AMSER Case of the Month February 2023

66-year-old male with shortness of breath and chest discomfort

Hira Qureshi, Case Western Reserve School of Medicine

Dr. Andrew Roy, Department of Radiology, Cleveland Clinic

Dr. Ruchi Yadav, Staff, Department of Thoracic Radiology, Cleveland Clinic

Patient Presentation

- HPI: Patient with known COPD presents with progressive SOB for 2 weeks and was treated for COPD exacerbation with antibiotics, steroids and 2L oxygen supplement with no improvement
- PMHx: COPD
- SHx: Current smoker (40 pack year)
- Vitals: Afebrile, 147/88, HR 112, RR 26, SpO2 on 2L 78%
- Labs: COVID and RSV negative, leukocytosis, BNP 2338, troponin negative
- EKG: Sinus tachycardia with occasional premature ventricular complexes. Complete RBBB

What imaging should we order?

ACR Appropriateness Criteria

Clinical Condition: **Acute Chest Pain — Suspected Pulmonary Embolism**

Variant 1: **Adult.**

Radiologic Procedure	Rating	Comments	RRL*
X-ray chest	9	To exclude other causes of acute chest pain. Complementary to other examinations.	☢
CTA chest with contrast	9	Current standard of care for detecting PE.	☢☢☢
Tc-99m V/Q scan lung	8		☢☢☢
US lower extremity with Doppler	7	If chest x-ray is negative and index of suspicion is high.	O
CTA chest with contrast with CT venography lower extremities	6		☢☢☢
Arteriography pulmonary with right heart catheterization	5	If suspicion is high and CTA is inconclusive, or if intervention is needed.	☢☢☢☢
MRA pulmonary arteries without and with contrast	4	If patient is unable to receive iodinated contrast, may be alternative to V/Q scan. See statement regarding contrast in text under "Anticipated Exceptions."	O
MRA pulmonary arteries without contrast	3		O
US echocardiography transesophageal	2	Limited experience. Has been used for central pulmonary emboli.	O
US echocardiography transthoracic resting	2	To assess for RV strain or failure in the presence of major pulmonary embolism.	O

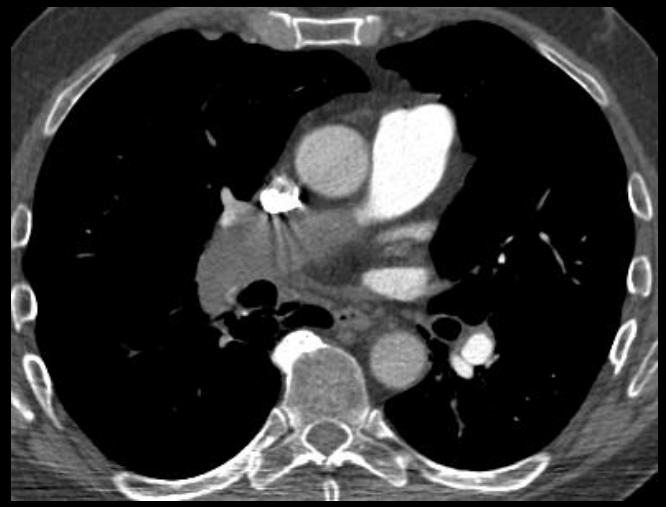
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate

*Relative Radiation Level

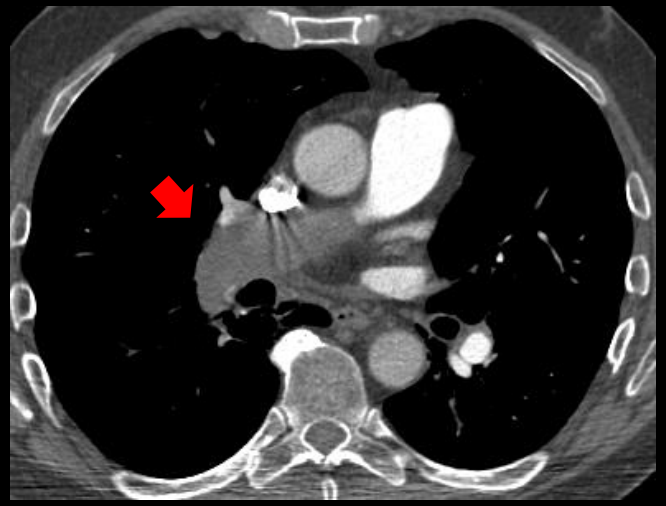
These imaging modality were ordered by the ER physician

