Project: Ghana Emergency Medicine Collaborative

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Pulmonary Embolism Part 2

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Diagnostic Evaluation

Wells Clinical Prediction Rule for Pulmonary Embolism (PE)

- Clinical feature   Points
- Clinical symptoms of DVT   3
- Other diagnosis less likely than PE   3
- Heart rate greater than 100 beats per minute   1.5
- Immobilization or surgery within past 4 weeks   1.5
- Previous DVT or PE   1.5
- Hemoptysis   1
- Malignancy   1
- *Total points*
-
- PE = pulmonary embolism; DVT = deep venous thrombosis.
- Risk score interpretation (probability of PE):

>6 points: high risk (78.4%);
2 to 6 points: moderate risk (27.8%);
<2 points: low risk (3.4%)

Diagnostic Evaluation

	Points	
Wells Clinical Prediction Rule for Deep Venous Thrombosis (DVT)		
Clinical feature	Points	
Active cancer (treatment within 6 months, or palliation)	1	
Paralysis, paresis, or immobilization of lower extremity	1	
Bedridden for more than 3 days because of surgery (within 4 weeks)	1	
Localized tenderness along distribution of deep veins	1	
Entire leg swollen	1	
Unilateral calf swelling of greater than 3 cm (below tibial tuberosity)	1	
Unilateral pitting edema	1	
Collateral superficial veins	1	
Alternative diagnosis as likely as or more likely than DVT	-2	
Total points		

DVT = deep venous thrombosis.
Risk score interpretation (probability of DVT):
>/=3 points: high risk (75%);
1 to 2 points: moderate risk (17%);
<1 point: low risk (3%).

Diagnostic Evaluation

- **Laboratory:**
  - Routine laboratory findings are nonspecific.
  - Include leukocytosis
  - Increased erythrocyte sedimentation rate (ESR), and an elevated serum LDH or AST (SGOT)
  - normal serum bilirubin.

Diagnostic Evaluation

- **Arterial blood gas**
  - Arterial blood gas (ABG) measurements and pulse oximetry have a limited role in diagnosing PE.
  - ABGs usually reveal hypoxemia
    - Hypocapnia,
    - Respiratory alkalosis.

Diagnostic Evaluation

- **Troponin** :
  - Serum troponin I and troponin T are elevated in 30 to 50 percent of patients who have a moderate to large pulmonary embolism.
  - Presumed mechanism is acute right heart overload.

- **Brain Naturetic Peptide:**
  - Very non specific peptide
  - Large elevation can suggest poor prognosis

Diagnostic Evaluation

- **Electrocardiogram**
  - ECG abnormalities common in patients with and without PE
  - limiting the diagnostic usefulness of the ECG
  - Most common Ekg finding is a sinus tachycardia
    - Or non specific ST and T wave changes
  - abnormalities historically considered to be suggestive of PE
    - S1Q3T3 pattern, right ventricular strain, new incomplete right bundle branch block

Diagnostic Evaluation

- **V/Q scan** :
  - The most extensive evaluation of the accuracy of the ventilation-perfusion (V/Q) scan was the Prospective Investigation of Pulmonary Embolism Diagnosis (PIOPED)
  - Accuracy was based on comparison with the gold standard test of Pulmonary angiogram
  - The found clincally accuracy was best when combined with pretest probabilities

Diagnostic Evaluation

- **V/Q scan** :
- Patients with high clinical probability of PE and a high-probability V/Q scan had a 95 percent likelihood of having PE
- Patients with low clinical probability of PE and a low-probability V/Q scan had only a 4 percent likelihood of having PE
- A normal V/Q scan virtually excluded PE

Diagnostic Evaluation

- **Ultrasound:**
  - In some patients clinicians have attempted to use lower extremity Doppler's to evaluate
  - Studies show that many patients with PE are missed
  - Bilateral lower extremity doppler's will decrease the rate of missed DVT
  - Operator dependent

Diagnostic Evaluation

- **D-dimer:**
  - D-dimer is a degradation product of cross-linked fibrin. It can be detected in serum using a variety of different assays:
  - Enzyme-linked immunosorbent assay (ELISA) (results in >8 hrs)
  - Quantitative rapid ELISA (results in 30 min)
  - Semi-quantitative rapid ELISA (results in 10 min)
  - Qualitative rapid ELISA (results in 10 min)
  - Quantitative latex agglutination assay (results in 10 to 15 min)
  - Semi-quantitative latex agglutination assay (results in 5 min)

Diagnostic Evaluation

- **D-Dimer:**

- For the quantitative assays, a level >500 ng/mL is usually considered abnormal

- They are best characterized as having good sensitivity and negative predictive value

- Poor specificity and positive predictive value.

