



Right Ventricular Heave as Sign of Sub-Massive Pulmonary Embolism in the Outpatient Setting



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Learning Objectives

1. List at least two physical examination and clinical laboratory findings which would suggest pulmonary embolism in the outpatient setting.
2. Understand the algorithm for management especially in patients with sub-massive or massive pulmonary embolism.

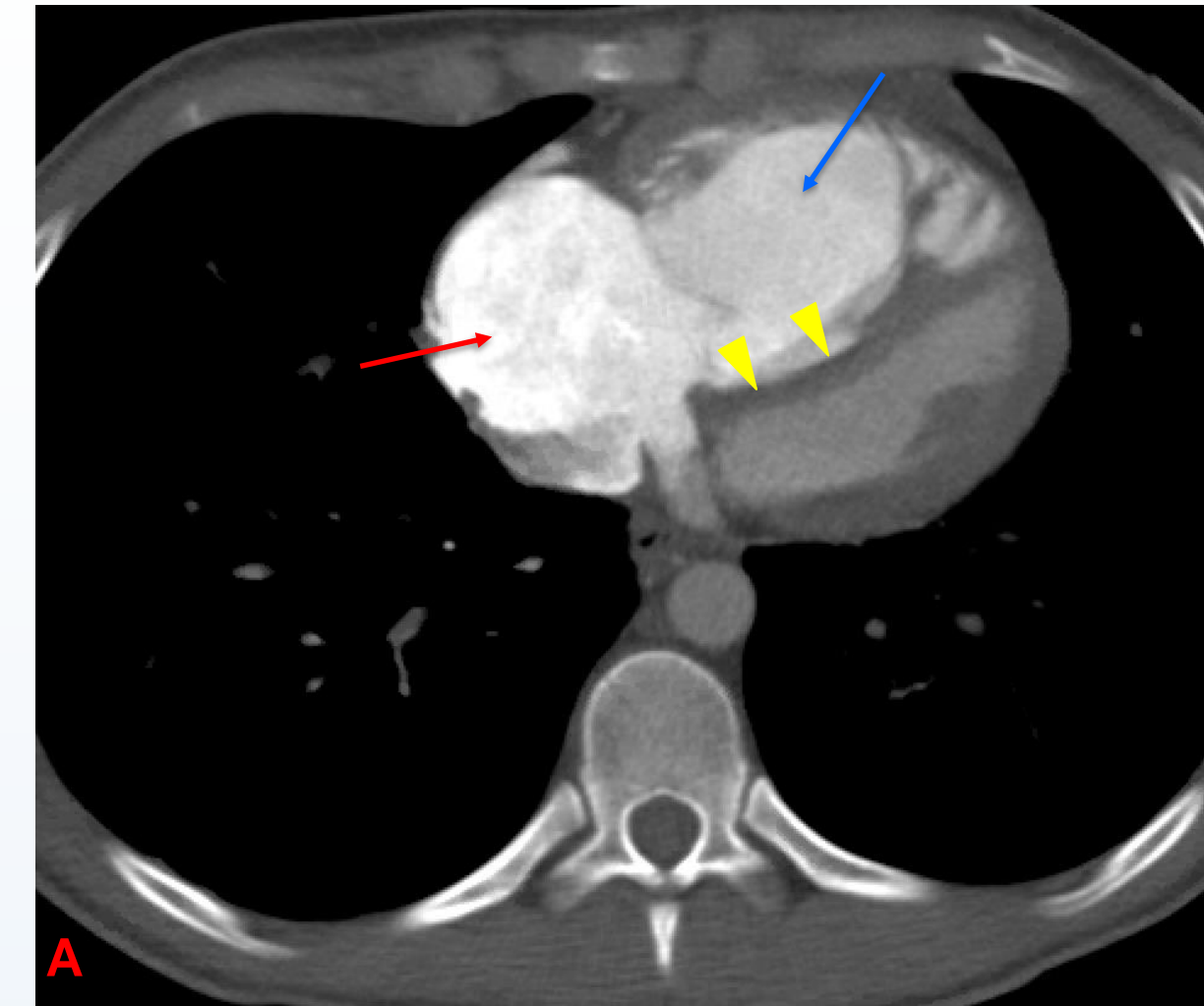
Case Description

- 21 year old male with no past medical history presented to the outpatient internal medicine clinic for cough, shortness of breath and hemoptysis. The patient denied any fevers, chills, sick contacts or tobacco use.