AMSER

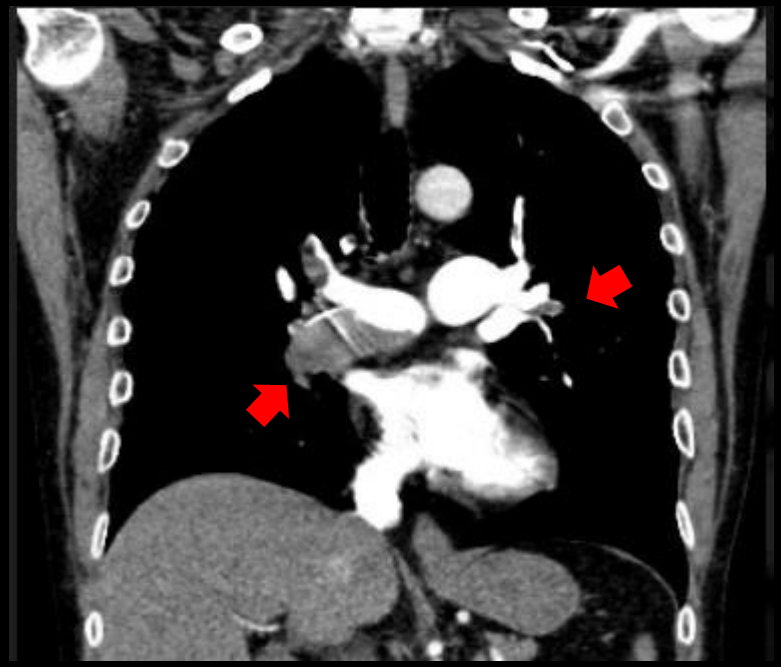
Findings (unlabeled)



Findings (labeled)



Axial view of occlusive thrombus in the right main pulmonary artery with thrombus extension into interlobar and right lower lobe pulmonary artery



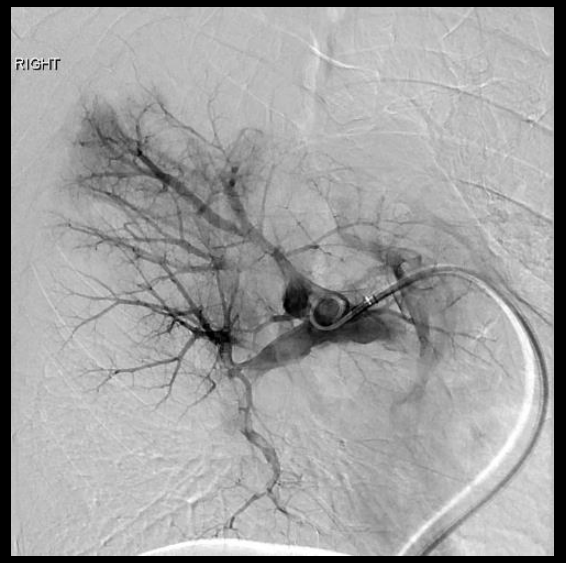
Coronal view of bilateral pulmonary emboli

Axial view of straightening of interventricular septum s/o right heart strain; R/L ventricular ratio >0.9

AMSER

Given the lack of hypotension , patient was diagnosed as submassive pulmonary embolism and started on anticoagulation. Due to worsening oxygen requirement during admission, a shared decision between the PERT team and interventional radiology was made to proceed with catheter directed thrombolysis/aspiration thrombectomy

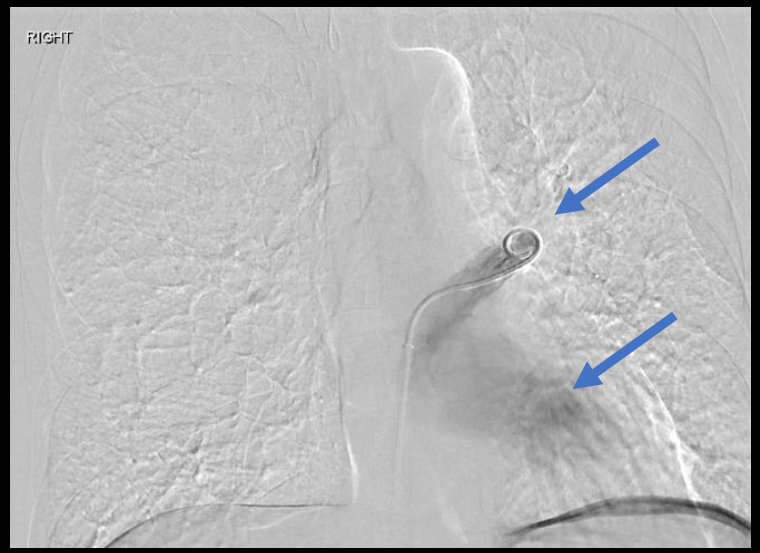
Findings: (unlabeled)



