How to Approach PE CT

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Background considerations

- Study indications:
  - CT pulmonary angiography (CTPA) is performed to evaluate for pulmonary emboli
  - Varied clinical presentations including:
    - Shortness of breath
    - Hypoxia
    - Chest pain
    - Cough
    - Positive d-dimer

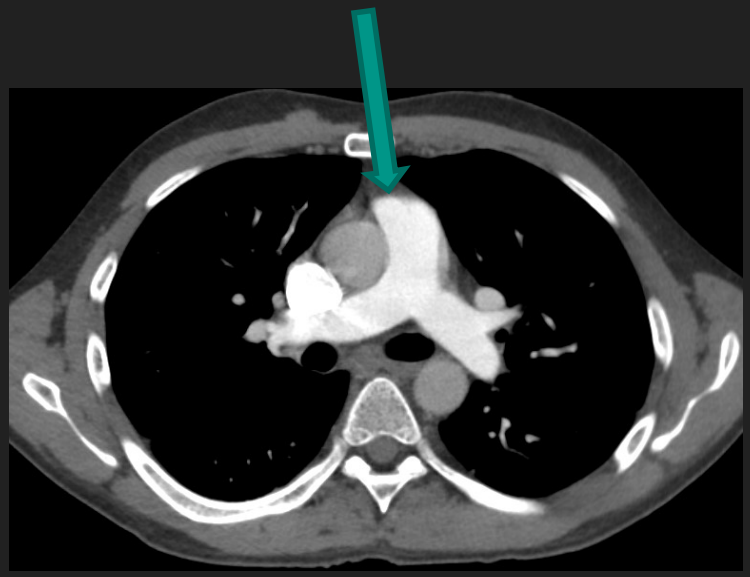
Background considerations

- Contraindications for CTPA:
  - Inadequate IV access
  - Contraindications to IV contrast
    - Renal impairment
    - Contrast allergy
  - Inability to lie flat (relative)
  - Inability to breath-hold (relative)

Background considerations

- Vessel opacification:
  - Timing and contrast bolus are everything
  - The pulmonary arteries must be appropriately opacified in order to make a diagnosis of PE

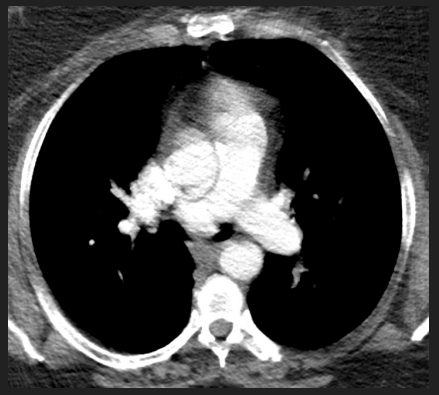
Good vessel opacification



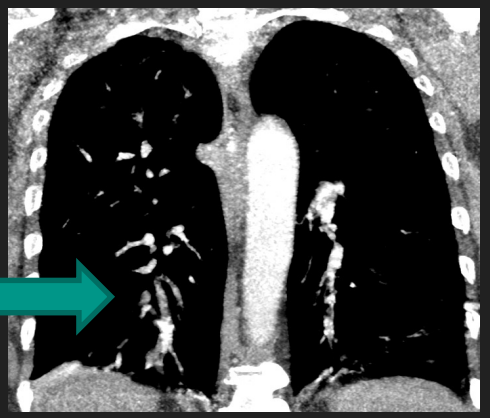
Factors affecting vessel opacification

- **Rate of contrast administration** - often dependent on IV size and location. Requires 20G or larger, 4cc/second injection
- **Circulation time** - young patients with fast circulation times have less well opacified vessels than patients with heart or lung disease. Patients with heart failure often have well opacified vessels
- Intrinsic cardiac **anatomic abnormalities** - patients with congenital heart disease and shunts have unique challenges for timing of contrast bolus for opacification of the pulmonary arteries
- **Motion** can limit the study