- Despite a course of doxycycline, the patient was still symptomatic and a chest radiograph showed ill defined peripheral opacities. The patient was given a second course of antibiotics for presumed pneumonia.
- Two months later, the patient again came to the internal medicine clinic with worsening shortness of breath, continuing cough and scant hemoptysis.
- Follow up chest radiographs prior to his clinic appointment showed resolution of previously seen opacities but a new right upper lobe infiltrate.
- Vital Signs: Temp 97.6 F, HR 118 bpm, BP 110/70, RR 18 and 97% O2 sat on room air
- Physical Examination: Tachycardia and a palpable right ventricular heave. Lungs were clear to auscultation.

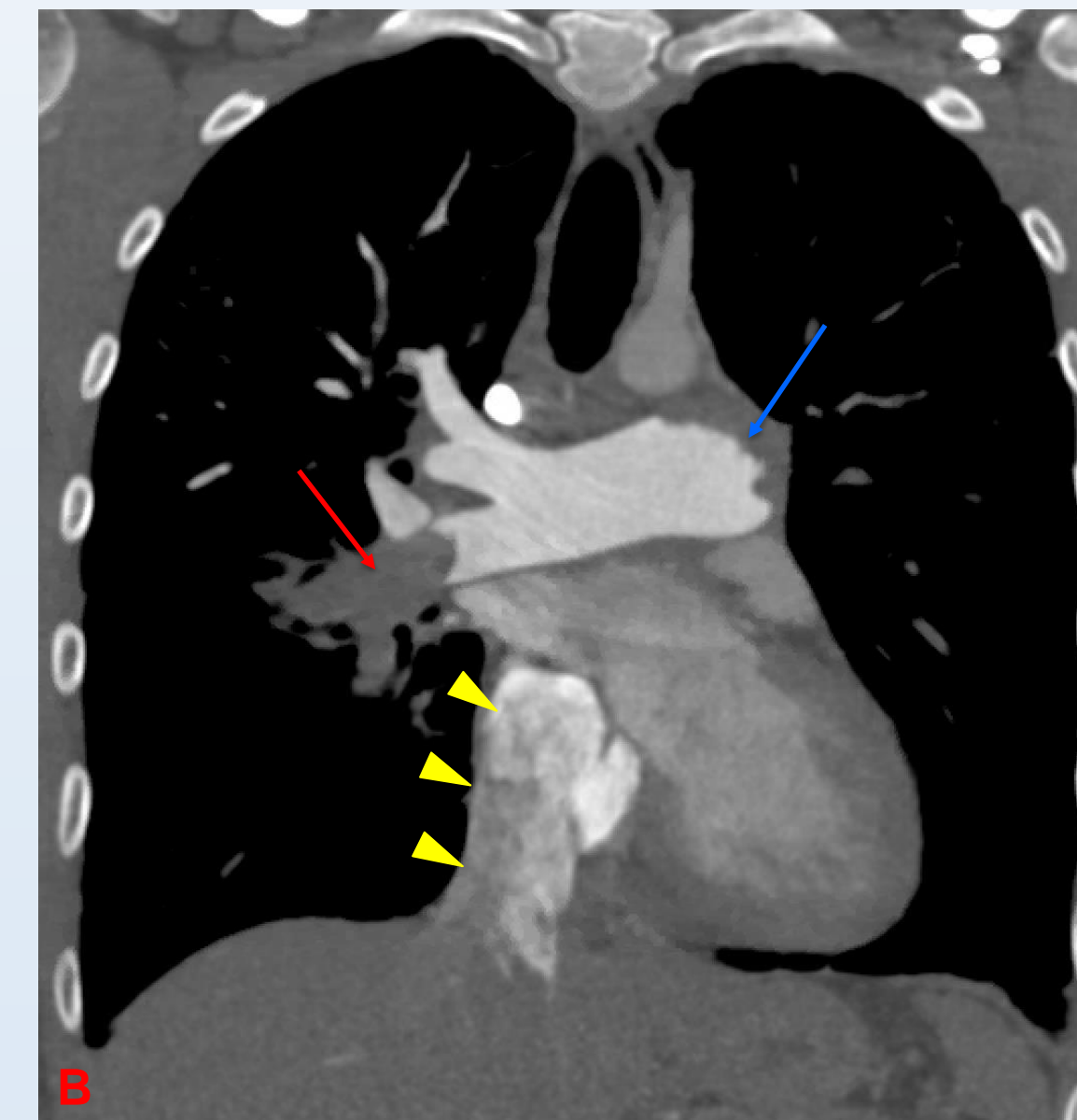
Case Description (Continued)

