enumerate some typical situations in which PPH is likely to occur?
3. What are the clinical manifestations of severe uterine atony?
4. What is the medical management of uterine atony?
5. Describe the side effects of uterotonic drugs.
6. How would you support the circulation in a bleeding parturient?
7. At what point should you declare a bleeding emergency?
8. What is the emergency bleeding protocol at our institution?
9. What are the complications from massive transfusion?
10. What is the role of anesthesiologist in a multidisciplinary team?
11. How do professionals deal with the errors and/or knowledge gaps of others not in their immediate jurisdiction?
12. What would be the best strategy to review the surgeon actions/medical knowledge/communication style presented in this scenario?

# Appendix E: Bleeding Emergency Protocol

**BLEEDING EMERGENCY PROTOCOL**

- Attending (OB or Anesthesia) declares bleeding emergency
- Circulating RN contacts Blood Services
- Order <u>OB BLEEDING EMERGENCY BLOOD PRODUCTS</u>
  - * 2 units O-negative uncrossmatched RBC
  - * Thaw 4 units stock AB FFP
  - * Thaw 1 pool (=6 units) stock cryoprecipitate
- Order <u>OB BLEEDING EMERGENCY HEMORRHAGE PACK</u>
  - * 4 units RBC "release uncrossmatched"
  - * 6 units apheresis platelets
  - * 1 pool (=6 units) cryoprecipitate
- Order & send labs
  - * Emergency Hemostasis Panel
  - * ABG
- TRANSFUSION ALGORITHM
  - * Hgb <7 consider RBC transfusion
  - * Platelets < 100,000 $\rightarrow$ transfuse 6 units apheresis platelets
  - *Fibrinogen < 125 $\rightarrow$ transfuse 1 pool (= 6 units) cryoprecipitate
  - * INR > 1.5 $\rightarrow$ transfuse 4 units FFP

**Bleeding parturient management**

- Provide early diagnosis, treat the cause
- Follow general principles of resuscitation (ABC: airway, breathing, cardio-vascular resuscitation)
- **Call for help**
- Convert to GA (general anesthesia) if parturient unstable:
  - ► Administer a nonparticulate antacid. Consider: H1 blocker, e.g., metoclopramide or an H2 blocker, e.g., Ranitidine
  - ► Preoxygenate (3-5 minutes), perform RSI with crycoid pressure (use etomidate, ketamine and Sux in the unstable OB patient)
  - ► Maintain anesthesia with nitrous oxide/oxygen/opioid/midazolam
- Start second large-bore intravenous line
- Order blood tests (hemoglobin, coagulation panel, cross-match)
- Order blood, -in emergency O negative
- Provide crystalloid/colloid to assure isovolemia
- Start high-pressure infusion system (Alton-Dean, Level 1)
- Insert arterial line (serial hemoglobins, coagulation studies)
- Provide air warming blanket
- Provide cell-saver?
- Insert central venous line (after stabilization)
- Begin prompt treatment of clotting disorders
- Monitor urine output
- Consider use of vasopressors

# Appendix F: Team Evaluation Form

**Team Evaluation Form**

**Team Members**

**Date**: _____ _____

**Time**: _____ _____

**Evaluator**: _____ _____

_____

_____

_____

***Rating***

*Strongly Disagree / Strongly Agree* *1-5*

*N/A:* *N/A*

**Team Leader:**

| | | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree | N/A |
|---|---|---|---|---|---|---|---|
| 1. | Command authority / leader clearly recognized by team members. | 1 | 2 | 3 | 4 | 5 | N/A |
| 2. | Maintains situational awareness – does not get side tracked, reassess situation. | 1 | 2 | 3 | 4 | 5 | N/A |
| 3. | Assigns team members appropriately. | 1 | 2 | 3 | 4 | 5 | N/A |
| 4. | Prioritizes appropriately. | 1 | 2 | 3 | 4 | 5 | N/A |
| 5. | Engages team members in decisions. | 1 | 2 | 3 | 4 | 5 | N/A |
| 6. | Good communication (e.g. addresses specific person when requesting info or assigning tasks). | 1 | 2 | 3 | 4 | 5 | N/A |
| 7. | Monitors actions of team members. | 1 | 2 | 3 | 4 | 5 | N/A |
| 8. | Balanced team workload. | 1 | 2 | 3 | 4 | 5 | N/A |
| 9. | Resource management (e.g. use of non-anesthesia personnel). | 1 | 2 | 3 | 4 | 5 | N/A |
| 10. | Appropriate handover/description of problem to new attending. | 1 | 2 | 3 | 4 | 5 | N/A |