Motion artifact



Notice the poor vessel opacification

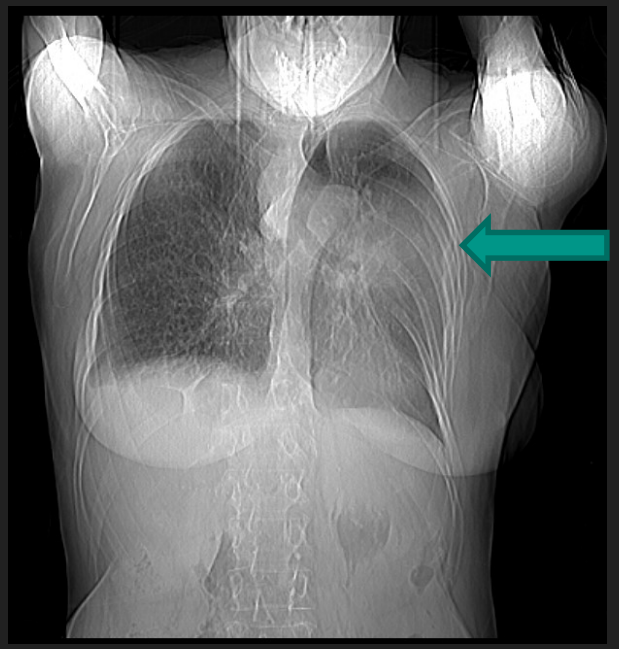


Technique

- Ensure appropriate IV access - minimum 20G in above wrist upper extremity. May use central line in specific cases if power injector compatible
- Study is performed with patient supine, arms over head. Breath hold required for the scan portion of the test.
- Scout image obtained and scan area selected. IV is checked for patency.
- Test bolus of contrast administered to determine contrast delay.
- When scan initiated, patient is instructed to deeply inspire and then hold breath on inspiration.
- Contrast is administered IV at a rate of 4cc/second, using the delay determined with the test bolus
- Some centers scan from lung bases to apices, some from apices to bases and some only scan the region of the pulmonary arteries. Much of this depends on patient and CT scanner factors

Approach to interpretation

ALWAYS review the scout image - a significant amount of information can be gleaned from the scout, including presence and location of support apparatus, presence of pulmonary edema etc



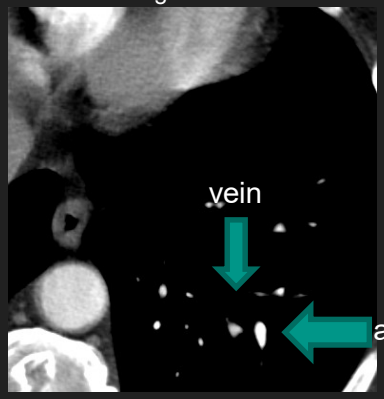
Left upper lobe opacity was a large lung mass

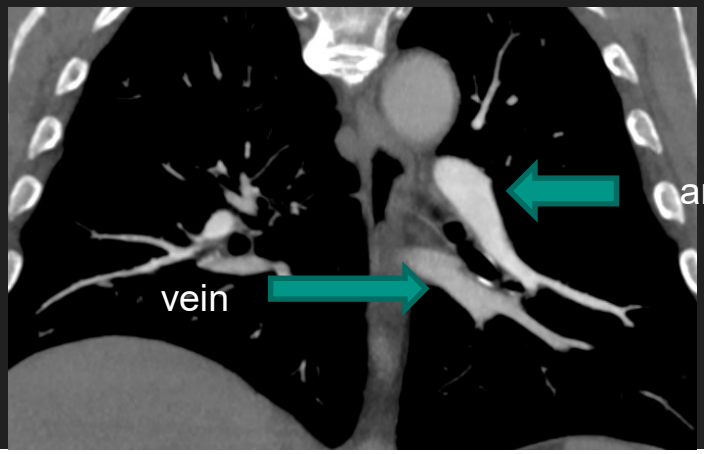
Approach to interpretation

Review the axial images

Assess the contrast bolus in the pulmonary arteries - is there adequate opacification and if so, to what level (main PA, segmental or subsegmental branches?)

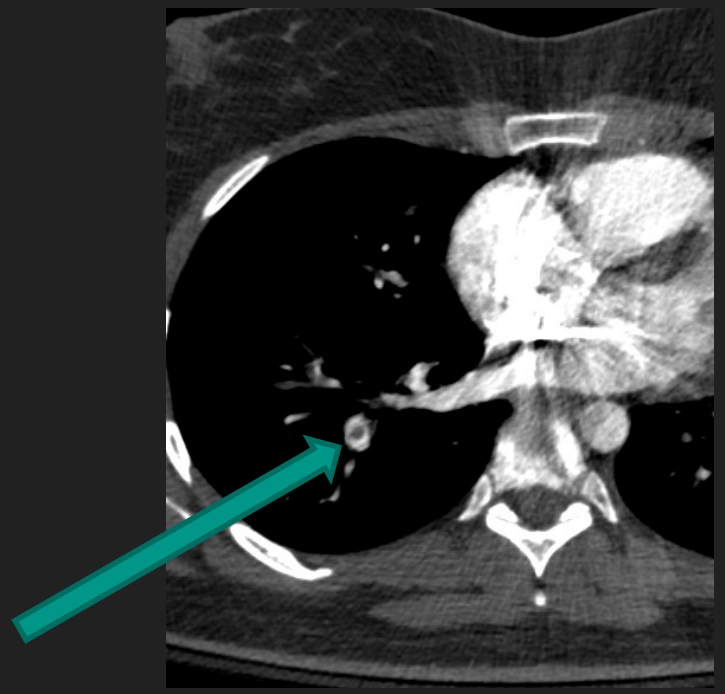
Notice the good opacification, even of subsegmental vessels





