

CLINICAL PRESENTATION AND RADIOLOGY QUIZ QUESTION

A 44 year old woman presents with chest pain. The patient also indicates that she has been short of breath, particularly with exertion, over the past three days. Her temperature is 98.7° F, her pulse is 134, her respiration 26, and her blood pressure 136/83. Pulse oximetry is 92% on room air. The patient has a prior history of deep venous thrombosis. The patient's legs are nontender and there is a negative Homan's sign. A D-dimer test is positive.

Which of the following imaging studies should be performed on an emergent basis?

- (a) left side down decubitus plain film examination
- (b) chest computed tomography angiogram (CTA) of the pulmonary arteries
- (c) ultrasound of the chest
- (d) magnetic resonance imaging of the chest

RADIOLOGY QUIZ QUESTION, ANSWER, AND EXPLANATION

Which of the following imaging studies should be performed on an emergent basis?

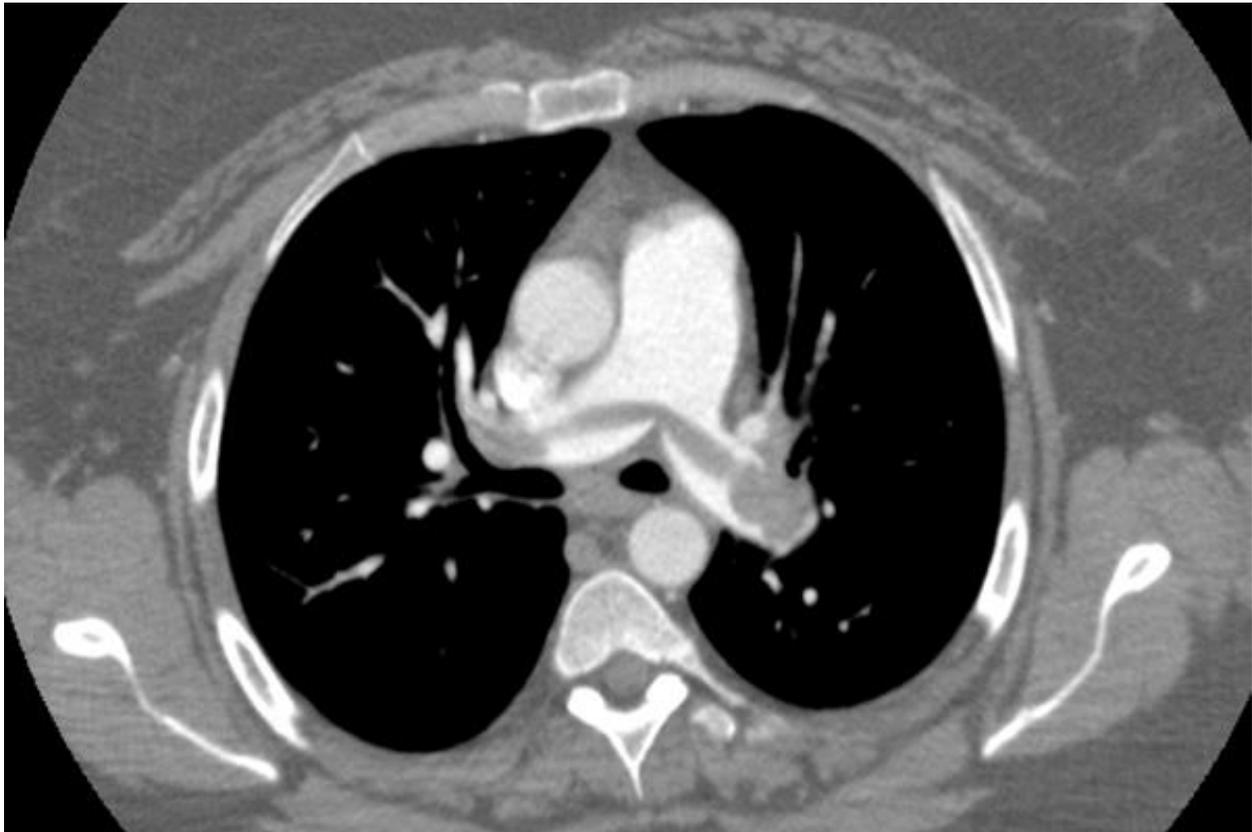
- (a) left side down decubitus plain film examination
- (b) chest computed tomography angiogram (CTA) of the pulmonary arteries
- (c) ultrasound of the chest
- (d) magnetic resonance imaging of the chest

Answer: (b), chest computed tomography angiogram (CTA) of the pulmonary arteries, is the correct response. The patient has symptoms (chest pain, dyspnea), historical features (personal history of deep venous thrombosis), clinical features (tachycardia, tachypnea, and decreased pulse oximetry), and laboratory features (a positive D-dimer) suggesting pulmonary embolism, and such patients should undergo immediate CT angiography to exclude pulmonary embolism. A chest X-ray may be obtained, but is usually not necessary or helpful.