Diagnostic Evaluation

- **Angiography** :
  - Pulmonary angiography is the definitive diagnostic technique or "gold standard" in the diagnosis of acute PE.
  - It is performed by injecting contrast into a pulmonary artery branch after percutaneous catheterization, usually via the femoral vein. A filling defect or abrupt cutoff of a small vessel is indicative of PE.

Diagnostic Evaluation

- **Angiography:**
  - A negative pulmonary angiogram excludes clinically relevant PE.
  - Pulmonary angiography is generally safe and well tolerated in the absence of hemodynamic instability caused by acute, severe pulmonary hypertension
  - Radiation exposure depends on the length and complexity of the procedure, and greater than CT.
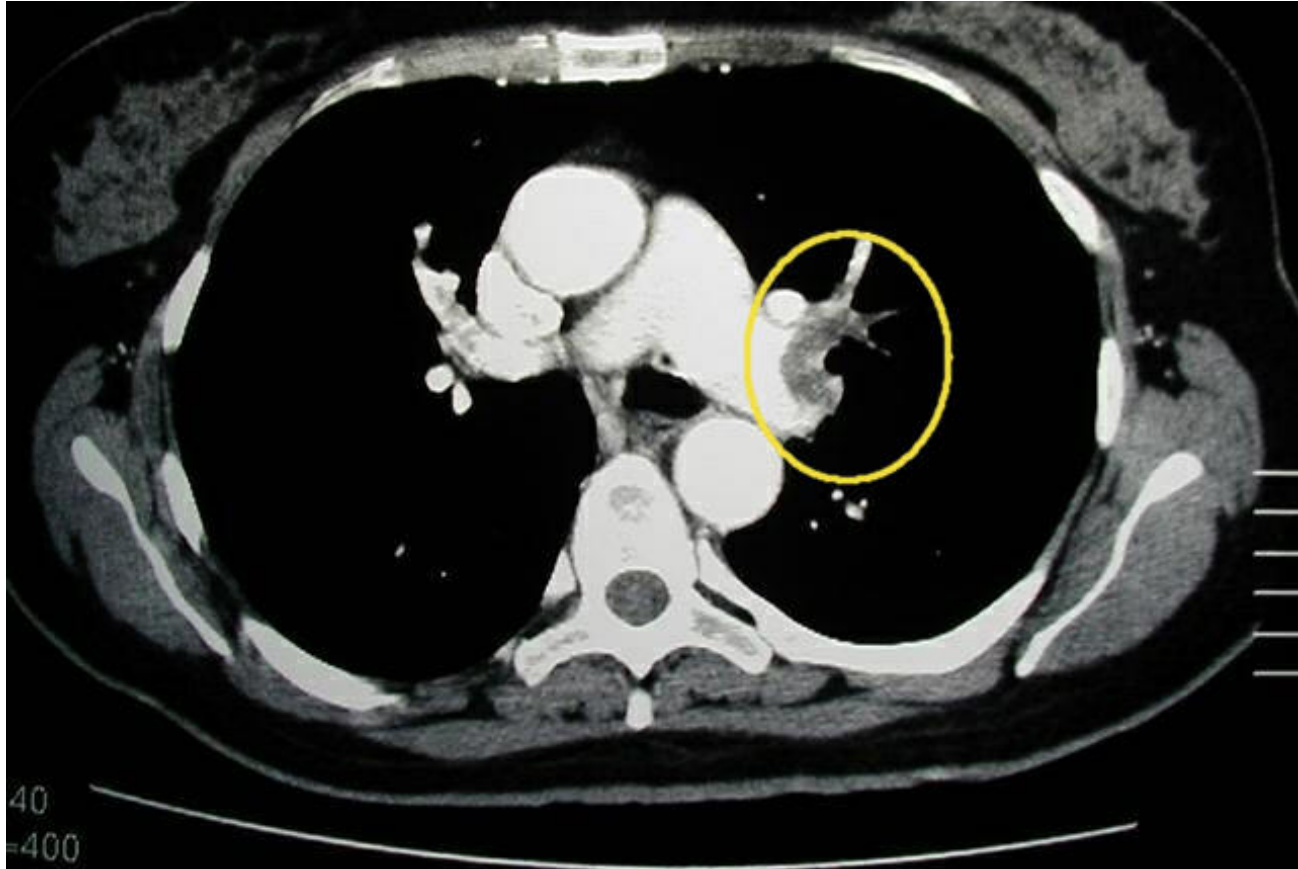
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Diagnostic Evaluation