Approach to interpretation

Determine if there are filling defects in the PAs. If so, are they central within the vessel (acute PE) or layering along the walls of the vessel (subacute or chronic PE). Get a sense of the clot burden - is it massive, submassive or only in one or two segmental or subsegmental arteries



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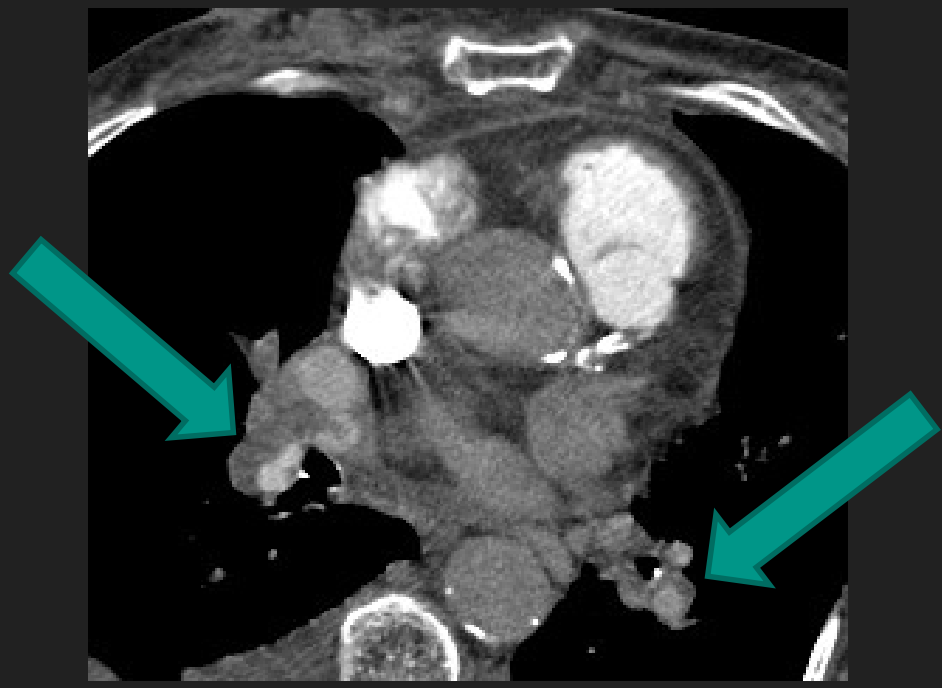

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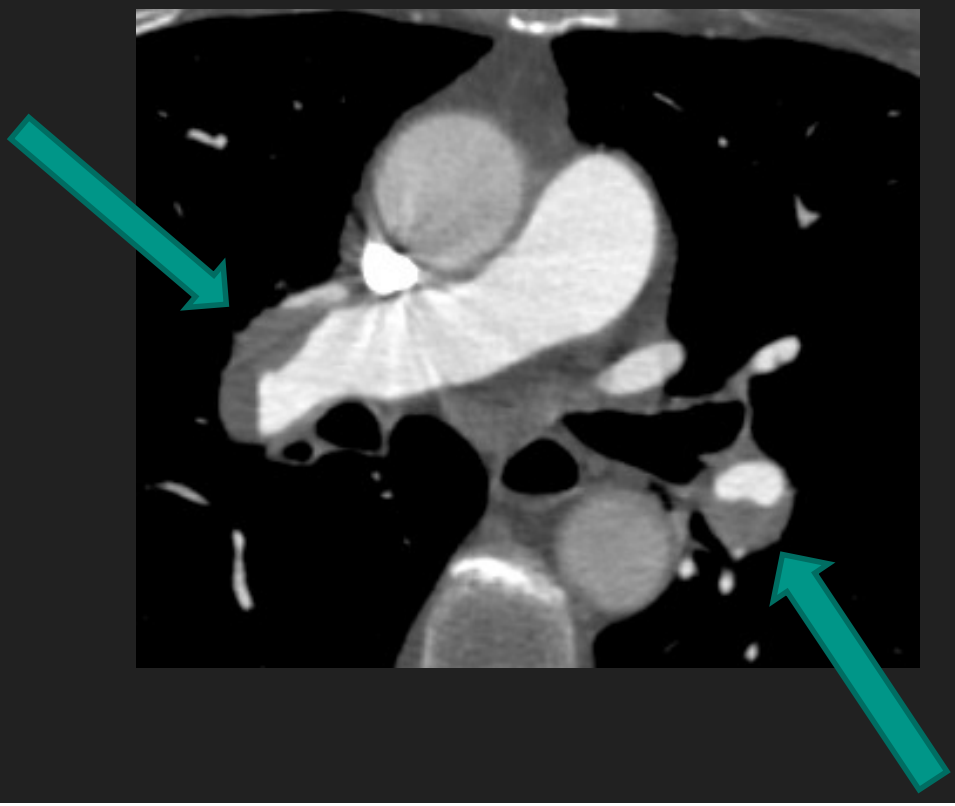