# Appendix F: Team Evaluation Form

## Team Member

| | | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree | N/A |
|---|---|---|---|---|---|---|---|
| 1. | Clear understanding of his/her role. | 1 | 2 | 3 | 4 | 5 | N/A |
| 2. | Verbalize observations/errors/critical info. | 1 | 2 | 3 | 4 | 5 | N/A |
| 3. | Ask for assistance if unable to complete task/during task overload. | 1 | 2 | 3 | 4 | 5 | N/A |
| 4. | Good Communication: closed loop communication/parrot back, clarifies instructions, verbalizes activities. | 1 | 2 | 3 | 4 | 5 | N/A |

## Group

| | | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree | N/A |
|---|---|---|---|---|---|---|---|
| 1. | Everyone involved in crises. | 1 | 2 | 3 | 4 | 5 | N/A |
| 2. | Avoids fixation errors. | 1 | 2 | 3 | 4 | 5 | N/A |
| 3. | Resolves conflicts/disagreements. | 1 | 2 | 3 | 4 | 5 | N/A |
| 4. | Roles are shifted to address urgent or emergent events, when appropriate. | 1 | 2 | 3 | 4 | 5 | N/A |

## Overall Assessment for Each Participant

| | | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree | N/A |
|---|---|---|---|---|---|---|---|
| 5. | This person functioned as an effective team leader or team member. | 1 | 2 | 3 | 4 | 5 | N/A |

# Appendix G: Simulation Evaluation Form

**Simulation Session Evaluation Form**

**Facilitator:** _____ **Date:** _____

**Case Presented:** _____

| | | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree | N/A |
|---|---|---|---|---|---|---|---|
| 1. | Learners should spend more time working in simulated environments. | 1 | 2 | 3 | 4 | 5 | N/A |
| 2. | The simulation case provided a realistic model of working in a clinical setting. | 1 | 2 | 3 | 4 | 5 | N/A |
| 3. | This simulation case was an effective educational tool. | 1 | 2 | 3 | 4 | 5 | N/A |
| 4. | This simulation case enhanced my understanding of how to handle critical incidents. | 1 | 2 | 3 | 4 | 5 | N/A |
| 5. | The debriefing after the case was an important learning opportunity. | 1 | 2 | 3 | 4 | 5 | N/A |

Can you list/describe 1 or more ways this simulation session will change how you do your job?

Comments:

# Appendix G: Simulation Evaluation Form

**Team Leader:**

| | | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree | N/A |
|---|---|---|---|---|---|---|---|
| 11. | The content was: | | | | | | |
| | Current | 1 | 2 | 3 | 4 | 5 | N/A |
| | Best Practice | 1 | 2 | 3 | 4 | 5 | N/A |
| | Free of Bias | 1 | 2 | 3 | 4 | 5 | N/A |
| | Relevant to My Practice | 1 | 2 | 3 | 4 | 5 | N/A |
| 12. | I will change my practice based on the information presented. | 1 | 2 | 3 | 4 | 5 | N/A |
| 13. | The education level of this activity was appropriate. | 1 | 2 | 3 | 4 | 5 | N/A |

