

SIMULATION CASE TITLE: Pregnant woman in a motor vehicle collision with open tibia/fibula fracture

LEARNER AUDIENCE: EM residents, EM attendings, trauma residents, trauma physician assistants, trauma attendings, EM nursing

PATIENT NAME: Carry Fortoo

PATIENT AGE: 34 year-old female

CHIEF COMPLAINT: Chest pain

PHYSICAL SETTING: 34 year-old pregnant woman at 28 weeks brought in by ambulance after moderate speed motor vehicle collision (MVC). Patient was the restrained driver that was T-boned on the driver's side, + airbag deployment, prolonged extrication. No loss of consciousness. Patient complains of pain in her chest and obvious deformity of left lower leg.

Brief narrative description of case

34 year-old woman, 28 weeks pregnant, in MVC with chest pain and left leg pain. Found to have open tibia/fibula fracture requiring emergent antibiotics. Given her mechanism of trauma, team must consider internal injuries/maternal-fetal blood interaction, ongoing monitoring and disposition.

Primary Learning Objectives

Learning:

1. Perform ATLS- Complete primary survey, secondary survey, adjunct studies, and stabilizing interventions in an organized and timely fashion
2. Review management of blunt trauma in pregnant patient
3. Review indications for Rhogam
4. Review management of open fractures and antibiotic choice for pregnant patients

Communication:

1. Become familiar with team roles and responsibilities
2. Employ closed loop communication
3. Practice using shared mental model

Critical Actions

- ☐ Team members wear PPE
- ☐ Expose patient starting at the chest to allow for vitals and IV placement
- ☐ Place on monitor
- ☐ Place large bore IVs
- ☐ Perform primary survey
- ☐ Obtain Chest X-ray and EFAST
- ☐ Perform secondary survey

	☐ Obtain type and cross ☐ Order Kleihauer-Betke test ☐ Consider indications for Rhogam ☐ Place patient in left lateral decubitus position ☐ Perform external vaginal exam for blood ☐ Order appropriate antibiotics for open fracture that are safe in pregnancy ☐ Discuss indication and risk/benefit of CT scans ☐ Consult OB/GYN
Learner Preparation or Prework	<i>None</i>
Simulation Moulage/equipment	<u>Moulage:</u> C-collar in place Fully clothed Ecchymosis over chest wall in driver's side seatbelt distribution Open left tibia/fibula with bone protruding, brought in with EMS orange splint on leg <u>Equipment:</u> Pregnant manikin or abdominal false pregnant belly Simulated antibiotics EMS splints and gauze

INITIAL PRESENTATION	
Overall Setting and Appearance	Scenario: In trauma bay Patient on stretcher, fully clothed
Trauma Activation level	Level 2
Activation level justification	High risk motor vehicle collision
Assigned sim team roles	EMS-gives team field information and vital signs The Patient- all cases utilize a manikin, but someone needs to be the voice of the patient Observer-ensures that team achieves critical actions and takes notes on team dynamics Debrief-er-leads post sim debrief on team communication, resuscitation logistics and medical management

EMS Report	34 year-old restrained driver involved in a moderate speed motor vehicle collision (MVC). Airbags were deployed. Patient was unable to get out of the car by herself, + prolonged extrication. There was no loss of consciousness (LOC). Patient complains of chest pain has an obvious injury to her leg so we splinted it		
EMS vital signs	HR 115, BP 110/75		
Past Medical/Surgical History	Medications/Allergies	Social History	Last meal
PMH: G1P0 LMP 28 weeks ago, can't remember the exact date PSH: none	Meds: none All: NKDA	Social: denies tobacco, alcohol or drugs	Breakfast this morning before leaving the house

Primary Survey	
Initial vital signs	HR 111, BP 110/75, SpO2 98% RA, RR 20
General	Gravid abdomen , patient is mildly anxious
Airway	Intact
Breathing	Equal bilateral breath sounds
Circulation	2 + distal pulses including dorsalis pedis and posterior tibialis
Disability	GCS 15, Alert, responding to questions
Exposure	No cervical/thoracic/lumbar spine tenderness
EFAST	Normal in all views (video # 1,2,3,5,11)