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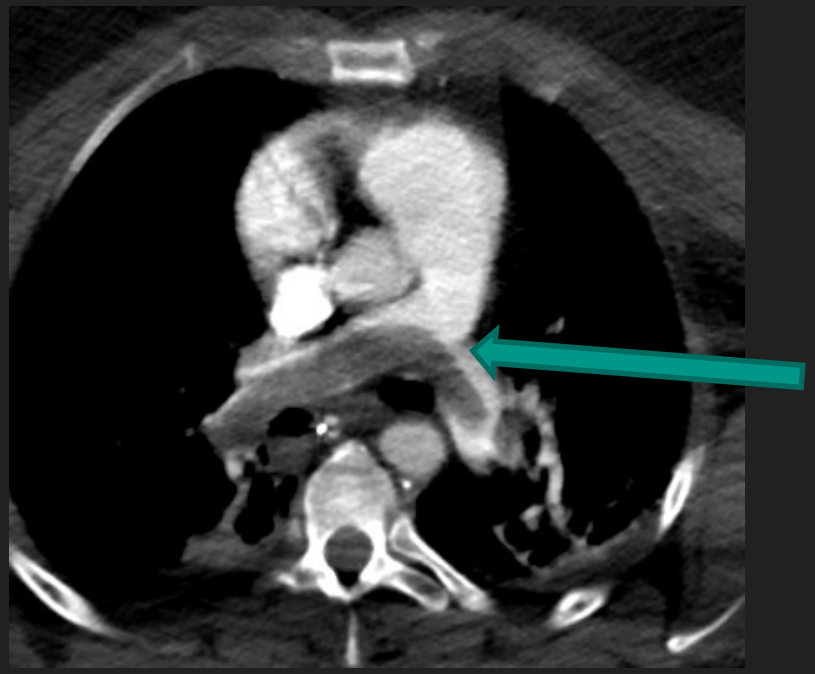
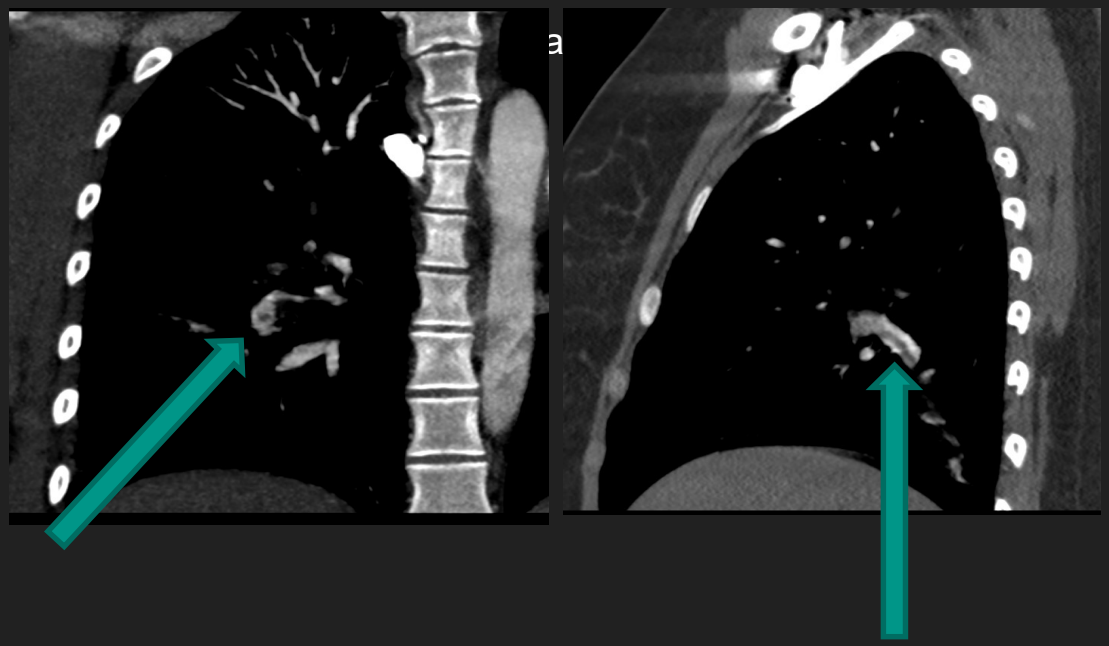