**Content Evaluation**

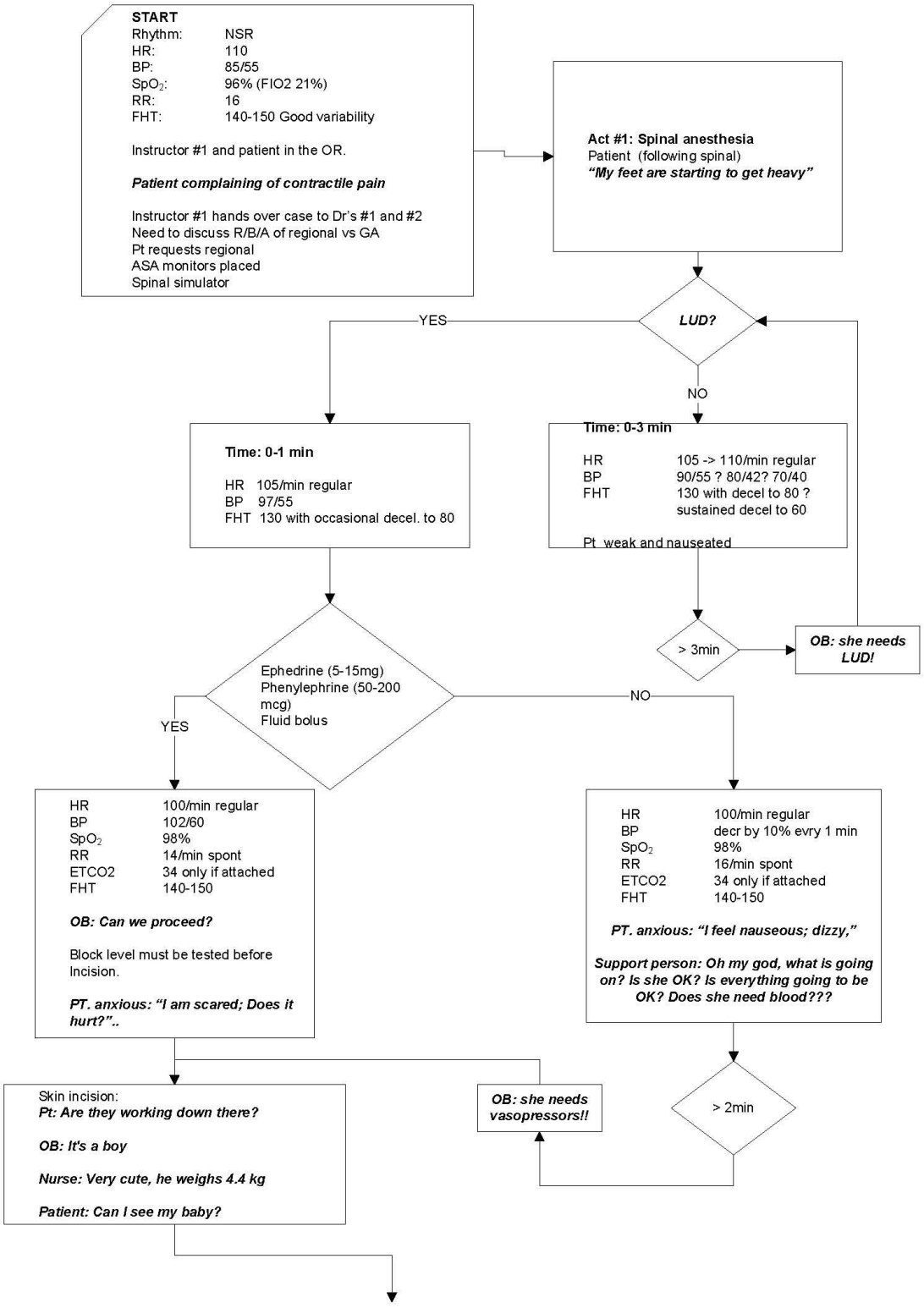
The most important concept learned during this session that may contribute to a change in patient care is:

