Pulmonary Embolism

Section 1: Case Summary

Scenario Title:	**Pulmonary Embolism**
Keywords:	Respiratory Distress/Pulmonary Embolus/PEA Arrest
Brief Description of Case:	65 year old male with chest pain and dyspnea. Has a syncopal episode brought to ED complaining of chest pain and dyspnea. Diagnosis is Submassive PE, case has a couple of options, can run as either the patient deteriorates into PEA arrest and requires thrombolysis or patient remains hemodynamically stable but has concomitant head trauma and thrombolysis is withheld.

Goals and Objectives	
Educational Goal:	Approach to chest pain, respiratory distress in an unstable patient
Objectives: (Medical and CRM)	CRM: Effectively lead team members through complex critical scenario. Medical: 1) Approach to an undifferentiated patient with hypotension. 2) Generate a differential diagnosis including PE, Ischemia, tamponade, or aortic dissection and determine best imaging modalities/investigations to differentiate between the possible diagnosis. 3) Management of submassive vs massive PE 4) Management of PEA arrest 5) Indication for use of thrombolytics in massive PE 6) Use closed-loop communication and frequent summaries in order to maintain effective communication and a shared mental model.
EPAs Assessed:	F1 Initiating and assisting in resuscitation of critically ill patients C3 Provide airway management and ventilation TD 3: Facilitating communication of information between a patient in the emergency department, caregivers, and members of the health care team to organize care and disposition of the patient

Learners, Setting and Personnel				
Target Learners:	☐ Junior Learners	☒ Senior Learners	☒ Staff	
	☐ Physicians	☐ Nurses	☐ RTs	☒ Inter-professional
	☐ Other Learners:			
Location:	☒ Sim Lab	☒ In Situ	☐ Other:	
Recommended Number of Facilitators:	Instructors: 1			
	Confederates:			
	Sim Techs: 1			

Scenario Development	
Date of Development:	March 2, 2020
Scenario Developer(s):	Dr Jeanne Macleod
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Last Revision Date:	
Revised By:	
Version Number:	

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Section 2A: Initial Patient Information

A. Patient Chart					
Patient Name: John			Age: 65	Gender: male	Weight:
Presenting complaint: Chest Pain					
Temp:37.4	HR: 120	BP:105/60	RR:28	O_2Sat:93% r/a	FiO_2:
Cap glucose: 6			GCS: (E V M) 15		
Triage note: Patient had a fainting episode at work. Had chest pain and dizziness prior to fainting. Co workers witnessed the collapse and noted that patient struck head against desk when he fainted. 911 called and EHS at scene noted patient to be pale, sweaty and anxious. Initially at the scene EHS found to have HR= 130 and BP systolic of 80. Received 500 cc NS en route. Complaining of ongoing chest heaviness. Given ASA 160mg PO.					
Allergies: penicillin- anaphylaxis in the past with severe reaction					
Past Medical History: Hypercholestermia GERD COPD			Current Medications: Pantaprozole 20mg PO Od Rosuvastatin 20mg Po OD Combivent Inhaler BID		

Section 2B: Extra Patient Information

A. Further History
Include any relevant history not included in triage note above. What information will only be given to learners if they ask? Who will provide this information (mannequin's voice, confederate, SP, etc.)? Patient brought in by EHS who obtained Hx from a co-worker who witnessed the patient saying he felt dizzy and lightheaded and then had sudden collapse. Struck head against desk and floor and then LOC for approximately 60 secs. No seizure of urinary incontinence. Co workers checked pulse and he had a pulse and was breathing. When EHS arrived initially hypotensive but has responded to fluid and complaining of chest pain radiating to the back. Patient can give rest of the HX and no prior known CAD/PE/Valvular problems or any risk factors for PE. He is a smoker and has COPD and has felt "under the weather" lately with a non productive cough. No fever.

