

Simulation Patient Design (March, 2022) Case of Uterine Rupture

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Introduction

Uterine rupture is complete division of all three layers of the uterus (endometrium, myometrium and perimetrium), compared with uterine dehiscence which is incomplete division that does not penetrate all three layers. Uterine rupture has an incidence 1:5000-7000 births and can cause significant morbidity and mortality to the mother and neonate.^{1,2} The majority of uterine ruptures occur in pregnant women, although they have been reported in non-pregnant women when the uterus is exposed to trauma, infection, or cancer.³ The rate of uterine rupture in a patient undergoing a trial of labor after cesarean (TOLAC) with a history of one cesarean delivery (CD) is approximately 1%, compared with 3.9% for those with ≥ 2 previous CDs. The uterine rupture rate depends on the type and location of the previous uterine incision, and rates are highest (4-9%) with a previous classical or T-shaped incision versus low-vertical incisions (1-7%).⁴ Trial of labor after myomectomy is associated with a 0.47% risk of uterine rupture.⁵

Risk factors for uterine rupture include:

- With a scarred uterus: Previous myomectomy; previous CD; previous rupture, trauma, injury from instrumentation during an abortion
- With a non-scarred uterus: Trauma (e.g. fall, assault, motor vehicle accident, instrumental delivery); weakness (e.g. Ehlers-Danlos and Loeys-Dietz syndromes); prolonged induction or augmentation of labor with oxytocin and prostaglandin; uterine overstretching (e.g. macrosomia, polyhydramnios, multiple gestation and multiparity), malpresentation, obstructed labor

Classic symptoms (but can be absent) for uterine rupture include a non-reassuring fetal heart trace (NRFHT), acute onset abdominal pain, vaginal bleeding, and a change in the contraction pattern on tocodynamometry.⁶ Other signs include hypotension (may occur late), expulsion or protrusion of the fetus, placenta, or both into the abdominal cavity, cessation of uterine contractions, hematuria and loss of station. NRFHT is the most reliable and sensitive clinical sign of uterine rupture, and breakthrough pain requiring frequent dosing of neuraxial labor analgesia may indicate an impending/evolving uterine rupture.⁷

Initial treatment involves an *emergent CD* (with or without an exploratory laparotomy) most commonly performed with general anesthesia (even if the patient has an epidural in-situ) due to the emergent status, and surgical options include uterine repair, uterine artery ligation and cesarean hysterectomy.⁸ Uterine dehiscence in a term pregnancy is often managed by CD, with expectant management shown to be successful in the preterm period.⁹

Emergency peripartum hysterectomy is associated with increased blood loss, worsening coagulopathy, and increased transfusion rates compared with planned peripartum hysterectomy.⁸ Due to the potential for uterine rupture and significant fetal and maternal morbidity the availability of providers in obstetrics, anesthesia, neonatology, as well as operating room personnel should be considered when planning a TOLAC.^{8,9} Awareness of the risk factors, as well as the signs and symptoms of uterine rupture, are essential for early diagnosis and prompt management.

Educational Rationale: To teach team skills in managing uterine rupture

Target Audiences: Nursing, OB, Anesthesiology, Neonatology, 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 clinical signs and symptoms of uterine rupture
- *Patient care:* Describe risk factors that predispose patients to uterine rupture and discuss management options available for uterine rupture
- *Practice-based learning and improvement:* Identify the setting, equipment and medications necessary to manage a patient with uterine rupture including sequelae such as NRFHT, massive obstetric hemorrhage and disseminated intravascular coagulation (DIC)
- *Interpersonal and communication skills:* Designate a team leader who will coordinate the team to provide optimal care to the patient and maintain ongoing communication about the clinical situation among the providers
- *Professionalism:* Demonstrate mutual respect for team members
- *Systems-based practice:* Ensure all resuscitation equipment, medications, and protocols are readily identifiable and available on the Labor and delivery unit including airway management, anesthesia induction/emergency medications, vascular access, massive transfusion; include identification of barriers within the hospital system such as staffing, medication and equipment/protocols

Questions to ask after the scenario:

- Did each team member have a well-defined role and was a team leader identified?
- Did team members communicate effectively?
- Was all the necessary equipment readily available?
- Were management steps clearly outlined by the care team?
- Were any barriers identified when caring for the patient and timely CD?
- What are the clinical signs and treatment steps of uterine rupture?
- What are the differential diagnoses of DIC in an obstetric patient?
- Were any system improvement opportunities identified during this simulation?
- Would cognitive aids have been useful in this scenario, if so, why?

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

L&D:

Maternal monitoring equipment

Fetal heart tracing/tocodynamometer

IV access equipment

OR:

Monitoring equipment: EKG, pulse oximeter, NIBP, ETCO₂, temperature

Airway equipment: Video laryngoscope, ETTs, oral airways, suction

Rapid infusion equipment/fluid warmer

Central/arterial vascular access
 Massive Transfusion Protocol products
 Uterotonic medications
 Bair hugger
 Crash cart with resuscitation drugs and drips

Simulation Scenario Set-up:

The case

Ms. Abby Dee, a 35-year-old multiparous patient (G3P2) at 39 weeks gestation has presented to the L&D Triage Unit with abdominal pain that woke her from her sleep, so her husband rushed her to hospital. She has a history of 2 CDs and this pregnancy has been uneventful, and she is otherwise healthy.