**Instructor**

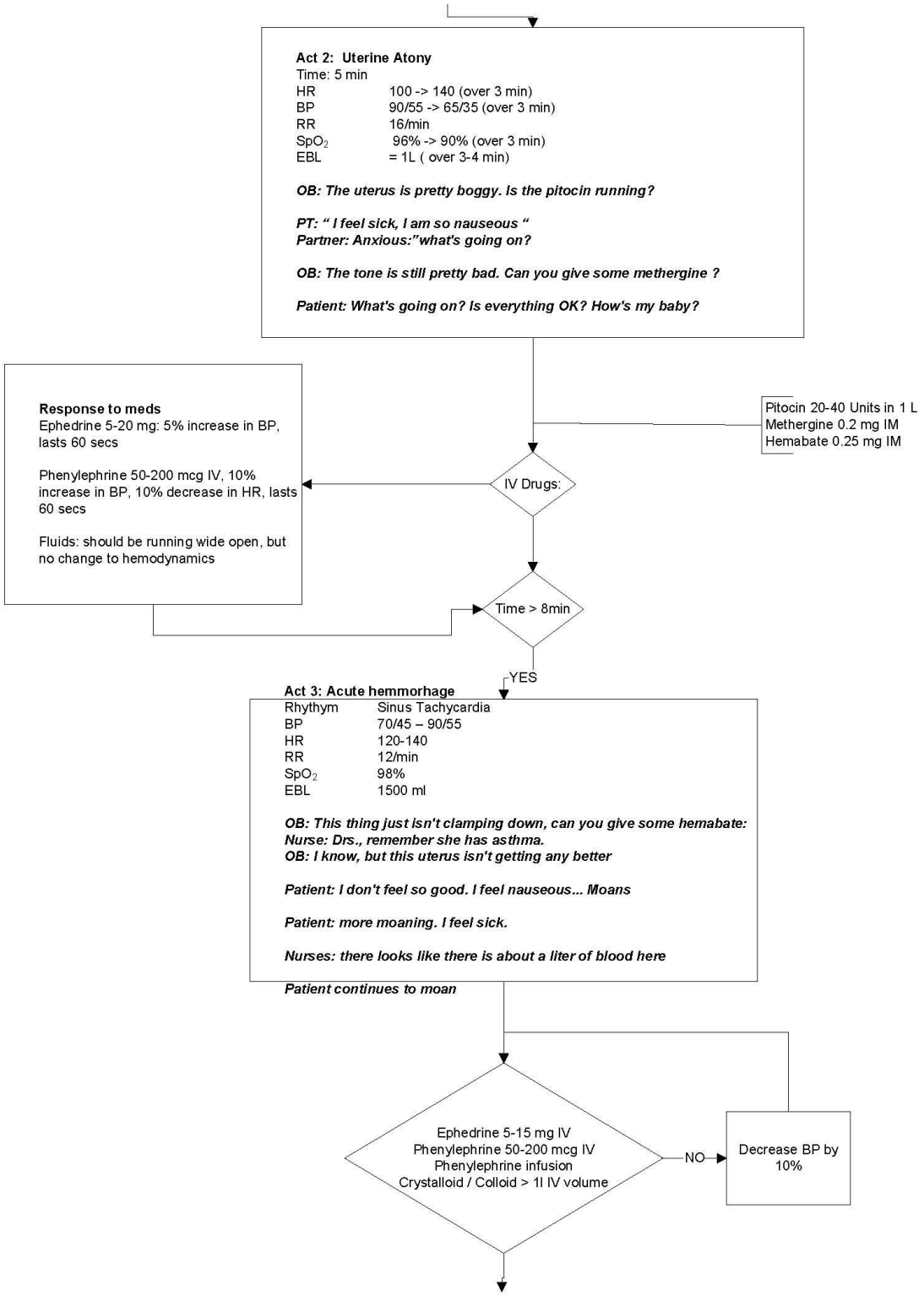
| | | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree | N/A |
|---|---|---|---|---|---|---|---|
| 1. | The instructor had a good command of the content. | 1 | 2 | 3 | 4 | 5 | N/A |
| 2. | The instructor's presentation was clear and concise. | 1 | 2 | 3 | 4 | 5 | N/A |
| 3. | The instructor clearly demonstrated the required skills. | 1 | 2 | 3 | 4 | 5 | N/A |
| 4. | The instructor created a safe environment for the debriefing. | 1 | 2 | 3 | 4 | 5 | N/A |
| 5. | The instructor was an effective facilitator. | 1 | 2 | 3 | 4 | 5 | N/A |
| 6. | The instructor's feedback was helpful. | 1 | 2 | 3 | 4 | 5 | N/A |
| 7. | Overall, the instructor contributed to my learning. | 1 | 2 | 3 | 4 | 5 | N/A |