Approach to interpretation

Confirm the findings on coronal and sagittal reformatted images

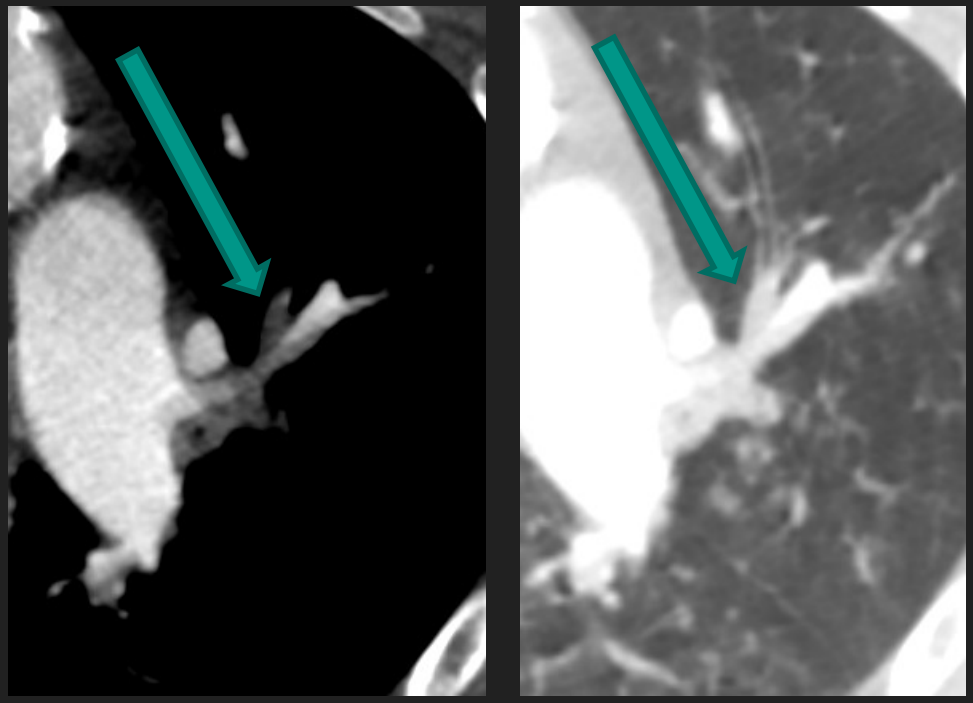


Approach to interpretation: pitfalls

Make sure the “filling defect” is not an artifact or mimic.

Put on “lung windows” to make sure the defect is not mucus in a bronchus.

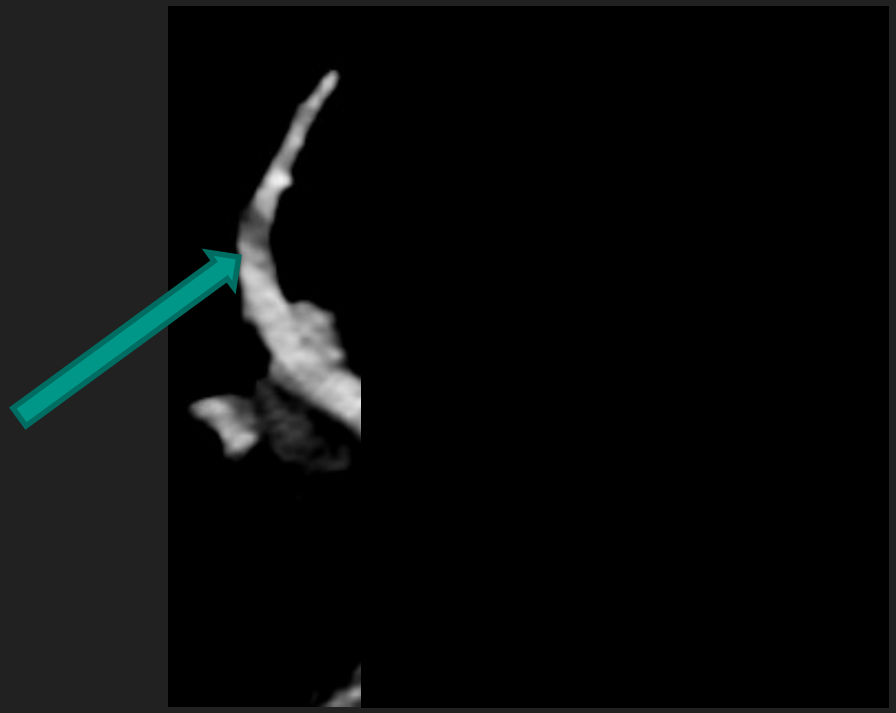
Follow the vessel back to the hilum to make sure it is an artery, not a vein.