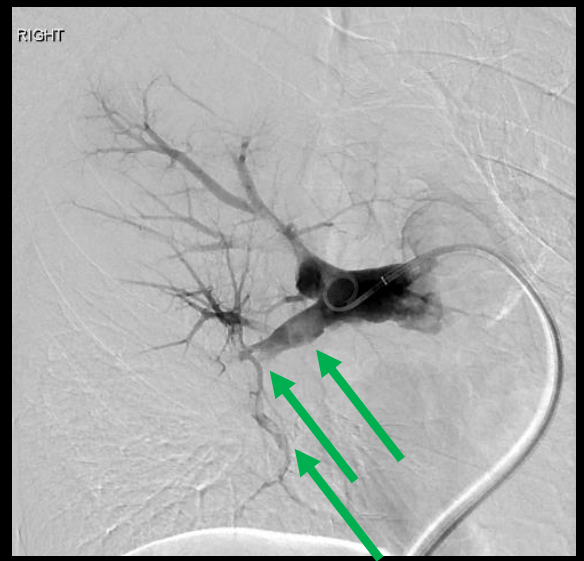
Main pulmonary artery pressure: 77/17 mmHg with a mean of 38 mmHg

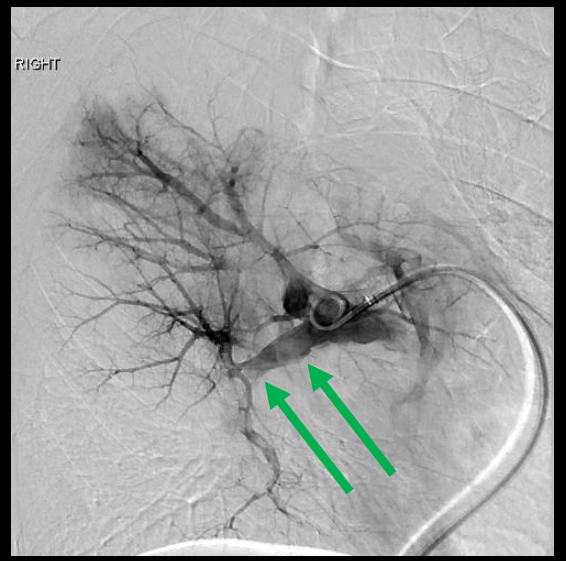
AMSER

Findings: (labeled)



Attempt at catheterizing right pulmonary artery, contrast injected to determine location, revealed unexpected contrast filling of left ventricle and aorta (blue arrows), consistent with PFO





Right pulmonary artery was successfully targeted, images from right to left showing filling defects (green arrows) during contrast injection consistent with PE

AMSER

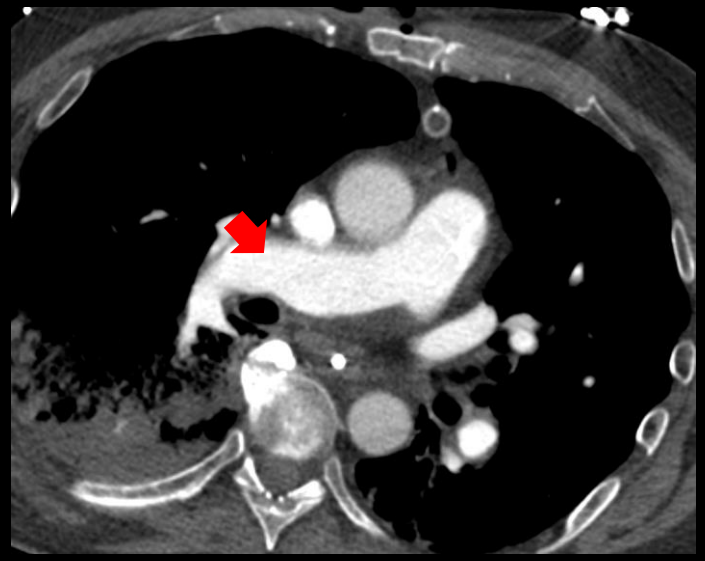
Final Dx:

