

Simulation Patient Design (May, 2021) Anaphylaxis in an obstetric patient in Labor and delivery

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Introduction

The estimated incidence of anaphylaxis in a pregnant patient in the United Kingdom (between 2012-2015) is 1.6/100,000 pregnancies, whereas in the United States (between 2004-2014) the incidence is 3.8/100,000 hospitalizations while pregnant.^{1,2}

Risk factors that increase the odds of anaphylaxis during pregnancy include: cesarean delivery (CD) (adjusted OR [aOR], 4.19; 95% CI, 3.28-5.35) compared with non-CD; history of an allergic reaction (aOR, 4.05; 95% CI, 2.64-6.23) compared with no history; and a black race (aOR, 1.57; 95% CI, 1.15-2.15) and other race (aOR, 1.69; 95% CI, 1.08-2.63) compared with white race.¹

Etiologies for anaphylaxis during pregnancy are similar for pregnant and non-pregnant adults (e.g. drugs and stinging insects), however during labor and delivery, common etiologies include β -lactam antibiotics (e.g. prophylactic penicillin or cephalosporin to prevent neonatal group-B streptococcal (GBS) infection or maternal infection after a CD), latex, and other agents used in medical and perioperative settings (e.g. other antibiotics, oxytocin, neuromuscular blockers, epidural medications, general anesthetics, latex and chlorhexidine).³

The higher incidence in the United States compared with the United Kingdom could be attributable to misclassification, routine screening for GBS vs. a risk-based prevention strategy, and a higher rate of CD.³ Although rare, anaphylaxis during pregnancy can be associated with significant adverse outcomes for both mother and the fetus and standard treatment protocols should be followed, with the addition of optimizing maternal position to ensure placental perfusion (e.g. left lateral position).⁴ To enable efficient and coordinated care, it is useful to use cognitive aids in emergency situations especially when dealing with rare events.^{5,6}

Historically, it has been understood that there is approximately a 10% risk of cross-reactivity of cephalosporins in patients with a penicillin allergy, however it is approximately 1% when using first-generation cephalosporins or cephalosporins with similar R1 side chains.⁷ Third- or fourth-generation cephalosporins are associated with minimal risk of cross-reactivity.⁷

In patients with a history of a systemic allergic reaction, confirming the etiology prior to pregnancy with instructions for avoidance is advisable as allergy testing during pregnancy is best avoided.³

Educational Rationale: This multidisciplinary team simulation is designed to give learners the opportunity to apply their knowledge of team skills in managing an anaphylactic reaction in pregnancy, and it is designed to be performed in-situ in Labor and delivery (L&D) to enable identification of system deficiencies, improve knowledge gaps, and optimize patient safety

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:* Recognize signs, symptoms and specific management of anaphylaxis
- *Patient care:* Apply a systematic approach to assessing and treating a patient with anaphylaxis, stop the offending drug/exposure, use emergency drugs and equipment as indicated to optimize care of the patient and fetus
- *Practice-based learning and improvement:* Demonstrate the appropriate use of drugs, route of administration and dosing when managing anaphylaxis in pregnancy
- *Interpersonal and communication skills:* Call for help, communicate with team members (e.g. anesthesiologists, obstetricians, and nurses) using SBAR and closed-loop communication techniques
- *Professionalism:* Demonstrate mutual respect for the expertise of other team members, and discuss the importance of leadership and communication among team members
- *Systems-based practice:* Identify existing barriers within the system (such as shortages of equipment or personnel) that need change in order to improve patient outcomes

Questions to ask after the scenario (in the debrief):

1. What are differential diagnoses for anaphylaxis during pregnancy?
2. How was the response to the situation managed?
3. Did each team member have a well-defined role?
4. Was it clear which steps needed to be taken by the team?
5. Was all necessary equipment available?
6. Were any barriers identified when caring for this patient?
7. Were treatment options readily available (e.g. drugs, airway equipment)?
8. What factors would lead you to intervene with this patient’s airway?
9. What factors might influence the decision 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:

- Pregnant mannequin (with the person speaking not visible to the participants), or an actor
- IV cannula and IV fluid infusion (with tubing that contains a port for drug administration)
- IV infusion of ampicillin
- Epidural infusion attached to an epidural catheter
- Other equipment which is normally available on L&D (which if found to be unavailable during the simulation can be identified as a system issue)

Time Duration

Set-up	20 min
Brief/consent	10 min
Orientation	5 min
Simulation	10 min
Debrief	15-20 min

Simulation Scenario set up:

The case

Ms. Williams is a 26 year-old G1P0 patient who is 38 weeks pregnant and was admitted to L&D a few hours ago in spontaneous labor. She is healthy with no past medical history and no known allergies. Routine screening showed she is GBS positive and an intravenous ampicillin infusion was started 5 minutes ago. A labor epidural was placed approximately 5 hours ago which has just been bolused by the anesthesiologist as she was complaining of pain 5/10, and she is now comfortable.

