Simulation Patient Design (April 2024)
Case of Non-Obstetric Surgery in a Parturient

Author(s): Anusha Reddy, MD, Benjamin Hyers, MD, Icahn School of Medicine at Mount Sinai
Editors: Sonal Zambare, MD, FASA, Jessica Sheeran, MD

Introduction
Non-obstetric surgery being conducted in both the United States and the European Union is estimated from 0.3% to 2.2%, resulting in about 100,000 cases per year. [1] These include surgeries that may be necessary at any stage of the pregnancy, with pregnancy-related surgeries related to cervical incompetence, ovarian cysts, fetal surgery, and nonpregnancy-related surgeries including acute abdominal disease, malignancies, and trauma. ACOG guidelines say that elective surgery should not be performed during pregnancy but if surgery is deemed necessary, then the second trimester should be the preferred trimester due to its association with the lowest risk of spontaneous abortion and preterm labor. [1]

Pregnancy leads to many maternal physiological changes and the various anesthetic implications of these changes should be considered when caring for a pregnant patient and her fetus, along with the pathology of the acute condition. Fetal well-being depends on maternal and fetal oxygenation, acid-base status, and uteroplacental perfusion.

ACOG and ASA have published guidelines on fetal monitoring during nonobstetric surgery. The guidelines state that intraoperative electronic FHR monitoring "may be appropriate when all of the following apply: (1) the fetus is viable; (2) it is physically possible to perform intraoperative electronic monitoring; (3) a health care professional with obstetric surgery privileges is available and willing to intervene during the surgical procedure for fetal indications; (4) when possible, the woman has given informed consent to emergency cesarean delivery; and (5) the nature of the planned surgery will allow the safe interruption or alteration of the procedure to provide access to perform emergency delivery." [1] Per the Association of Professors of Gynecology and Oncology, only 43% routinely use intraoperative FHR monitoring. [1] Additionally, the use of intra-operative monitoring requires a physician who can appropriately interpret the tracing, with a plan in place on how to proceed in the event of non-reassuring fetal status, which includes an emergency cesarean delivery.

Educational Rationale: To teach team skills in managing complications that can arise during non-obstetric surgery, including emergency cesarean delivery
Target Audiences: Anesthesiologists, Obstetricians, Resident Physicians, L&D nurses, L&D support staff, medical students
Learning Objectives: As per the Accreditation Council for Graduate Medical Education (ACGME) Core Competencies
Upon completion of this simulation (including the debrief) learners will be able to:

- *Medical knowledge*: understand how the physiologic changes affect general anesthesia in parturients and how to safely manage.
- *Patient care*: ask appropriate preoperative questions and do a physical exam to come up with an appropriate induction, maintenance, and extubation plan for the patient; as well as a contingency plan if fetal distress occurs.
- *Practice-based learning and improvement*: effectively implement interdisciplinary emergency

response and identify skills and equipment needed to appropriately manage nonobstetric surgery in a parturient.
- *Interpersonal and communication skills*: utilize closed-loop communication with the surgical team, nursing team, anesthesiologists, and obstetric team to ensure safety for parturient and fetus.
- *Professionalism*: demonstrate compassion to the patient and mutual respect with other team members involved in the patient's care.
- *Systems-based practice*: identify and understand existing barriers within the system with regards to equipment, knowledge gaps, and institutional protocols.

Questions to ask after the scenario:

1. What are the main parameters that were looked at to prevent fetal distress?
2. How did the FHR change throughout the case?
3. How quickly was the emergency response initiated?
4. What was prepared beforehand in anticipation of emergency cesarean delivery?
5. What was done differently after delivery of the baby to ensure appropriate post-partum care?