B. Physical Exam	
List any pertinent positive and negative findings	
Cardio: normal	Neuro:
Resp: normal	Head & Neck:
Abdo:	MSK/skin:
Other:	

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Section 3: Technical Requirements/Room Vision

A. Patient
☒ Mannequin *(specify type and whether infant/child/adult)*
☐ Standardized Patient
☐ Task Trainer
☐ Hybrid
B. Special Equipment Required
-airway equipment
C. Required Medications
D. Moulage
E. Monitors at Case Onset
☐ Patient on monitor with vitals displayed ☒ Patient not yet on monitor
F. Patient Reactions and Exam
Include any relevant physical exam findings that require mannequin programming or cues from patient (e.g. – abnormal breath sounds, moaning when RUQ palpated, etc.) May be helpful to frame in ABCDE format. -Could display large abrasion over right frontal area.

Section 4: Confederates and Standardized Patients

Confederate and Standardized Patient Roles and Scripts	
Role	*Description of role, expected behavior, and key moments to intervene/prompt learners. Include any script required (including conveying patient information if patient is unable)*

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Section 5: Scenario Progression

Scenario States, Modifiers and Triggers				
Patient State/Vitals	Patient Status	Learner Actions, Modifiers & Triggers to Move to Next State		Facilitator Notes
1. Baseline State Rhythm: sinus HR: 120 BP: 105/60 RR: 28 O_2SAT: % 93 r/a T: ^oC 37.4 GCS: 15	*Patient appears anxious, pale. Has abrasion over right forehead. NOT tender c spine*	<u>Expected Learner Actions</u> ☐ O2/IV/Monitor STAT ECG ☐ Primary survey ☐ Secondary survey ☐ POCUS -right heart strain ☐ Labs- drawn cultures/troponin/d dimer/coag ☐ CXR ☐ Avoid large bolus of fluid-start with 1 litre and reassess.	<u>Modifiers</u> *POCUS shows dilated RV/right heart strain- recognizes possible PE* -Start heparin- unfractionated infusion since risk of head trauma and in this case , patient has potential to become unstable. learner can verbalize concern about head trauma and heparin. <u>Triggers</u> *Order CT Chest AND CT head since evidence of head injury +/- CT C-spine*	Should look for pulse/BP differential and for aortic dissection on US. Make sure learner verbalizes what they are looking for on POCUS- PE/Pericardial effusion/Dissection Try to look for IVC- should be dilated. -Judicious use of fluids- esp if recognize that IVC is dilated- Makes sure ECG is performed prior to CT Scan. Makes sure CT head is performed when CT Chest is ordered.
2. Stage 2 HR=120 BP=100/60 O2 Sat'n= 95% on mask RR= 35	Patient returns from CT still has Tachypnea/resp distress. Breath sounds adequate, crackles at bases.	<u>Expected Learner Actions</u> ☐ Primary survey- repeat- airway/breathing ☐ CALL FOR HELP ☐ Recognize SubMassive PE with potential hemodynamic instability and potential deterioration ☐ Set up for possible thrombolytics if patient deteriorates. ☐ Set up for potential RSI	<u>Modifiers</u> -CT chest -show large embolus -Remembers to check CT head if ordered. <u>Triggers</u> - If don't order CT head or check CT head, go to stage 3	CT head is positive for small bleed--Call neurosurgery -Hold Heparin -Call Thoracic for possible catheter directed thrombolysis or surgical embolectomy. -Troponin and D-dimer +

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3. Stage 3 -PEA arrest No pulse Irregular, narrow complex rhythm at 50	Patient becomes unresponsive	Learner Actions ☐ Run PEA algorithm- CPR/Epi ☐ Crash INtubation ☐ If learner has not ordered CT head then may give thrombolytics.	Modifiers - If learner knows that CT head shows bleed, then have PEA arrest for short time period only and proceed to **Stage 4** quickley. -If no recognition of CT head findings, then proceed with PEA arrest and thrombolytics given. Can proceed to stage 4 or end case.	Lytics dose: If massive with pulse and BP, give Alteplase 10mg bolus followed by 40mg IV over next 2 hours. If in cardiac arrest can give 50mg IV alteplase push and if no improvement over 5 min, then give another 50mg IV alteplase push or give full dose of tenectaplase (TNK)
4. Stage 4 -BP 100/65 -HR-120 - O2 Sat'n =94% on ventilator/bagged		Expected Learner Actions ☐ Summarize case to ICU team	Modifiers Triggers	ICU team arrives and takes to interventional radiology suite for catheter directed embolectomy