Comments:

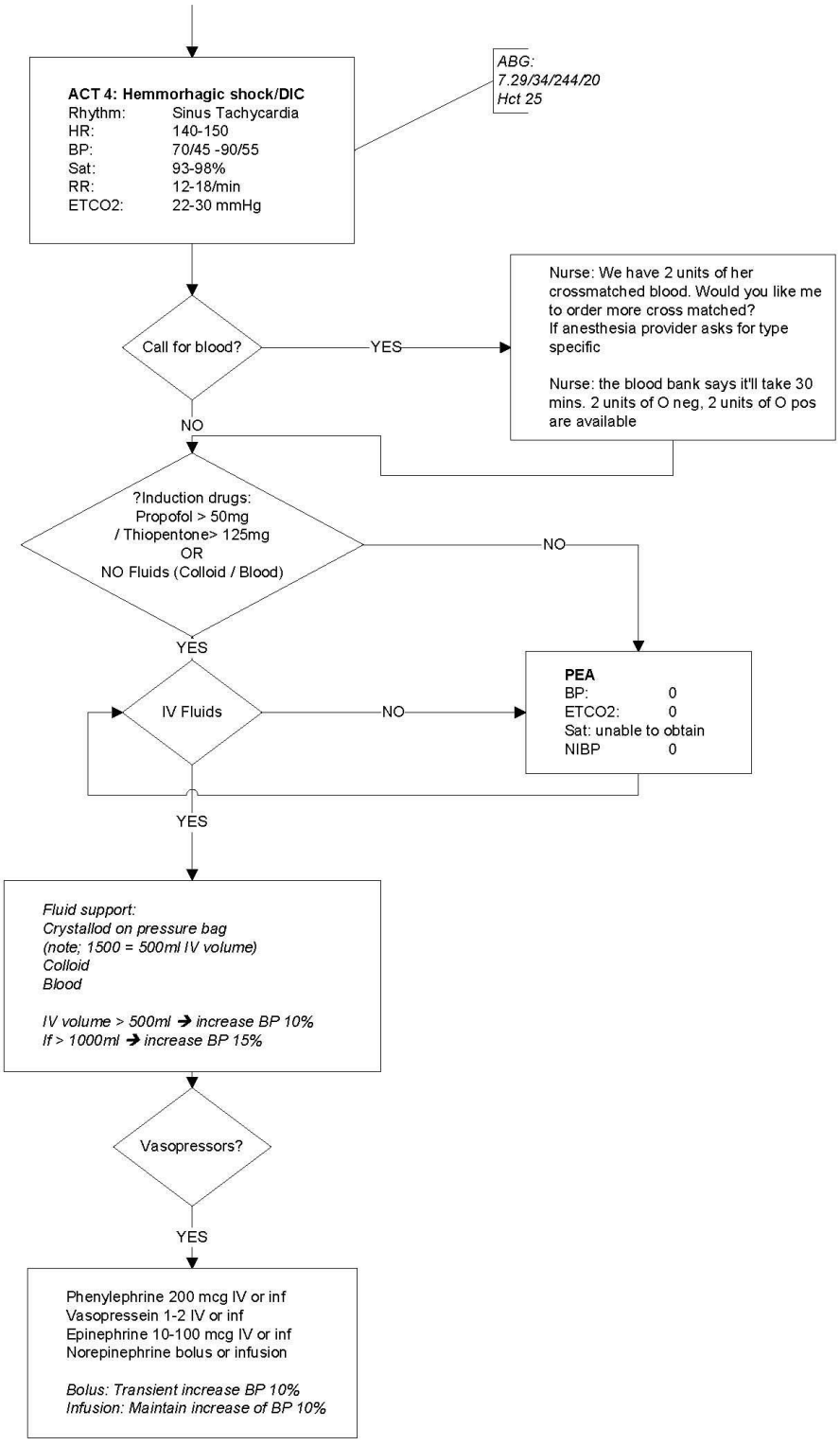
# Appendix H: Scenario Algorithm



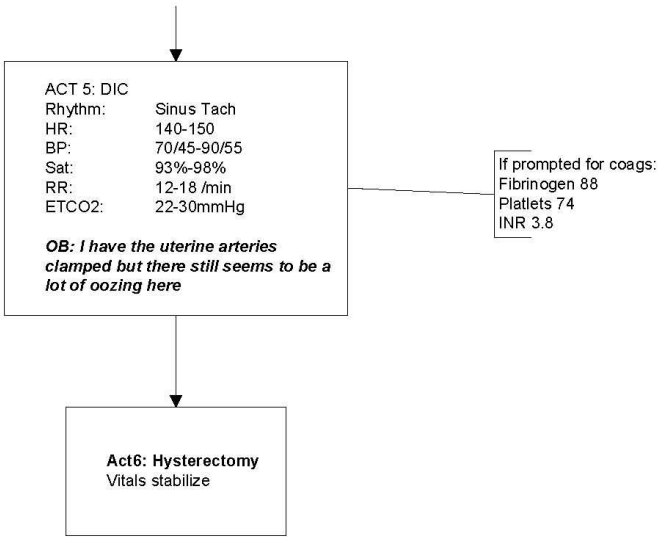
# Appendix H: Scenario Algorithm



# Appendix H: Scenario Algorithm



# Appendix H: Scenario Algorithm



# Appendix I: Equipment Set-up

**OB BLEEDING SET-UP**

**Anesthesia cart**

OB Anesthesia Bag

- ☐ Lidocaine PF 20 mg/ml 5 ml vial x7
- ☐ Odansetron 2 mg/ml 2 ml vial
- ☐ Metoclopramide 5 mg/ml 2 ml vial
- ☐ Ephedrine 50 mg/ml 1 ml vials x2
- ☐ Oxytocin 10 Units /ml 10 ml vial
- ☐ Phenylephrine 10 mg/ml 1 ml vial
- ☐ Epinephrine 1:1000 1 mg/ml vial
- ☐ Sodium Citrate and Citric Acid Oral Solution 3g/30 mL

On top

- ☐ Gloves (Small, Medium, Large)
- ☐ Eschman Stylette
- ☐ 3, 5, 10, 20cc syringes
- ☐ Drug labels
- ☐ Wipes, end caps and stopcocks
- ☐ Silk tape and Hy-tape (pink)
- ☐ 20, 18,16 & 14 gauge IV needles and arterial line catheters
- ☐ Rubbish container
- ☐ Sharps container
- ☐ Dirty laryngoscope container

Top Drawer – Standard drug tray

- ☐ Propofol (10 mg/ml) 20 ml
- ☐ Thiopenthal (25mg/ml) 20 ml
- ☐ Fentanyl (50 mcg/ml) 5ml
- ☐ Midazolam (1 mg/ml) 2 ml
- ☐ Etomidate (2mg/ml) 10 ml
- ☐ Ketamine (10mg/ml) 20ml
- ☐ Succinylcholine (20mg/ml) 10ml in 20ml syringe X 2
- ☐ Rocuronium (10mg/ml) 5ml
- ☐ Kefzol (1 gm/250 ml)
- ☐ Ephedrine (5mg/ml) 5ml in 10ml syringe X 2
- ☐ Phenylephrine (200mcg/ml) 10 ml syringe
- ☐ Atropine (0.4mg/ml) 2.5ml in a 5 ml syringe
- ☐ Calcium chloride (100mg/ml) 10ml