Submassive, occlusive pulmonary embolism and incidental large PFO

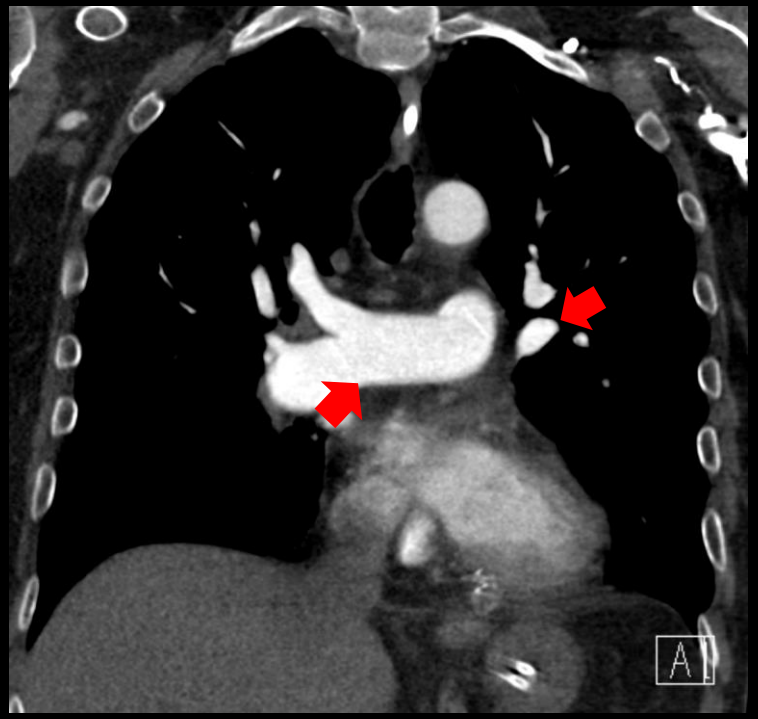
Case progression:

Aspirated small amount of subacute clot in IR suite→
TTE with agitated saline contrast confirming PFO→
TPA with no improvement→
Balloon occlusion of PFO with no improvement→
Bilateral pulmonary thromboendarterectomy and PFO closure with ECMO

Post Thrombectomy Chest CT



Axial view demonstrates resolution of previous thrombus



Coronal view demonstrates resolution of previous thrombus

Case Discussion: Classification and Tx of PE

- Classification of PE: massive and submassive
  - Massive: hemodynamically unstable (systolic pressure <90 mmHg for at least 15 minutes, pulselessness, HR <40 bpm with signs of shock)
  - Submassive: hemodynamically stable with Right ventricular dysfunction (via echo, RV/LV diameter ratio >0.9 or EKG findings) or elevated cardiac biomarkers
- Tx approach:
  - Massive→ thrombolysis via TPA ideally within 48 hours
  - Submassive: controversial, thrombolysis indicated in PE with low risk of bleeding and poor prognosis (ie RV dysfunction, severe respiratory failure)
- Embolectomy is recommended for patients with absolute contraindications to thrombolytics, failed thrombolytic therapy or in cardiogenic shock

Case Discussion: Pulmonary Artery Pressure

- Pulmonary artery pressure (PAP) can be measured by a right heart catheterization; pulmonary artery hypertension is >25 mmHg
  - Mild: 31-45 mmHg
  - Moderate: 46-70 mmHg
  - Severe: >70 mmHg
- PAP increases if >30-50% occlusion of pulmonary vessel
  - some studies suggest a positive correlation between embolism area & pressure
- In addition to lack of visualization of pulmonary branches during contrast injection, discrepancy in expected PAP should raise suspicion for possible PFO that can be worked up with an echo and bubble study

References:

- American College of Radiology ACR Appropriateness Criteria Acute Chest Pain https://acsearch.acr.org/docs/69355/Narrative/
- De Gregorio MA, Guirola JA, Lahuerta C, Serrano C, Figueredo AL, Kuo WT. Interventional radiology treatment for pulmonary embolism. *World J Radiol*. 2017;9(7):295-303. doi:10.4329/wjr.v9.i7.295
- Nosher JL, Patel A, Jagpal S, Gribbin C, Gendel V. Endovascular treatment of pulmonary embolism: Selective review of available techniques. World *J Radiol*. 2017;9(12):426-437. doi:10.4329/wjr.v9.i12.426
- Yin, D., Wang, Y., Zheng, M., Wei, H., Li, M., Lv, T., ... & Wu, X. (2019). Comparison of pulmonary artery pressure measurement with Doppler echocardiography or with right heart catheterization in patients with congenital heart disease. Frontiers in Pediatrics, 7, 421.
- Couturaud F, Bertoletti L, Pastre J, et al. Prevalence of Pulmonary Embolism Among Patients With COPD Hospitalized With Acutely Worsening Respiratory Symptoms. JAMA. 2021;325(1):59–68. doi:10.1001/jama.2020.23567