ACEP Simulation Case Template

SIMULATION CASE TITLE: Diagnosing necrotizing fasciitis in a low resource ED
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PATIENT NAME: Adrian Singh
PATIENT AGE: 45
CHIEF COMPLAINT: Left lower leg rash

Brief narrative description of case *Include the presenting patient chief complaint and overall learner goals for this case*	45 year old male with history of DM arrives from private vehicle for left lower leg rash and pain that started last night. He appears in distress and is borderline hypotensive upon arrival. The goals for this case are to recognize the emergent nature of necrotizing fasciitis and the importance of using bedside POCUS in conjunction with the clinical history to obtain definitive treatment in the OR.
Primary Learning Objectives *What should the learners gain in terms of knowledge and skill from this case? Use action verbs and utilize Bloom's Taxonomy as a conceptual guide*	- Identify risk factors for necrotizing fasciitis - Resuscitate a hypotensive patient- large bore IVs, central venous access if needed, crystalloids, pRBC - Perform a bedside soft tissue US - Start board spectrum antibiotics including clindamycin/linezolid - Consult the appropriate service (General Surgery) in an expedited manner for definitive treatment
Critical Actions *List which steps the participants should take to successfully manage the simulated patient. These should be listed as concrete actions that are distinct from the overall learning objectives of the case.*	- IV - Monitor - Bedside soft tissue US of soft tissue - recognize necrotizing fasciitis - Fluid resuscitation - Start board spectrum antibiotics with clindamycin/linezolid - Consult General Surgery
Learner Preparation *What information should the learners be given prior to initiation of the case?*	45 year old male with history of diabetes arrives from private vehicle for left lower leg rash and pain that started last night.

Required Equipment *What equipment is necessary for the case?*	Ultrasound

INITIAL PRESENTATION			
Initial vital signs	HR: 120 BP: 90/60 RR: 22 O_2SAT: 98 T: 38.5^{o}C		
Overall Appearance *What do learners see when they first enter the room?*	Middle-aged man that appears ill and in significant distress. His left lower leg has a black t-shirt loosely tied at the calf		
Actors and roles in the room at case start *Who is present at the beginning and what is their role? Who may play them?*	EMS: Giving report Nurse: Taking report		
HPI *Please specify what info here and below must be asked vs what is volunteered by patient or other participants*	A 45-year-old male in his usual state of health sustained two parallel 3 cm superficial lacerations on his left lateral lower leg, just proximal to his ankle, last night when he dropped and shattered a glass cup. (volunteered) Noticed the lacerations became so painful that it woke up him from sleep (asked) Noticed redness, swelling, and warmth around the laceration that is spreading every time he looks at it (asked) States subjective fever and chills (asked) Tetanus shot is up to date (asked) No leg paresthesia, chest pain, sob, URI symptoms, or UTI symptoms (asked) Social History: Smoker- 1 pack per day, EtOH- denies, Illicit drug use- denies (asked)		
Past Medical/Surg History	**Medications**	**Allergies**	**Family History**
DM	Metformin	NKDA	DM
Physical Examination			
General	Appears ill and in significant distress.		
HEENT	Normal		

Neck	Normal
Lungs	Clear to auscultation, mild tachypnea
Cardiovascular	Tachycardic, regular rhythm, normal S1/S2
Abdomen	Abd soft, nontender, no bruising noted; no CVA ttp
Neurological	Normal
Skin	Left lateral lower leg has two parallel 3 cm superficial lacerations just proximal to his ankle. Skin surrounding the lacerations is erythematous, swollen, and warm to touch tracking to his distal knee, patient screams in pain with a light touch Skin appears tense with some areas of discoloration There is severe tenderness out of proportion to the physical findings. No crepitus
GU	Normal, good rectal tone
Psychiatric	Anxious

1) **SCENARIO STATES, MODIFIERS AND TRIGGERS**
2) *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?*

PATIENT STATUS	**LEARNER ACTIONS, MODIFIERS & TRIGGERS TO MOVE TO THE NEXT STATE**	
1. Baseline State Rhythm: Sinus Tachycardia HR: 120 BP: 90/60 RR: 22 O_2SAT: 98 T: 38.5 ^oC	Learner Actions ● 2 large bore IVs, Cardiac Monitor ● Obtain brief history from patient and EMS ● Elicit risk factors of DM ● Perform a through left lower leg skin physical exam ● Start 1L crystalloid bolus	Modifiers *Changes to patient condition based on learner action* ● If no IV or crystalloid started, BP drops to 86/58, HR raises to 128 and pt becomes lightheaded • If IV and crystalloid started, BP and HR improve to 98/66 • If only antipyretics are given, temperature decreases to 37.8 C, heart rate decreases to 112, and blood pressure remains stable. • If both fluids and antibiotics are given, temperature decreases to 37.8 C, heart rate decreases to 112, and blood pressure improves to 98/66 • If any analgesia is given, patient feels better, and vitals remains the same

