

SIMULATION CASE TITLE: Traumatic leg amputation, hemoperitoneum and hemorrhagic shock after being struck by a train

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

PATIENT NAME: Sansa Tremity

PATIENT AGE: 23 year-old male

CHIEF COMPLAINT: Left lower extremity pain

PHYSICAL SETTING: 23 year-old male brought in by ambulance after he fell onto the subway tracks and was struck by a train. Patient reports copious alcohol prior to the incident. He reports pain to left lower leg.

Brief narrative description of case	23 year-old male with history of alcohol abuse presents with obvious left lower extremity trauma/amputation after falling onto the subway tracks and being struck by a train. Team should recognize that EMS ace bandage is not controlling bleeding and should apply tourniquet, resuscitate bleeding with massive transfusion and consider tranexamic acid (TXA).
Primary Learning Objectives	<i>Learning:</i> <ol style="list-style-type: none">1. Perform ATLS- Complete primary survey, secondary survey, adjunct studies, and stabilizing interventions in an organized and timely fashion2. Practice resuscitation of a patient with hemorrhagic shock3. Complete ABCs in order, life before limb4. Recognize and manage extremity amputation by applying tourniquet to control bleeding5. Give antibiotics for open fracture <i>Communication:</i> <ol style="list-style-type: none">1. Become familiar with team roles and responsibilities2. Employ closed loop communication3. Practice using shared mental model
Critical Actions	<ul style="list-style-type: none"><input type="checkbox"/> Team members wear PPE<input type="checkbox"/> Expose patient starting at the chest to allow for vitals and IV placement<input type="checkbox"/> Place on monitor<input type="checkbox"/> Place large bore IVs<input type="checkbox"/> Perform primary survey<input type="checkbox"/> Apply tourniquet to left leg to control bleeding<input type="checkbox"/> Obtain CXR, PXR and EFAST

	<input type="checkbox"/> Perform secondary survey <input type="checkbox"/> Identify and treat hemorrhagic shock <input type="checkbox"/> Give prophylactic antibiotics
Learner Preparation or Prework	None
Simulation Moulage/equipment	<p><u>Moulage:</u> Left leg amputation, mid femur with active bleeding Ace bandage loosely applied to leg Abrasions/dirt all over from falling on the tracks</p> <p><u>Equipment:</u> Manikin C-collar in place Fully clothed Non-rebreather on face CAT Tourniquet Simulated uncrossed pRBC product/ MTP bag Simulated antibiotics</p>

INITIAL PRESENTATION	
Overall Setting and Appearance	Scenario: In trauma bay Patient on stretcher, fully clothed
Trauma Activation level	Level 1
Activation level justification	Leg amputation, hypotension
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- leads post sim debrief on team communication, resuscitation logistics and medical management
EMS report	23 year-old male with history of alcohol use disorder fell onto the subway tracks and was hit by a train.

	<p>Unclear loss of consciousness per bystanders, but the patient has been perseverating on pain in left leg.</p> <p>There is an obvious amputation to his left mid femur with active bleeding. We put an ace bandage to help control the bleeding.</p>		
EMS vital signs	HR 120, BP 90/60, SpO2 98% RA		
Past Medical/Surgical History	Medications/Allergies	Social History	Last meal
PMH: alcohol abuse PSH: denies	Meds: none All: no known drug allergies	Soc: alcohol abuse: binge drinker, -tobacco, + marijuana	Drinking all night

Primary Survey	
Initial vital signs	HR 111, BP 100/65, SpO2 98% RA, RR 20
General	Diaphoretic
Airway	Intact
Breathing	Equal bilateral breath sounds
Circulation	2 + distal pulses in upper extremities and right dorsal pedis/posterior tibialis, left leg with active bleeding from amputated limb
Disability	GCS 14 (eyes 4, motor 5, verbal 5- mildly confused)
Exposure	mid femur amputation of left leg
EFAST	+ fluid in right upper quadrant (video #7) All other views negative ((video #1,3,4,5,))

Secondary Survey- should be completed after intubation	
General	Mildly diaphoretic
HEENT	Mild abrasions and dirt on face
Neck	No stepoffs, non tender
Lungs	Equal bilateral breath sounds

Cardiovascular	Tachycardic, S1/S2, no chest wall crepitus or instability
Abdomen	Soft, diffuse tenderness
Pelvis/MSK	Stable pelvis, No c/t/l spine step-offs or tenderness + obvious amputation of left leg
Neurological	GCS 14 (eyes 4, motor 5, verbal 5- mildly confused)
Skin	Open wound with exposed bone mid femur
GU	Normal GU exam
Psychiatric	NA