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 and operating room
- One nurse is at the bedside with the rest of the team outside
- Simulation driver plays the patient
- Confederate plays the patient’s partner

Scenario Details

Trigger	Patient Condition	Action	Done	Time	Comments
Patient in L&D triage with acute abdominal pain	Patient is awake, responsive but in a lot of pain HR 138 bpm BP 96/55 mm Hg SpO ₂ 97% (air) Resp 22/min Temp 37.1°C FHR: 146 bpm, reduced variability, non-reassuring progressing to prolonged + sustained fetal bradycardia (65 bpm)	1) L&D triage nurse performs initial patient evaluation + examination <ul style="list-style-type: none"> <input type="checkbox"/> Call the OB team to assess the patient’s acute abdominal pain <input type="checkbox"/> Place 18G IV + send labs (CBC, Coags, BMP, Type and screen) <input type="checkbox"/> Initiate IV fluid infusion <input type="checkbox"/> Administer IV analgesia 2) OB team assesses patient <ul style="list-style-type: none"> <input type="checkbox"/> Call emergency CD (prolonged fetal bradycardia) – no time for USS or fetal scalp electrode <input type="checkbox"/> Inform OR team <input type="checkbox"/> Inform the anesthesiology team 			

<p>Patient transferred to the OR</p>	<p>Supine (with left uterine displacement)</p> <p>HR 142 bpm BP 100/40 mm Hg SpO₂ 99% (FiO₂ 1.0) Temp 36.9°C</p> <p>FHR: 67 bpm</p>	<p>1) Prepare + plan for general anesthesia</p> <ul style="list-style-type: none"> <input type="checkbox"/> Administer sodium citrate <input type="checkbox"/> Perform RSI with video-laryngoscope <input type="checkbox"/> Confirm ETT placement <p>2) Anesthesia team also to</p> <ul style="list-style-type: none"> <input type="checkbox"/> Fluid resuscitate <input type="checkbox"/> Initiate phenylephrine infusion <input type="checkbox"/> Initiate active warming <input type="checkbox"/> Administer antibiotic 			
<p>OB team incises the abdomen + announces, "The patient's blood is watery. Please give some blood!"</p>	<p>Asleep + intubated</p> <p>HR 125 bpm BP 110/50 mm Hg SpO₂ 99% (FiO₂ 0.5) Temp 36.0°C</p> <p>Hb 9.2 g/dL Plts 100 x10⁹/L INR 1.3</p>	<p>1) Review lab results from initial presentation (1 h ago)</p> <p>2) Anticipate PPH</p> <ul style="list-style-type: none"> <input type="checkbox"/> Send repeat labs (include TEG, ABG) <input type="checkbox"/> Request blood products/ MTP (including cryoprecipitate) <input type="checkbox"/> Place 14/16 g PIVs <input type="checkbox"/> Prepare rapid infusor 			
<p>Delivery of fetus (requires resuscitation by NICU)</p> <p>OB describes uterine rupture, poor uterine tone + brisk bleeding</p>	<p>Patient looks pale + diaphoretic</p> <p>HR 129 bpm BP 82/45 mm Hg SpO₂ 98% (FiO₂: 0.5) Temp 36.2°C</p>	<p>1) Administer uterotonic drugs</p> <ul style="list-style-type: none"> <input type="checkbox"/> Initiate oxytocin infusion <input type="checkbox"/> Administer methylergonovine <input type="checkbox"/> Titrate sevoflurane/ nitrous oxide <p>2) MTP arrived</p> <ul style="list-style-type: none"> <input type="checkbox"/> Transfuse pRBCs + FFP <p>3) Transfer neonate to NICU</p>			
<p>OB reports that the uterine</p>	<p>Lab results (from OR):</p> <p>Hb 7.1 g/dL Plts 60 x10⁹/L</p>	<p>1) Administer second 2nd-line uterotonic drug (e.g. carboprost)</p>			

<p>tone is still poor with diffuse oozing from surgical field</p> <p>EBL 2.5 L</p>	<p>INR 2.5 Fib 70 mg/dL</p>	<ol style="list-style-type: none"> 2) Transfuse Plts + cryoprecipitate (or fibrinogen concentrate) 3) Consider manual compression of aorta and uterine artery ligation 4) Place arterial line 5) Administer vasopressors as indicated 6) Administer tranexamic acid 1g IV 7) Replete calcium 8) Administer repeat antibiotic dose 			
<p>OB team decides to perform hysterectomy</p> <p>EBL 4.0 L</p>	<p>HR 138 bpm BP 78/45 mm Hg SpO₂ 99% (Fio₂: 1) Temp 35.8°C</p> <p>Repeat lab results (from earlier in OR): Hb 6.2 g/dL Plts 75 x10⁹/L INR 1.8 Fib 140 mg/dL</p>	<ol style="list-style-type: none"> 1) OB + anesthesia teams discuss further management <ul style="list-style-type: none"> <input type="checkbox"/> Consider consulting Gyn-Onc/trauma/vascular surgeons/urology for surgical assistance <input type="checkbox"/> Consult with ICU for postoperative admission 2) Continue blood transfusion as needed 3) Vasopressors continued as indicated 4) Replete calcium 			
<p>Surgery is complete</p>	<p>Vital signs stable, still on pressors</p> <p>HR 72 bpm BP 112/72 mm Hg SpO₂ 98% (intubated) Temp 36.9° C</p>	<ol style="list-style-type: none"> 1) Send repeat labs 2) Transfer patient to ICU (intubated) + handoff 3) Update family 			

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 ability to identify risk factors for uterine rupture?

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 to discuss differential diagnoses of uterine rupture?

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 describe the signs and symptoms of uterine rupture?

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 understand delivery planning for uterine rupture and TOLAC?

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 when confronted with uterine rupture involving massive obstetric hemorrhage and coagulopathy?

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:

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