

Simulation Patient Design (February, 2022) Case of Acute Transfusion Reaction

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Introduction

The incidence of postpartum hemorrhage (PPH) is approximately 3% of all deliveries, and primary PPH is the most common reason for blood transfusion with approximately one-third of these patients requiring blood products.¹ Other indications for a blood transfusion during pregnancy include anemia, sickle cell disease, thalassemia, trauma, or antepartum hemorrhage (e.g. missed abortion, ectopic pregnancy, abruption, or placenta previa). It is important for the obstetric care team to be aware of signs and symptoms of a transfusion reaction (which is any adverse event associated with transfusion of blood components), risk factors and incidence, as well as its management and work-up.

The reported incidence of a transfusion reaction (TR) during pregnancy is 0.8% of women transfused with blood product, an odds ratio of 2.0 when compared to non-pregnant women.² Risk factors for a TR include preeclampsia, induced labor, and prematurity.²

TRs can be classified by etiology as immunologic or nonimmunologic, hemolytic or nonhemolytic, or by acuity as acute or delayed.^{2,3} Reactions include sepsis, urticarial and anaphylaxis, as well as transfusion-related acute lung injury (TRALI) and transfusion-associated circulatory overload (TACO). TACO is the most common serious TR with an incidence of 1%.⁴ TRALI has been identified in 0.08% of transfusions, while anaphylaxis and hypotensive reactions were found in 0.02% of episodes of transfusion.⁴ Febrile non-hemolytic reactions have a reported incidence of 0.62% and minor allergic reaction noted in 0.3%. Potentially fatal TRs include TACO, TRALI, acute hemolytic transfusion reaction (AHTR), sepsis and anaphylaxis.⁵

Signs and symptoms of a TR include fever, chills, chest pain, back pain, hemoglobinuria, and coagulopathy. Monitoring of vital signs is required before, during, and immediately after administration of blood products. It is important to recognize that the initial sign and symptoms of a TR may not distinguish between a benign versus a potentially fatal reaction, therefore all TRs should be considered serious and evaluated accordingly until proven otherwise.⁵

Action steps when a transfusion reaction is suspected⁵ (also see flowchart in Ref #5):

- 1) Immediately stop the transfusion
- 2) Activate institutional emergency protocols if the patient is unstable, and call for additional help
- 3) Monitor vital signs and provide necessary hemodynamic support
- 4) Do not flush the IV line through which blood products were transfused, place a new IV line for resuscitation
- 5) Repeat all clerical/identity checks and ensure the correct products were administered to the correct patient
- 6) Notify blood bank of the possible TR and send the product unit and the IV tubing to the blood bank for further testing, along with a fresh blood (for repeat ABO testing and antibody screening, hemolysis, direct antiglobulin test) and urine sample

Educational Rationale: To teach team skills in recognizing and managing acute TRs in the obstetric patient

Target Audiences: OB anesthesiology team, OB team, OB nursing

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:* Recall specific signs, symptoms, and treatment of a TR
- *Patient care:* Recognize actions required to mitigate risk and appropriately treat TRs
- *Practice-based learning and improvement:* Identify clinical signs of a TR and demonstrate appropriate cessation of transfusion with pharmacologic support when required
- *Interpersonal and communication skills:* Recognize the need for additional help, and organize and direct the team of healthcare professionals
- *Professionalism:* Value the input of physician and nursing colleagues in obstetrics
- *Systems-based practice:* Examine any institutional system issues in the prevention and treatment of TRs, and propose improvements for patient safety

Questions to ask after the scenario:

- 1) What are the signs and symptoms of a TR?
- 2) What are the types of TRs?
- 3) What is the most common type of TR?
- 4) When would you intubate a patient with a TR?
- 5) Would a TR necessitate an emergent cesarean delivery (CD)?
- 6) Did all members of the team have a defined role?
- 7) Were any system-based barriers identified?

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

- Pregnant mannequin or actor
- IV infusion of blood product + IV port for drug administration
- Epidural catheter with infusion
- Standard labor and delivery room (LDR) setup

Simulation Scenario Set-up:

The case

Ms. Karen White is 32 year-old, G2P1 at 40 weeks and 1-day gestation who presented in spontaneous labor. She has a history of a CD 2 years ago for fetal bradycardia, and requested a trial of labor after CD (TOLAC). She has no other past medical history. She had an epidural placed 2 hours ago and has just delivered vaginally and the QBL is 450 mL.

Weight: 56 kg (123 lbs.) Height: 153 cm (5'0") BMI: 24

Airway exam: Mallampati II with full ROM, adequate oral opening and thyromental distance, mandibular protrusion test class A

Baseline labs: Hct 30%, Hb 10 g/dL, Plt 200 x10⁹/L, Type/Screen A positive with negative antibody screen

Simulation Pre-brief

- Participants will familiarize themselves with the location of standard items in the LDR/OR being used for simulation
- All participants will read the case
- Participants take their place in the OR (obstetrician, anesthesiologist, circulating nurse)

