Simulation Patient Design (September, 2021)
Case of (non-eclamptic) Seizure on Labor and Delivery

Authors: Emmarie Myers, MD, Jessica Sheeran, MD, University of Virginia, VA
Editors: Sonal Zambare, MD, Gillian Abir, MBChB

Introduction

Seizures are the most common neurologic complication in a pregnant patient, with an estimated incidence of 1.2% in the United States.[1] There are many etiologies of seizures which include epilepsy, metabolic derangements (e.g. hyperemesis gravidarum, metabolic diseases, hyponatremia, hypo/hyperglycemia), infectious/toxic processes, intracranial structural/ vascular abnormalities, psychogenic, and pregnancy-related (e.g. eclampsia). Most seizures during pregnancy occur in women with pre-existing epilepsy, and new-onset seizures are most commonly eclampsia.[2]

Epilepsy affects 0.5-1.0% of pregnant women and the majority (approximately 60%) will have no change in seizure frequency compared to pre-pregnancy or will remain seizure free, while an estimated 15-30% will experience an increase in seizure frequency.[1,2,3] Seizures are most likely to occur in the first trimester, or in the peripartum period with approximately 5% of epileptic women having a seizure in the peripartum period.[2] The increase in seizure frequency can be due to various etiologies that include: hormonal; physiologic (pain, stress, fatigue); metabolic (decreased oral intake, dehydration); pharmacologic (interruption/poor compliance in drug intake); pharmacokinetic (doses of antiepileptic drugs (AEDs) may need to be adjusted as hormonal changes, increased drug clearance, and volume expansion can alter free drug levels).[3] AEDs should be continued throughout labor to reduce the risk of triggering a seizure.

Any new-onset seizure should be treated as eclampsia until proven otherwise, and the patient should receive prophylaxis with magnesium sulfate (bolus dose and infusion) and antihypertensive drugs, if indicated. In patients with a known seizure disorder or a non-terminating seizure, benzodiazepines are the preferred treatment to terminate a seizure.

Seizures in pregnancy pose risks to the mother and fetus as sustained convulsions can lead to maternal hypoxia, lactic acidosis and uterine hypertonus causing a reduction in uteroplacental blood flow resulting in fetal bradycardia and hypoxemia (can lead to fetal demise).[1] Initial management involves maintaining a patent airway, maximizing maternal oxygenation and placental blood flow to break the hypertonus (in the left lateral decubitus position which will also decrease the aspiration risk). For other etiologies of hypertonus, terbutaline or nitroglycerine are commonly indicated. Typically, fetal heart rate changes normalize within 10-15 minutes of seizure termination, and prolonged abnormalities should raise concern for fetal anemia or placental abruption.[1] Seizures alone are not an indication for cesarean delivery (CD), however if CD is indicated, the seizure should be controlled and the patient stabilized prior to initiating surgery.

Educational Rationale: To teach team skills in early recognition and management of an obstetric patient who undergoes a non-eclamptic seizure (e.g. epileptic)

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*: Recognize the emergency management of seizures on Labor and delivery (L&D)
- *Patient care*: Describe management of epilepsy, including patient positioning, airway management, drugs to terminate the seizure and assess fetal well-being
- *Practice-based learning and improvement*: Identify equipment and skills necessary to recognize and manage an obstetric patient that has an epileptic seizure
- *Interpersonal and communication skills*: Designate a team leader and effectively communicate with L&D teams regarding urgency and status of the mother and fetus. Utilize closed-loop communication among all participants (specific role assignment).
- *Professionalism*: Demonstrate mutual respect for the expertise of other team members
- *Systems-based practice*: Ensure all resuscitation equipment including suction are set up in the LDR; Ambu bags are easily accessible; drugs are available; identify the location of the airway box and back-up airway equipment (e.g. video laryngoscope and fiberoptic scope).

Questions to ask after the scenario:
1. What is the differential diagnosis for a seizure in an obstetric patient?
2. How was the response during the crisis?
3. Did each team member have well-defined roles?
4. Were the steps that needed to be taken by the team clear?
5. Was all the necessary equipment available?
6. Were any barriers identified to care for this patient?
7. What is the treatment for a seizure in an obstetric patient?
8. What are potential complications during and after a seizure in an obstetric patient?
9. Who should intervene to secure the patient's airway?
10. When would the decision be made for an emergent CD?

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 fetal monitoring available (not currently on)
18 g IV in the hand with normal saline
Non-rebreather face mask and Ambu bag
Monitors: Pulse oximetry, blood pressure cuff, and EKG leads available
Benzodiazepine (e.g. midazolam)

Magnesium sulfate
Airway equipment (in airway box if available)

Simulation Scenario Set-up:
The case
Ms. Megan Myer is 37 years old (G2P1) at 34 weeks gestation admitted with a three day history of persistent vomiting and inability to maintain oral intake of food, fluid or medications in the setting of presumed (viral) gastroenteritis. She has a history of epilepsy for which she has been taking daily levetiracetam, and has been seizure-free for two years.
She was admitted to the antepartum service for intravenous hydration and observation and has just called out because she is not feeling right and is hearing loud noises.

