SOAP Society for Obstetric Anesthesia and Perinatology

Simulation Patient Design (July, 2022)
Case of Hypoxia due to Massive Pulmonary Embolism on L&D

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Introduction

Acute respiratory failure affects up to 1 in 500 pregnancies, and there are pregnancy-specific conditions that need to be considered when evaluating acute respiratory failure in a pregnant patient.[1] Venous thromboembolism (VTE) events, occur four to five times more frequently in a pregnant patient.[2] Normal physiologic hemostatic changes of pregnancy lead to double the coagulation activity typically found in a non-pregnant individual.[3] VTEs account for 3% of maternal deaths worldwide and as many as 15% of maternal deaths in the United States, so prompt diagnosis and treatment are essential.[4]

While there are clear recommendations for workup and management of prenatal pulmonary embolism (PE), there is a dearth of guidelines regarding management of intrapartum PE. It is often unfeasible to move an actively laboring patient to a CT suite for angiography, and treatment of peripartum PE with tissue plasminogen activator (tPA) carries the risk of massive hemorrhage. A possible alternative to tPA is percutaneous intervention and extracorporeal membrane oxygenation (ECMO), but these services are not available at every facility. Because of this, careful risk benefit analysis should be considered by a multidisciplinary team when planning care for a pregnant patient suffering from an intrapartum PE.

Here we present a case of acute respiratory failure due to intrapartum massive PE.

Educational Rationale: To teach team skills in managing intrapartum massive PE
Target Audiences: Nursing, OB, Anesthesiology, OR personnel
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 diagnosis, appropriate investigations and management of hypoxia in a laboring patient (with or without neuraxial labor analgesia)
- *Patient care*: Discuss institutional policies for escalating care for the acutely unstable patient
- *Practice-based learning and improvement*: Identify the risks and benefits of treatment options when managing a massive PE in a laboring patient
- *Interpersonal and communication skills*: Effectively communicate with the patient, obstetrician, and critical care physician(s)
- *Professionalism*: Demonstrate mutual respect for the expertise of other team members
- *Systems-based practice*: Ensure all resuscitation equipment, medications, and protocols are readily available

Questions to ask after the scenario:

1. What was the differential diagnosis?
2. What were the clinical findings leading to a diagnosis of PE?
3. When did you decide on the working diagnosis?
4. Describe any unexpected events during the simulation
5. What went well in the simulation?
6. What could have been done better or differently in the simulation?

Assessment Instruments:

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

Equipment Needed and Set-up:

In-situ set-up

Mannequin with epidural catheter in situ
Standard monitors: HR, BP, Pulse oximetry
IV catheter and IV fluids
Ultrasound
Airway equipment
Central line and arterial line equipment
Anesthesia machine

Simulation Scenario Set-up:

Mrs. Jen Wilms is a 37-year-old patient (G1P0) at 39w4d who has been admitted in spontaneous early labor and is currently 3 cm dilated. She has a history of mild intermittent asthma and obesity (BMI 46). Approximately 12 hours ago a combined spinal-epidural was attempted, however an inadvertent dural puncture occurred. The epidural catheter was threaded intrathecally, following which the patient has been comfortable and is currently 8 cm dilated.

Simulation Pre-brief

- Read the scenario and instruct team members on their role during the simulation
- The learners take their places

Scenario Details

Trigger	Patient Condition	Action	Done	Time	Comments
Patient in labor room	Patient is awake + responsive Complaining of mild SOB HR 98 bpm BP 134/91 mm Hg SpO_2 90% (air) Resp 20/min Temp 37.1^oC Pain score 0/10 FHR Category I	1. L&D triage nurse calls anesthesiologist to assess patient 2. Anesthesiologist: ☐ Requests full set of vital signs ☐ Provides supplemental oxygen (5 L/min via a non-rebreather face mask) ☐ Enquires into symptoms of SOB (differential should include **intrathecal catheter, high dermatomal level, pulmonary edema secondary to preeclampsia or peripartum cardiomyopathy, aspiration, AFE, PE, pulmonary edema, bronchospasm, aortocaval compression**) ☐ Performs physical exam (patient demonstrates an appropriate dermatomal level + adequate grip strength, lungs with mild wheezing) ☐ Ensures adequate IV access + sends baseline labs ☐ Administers albuterol 8 puffs via inhaler			
Patient with worsening SOB	Patient in mild distress HR 116 bpm BP 94/56 mm Hg SpO_2 91% (5 L/min) Resp 22/min Temp 37.0^oC FHR Category I	1. Anesthesiologist called back (if they left) ☐ Requests repeat set of vitals ☐ Increases supplemental O_2 ☐ Calls for help (OB Rapid Response Team/ICU consult ☐ Administers vasopressor(s) as needed ☐ Sends ABG + troponin + lactate ☐ Requests CXR + ECG ☐ Performs bedside POCUS (to assess lung fields + cardiac views) ☐ Discusses differential diagnoses with OB team			