Secondary Survey	
General	No change
HEENT	PERLA, EOMI
Neck	Cervical collar in place, no cervical spine tenderness to palpation

Lungs	Equal bilateral breath sounds, no wheezing, no increased work of breathing
Cardiovascular	No murmurs, normal heart sounds, 2+ distal pulses
Abdomen	Soft, gravid abdomen with no tenderness
Pelvis/MSK	Stable pelvis, once splint taken off, obvious bone protruding from mid shin +TTP to left chest wall
Neurological	GCS 15, Alert, responding to questions, neurologically intact, sensation intact
Skin	Ecchymosis over chest wall in seatbelt pattern, open fracture to left lower leg
GU	Normal GU exam, no blood on external vaginal exam
Psychiatric	Mildly anxious

Imaging (see image bank)	
Chest X-ray	Left rib # 9 and 10 broken, non-displaced, no obvious hemothorax or pneumothorax (image #13)
Pelvis X-ray	Normal if done (image #2)
EFAST	Normal in all views, moving fetus is seen in suprapubic view (video # 1,2,3,5, 11)

INSTRUCTOR NOTES - CHANGES AND CASE BRANCH POINTS		
<i>This section should be a list with detailed description of each step than may happen during the case. If medications are given, what is the response? Do changes occur at certain time points? Should the nurse or other participant prompt the learners at given points? Should new actors or participants enter, and when? Are there specific things the patient will say or do at given times? There are a few examples given, but it is expected that most cases will have many more changes and potential branch points.</i>		
Intervention / Time point	Change in Case	Additional Information
Repeat vitals signs after examination	HR 115, BP 95/55, SpO2 98%	Team to recognize that patient is pregnant and should consider left lateral decubitus position
Antibiotics for open fracture		Team should discuss which antibiotics are appropriate and safe to give to pregnant patient with grade 2 open fracture

Consult OBGYN	Team should discuss Kleihauer-Betke test and need for Rh status Consider placental abruption	
Imaging	Team should discuss imaging options	Mother comes first. Team should proceed with CT scan given the mechanism of injury and chest pain with rib fractures, concerning for associated injuries.

Ideal Scenario Flow

Learners enter the room to find a patient fully clothed with cervical collar in place. As the team walks into the room roles should be assigned. Team leader and primary nurse should identify themselves clearly. All team members must don personal protective equipment (PPE). As the team approaches the patient, nurse should be putting the patient on the monitor and getting vital signs as examining residents begin the primary survey. Two large bore IVs are placed. Team initiates the primary survey and calculates GCS 15. Team acknowledges that the patient is pregnant with gravid abdomen. Team leader should recognize and share with team that since patient is pregnant, tachycardia may be normal physiologic change. However, given that she was in a motor vehicle collision, this tachycardia should be assumed to be secondary to bleeding until proven otherwise. Team completes EFAST at end of primary survey, which is normal. While completing the secondary survey, lower extremity splint is removed and open fracture becomes apparent. Team should discuss and administer appropriate antibiotics for pregnant patient with grade 2 open fracture. External vaginal exam shows no blood, but team should discuss that while external bleeding is not evident, internal bleeding may be. Team should send type and screen/cross as well as Kleihauer-Betke test since Rh-negative pregnant patients should receive a loading dose of 300-ug Rhogam, and wait for result of Kleihauer-Betke test to determine need for additional doses.

Team should discuss imaging options and safety. They should note that the mother comes first. Given her mechanism of injury, they should proceed with trauma scan. Team discusses need for ongoing monitoring. Case concludes with patient going to CT scan.

Anticipated Management Mistakes

Possible management errors or difficulties that are commonly encountered when using this simulation case.

