ACEP Ultrasound Simulation Case Template

SIMULATION CASE TITLE: Focal WMA, STEMI with cardiogenic shock
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PATIENT NAME: James Crew
PATIENT AGE: 55 years old
CHIEF COMPLAINT: shortness of breath and lightheadedness

Brief narrative description of case *Include the presenting patient chief complaint and overall learner goals for this case*	55 yo M presents to the Emergency Department with progressive shortness of breath and lightheadedness for one day. At arrival he is found to be hypotensive with signs of cardiogenic shock. EKG shows ST elevations in inferior leads. Learners should incorporate US as part of the assessment of this hypotensive patient and be able to resuscitate this patient in cardiogenic shock from underlying inferior MI.
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*	• Recognize clinical presentation of cardiogenic shock • Demonstrate appropriate management principles of cardiogenic shock and acute MI • Incorporate the use if bedside ultrasound in the assessment of a patient with shock and specifically cardiogenic etiology
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.*	• Recognize patient in acute distress • Identify abnormal vital signs • Perform bedside ultrasound for the patient with undifferentiated hypotension (i.e. RUSH exam) • Perform focused echocardiographic assessment of the patient recognized to be in cardiogenic shock and suspected MI (echo and lung ultrasounds) • Recognize clinical picture of cardiogenic shock
Learner Preparation *What information should the learners be given prior to initiation of the case?*	This case occurs in an academic emergency department. There is a team available to resuscitate this patient including ED nurses (2), additional ED providers to assist with interventions, consultants, pharmacy, laboratory, cardiac catheterization lab, CCU and medical ICU with beds available.
Required Equipment *What equipment is necessary for the case?*	Cardiac monitoring, O2 devices, IV kits, EKG, IV fluids, pulse oximetry, BP cuff, mechanical ventilator with option for NIV (Mask), intubation equipment, ultrasound machine with cardiac, abdominal and linear probes available.

INITIAL PRESENTATION	
Initial vital signs	HR: 90/min BP: 110 /60 RR: 28/min O$_2$SAT: 94% on NRB mask FIO2 around 80% T: 37° C
Overall Appearance *What do learners see when they first enter the room?*	Male who appears uncomfortable laying in EMS gurney, increased breathing effort, pale and diaphoretic. Breathing with NRB mask, peripheral IV in place on right antecubital fossa. EMS at the bedside.
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 at the bedside delivering the patient to ED team ED team: 2 RNs and additional providers (residents) can be recruited upon request
HPI *Please specify what info here and below must be asked vs what is volunteered by patient or other participants*	EMT provides hand-off: "Mr. Crew is a 55-year-old male, with history of HTN, non-insulin dependent DM2 and HLD, who was picked at his home. Mr. Crew called EMS complaining of shortness of breath and feeling progressively lightheaded over the past 24 hours. Checked his glucose thinking that it was his diabetes but it was WNL. He was in his usual state of health until the day prior to onset of these symptoms. No recent illness. At EMS arrival patient was noted borderline hypotensive BP 85/50 with HR 90. EMS gave him a bolus of 1000 ml of 0,9 % NaCL with improvement of his BP. EMS reports a normal EKG in the field with no concern for ischemia.
ROS	(+) Nausea (+) diaphoresis (+) fatigue (+) lightheadedness (+) dyspnea (-) chest pain (-) cough (-) fevers (-) abdominal pain (-) Rest of ROS
Past Medical History	DM, HTN, HLD
Past Surgical History	None
Family History	Father died from MI at age of 50
Medications	Aspirin, Enalapril, Atenolol
Allergies	Penicillin
PHYSICAL EXAMINATION	
General	Uncomfortable appearing, pale
HEENT	Normocephalic, without obvious abnormality, atraumatic
Neck	Supple, trachea midline, no cervical lymphadenopathy No JVD

Respiratory	Increased breathing effort, RR 28, + crackles and decreased BS in both bases
Cardiovascular	Regular rhythm, no murmurs, rubs or gallops
Abdomen	Soft, NT, ND
Neurological	Alert and oriented x 3. No evident deficits.
Skin	Diaphoretic
GU	Normal
Extremities	No lower extremity edema, peripheral pulses palpation, symmetric
Psychiatric	Normal

SCENARIO STATES, MODIFIERS AND TRIGGERS
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 Rhythm: sinus rhythm HR: 90/min BP: 110 /60 RR: 28/min O$_2$SAT: 94% on NRB mask FIO2 around 80% T: 37° C	Learner Actions: • Transfer from EMS gurney and place patient on cardiac monitor • Identify patient in distress and relative hypoxemia on NRB O2 supplementation • Discontinue IV infusion • Request immediate EKG • Order labs • Request portable CXR	Modifiers: *Changes to patient condition based on learner action* • CXR shows no pneumothorax, and presence of bilateral infiltrates suggesting edema Triggers: *For progression to next state* • If not done yet, Respiratory tech suggests to place patient on NIV given high demand of FIO2 and still relative hypoxemia
2. Rhythm: sinus rhythm HR: 92/min BP: 85 /55 RR: 28/min O$_2$SAT: 99% on NIV (BiPAP) FIO2 set 100% T: 37° C	Learner Actions: • Perform bedside US (lung and heart) • Request repeat vitals • EKG performed • Verbalize thought process to explain clinical picture • Recognize acute heart failure with low cardiac output likely due to underlying MI • Activate cardiac cath lab / consult cardiology	Modifiers: • Repeat vitals show that patient is now hypotensive • POC venous gas resulted: pH: 7,20 HCO3 15, PCO2 40, lactate 3,0 mmol/l (elevated) Triggers: • Learner verbalizes need to prepare for intubation • Bedside UD: shows decreased EF with no pericardial effusion, and anterolateral RWMA. • Identifies metabolic academia with elevated lactate • Clinical picture recognized as cardiogenic shock