Drawer 2

- ☐ Nasal airways 28, 32, 34
- ☐ Small, medium and large oral airway (red, yellow, green)
- ☐ Blades: Miller 2 and 3, Mac 3 and 4

# Appendix I: Equipment Set-up

Drawer 2 cont'd

- ☐ 2 handles
- ☐ ETT size 6-8
- ☐ LMAs sizes #3,4,5
- ☐ Batteries, scissors, hemostats, McGill Forceps
- ☐ Esophageal stethoscope
- ☐ Rigid stylettes

Drawer 3

- ☐ 2 Breathing circuits including mask
- ☐ $O_2$ masks and nasal airway
- ☐ Medium gloves
- ☐ 4X4 pads
- ☐ Tegaderm

Drawer 4 – Circulation

- ☐ Hotline
- ☐ Extension sets
- ☐ Dial-a-flow infusion set
- ☐ LR 3-4
- ☐ Y-infusion set (1-2)
- ☐ 50cc syringes w/ fine bore infusion tubing and saline
- ☐ Micro infusion set

Anesthetic Machine

- ☐ Gas supply on: $O_2$, $N_2O$, Air
- ☐ LMA / ETT
- ☐ Oral / nasal airway
- ☐ Face mask
- ☐ Breathing circuit
- ☐ $O_2$ sensor calibrated & attached
- ☐ $O_2$ cylinder attached
- ☐ Suction tubing, yankauer, turned on
- ☐ ETT suction tubes
- ☐ Turned on
- ☐ Stethoscope

Circulation aids

- ☐ Additional IV setup
  - ○ Hotline/Blood tubing setup
  - ○ Normal saline
- ☐ Pressure bags
- ☐ Alton Dean
- ☐ Arterial line setup
- ☐ Blood products
  - ○ O negative 6 Units
  - ○ FFP/cryoprecipitate

# Appendix I: Equipment Set-up

Ventilator

- ☐ Set to manual / bag
- ☐ Tidal Volume to 600cc
- ☐ Rate 12/min

Monitoring (standard)

- ☐ Screen setup
  - ○ ECG
  - ○ $SpO_2$
  - ○ NIBP cycle every 5min
  - ○ ET agent (usually Iso)
  - ○ $O_2$
  - ○ $CO_2$
- ☐ Temp cable
- ☐ Agent analysis tubing

Manikin

- ☐ SimMama (Laerdal SimMan with wig, breasts and belly)
- ☐ Blanket for left uterine displacement
- ☐ Fetal heart tone monitors (or strip with FHR)
- ☐

Spinal Setup

- ☐ Spinal model
- ☐ Regional tray
- ☐ Spinal drugs
  - ○ Bupivacaine(2cc 0.75% with dextrose, 20cc 0.5% plain, 20cc 0.25% plain)
- ☐ Spinal Needles
  - ○ 25 G Sprotte
  - ○ 27 G Sprotte
- ☐ Safety pins

# Appendix J: Performance Checklist

## Performance Checklist

**Preoperative Assessment & Spinal Anesthesia**

-------Verifies patient identity
--------Reviews patient history and physical (focus on asthma, airway, labs)
--------Discuss the risks and benefits of regional anesthesia vs. general anesthesia
--------Attaches standard ASA monitors
--------Surveys anesthesia set-up including airway equipment, anesthetic, OB specific, and emergency drugs; prepares spinal tray
-------Takes precautions for full stomach ( Bicitra PO)
--------Performs spinal anesthesia (anatomy, drugs, dosage)
--------Recognizes post-spinal hypotension
--------Orders LUD; administers O2, pressors and fluids

**Uterine Atony**

--------Appropriate step-wise administration of uterotonics
--------Knows route of administration & dose
--------Recognizes and treats side effects
--------Requests uterine massage to be performed by surgeon
--------Constantly evaluates patient vitals