Approach to interpretation: pitfalls

Make sure the “filling defect” is not due to contrast timing or respiratory motion artifacts.

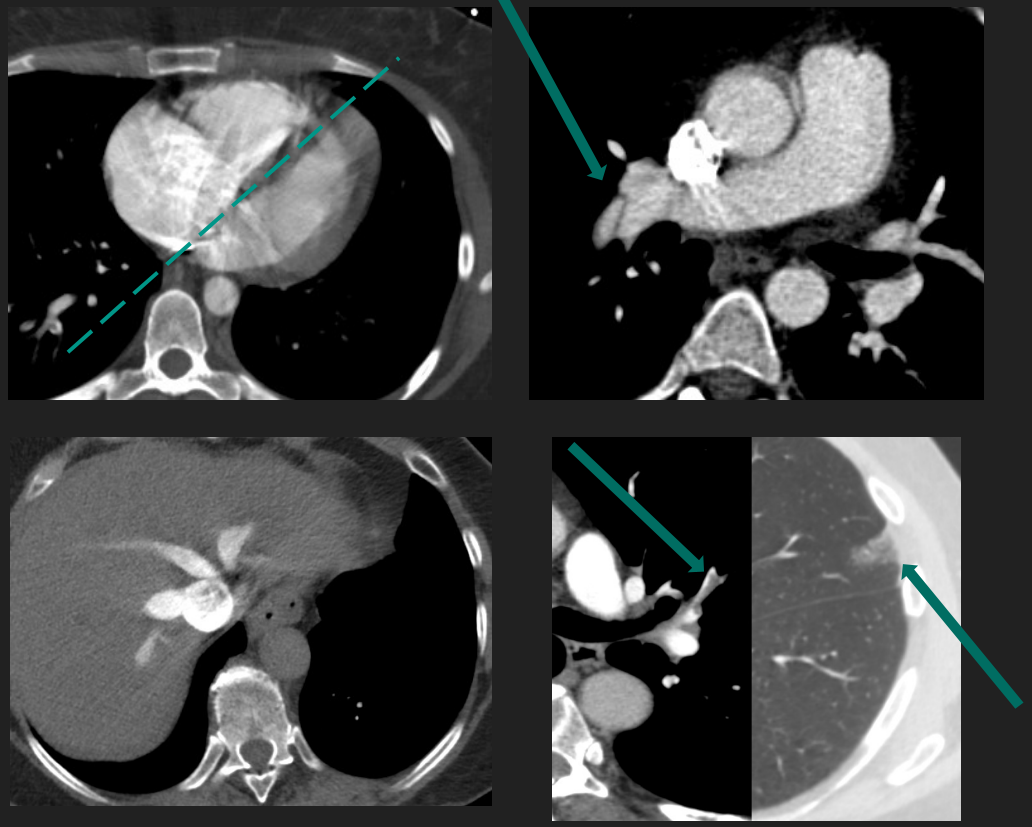
True PEs will appear as filling defects with NO contrast distal to the clot. If there is contrast beyond the “clot”, it is likely an artifact due to bolus timing or motion



Approach to interpretation: secondary findings

Right heart strain
Pulmonary infarct

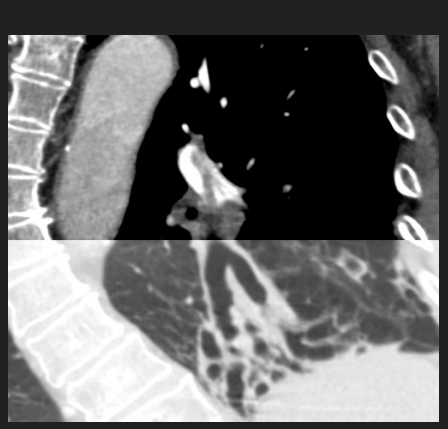
intraluminal webs, calcification, thrombus recanalization, and filling defects adherent to the wall that form obtuse angles and concave surfaces