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Appendix A: Laboratory Results

CBC WBC Hgb Plt Lytes Na K Cl HCO_3 AG Urea Cr Glucose Extended Lytes Ca Mg PO_4 Albumin TSH VBG pH pCO_2 pO_2 HCO_3 Lactate	Cardiac/Coags Trop D-dimer INR aPTT Biliary AST ALT GGT ALP Bili Lipase Tox EtOH ASA Tylenol Dig level Osmols Other B-HCG

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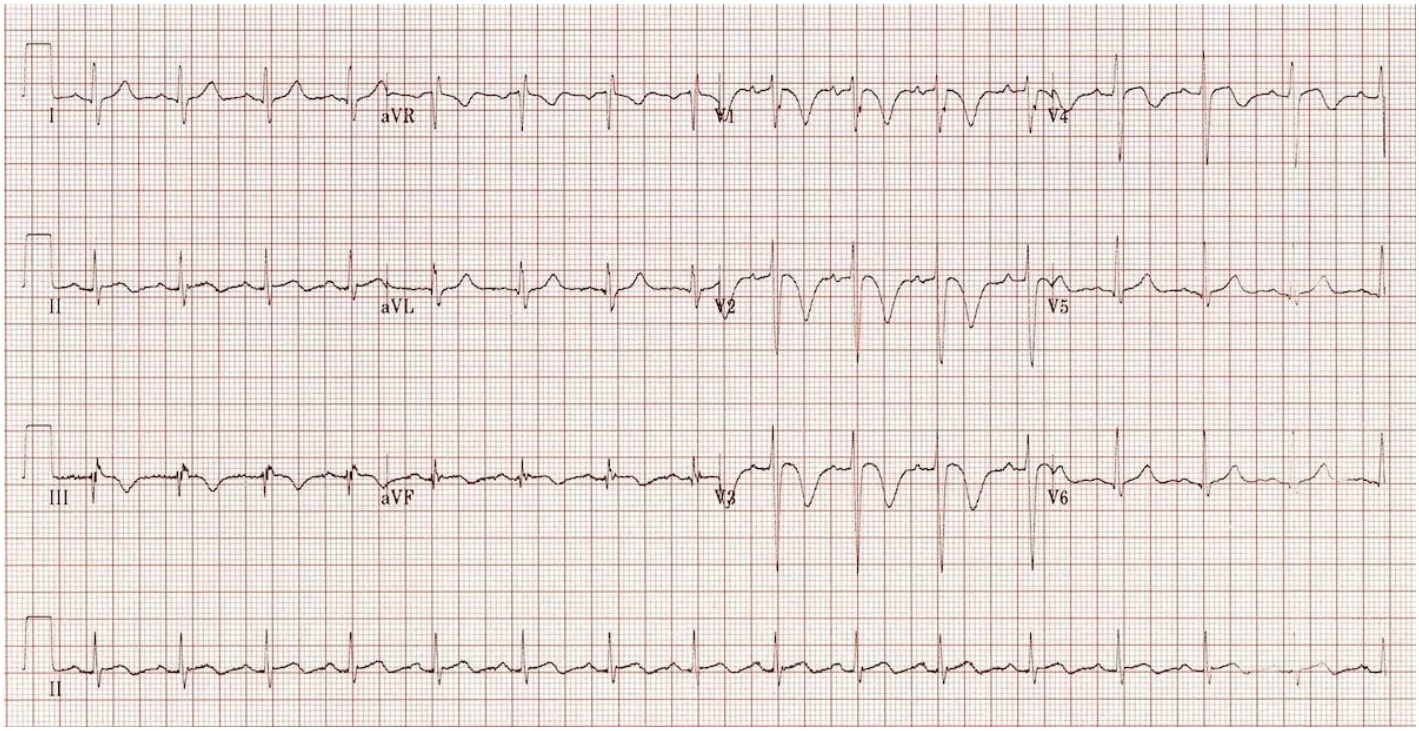
Appendix B: ECGs, X-rays, Ultrasounds and Pictures

Paste in any auxiliary files required for running the session. Don't forget to include their source so you can find them later!