Patient now complaining of mild chest pain + worsening rectal pressure OB performs cervical exam (9 cm dilated) If learner suggests tPA they need to activate MTP + obtain better IV access (RIC, CVC) + prepare rapid infuser	Patient noticeably uncomfortable due to rectal pressure HR 130 bpm BP 90/54 SpO_2 95% (10 L/min) Resp 28/min Temp 37.0^oC FHR Category 2 ECG: Sinus tachycardia CXR: Mild pulmonary edema ABG: pH 7.38 pCO_2 28 mm Hg pO_2 65 mm Hg Bicarb 18 mmol/L Lactate: 2.0 mmol/L Troponin: pending POCUS: Lung: >3 B-lines per field Cardiac: Dilated RV	1. Anesthesiologist ☐ Considers massive PE as the leading differential (although peripartum cardiomyopathy should also be highly considered) ☐ Places arterial line ☐ Administers pressor as needed ☐ Informs the OB team that the patient cannot go to CT (9 cm + hemodynamically unstable) 2. OB team decides to proceed with cesarean delivery in the cardiac OR 3. OB Anesthesiology team requests co-management with the cardiac anesthesiology team			
Patient arrives in OR	Patient in acute distress HR 140 bpm BP 88/49 mm Hg SpO_2 93% (10 L/min) Resp 30/min Temp 37.0^oC	1. Anesthesiologist: ☐ Performs left uterine displacement ☐ Places defibrillator pads on patient ☐ Start pressor infusion(s) if not already started (epinephrine, vasopressin etc.) -> **results in moderate improvement in hemodynamics** ☐ Places central access ☐ Prepares for general anesthesia (patient will not tolerate sympathectomy associated with dosing the epidural for surgical anesthesia – DO NOT PULL EPIDURAL (potential need for tPA)			

		☐ (Cardiac anesthesiologist) cannulates for ECMO prior to induction of anesthesia (incase ECMO needs to be initiated) ☐ Performs RSI (with a cardiac stable induction)			
Patient successfully intubated	HR 122 bpm BP 115/85 mm Hg SpO_2 99% (FiO_2 1.0) Resp 16/min Temp 36.8^oC TEE findings reflect TTE findings (RV strain)	1. Cardiac anesthesiologist: ☐ Performs TEE 2. Maintenance of anesthesia with sevoflurane <0.5 MAC + nitrous oxide			
Baby delivered Adequate uterine tone	HR 119 bpm BP 111/82 mm Hg SpO_2 99% (FiO_2 1.0) Resp 16/min Temp 37.0^oC	1. Anesthesiology team: ☐ Administers oxytocin ☐ Plans to transfer to IR (intubated + sedated) for pulmonary CTA for possible aspiration thrombectomy postoperatively vs. tPA ☐ Plans to initiate a heparin infusion after skin closure			
IR suite CTA reveals extensive bilateral PE	HR 130 bpm BP 109/78 mm Hg SpO_2 99% (FiO_2 1.0) Resp 16/min Temp 37.0^oC	1. On-going care by the cardiac anesthesiology team only 2. Update support person			

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 differential diagnosis of intrapartum hypoxia?

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

2. How would you rate your knowledge of signs and symptoms of pulmonary embolism?

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

3. How would you rate your knowledge of management for intrapartum pulmonary embolism?

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

4. How would you rate your overall confidence when confronted with intrapartum hypoxia and pulmonary embolism?

BEFORE THE SIMULATION							END OF SIMULATION						
1	2	3	4	5	6	7	1	2	3	4	5	6	7
Little/none						Knowledgeable	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. Lapinsky SE. Management of Acute Respiratory Failure in Pregnancy. Semin Respir Crit Care Med. 2017;38(2):201-207. doi: 10.1055/s-0037-1600909. PMID: 28561251.
2. American College of Obstetricians and Gynecologists' Committee on Practice Bulletins—Obstetrics. ACOG Practice Bulletin No. 196: Thromboembolism in Pregnancy. Obstet Gynecol. 2018;132(1):e1-e17. doi: 10.1097/AOG.0000000000002706. Erratum in: Obstet Gynecol. 2018 Oct;132(4):1068. PMID: 29939938.
3. Katz D, Beilin Y. Disorders of coagulation in pregnancy. Br J Anaesth. 2015;115 Suppl 2:ii75-88. doi: 10.1093/bja/aev374. PMID: 26658204.
4. Dado CD, Levinson AT, Bourjeily G. Pregnancy and Pulmonary Embolism. Clin Chest Med. 2018;39(3):525-537. doi: 10.1016/j.ccm.2018.04.007. PMID: 30122177; PMCID: PMC8018832.