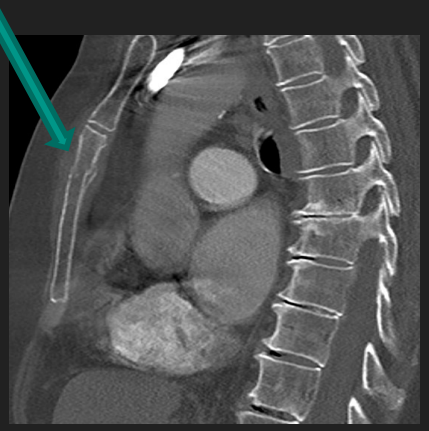


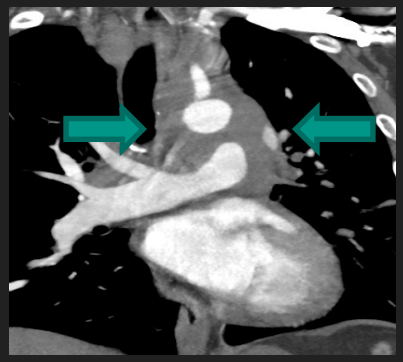
Approach to interpretation: unrelated findings

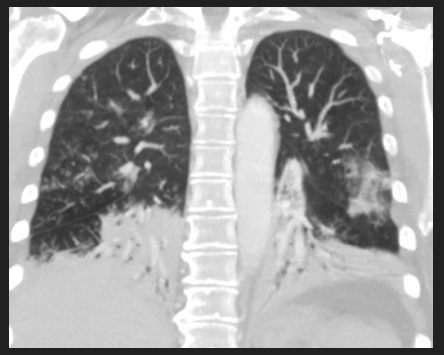
Avoid satisfaction of search.

Thoroughly assess the lungs, mediastinum, bones and included portions of the abdomen for unrelated, but clinically relevant findings.