ECG:



https://litfl.com/wp-content/uploads/2018/08/ECG-Massive-Pulmonary-embolus-RVH-RV-Strain.jpg

Look at Pulmonary Embolism category for US image: https://www.bcpocus.ca/presentingproblem/dyspnea/

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Appendix C: Facilitator Cheat Sheet & Debriefing Tips

Include key errors to watch for and common challenges with the case. List issues expected to be part of the debriefing discussion. Supplemental information regarding any relevant pathophysiology, guidelines, or management information that may be reviewed during debriefing should be provided for facilitators to have as a reference.

-Please note: There are numerous ways to run this scenario
1) Submassive PE which develops into Massive Crashing PE requiring thrombolytics or
2) Submassive PE which then goes into PEA arrest or
3) Submassive PE which stays stable and learner needs to pick up that they have an absolute contraindication to thrombolysis

The interesting discussion points are:

1**)Fluid Conservative strategy**
- If patient unstable, need to ask if PE is the only reason driving the instability- don't forget about hypovolemia/sepsis. If instability due to PE should have dilated RV and dilated IVC on echo/POCUS.

2) **Indication for Thrombolysis**
-Submassive vs Massive PE definition- important distinction because literature supports thrombolytics for Massive PE but in inconclusive for Submassive PE.

Massive PE: Any of these features: SBP<90 for 15min **or** fall in BP >40mm for 15 min **or** requirement for vasopressors **or** persistent bradycardia (<40) with signs of shock.
AND sign of RV dilatation on echo/CT

Submassive PE May have Signs of large PE/elevated troponin/Right heart strain on ECG and/or Signs of RV dilatation on imaging but **without** hypotension/hemodynamic instability described above. Not enough evidence to support thrombolysis in this group of patients.

-If patient with Massive PE does not improve or deteriorates or requires high dose of vasopressor (> 10mg/min epinephrine infusion), then consider to be "**Crashing Massive PE**" and may give thrombolytics. Avoid any unnecessary lines such as central catheters and ABG.

-- Give Alteplase 10 MG IV push follow by 40mg over 2 hours if Crashing Massive PE.(This is half dose of what is used for STEMI).
- If patient in cardiac arrest- can give either 50mg or full dose 100mg IV alteplase push. If have tenectaplase then just push full STEMI dose.
-Alteplase has a lower rate of bleeding than tenecteplase.
-The goal of lytic therapy is not to normalize the pulmonary pressure but to cut back pressure sufficiently to prevent sudden cardiac death. Remember to D/C heparin infusion prior to thrombolytics

3) **Pressor -aggressive strategy**
-Epinephrine Infusion titrate for Map>65

4) **Intubation Strategy**
In submassive/massive PE Avoid intubation:

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-sedatives will drop BP
-+ pressure within chest decreases preload
-overdistention of lungs many compress capillaries increasing the pulmonary vascular resistance.

Try high flow O2 over intubation
If crashing massive PE, give thrombolytics first and then intubate.
If going to intubate in PE: start epinephrine drip to have systolic BP= 130-140, be prepared to give push dose epi to support BP post intubation, use hemodynamically stable sedatives for intubation and post intubation sedation (Ketamine).
-First 10 min post intubation is most likely when patient will arrest

5) **Other PE-directed therapies**
-interventional radiology clot extraction
-cardiothoracic surgical extraction
-VA ECMO

References

1. https://emcrit.org/ibcc/pe/

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