- Given the continued dyspnea as well as tachycardia and right ventricular heave, the patient was sent from the clinic to the emergency department for concern of pulmonary embolism.
- In the emergency department, laboratory workup demonstrated an elevated BNP of 9,404 pg/ml and a total bilirubin level of 1.6 mg/dl. Infectious workup, including sputum gram stain and blood cultures, were negative.
- CTA of the chest revealed severe right heart strain with extensive bilateral pulmonary emboli with peripheral opacities suggestive of pulmonary infarctions.
- Transthoracic echocardiogram demonstrated severe right ventricular hypertrophy with decreased right ventricular systolic function and hypokinesis.
- Thrombectomy was attempted by IR but was aborted as the patient became unstable, requiring pressor support. His vitals on admission to the MICU was HR 126, RR 21, BP 98/59 on 0.04 mcg/kg/min of peripheral norepinephrine.
- Subsequently, the patient underwent bilateral pulmonary artery thromboendarterectomy and tolerated the procedure well. The patient was discharged with therapeutic anticoagulation.
- Additional workup post-discharge:
 - Intraoperative specimens negative for malignancy.
 - Hypercoagulability workup, including JAK2 and exome sequencing, were unrevealing.

Case Description (Continued)



A: Axial CTA images through the chest showed severe right heart strain with right atrial (red arrow) and right ventricular dilation (blue arrow). There was bowing along the interventricular septum (arrowheads).



B: Coronal CTA images demonstrated complete occlusion of the right middle lobe (red arrow) and left main (blue arrow) pulmonary arteries. Note the reflux of contrast into the IVC (arrowheads), a finding which can be seen in right heart strain. Other occlusive segmental and sub-segmental emboli (not shown) were present.

Discussion (Continued):

- Pulmonary embolism is a common clinical entity with a high morbidity and mortality.
- Unfortunately, pulmonary embolism is a diagnostic challenge, especially in the outpatient setting, due to its non-specific presentation and radiographic findings. These difficulties often lead many patients to be misdiagnosed and causes delay in treatment.
- Evaluation for pulmonary embolism as an outpatient should be determined as per the Well's criteria and a D-dimer. A Well's score of 1-2 corresponds to a very low risk for pulmonary embolism (prevalence of 1.3%).
- Certain physical exam and lab findings can clue the provider to right heart strain (table 1). Right heart strain can be further investigated with CT angiogram or echocardiogram.
- These findings and other signs of hemodynamic instability should alert the provider to the possibility of a sub-massive (right heart strain based on imaging or laboratory findings) or massive (hemodynamic instability) requiring emergent referral to a tertiary care center for possible intervention.

Table 1: Findings suggestive of right heart strain in the setting of pulmonary embolism

Physical Examination	
	Jugular venous distension
	Loud P2
	Right ventricular heave
Laboratory findings	
	Elevated BNP
	Elevated Troponins