Weight = 80.5 kg (177 lbs), height = 168 cm (5'6"), BMI = 28.5
Airway exam: Mallampati class 2, full ROM neck, normal mouth opening and thyromental distance

Simulation Pre-brief
- Read the scenario and instruct team members on their role during the simulation
- The learners take their places inside and outside of the labor room
- Simulation driver plays the patient
- Confederate plays the partner

Scenario Details

Trigger	Patient Condition	Action	Done	Time	Comments
Patient in L&D	Patient awake and responsive but complaining of intense nausea, dizziness + everything around her sounds 'loud' (when prompted) HR 95 bpm BP 117/85 mm Hg SpO$_2$ 97% (air) Resp 16/min Temp 37.1^{o}C FHR 130/min	1. L&D nurse performs initial patient evaluation + examination ☐ Call the OB to assess the patient ☐ Monitor vital signs (+ FHR) ☐ Send labs (CBC, CMP, type and screen, serum levetiracetam level) ☐ Initiate IV fluid bolus + continue maintenance			

During evaluation by the OB resident	Patient seizes (until a benzodiazepine is administered, or 4 minute pass)
	
	HR 145 bpm
	FHR 100/min
	
	NIBP/SpO$_2$/Resp (not able to assess during seizure)
		1. Call OB emergency (OB Rapid response)
		2. Notify the anesthesiology and OB teams (if not already)
		3. Place patient in left lateral decubitus position
		4. Continuous monitoring (EKG, NIBP q2 min, SpO$_2$)
		5. Anesthesiologist:
		  ☐ Administer oxygen (15 L/min) via non-rebreather facemask + support the airway (suction is set-up + advanced airway equipment is requested)
		  ☐ Prepare intubation drugs (while nurse or 2nd anesthesiologist manages the airway)
		  ☐ Request + administer midazolam 2 mg IV
		6. Discuss differential diagnosis + consider if magnesium is indicated (e.g. eclampsia vs. epilepsy)
		7. Consider additional labs (e.g. glucose, ammonia, cultures, toxicology)			

Confederate is worried and asks. 'Does the patient need to go to the OR for an emergency cesarean?'	Seizure continues Uterine hypertonus FHR 90/min	1. Administer 2nd dose of midazolam (2 mg IV) 2. Request phenytoin (as 2nd-line drug for status epilepticus) 3. Request + administer terbutaline for uterine hypertonus 4. Request OR preparation in case of surgical intervention (or for intensive monitoring)			

Uterine hypertonus resolves Confederate asks again asks, 'Does she need to go to the OR for an emergency cesarean?'	Seizure terminates (post-ictal for approx. 3 min) Patient in left lateral decubitus position HR 130/min BP 146/80 mm Hg SaO_2 93-95% (oxygen 15 L/min) Resp 20/min FHR 80/min with minimal variability	1. Discussion of need for emergency CD due to FHR tracing 2. Continue oxygen administration + prepare for advanced airway support 3. Optimize maternal hemodynamics: BP, oxygenation, ventilation 4. Consider other etiologies for FHR abnormalities (e.g. fetal anemia or abruption 5. Send ABG if respiratory status does not improve			
FHR tracing improves	Patient subdued (post-ictal) HR 108/min BP 128/68 mm Hg SaO_2 96% (oxygen 15 L/min) Resp 18/min ABG results: pH 7.45 $PaCO_2$ 64 mm Hg PaO_2 100 mm Hg HCO_3 35 mEq/L BE 10 Cl 81 mmol/L K 2.9 mmol/L FHR 132/min	1. Continue IV fluid infusion 2. Replete serum potassium 3. Initiate IV levetiracetam (Keppra) loading dose + resume usual PO dose when able			
Patient stabilizes FHR stable	Patient stabilizes, is alert, and asks 'what happened?'	1. Re-evaluate discussion for prioritization of need for emergency CD vs. emergency head CT vs. resuscitation with IV fluids 2. OB + anesthesiologist to discuss patient disposition 3. Discuss events with patient + support person(s)			

Appendix 1

<center>

Learner Knowledge Assessment
Labor and Delivery Multidisciplinary Team Simulation

</center>

Name of simulation: _____   Date: _____

OB   Nursing   Anesthesiology

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 for seizures during pregnancy?

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 treatment options for epilepsy during pregnancy?

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 the closet location of emergency airway equipment to the labor rooms?

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 medical management of a seizure?

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 knowledge of delivery options after a seizure?

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. Bollig KJ, Jackson DL. Seizures in Pregnancy. Obstet Gynecol Clin North Am. 2018;45(2):349-367
2. Beach RL, Kaplan PW. Seizures in pregnancy: diagnosis and management. Int Rev Neurobiol. 2008;83:259-71
3. Harden C, Lu C. Epilepsy in Pregnancy. Neurol Clin. 2019;37(1):53-62