1. Failure to recognize tachycardia as normal physiological change of pregnancy and initiate MTP
2. Failure to order antibiotics for open fracture that are safe during pregnancy
3. Failure to consider possible maternal-fetal blood interaction and not order Kleihauer-Betke test
4. Withhold imaging because of pregnancy

Debrief Points		Additional Information
Communication	Closed loop communication	Don't ask the room for things, ask people, especially for critical actions
	Shared mental model	Thinking out loud ensures plan clarity among team members If someone on the team is not sure about management options, talk about it out loud so that everyone can be on the same management page
	Role clarity	-Designate roles out loud, so everyone knows who is doing what. -Be sure to ask who the team leader is and who the primary nurse is. -When you arrive, introduce yourself. -Speak up if you can't complete the task asked of you.
Logistics	How to order Kleihauer-Betke test and Rhogam	Discuss process of ordering the test Rhogam comes from blood bank, some institutions require consent
Medical		

Medical management consideration in pregnancy	1. Do not deviate from established trauma guidelines- treat the mother first, this is the best way to treat the fetus 2. Do not withhold clinically indicated imaging a. ACOG recommendations state that up to 5 rad exposure to the fetus is not associated with an increased risk of fetal loss or birth defects - all trauma imaging falls below this threshold (CT Head <-.05 rad, CT chest <0.1 rad, Abd/Pelvis <2.6 rads b. Shield fetus whenever possible c. Consolidate scans and avoid repeat imaging when possible 3. Place patients in left lateral decubitus position when possible- this moves the gravid uterus off the inferior vena cava to increase venous return and cardiac output 4. Patients over 24 weeks gestation with major trauma need minimum of 24 hours of fetal cardiac monitoring, minor trauma- 4 hours 5. Rh-negative mothers should receive a loading dose of 300-ug Rhogam, send Kleihauer-Betke test to determine need for additional doses	https://litfl.com/trauma-and-pregnancy http://www.emdocs.net/resuscitation-of-the-pregnant-trauma-patient-pearls-pitfalls https://play.acast.com/s/coreempodcast/episode-34-0-trauma-in-pregnancy
Physiological changes of pregnancy	1. Cardiac output increases, and therefore tachycardia may be normal	

	Never assume it is until you've ruled out bleeding! 2. Minute ventilation increases due to increased tidal volumes and decreased FRC in a setting of gravid uterus; therefore, physiologic reserve is usually lower (pregnant patients can desaturate more quickly with minor insults, e.g., pulmonary contusions) 3. The diaphragm may become elevated as much as 4cm higher than usual -- this is an important consideration when placing a chest tube. Use 3rd intercostal space in 3rd trimester and 4th ICS in 2nd trimester 4. Pelvic ligaments have increasing laxity with advancing pregnancy and may result symphysis pubis diastasis, giving a false-positive physical exam for pelvic instability and widened joints on pelvic x-ray 5. Blood volume increases which can mask hypotension and tachycardia in hemorrhagic shock-- typically 1.5L of blood loss occurs before hypotension begins in pregnancy	
Open Fracture grades and treatment	Grade 1: <1 cm wound, Minimal soft tissue injury/contamination Simple fracture pattern Cefazolin 1gm IV is preferred Vancomycin 15mg/kg if severe beta lactam allergy Add flagyl 500mg if grossly contaminated w/soil/feces Grade 2: 1-10 cm wound WITHOUT major soft tissue,	Our patient is grade 3 due to exposed bone. All of these antibiotics except gentamicin are safe in pregnancy (all are pregnancy category B except gent is category D). If you have a pregnant patient with a grade 3 fracture with severe beta lactam allergy, give

	flaps, or avulsions Cefazolin 1gm IV is preferred Vancomycin 15mg/kg if severe beta lactam allergy Add flagyl 500mg IV if grossly contaminated w/soil/feces Grade 3: >10 cm wound OR any wound with exposed bone, arterial bleeding,extensive soft tissue injury, or complex and/or highly comminuted fracture pattern Ceftriaxone 2g IV is preferred If exposure to standing water/subway tracks: Zosyn 4.5g is preferred If severe beta lactam allergy: vanc 15mg/kg+ Gent 5mg/kg IBW If gross contamination w/soil or feces: Add flagyl 500mg IV	vanc/zosyn instead of vanc/gentamicin Otherwise, follow protocol as usual.