Imaging (see image bank)	
CXR	Normal (image #1)
PXR	Normal (image #2)
EFAST	+ fluid in right upper quadrant (video #7) All other views negative ((video #1,3,4,5,))

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
Worsening hypotension during primary survey Team should apply tourniquet	HR 120, BP 85/45 , SpO2 98% RA	Vital signs do not improve despite tourniquet
Worsening vital signs	HR 130, BP 75/40 , SpO2 96% RA	If not already started, team should give blood product, activate massive transfusion protocol (MTP) and consider TXA
Once blood products are given, vital signs start to improve	HR 110, BP 90/43 , SpO2 96% RA	No change in primary survey or EFAST if these are repeated

Ideal Scenario Flow

Learners enter the room to find a patient fully clothed. 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 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.

While 2 large bore IVs are placed. Team initiates the primary survey while a team member starts to expose the patient. Team notices the amputated left leg, team leader reminds team to complete ABCs in order and address the amputated leg as part of “C” for circulation and source of life threatening blood loss. A tourniquet should be applied with controlled bleeding. Team should make note of tourniquet time. Team starts primary survey again to ensure nothing is missed. Blood pressure is noted to be low and blood transfusion is initiated. Initially, the blood pressure does not respond to blood products since so much blood has been lost.

Team completes EFAST, which shows free fluid in the right upper quadrant. As the team continues to resuscitate, the blood pressure gets better. Case concludes with the patient going to the operating room or CT scan.

Team should handoff tourniquet time to operating room team as well as how much blood was given.

Anticipated Management Mistakes

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

1. Focusing on extremity injury before assessing airway and breathing.
2. Failure to complete EFAST and identify fluid in RUQ
3. Failure to properly apply tourniquet
4. Failure to document tourniquet time
5. Delayed blood resuscitation
6. Failure to complete primary and secondary survey due to distracting limb injury

Debrief Points		Additional Information
Communication	Closed loop communication	Don't ask the room for things, ask people, especially for critical actions
	Role clarity	-Designate roles out loud, so everyone knows who is doing what.

		<ul style="list-style-type: none"> -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 not complete the task asked of you.
	Shared mental model	<ul style="list-style-type: none"> -Team leader and team should not be distracted by amputation -Discuss plan for tourniquet. -Communicate tourniquet time with nurse, OR team -Talk out loud so that everyone is on the same page -Summarize the case at key moments or pauses
Logistics	How to activate MTP	Discuss the process at your institution
Medical		
Mangled extremity phenomenon Do ABCs first, life over limb	<p>Significant traumatic amputations portend significant internal injuries that may be more immediately life-threatening</p> <p>Control hemorrhage & proceed with ATLS resuscitation as you would any trauma</p>	
Traumatic amputations	<p>Roughly 83,000 traumatic amputations in the U.S. yearly</p> <p>The majority of victims are men (age 15-40)</p> <p>Most common mechanisms: MVC (51%), industrial accidents</p>	<p><u>Ischemia time</u></p> <p>Irreversible muscle necrosis begins at 6 hours of ischemia</p> <p>Temperature & muscle amount in tissue predict tolerable ischemia time</p>

	<p>(19%), agricultural accidents (10%)</p> <p>Most common sites: partial hand amputation (1+ fingers), unilateral upper extremity</p>	<p>Digits: less muscle mass, tolerate more ischemia time</p> <p>Warm ischemia time: 8-12 hours</p> <p>Cool ischemia time: up to 24 hours</p> <p>Limbs: more muscle mass, tolerate less ischemia time</p> <p>Warm ischemia time: 4-6 hours</p> <p>Cold ischemia time: 10-12 hours</p> <p>Mechanism of Injury</p> <p>Guillotine amputations best chance of successful reimplantation</p> <p>Crush/Avulsion amputations have worse prognosis for limb salvage</p> <p>Co-morbidities</p> <p>Young, healthy patients have better chance of successful limb salvage (shocking!)</p> <p>Worse prognosis: smoking, diabetes, PVD, rheumatologic disease</p>
<p>Indication for tourniquet</p>	<p>Uncontrollable bleeding from a site amenable to proximal placement of a tourniquet</p> <p>Limb amputation or mangled extremity</p>	<p>https://www.ncbi.nlm.nih.gov/pubmed/29190257</p> <p>https://www.stopthebleed.org</p>

	<p>Exsanguinating wound associated with shock</p> <p>Life-threatening hemorrhage inadequately controlled with direct pressure, elevation and other hemostatic methods</p> <p><u>How to apply a tourniquet:</u></p> <p>Place the tourniquet as distal as possible, at least 5 cm proximal to the injury</p> <p>Do not place over joints</p> <p>Apply directly onto exposed skin</p> <p>Time of application should be recorded</p>	