A left-side down decubitus plain film might be helpful in cases where a left pleural effusion or a right pneumothorax was suspected on a supine radiograph, but not in this case, and (a) is incorrect. Ultrasound of the chest is helpful to evaluate the location and extent of a pleural effusion, but this is not a consideration in this case, and (c) is incorrect. Magnetic resonance of the chest is rarely performed and is not the standard next step in evaluation of chest pain especially when there are multiple features suggesting pulmonary embolism, and (d) is incorrect. Note that magnetic resonance of the chest *may* be the study of choice in those who are allergic to iodinated contrast material. In addition, in patients under the age of 40, some centers are directing patients toward MR to avoid the radiation associated with CT angiography.

IMAGING STUDY AND QUESTIONS

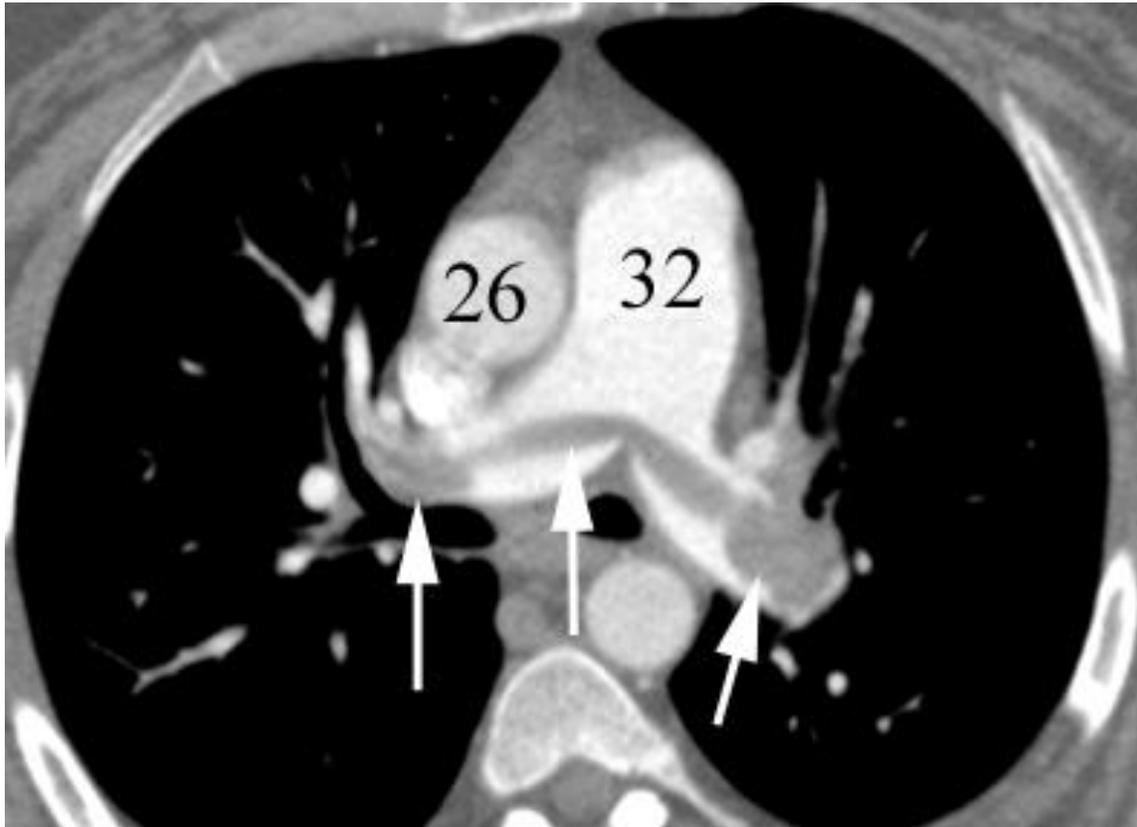
The patient underwent further imaging:



Imaging questions:

- 1) What type of study is shown?
- 2) Are there any abnormalities?
- 3) What is the most likely diagnosis?
- 4) What is the next step in management?