Scenario Details

Trigger	Patient Condition	Action	Done	Time	Comments
<p>Vaginal bleeding</p> <p>OB team + anesthesiology team at bedside</p> <p>Epidural infusion running</p>	<p>Patient is awake + comfortable</p> <p>HR 90 bpm BP 110/70 mm Hg SpO₂ 99% (NC) Resp 16/min Temp 37.1°C</p>	<ol style="list-style-type: none"> 1. Bedside nurse calls the anesthesiologist to the bedside 2. Anesthesiologist assesses the status of the patient <ul style="list-style-type: none"> <input type="checkbox"/> Assesses function of epidural catheter (in case need to convert to surgical anesthesia) <input type="checkbox"/> Continue oxytocin infusion <input type="checkbox"/> Review vital signs <input type="checkbox"/> Place additional large bore PIV + send labs <input type="checkbox"/> Ask nurse for QBL <input type="checkbox"/> IV fluid resuscitation with 500 – 1000 mL bolus of LR <input type="checkbox"/> Communicate with OB regarding bleeding status + uterine tone 			
<p>OB states poor uterine tone with significant bleeding + clots noted</p> <p>QBL 1300 mL</p>	<p>Stat Lab results: Hb 10.2 g/dL Plt 160 x10⁹/L INR 1.0 Fib 340 mg/dL</p> <p>HR 110 bpm BP 90/65 mm Hg SpO₂ 98% (NC) Resp 20/min Temp 36.9°C</p>	<ol style="list-style-type: none"> 1. OB team requests uterotonic drugs <ul style="list-style-type: none"> <input type="checkbox"/> OB team performs bimanual massage <input type="checkbox"/> Bolus 3 units of oxytocin IV + increase infusion rate <input type="checkbox"/> Administer methylergonovine 0.2 mg IM 2. Acknowledge PPH <ul style="list-style-type: none"> <input type="checkbox"/> Nurse to contact blood bank for MTP <input type="checkbox"/> Increase fluid rate (pressurize bags) 			

<p>OB reports uterine tone still poor with continued vaginal bleeding</p> <p>Patient hemodynamics deteriorating</p> <p>QBL 1800 mL</p>	<p>Awake + oriented, nauseous, vomiting</p> <p>HR 130 bpm BP 88/50 mm Hg SpO₂ 97% (NC) Resp 20/min Temp 36.7°C</p>	<ol style="list-style-type: none"> MTP in room <ul style="list-style-type: none"> <input type="checkbox"/> Nurse to check units with anesthesiologist Administer second 2nd line uterotonic drug (carboprost 0.25 mg IM) Discuss with OB team need for transfusion Administer tranexamic acid 1 g IV 			
<p>OB reports uterine tone improving</p> <p>Patient hemodynamically unstable</p> <p>QBL 2000 mL</p>	<p>Awake + oriented, anxious, nauseous, pale</p> <p>HR 150 bpm BP 70/50 mm Hg SpO₂ 95% (NC) Resp 25/min Temp 36.5°C</p>	<ol style="list-style-type: none"> Start PRBC transfusion (pressurized, warmed) Communicate with OB regarding status of hemorrhage Monitor vitals during transfusion 			
<p>OB reports uterine tone has improved</p> <p>1st unit PRBC is complete</p> <p>Temperature has increased</p>	<p>Patient awake + oriented; complains of chills</p> <p>HR 100 bpm BP 102/60 mm Hg SpO₂ 98% (NC) Resp 20/min Temp 39.0°C</p>	<ol style="list-style-type: none"> Stop transfusion Assess for any other symptoms (e.g. chest pain, angioedema, hives, respiratory distress, hypotension, etc.) Communicate with OB regarding suspicion for acute transfusion reaction Recheck unit of blood with nurse Inform blood bank of transfusion reaction Initiate workup for acute hemolytic transfusion reaction (AHTR) <ul style="list-style-type: none"> <input type="checkbox"/> CBC, PT/INR, PTT, fibrinogen, thromboelastography, direct antiglobulin test (DAT) <input type="checkbox"/> Assess color + volume of urine 			
<p>Patient's fever is trending down + chills are resolving</p>	<p>HR 95 bpm BP 110/60 mm Hg SpO₂ 98% (NC) Temp 37.5°C</p>	<ol style="list-style-type: none"> Discuss significance of lab results with OB Discuss with blood bank regarding work-up 			

	<p>Lab results (from AHTR w/u): Hb 8.1 g/dL Plt 90 x10⁹/L INR 1.0 Fib 260 mg/dL DAT and thromboelastogram pending</p> <p>Urine is pink</p>	<ol style="list-style-type: none"> 3. State likely diagnosis is acute febrile non-hemolytic reaction (AFNHR) <ul style="list-style-type: none"> <input type="checkbox"/> Acknowledge this is a diagnosis of exclusion 4. Continue to monitor in LDR for signs + symptoms of a more serious transfusion reaction <ul style="list-style-type: none"> <input type="checkbox"/> Follow-up pending lab results 5. Update patient and family 			
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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 acute transfusion reactions?

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 differential diagnoses of acute transfusion reactions?

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 signs and symptoms of acute transfusion reactions?

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 knowledge of management of an acute transfusion reaction?

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 overall confidence if confronted with an acute transfusion reaction?

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
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PHYSICAL SPACE

Realism of the simulator 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 scenarios	1	2	3	4	5	N/A
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Ability of the scenarios to test technical skills	1	2	3	4	5	N/A
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Ability of the scenarios to test behavioral skills	1	2	3	4	5	N/A
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Overall quality of the debriefings	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/SUGGESTIONS:

References:

1. Reale SC, et al. Trends in Postpartum hemorrhage in the United States from 2010 to 2014. *Anesth Analg.* 2020;130(5):e119-e122 doi:10.1213/ANE.0000000000004424
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