3.	Learner Actions:	Modifiers:
Rhythm: sinus rhythm HR: 94/min BP:105/62 RR: 26/min O₂SAT: 95% on NRB mask FIO2 around 80% T: 37° C	• Discontinue NIV which leads to improvement of BP • Give Aspirin and Heparin bolus dose IF for STEMI • Discuss with cardiology need for intubation – cardiology recommends intubation prior to transfer to cath lab • Initiate dobutamine or other inotropic support prior to intubation anticipating high risk of hemodynamic decompensation in presence of hypotension and metabolic acidemia	• BP improves after discontinuation of NIV (effect from preload) • Dobutamine started for inotropic support with improvement in BP • Intubation successful Triggers: • Learner orders sedation and analgesia post intubation • Confirms placement of ETT with CXR and places NGT and elevates head 30 degrees
4. Rhythm: sinus tachycardia HR: 110/min BP:145/85 RR: 22/min O₂SAT: 99% intubated FIO2 80% T: 37° C	Learner Actions: • Learner prioritizes expediting transfer of patient to cath lab	End of the case with transport to cath lab

SUPPORTING DOCUMENTS, LAB RESULTS AND MULTIMEDIA	
Lab Results	POC venous gas: pH: 7,20 HCO3 15, PCO2 40, lactate 3,0 mmol/l (elevated) CBC: WBC 4.0, Hg 11, Hct 39%, Plt 120,000 CMP: Na 136, K 4.1, Cl 103, Co2 30, BUN 40, Cr 1.8, Glucose 100 **Troponin 4,0 (elevated)**
EKG	Sinus rhythm HR 87, ST elevations in anterolateral leads
CXR	Portable CXR shows bilateral infiltrates c/w pulmonary edema

Ultrasound Video Files	Echo: decreased EF around 30%, no pericardial effusion, RWMA in anterolateral region consistent with LAD occlusion
	Lungs: b-lines c/w pulmonary edema
	IVC: plethoric

SAMPLE QUESTIONS FOR DEBRIEFING

1) How is ultrasound useful in the assessment of a patient presenting with hypoxemia and hypotension? Describe any protocols that can be used for this purpose.

2) Describe physiology and principles of management of cardiogenic shock. Correlate this with the clinical and laboratory findings in this case.

3) Discuss how can the use of US support the assessment of patient with suspected acute coronary syndrome

Ideal Scenario Flow
Provide a detailed narrative description of the way this case should flow if participants perform in the ideal fashion.

The patient arrives brought in by EMS. The learner recognizes the patient in distress and the presence of hypoxemia. Performs early hemodynamic and respiratory assessment and recognizes the possibility of underlying ACS even in the absence of chest pain. Uses bedside US to identify pulmonary congestion and signs of heart failure on echo, and correlates findings of anterolateral RWMA seen on echo with findings on EKG. Makes diagnosis of cardiogenic shock and underlying STEMI and contacts cardiology / cath lab. While waiting for cath lab learner identifies metabolic academia, hemodynamic effect of NIV (if started ater suggestion by respiratory tech), focuses on hemodynamic stabilization and performs intubation. Performs post-intubation measures, and one patient is hemodynamically stabilized, prioritizes immediate transfer to cath lab for definitive care. In cath lab patient was found to have a complete occlusion of LAD with low EF from acute heart failure explaining clinical presentation. During PCI patient is transiently supported with Impella, percutaneous mechanical circulatory support device. After successful PCI requirement of inotropic support is reduced and patient is admitted to CCU.

Anticipated Management Mistakes

1. Failure to recognize the patient with hypoxemia: some learners may not recognize that the patient is hypoxemic if saturation is in mid 90s but requiring highest FIO2 possible in non-intubated patient
2. Failure to identify hemodynamic effect of non-invasive ventilation: some learners may not understand the hemodynamic effect of initiating NIV. Particularly in this case, the patient had borderline blood pressure, likely due to low output heart failure.
3. Failure to recognize the detrimental effect of IVFs in the patient with acute heart failure and clinical signs of pulmonary edema, despite the finding of low blood pressure.
4. Failure to use bedside US to support the thought process to explain the likely etiology for this patient
5. Failure to recognize STEMI given report of normal EKG in the field by EMS and absence of chest

pain in a diabetic patient. Can discuss atypical presentation of MIs and incorporate the use of echo in the systematic evaluation of patient with cardiovascular complaints (dyspnea and lightheadedness in this case).

6. Failure to recognize the need for intubation: some learners may not immediately recognize that the patient required airway management, leading to delay in diagnosis. Consider to allow the pulse oxygenation to continue to drop despite supplemental oxygen to prompt the need for intubation.

7. Uncertainty about the management of cardiogenic shock: some learners may not be familiar with the main management principles of cardiogenic shock. Consider to include a discussion around this specific topic.