IMAGING STUDY QUESTIONS AND ANSWERS

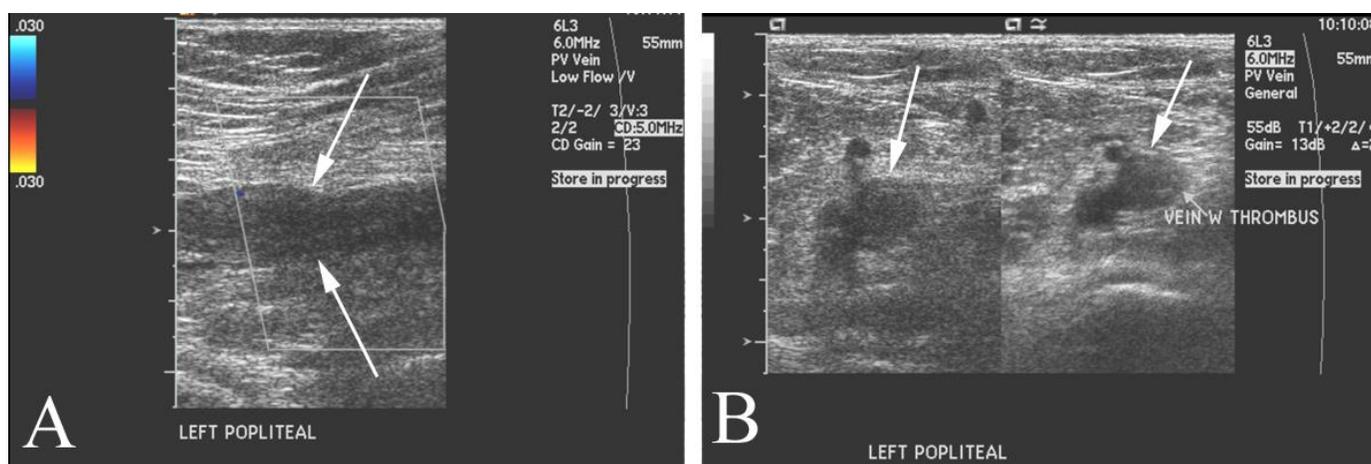


Imaging questions:

- 1) What type of study is shown? A CT angiogram of the pulmonary arteries. The displayed image is at the level of the main pulmonary artery bifurcation.
- 2) Are there any abnormalities? Yes. There is a filling defect that straddles the bifurcation of the main pulmonary artery and extends into both the right and left main pulmonary arteries (arrows). In addition, the main pulmonary artery measures 32 mm, 6 mm more than the ascending aorta at the same level. No right heart distension or inversion of the interventricular septum was identified on lower cuts (not shown)
- 3) What is the most likely diagnosis? The CT is diagnostic of a pulmonary embolism, specifically of a saddle embolism.
- 4) What is the next step in management? Anti-coagulation and close monitoring for any features of developing right heart failure.

PATIENT DISPOSITION, DIAGNOSIS, AND FOLLOW-UP

The patient underwent lower extremity venous ultrasound which demonstrated deep venous thrombus in the left lower extremity (see below figure). The patient placed on anti-coagulants and underwent placement of an inferior vena cava filter. Her shortness of breath and chest pain gradually remitted.



Deep venous thrombus in a patient with acute pulmonary embolism. A. Sagittal color Doppler examination of the popliteal fossa demonstrates lack of flow (no color signal) and abnormal increased echogenicity in the popliteal vein, indicative of deep venous thrombus. B. Axial pre (left) and post (right) compression ultrasound of the left popliteal vein shows internal echogenicity within the lumen of the vein and a lack of compressibility, diagnostic of a deep venous thrombus.

SUMMARY

Presenting symptom: The patient initially presented with chest pain. However, she also had several additional features including chest pain, tachypnea, tachycardia, abnormal pulse oximetry, and a personal history of deep venous thrombus, all of which increased her risk for pulmonary embolism substantially.

Imaging work-up: In patients with high risk for pulmonary embolism, a chest radiograph may be obtained (it was not in this case), followed by urgent computed tomographic angiography (CTA) of the chest. Rarely, patients with a pneumothorax may present with such features (although the previous history of deep venous thrombus in the leg would be a “red herring” in this case), and in these patients they would not need to get a chest CT, although the chest CT would certainly show the pneumothorax. The chest radiograph in patients with pulmonary embolism may show nonspecific findings such as consolidation, atelectasis, or pleural effusion.

Establishing the diagnosis: Multiple obvious filling defects within the pulmonary arterial tree are diagnostic of pulmonary emboli.

Take-home message: Patients with sudden onset of chest pain accompanied by dyspnea with clinical features suggesting pulmonary embolism should undergo urgent computed tomography angiography (CTA) of the chest. Chest radiography may be obtained prior to the chest CT but is usually not useful.

Note the similarity of this case with Radiology Quiz of the Week #62. Dyspnea and chest pain often co-exist, and both may be presenting features in patients with pulmonary embolism.

FURTHER READING

Renfrew, DL. Imaging of chest pain. Chapter 11 of *Symptom Based Radiology*, Symptom Based Radiology Publishing, Sturgeon Bay, WI, 2010, available for no charge at www.symptombasedradiology.com.

Wells PS et al. Derivation of a simple clinical model to categorize patients' probability of pulmonary embolism: increasing the model's utility with the SimpliRED D-dimer. *Thromb Haemost.* 2000; 83:416-420.

Winer-Muram HT. Pulmonary emboli. Chapter in Gurney JW, Winer-Muram HT, Stern EJ et al, *Diagnostic Imaging: Chest*. Amirsys, Salt Lake City, Utah, 2006.