**Acute Hemorrhage & Hemorrhagic Shock**

_____ Recognizes rapid deterioration of patient's condition; inform surgeon of the problem
_____ Considers differential diagnosis: sympatectomy, vaso-vagal reaction, anaphylaxis, pulmonary or amniotic fluid embolism, etc
_____ Supports the circulation: rapid fluid/colloid infusion, boluses of vasopressors
_____ Calls for help
_____ Oxygenates with 100% O2. Convert to general anesthesia. Recognizes potential for difficult airway and aspiration.
_____ Performs a RSI with cricoid pressure; use etomidate or ketamine and succiniylcholine for induction
_____ Confirms the correct position of the tracheal tube
_____ Place a second large-bore IV. Insert an arterial-line.
_____ Send blood samples urgently
_____ Check the field and suction containers for ongoing bleeding
_____ Discontinue volatile anesthetics; consider midazolam for amnesia
_____ Initiate bleeding emergency protocol
_____ Summon additional help
_____ Infuse immediately O negative blood as available through fluid warmer
_____ Prepare for massive transfusion (ask for rapid transfusion device or cell saver)
_____ Continue to support BP by infusing vasoactive drugs;
_____ Monitor labs frequently: Hct, ABG, coagulation panel
_____ Re-evaluate the situation; follow up with the surgeon
_____ Recognize the persistence of profuse bleeding
_____ Suspect coagulopathy and infuse blood products
_____ Consider alternative options to halt bleeding, such as administration of recombinant factor VII (Novoseven)
_____ Transport patient intubated & ventilated to ICU

# Appendix J: Performance Checklist

**Critical Steps in the Management of Uterine Atony**

_____ Appropriate step-wise administration of uterotonics
--------Knows route of administration & dose
--------Recognizes and treats side effects

_____ Recognizes rapid deterioration of patient's condition; inform surgeon of the problem
_____ Supports the circulation: rapid fluid/colloid infusion, boluses of vasopressors
_____ Calls for help
_____ Oxygenates with 100% O2. Convert to general anesthesia. Recognizes potential for difficult airway and aspiration.
_____ Performs a RSI with cricoid pressure; use etomidate or ketamine and succiniylcholine for induction
_____ Initiates bleeding emergency protocol

_____Prepare for massive transfusion

_____Fluid and hemodynamic resuscitation until svital signs stable

_____ Transport patient intubated & ventilated to ICU

# Appendix K: References


1. Bonnar J. (2000) Massive obstetric haemorrhage. Baillieres Best Pract Res Clin Obstet Gynaecol. 2000 Feb;14(1):1-18.
2. Callaghan WM, Kuklina EV, Berg CJ. (2010) Trends in postpartum hemorrhage: United States, 1994-2006. Am J Obstet Gynecol. 2010 Apr; 202(4):353.e1-6.
3. Davis, BG. (2009) Tools for Teaching. Willey John & Sons Inc.
4. Fuller AJ, Bucklin B. (2007) Blood component therapy in obstetrics. Obstet Gynecol Clin North Am. 2007 Sep;34(3):443-58.
5. Gaba DM, Fish KJ, Howard SK. Crisis management in anesthesiology. Churchill Livingstone 1994
6. Jansen AJG, van Rhenen DJ ,Steegers EAP et al. (2005) Postpartum hemorrhage and transfusion of blood and blood components, Obstet Gynecol Surv 2005; 60 : 663–671.
7. Malec JF, Torsher LC, Dunn WF, Wiegmann DA, et al. (2007) The Mayo High Performance Teamwork Scale: Reliability and validity for evaluating key crew resource management skills. Simulation in Healthcare: The Journal of the Society for Simulation in Healthcare. Spring 2007. 2(1):4-10.
8. Oyelese Y, Scorza WE, Mastrolia R, et al. Postpartum Hemorrhage. Obstet Gynecol Clin N Am. 2007; 34: 421-441.
9. Practice guidelines for perioperative blood transfusion and adjuvant therapies. An updated report by the American Society of Anesthesiologists task force on perioperative blood transfusion and adjuvant therapies. 2006 Anesthesiology 105. 198-208.
10. TeamSTEPPS: National Implementation. http://teamstepps.ahrq.gov/about-2cl_3.htm