Assessment Instruments:

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

Equipment Needed and Set-up:

In-situ Anesthesiology set-up

- Mannequin with left uterine displacement
- 16-gauge IV in left antecubital fossa with blood set
- 20-gauge IV in right antecubital fossa
- Arterial line in right radial artery
- Anesthesia machine and cart set up for general anesthesia

In-situ Surgeon set-up

- Surgeon equipment for craniotomy
- Neuromonitoring set up

In-situ Obstetric set-up

- Set up instruments for crash cesarean delivery
- Baby warmer set up
- Medications for c-section and hemorrhage ie sodium citrate, oxytocin, uterotonics, TXA
- FHR monitor

Simulation Scenario Set-up:

The case

Ms. Smith is a 28-year-old G1P0 at 35 weeks gestation with a history of prior clipped cerebral aneurysm presented with a massive headache and was found to have a ruptured aneurysm on imaging. Her pregnancy has been uncomplicated thus far with no other medical or surgical history. Her BMI is 23.9, she has no known drug allergies, and she last had crackers 8 hours ago. You consent her for general anesthesia for an emergent craniotomy to repair the aneurysm. Neurosurgery and her OB have both been called and are aware of the situation. FHR tracing has been Category 1 with good variability throughout her pregnancy. A discussion was had between neurosurgery, OB, and OB anesthesia about performing an emergent c-section if persistent fetal bradycardia and nonreassuring FHR tracing occurred during the craniotomy.

Vitals:
HR: 124 bpm
BP: 104/75 mmHg
O2 Sat: 98% on RA

Height: 5'3"
Weight: 135 lbs
BMI: 23.9

Airway: Mallampati 2, normal mouth opening, thyromental distance >6.5 cm

Simulation Pre-brief

- Read the scenario and instruct team members on their role during the simulation.
- The learners take their places.
- Circulator nurse, surgeon, scrub tech, obstetrician, L&D nurse, L&D baby nurse are in their appropriate places.
- Simulation driver sits to drive the simulation.

Scenario Details

Trigger	Patient Condition	Action	Done	Time	Comments
Patient in main operating room, laying on operating room bed Anesthesiologist at head of bed Surgeon, obstetrician, nursing in the room also at the bedside ready to assist Neonatology on standby	The patient is awake, responsive, anxious, and in pain HR 135 bpm BP 127/85 mm Hg SpO_2 98% (air) Resp 23/min FHR 124/min Patient eyes closed after propofol, fasciculations after succinylcholine	1. Place monitors: BP cuff, EKG leads, pulse oximetry 2. Left lateral uterine displacement 3. Hook up fluids to IV 4. The patient has received oral sodium citrate in Pre-op holding. 5. OB puts FHR monitor on patient 6. OB has instruments for STAT c-section prepared and available on the instrument table. 7. Preoxygenate patient on 100% FiO2 8. Place BIS on patient 9. ETT, intubation blade, and backup airway equipment ie VL ready 10. RSI with 200 mg propofol, 100 mg succinylcholine and cricoid pressure			

		11. Intubate patient, cuff up, and confirm EtCO2 with manual ventilation 12. Tape eyes and ETT 13. Turn on ventilator at appropriate settings – FiO2 100%, EtCO2 between 28-32 14. Turn on TIVA anesthetic 100 mcg/kg/min propofol and 0.2 mcg/kg/min remifentanil and phenylephrine infusion at 0.2 mcg/kg/min			
Preparing patient for surgery	Patient intubated and under general anesthesia TIVA HR 110 bpm BP 104/82 mm Hg SpO_2 100% (air) Resp 15/min FHR 120/min	1. Turn bed 180 degrees so patient is head away 2. Neuromonitoring electrodes placed by the neuromonitoring team 3. Arterial line placed by the anesthesiology team 4. 16 gauge IV placed by the anesthesiology team 5. Surgeons prep and drape 6. Time out is performed per hospital protocol 7. Multidisciplinary team discussion on FHR tracing and what FHR may warrant interventions			
Incision made for craniotomy 20 minutes after the incision, persistent fetal bradycardia noticed on FHR monitor	Patient intubated and under general anesthesia TIVA HR 115 bpm BP 87/50 mm Hg SpO_2 100% FHR 67/min	1. Treat BP with 10 mg ephedrine 2. OB monitor FHR a. Decels noticed with minimal variability 3. OB informs OR of emergency cesarean delivery in the setting of persistent fetal bradycardia 4. Peds and NICU team called and made aware of possible delivery 5. Neurosurgery halts craniotomy			