Weight 80.5 kg (177 lbs), height 168 cm (5'5"), BMI 29.5

Airway exam: Mallampati class 2, full ROM neck, normal mouth opening and thyromental distance

Simulation pre-brief

- Participants to familiarize themselves with the mannequin and the surroundings prior to the start
- Read the scenario to the bedside nurse only (other participants should not know the scenario topic prior to the simulation)
- Participants to take their places inside and outside of the labor room (one nurse at the bedside with the rest of the team outside the room)
- Confederate plays the patient's support person

Scenario details

Trigger	Patient condition	Action	Done	Time	Comment
Base line in the labor room Ampicillin infusion running Epidural infusion running	Awake and responsive HR 90 bpm BP 110/85 mm Hg RR 14/min SpO ₂ 98% on RA FHR 130 bpm	1. Nurse performs routine observation of the patient			
Phase I	Patient complains that she feels sweaty and lightheaded HR 115 bpm BP 85/45 mm Hg RR 18/min SpO ₂ 90% on air Temp 37.2°C FHR 140 bpm	1. Nurse calls for help - Additional nurse called - OB called - Anesthesiologist called 2. Nurse gives SBAR to team members 3. Position patient in left lateral position 4. Assess airway, breathing and circulation 5. Administer oxygen 10 L/min via a non-rebreather facemask 6. Administer rapid IV fluid bolus (1 L) 7. Place 2 nd large-bore IV 8. Increase the frequency of the BP measurement to q1-2 min			

Phase II	<p>Patient complains of chest tightness and general itchiness</p> <p>HR 125/min BP 60/40 mm Hg RR 22/min SpO₂ 93% on oxygen 10 L/min Temp 37.4°C FHR 140 bpm</p>	<ol style="list-style-type: none"> 1. Team discusses differential diagnoses 2. Anesthesiologist uses closed-loop communication to <ul style="list-style-type: none"> - Stop antibiotic infusion - Stop epidural infusion - Remove other potential allergens (e.g. latex) 3. Increase oxygen administration to 15 L/min 4. Repeat rapid IV fluid bolus (1 L) 5. Administer epinephrine 10 mcg IV bolus 6. Send labs for tryptase, CBC, BMP, ABG, glucose 			
Phase III	<p>Patient complains of difficulty breathing and speaking</p> <p>HR 125 bpm BP 75/40 mm Hg RR 20/min SpO₂ 90% on oxygen 15 L/min FHR 145 bpm</p>	<ol style="list-style-type: none"> 1. Reassess airway for angioedema 2. Team discusses need to move to the OR 3. Administer repeat dose of epinephrine 10 – 100 mcg IV bolus 4. Consider epinephrine infusion (0.01-0.1 mcg/kg/min) 5. Consider arterial line 6. Administer: <ul style="list-style-type: none"> - Bronchodilator: Albuterol inhaler 2 puffs (180 mcg) - H1 blocker: Diphenhydramine 50 mg IV bolus - H2 blocker: Ranitidine 50 mg IV bolus - Steroids: Hydrocortisone 100 mg IV bolus 			
Recovery	<p>Patient's breathing improves</p> <p>HR 120 bpm BP 100/75 mm Hg RR 18/min SpO₂ 100% on oxygen 15 L/min FHR 140 bpm</p>	<ol style="list-style-type: none"> 1. Titrate oxygen flow rate down in response to oxygen saturation 2. Consider ICU consult 3. Team to discuss delivery planning – continue with plan for vaginal delivery? 4. Team to discuss most likely etiology for anaphylaxis and choose alternative antibiotic prophylaxis (instead of ampicillin) 5. Team member to explain to the patient and support person the course of events and the plan for delivery 6. Team debrief 7. Discuss system issues (if any) 			

Follow-up		<ol style="list-style-type: none">1. Obtain tryptase result2. Refer to immunology3. Document appropriate allergy status in the medical record			
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Appendix 1

Obstetric Interdisciplinary Team Simulation

Name of simulation: _____

Date: _____

OB Nursing Anes Faculty/Fellow/Resident/Student/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.

1. How would you rate your ability to recognize signs and symptoms of anaphylaxis in a pregnant patient?

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 ability as a team member to formulate/execute a plan to manage anaphylaxis in a pregnant patient?

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 ability to determine the dose and route of administration of epinephrine in a pregnant patient with anaphylaxis?

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 ability to access appropriate medication and emergency equipment to manage such a pregnant patient with anaphylaxis in L&D?

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	

5. How would you rate your ability to use SBAR and closed-loop communication with your team members during an obstetric emergency?

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	

Any additional comments/insights on what you have/have not learnt:

Appendix 2

SIMULATION ACTIVITY EVALUATION FORM

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 simulation	1	2	3	4	5	N/A
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PHYSICAL SPACE

Realism of the simulation space	1	2	3	4	5	N/A
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EQUIPMENT

Satisfaction with the mannequin	1	2	3	4	5	N/A
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SCENARIOS

Realism of the scenario	1	2	3	4	5	N/A
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Ability of the scenario to test <i>technical</i> skills	1	2	3	4	5	N/A
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Ability of the scenario to test <i>behavioral</i> skills	1	2	3	4	5	N/A
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Overall quality of the debriefing	1	2	3	4	5	N/A
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DID YOU FIND THIS USEFUL?

To improve your clinical practice?	1	2	3	4	5	N/A
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To improve your teamwork skills?	1	2	3	4	5	N/A
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To improve your VERBAL communication?	1	2	3	4	5	N/A
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To improve your NONVERBAL communication?	1	2	3	4	5	N/A
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FACULTY

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

References:

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