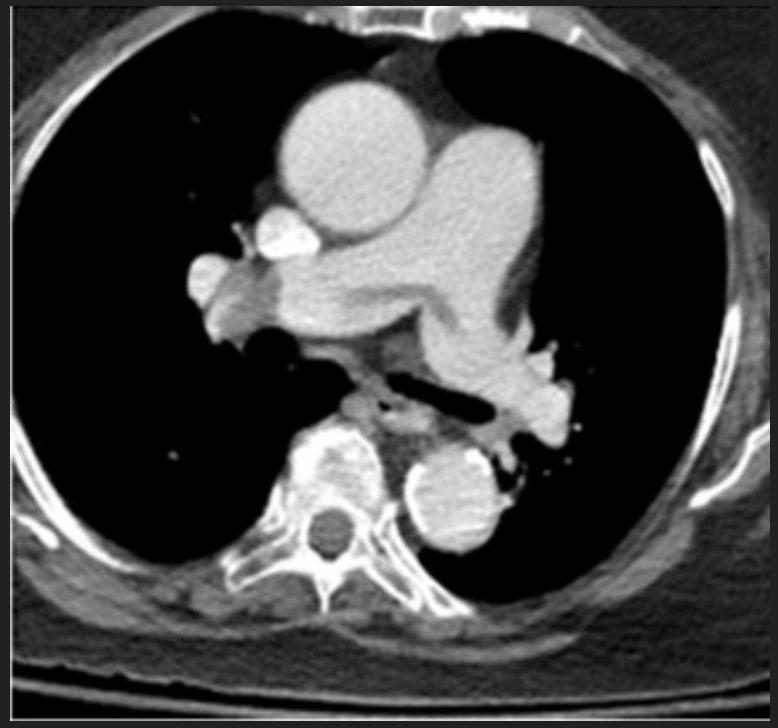


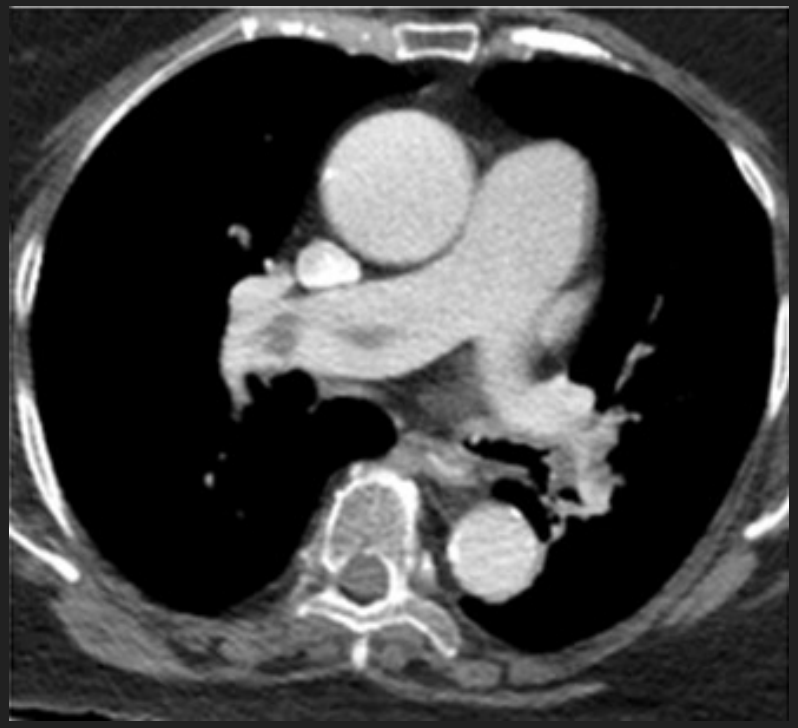




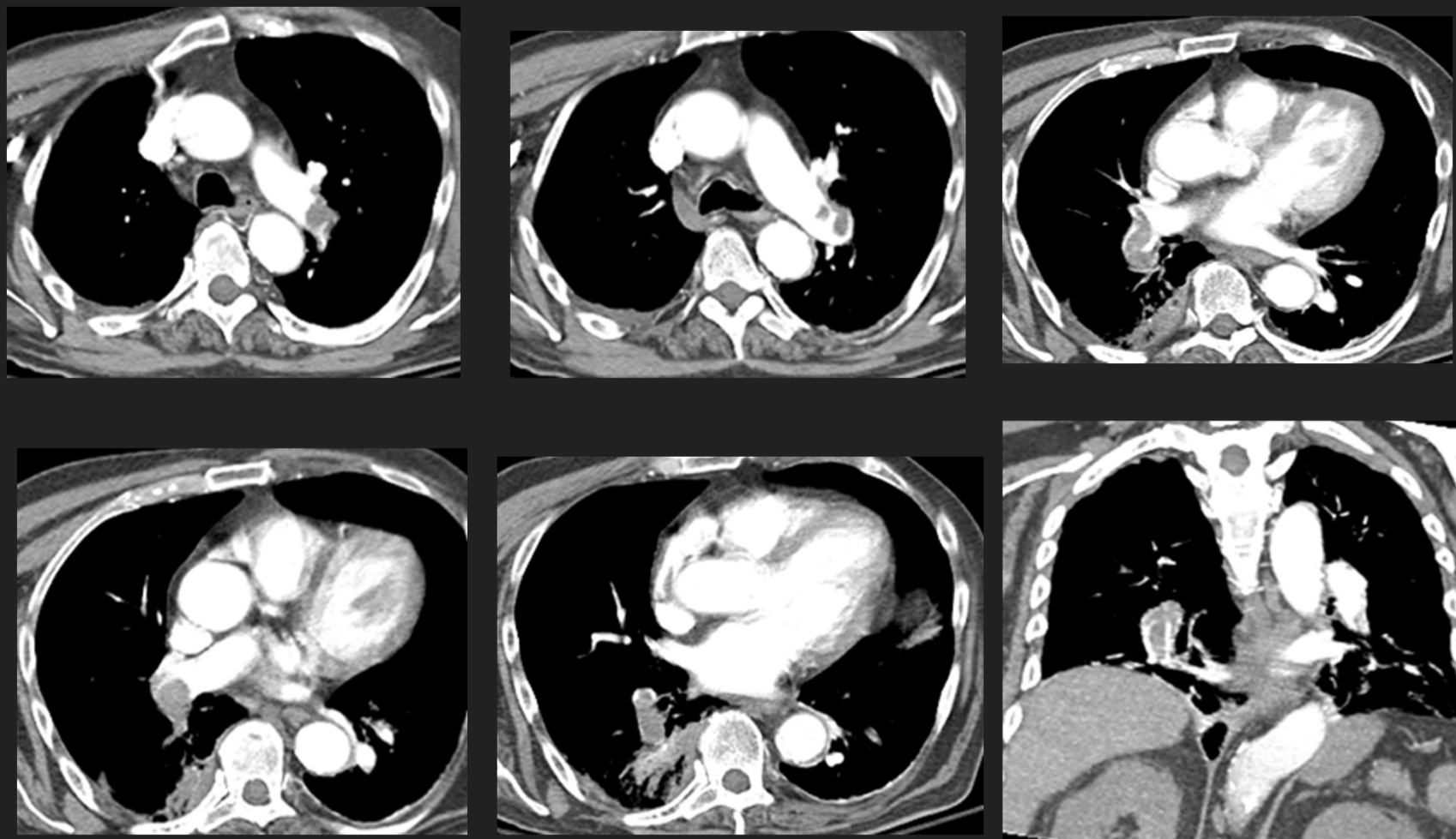


Additional Examples





Note the filling defects in the main and right pulmonary arteries, consistent with pulmonary emboli



Note the filling defects in the main and right main pulmonary arteries and right lower lobe segmental arteries consistent with pulmonary emboli