OB to prep with betadine and drape patient for emergency cesarean delivery Per OB, uterus is boggy and asks for uterotonics	HR 79 bpm BP 135/82 mmHg SpO_2 100% FHR 72/min	1. OB performs incision for delivery 2. Baby delivered and taken by peds/NICU team to the warmer in the OR for assessment and resuscitation 3. OB to finish cesarean section 4. Pitocin infusion started 5. 300 cc EBL noticed in suction canister 6. Ask about uterine tone and bleeding 7. Give IM hemabate as first line agent and OB to place misoprostol directly into uterus 8. Reassess tone and bleeding			
Uterine tone good with hemostasis Finishes cesarean section	HR 85 bpm BP 99/62 mm Hg SpO_2 100%	1. Cesarean incision covered 2. OB team leaves 3. Neonate successfully resuscitated by NICU team and taken to NICU			
Craniotomy to continue	Normal vitals	1. Maintain blood pressure per neurosurgery parameters 2. Monitor for continued blood loss 3. At least 2 units pRBC available 4. Craniotomy finished by neurosurgical team			
Emerging and extubating patient	HR 122 bpm BP 95/48 mm Hg SpO_2 100%	1. Titrate down propofol, remifentanil, and phenylephrine 2. Get patient breathing spontaneously on minimal patient support 3. Extubate when patient is following commands			
Patient in neuro ICU	Patient comfortable, awake, and stable	1. Team debrief 2. Discuss system issues			
Update partner		1. Be compassionate and considerate when information partner of life-saving interventions and update regarding the neonatal status			

Appendix 1

Learner Knowledge Assessment
Labor and Delivery Multidisciplinary Team Simulation

Name of simulation: ______________ Date: _____

OB Nursing Anes

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.

1. How would you rate your knowledge of risk factors for non-obstetric surgery in a parturient?

BEFORE THE SIMULATION	END OF SIMULATION
1 2 3 4 5 6 7 Little/none Knowledgeable	1 2 3 4 5 6 7 Little/none Knowledgeable

2. How would you rate your knowledge of what physiological derangements occur in parturients under general anesthesia?

BEFORE THE SIMULATION	END OF SIMULATION
1 2 3 4 5 6 7 Little/none Knowledgeable	1 2 3 4 5 6 7 Little/none Knowledgeable

3. How would you rate your knowledge of converting to an emergency cesarean delivery during a non-obstetric surgery?

BEFORE THE SIMULATION	END OF SIMULATION
1 2 3 4 5 6 7 Little/none Knowledgeable	1 2 3 4 5 6 7 Little/none Knowledgeable

4. How would you rate your knowledge of delivery planning for an emergency cesarean delivery during a non-obstetric surgery?

BEFORE THE SIMULATION	END OF SIMULATION
1 2 3 4 5 6 7 Little/none Knowledgeable	1 2 3 4 5 6 7 Little/none Knowledgeable

5. How would you rate your overall confidence when confronted with non-reassuring FHR tracing during non-obstetric surgery?

BEFORE THE SIMULATION	END OF SIMULATION
1 2 3 4 5 6 7 Little/none Knowledgeable	1 2 3 4 5 6 7 Little/none Knowledgeable

Appendix 2

Simulation Activity Evaluation

DATE OF SIMULATION: ____________

OCCUPATION: Consultant PG Yr 1 2 3 4 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 simulator	1	2	3	4	5	N/A
PHYSICAL SPACE						
Realism of the simulator 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
DID YOU FIND THIS USEFUL?						
To improve your clinical practice?	1	2	3	4	5	N/A
To improve your teamwork skills?	1	2	3	4	5	N/A
To improve your VERBAL communication?	1	2	3	4	5	N/A
To improve your NONVERBAL communication?	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/SUGGESTIONS:

References:

1. Wong, C. A., Tsen, L. C., Kee, W. D. N., Beilin, Y., & Mhyre, J. (n.d.). *Chestnut's Obstetric Anesthesia: Principles and Practice*. Saunders.