		Triggers *For progression to next state* ● Perform a through left lower leg skin physical exam
2. Rhythm: Sinus Tachycardia HR: 112 BP: 98/66 RR: 22 O_2SAT: 98 T: 37.8 ^oC	Learner Actions ● Bedside US findings of Necrotizing fasciitis (if FAST done, no free fluid identified. If the aorta was done, normal size, no dissection, and no aneurysm. If echo was done, negative except for tachycardia and hyperdynamic) ● Start broad spectrum antibiotics including clindamycin/linezolid	Modifiers ● If no US done, pt becomes more hypotensive 70/40 ● If CT ordered, nurse prompts learner that pt is too unstable to go to CT scanner ● If no antibiotics are ordered, BP 70/40 ● If antibiotics are ordered, BP stable Triggers ● US diagnosis of necrotizing fasciitis
3. Rhythm: Sinus Tachycardia HR: 112 BP: 98/66 RR: 22 O_2SAT: 98 T: 37.8 ^oC	Learner Actions ● Consult general surgery	Modifiers • If no clindamycin/linezolid was given, general surgery will ask "I forgot, but can you give the antibiotics that will suppress the toxin?" If learner doesn't know the general surgeon will remember. • If general surgery was not consulted, patient's BP: 70/40, HR: 126, RR 24. If no signs of general surgery consultation, the patient will ask, "will I need surgery?" Triggers ● Case ends when general surgery arrives to take patient to the OR.

SUPPORTING DOCUMENTS, LAB RESULTS AND MULTIMEDIA	
Lab Results	CBC: WBC: 20,000 /µL (Normal: 4,500-11,000 /µL) Hemoglobin: 14 g/dL (Normal: 13.8-17.2 g/dL) Platelets: 200,000 /µL (Normal: 150,000-450,000 /µL) CMP: Sodium: 128 mmol/L (Normal: 135-145 mmol/L) Potassium: 4.5 mmol/L (Normal: 3.5-5.0 mmol/L) Creatinine: 1.8 mg/dL (Normal: 0.6-1.2 mg/dL)

	Glucose: 200 mg/dL (Normal: 70-99 mg/dL) Blood cultures: Pending Lactate: 4.0 mmol/L (Normal: 0.5-2.2 mmol/L) CRP: 150 mg/L (Normal: <10 mg/L)
EKG	Sinus tachycardia
CXR CT imaging	X-ray (Left Lower Leg): Limited study from external hinderance. Within the limitation: Diffuse soft tissue swelling. Obscured anatomical tissue planes. Please clinically correlate
Ultrasound Video Files	Leg soft tissue: subcutaneous emphysema, fascial fluid collections, and thickened fascial planes. Echo- negative except for tachycardia and hyperdynamic Aorta- negative Fast- negative

SAMPLE QUESTIONS FOR DEBRIEFING
1) What are the different types of necrotizing fasciitis? **2) How does necrotizing fasciitis present on ultrasound?** **3) What does the lrinec score compromise of? How useful is it?** **4) Which antibiotics can be used to suppress toxins in necrotizing fasciitis?**

Ideal Scenario Flow

Learners should quickly identify the severity of the patient's condition based on his appearance and vital signs, which show tachycardia, hypotension, and fever. They should ask EMS to provide any history they have obtained. During the primary survey, the team ensures the patient's airway is patent. They establish one to two large-bore IV lines and initiate crystalloid fluid resuscitation. While the patient is being resuscitated, learners should gather a focused history about the left lower leg wound and rash, noting the presence of 2 lacerations and a significant medical history of DM. The physical examination reveals erythema, swelling, warmth, severe tenderness, and discoloration of the left lower leg. If crepitus is assessed, it is undetermined.

Recognizing these concerning signs as more than just cellulitis or an abscess, the team should order labs including CBC, CMP, lactate, CRP, and blood cultures. If a physical exam is not done, the nurse should question the t-shirt wrapped around the left lower leg. Bedside soft tissue ultrasound of the leg should be performed as this patient is at high risk for necrotizing fasciitis. Broad-spectrum antibiotics, such as

vancomycin and piperacillin-tazobactam, should be administered promptly. A toxin suppression antibiotic, such as clindamycin or linezolid, should also be administered. An X-ray of the left lower leg should be obtained to aid in the diagnosis of necrotizing fasciitis but in this case does not clearly show free air in the tissue.

In addition, the team can calculate the LRINEC score using the lab results: CRP of 150 mg/L (4 points), WBC of 20,000/µL (1 point), hemoglobin of 14 g/dL (0 points), sodium of 130 mmol/L (2 points), creatinine of 1.8 mg/dL (2 points), and glucose of 200 mg/dL (1 point), resulting in a total score of 10 points, indicating a high risk for necrotizing fasciitis.

General surgery should be consulted, and the patient should be rapidly transferred to the operating room.

Anticipated Management Mistakes

1. *Difficulty with bedside monitors: We found when using this case with medical students that many of our learners did not know how to properly connect EKG leads to the bedside monitor. Consider including an introduction to simulation cases that includes a tutorial for connecting patients to bedside monitoring.*
2. *Failure to recognize necrotizing fasciitis: Failure to recognize the severity and rapid progression of the patient's symptoms, leading to delays in diagnosis and treatment. Not obtaining a thorough history or performing a comprehensive physical examination, potentially missing key signs of necrotizing fasciitis. Not recognizing that the patient's pain is out of proportion to the physical findings, which is a hallmark of necrotizing fasciitis.*
3. *Failure to recognize the utility of bedside US diagnosis of negotiating fasciitis: In the unstable patient where there is concern for necrotizing fasciitis, a bedside US should be done to aid in the diagnosis. Although CT can be used to confirm necrotizing fasciitis, US can aid in the prompt treatment and surgical consultation especially in an unstable patient.*
4. *Failure to initiate aggressive resuscitation: The mortality necrotizing fasciitis is very high. These patients need resuscitation with crystalloid. There should not be delay in starting board spectrum and toxin suppressing antibiotics. General surgery consultation should not be delayed.*