- **Spiral CT:**
  - Spiral (helical) CT scanning with intravenous contrast (CT pulmonary angiography or CT-PA) is being used increasingly as a diagnostic modality for patients with suspected PE
  - Initial reports suggested that 98 percent of patients with PE were detected by CT-PA; however, that value decreased to 53 to 87 percent in subsequent studies
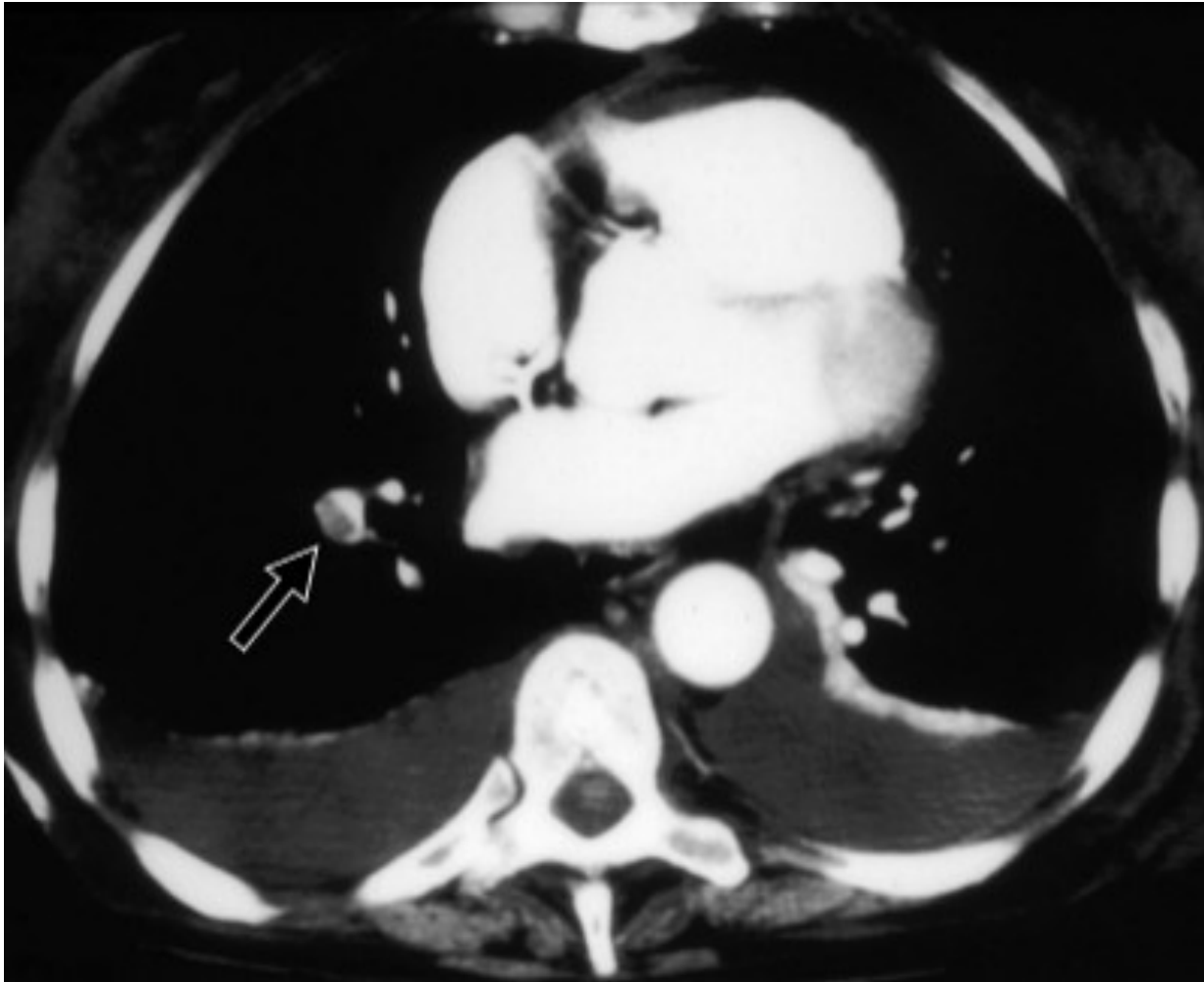
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PERC

- The following eight factors constitute the PE rule-out criteria (PERC):
- Age less than 50 years
- Heart rate less than 100 bpm
- Oxyhemoglobin saturation ≥95 percent
- No hemoptysis
- No estrogen use
- No prior DVT or PE
- No unilateral leg swelling
- No surgery or trauma requiring hospitalization within the past four weeks