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Pulmonary Embolism Part 2

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Diagnostic Evaluation

Wells Clinical Prediction Rule for Pulmonary Embolism (PE)

- Clinical feature
- 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

### Wells Clinical Prediction Rule for Deep Venous Thrombosis (DVT)

<table>
<thead>
<tr>
<th>Clinical feature</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active cancer (treatment within 6 months, or palliation)</td>
<td>1</td>
</tr>
<tr>
<td>Paralysis, paresis, or immobilization of lower extremity</td>
<td>1</td>
</tr>
<tr>
<td>Bedridden for more than 3 days because of surgery (within 4 weeks)</td>
<td>1</td>
</tr>
<tr>
<td>Localized tenderness along distribution of deep veins</td>
<td>1</td>
</tr>
<tr>
<td>Entire leg swollen</td>
<td>1</td>
</tr>
<tr>
<td>Unilateral calf swelling of greater than 3 cm (below tibial tuberosity)</td>
<td>1</td>
</tr>
<tr>
<td>Unilateral pitting edema</td>
<td>1</td>
</tr>
<tr>
<td>Collateral superficial veins</td>
<td>1</td>
</tr>
<tr>
<td>Alternative diagnosis as likely as or more likely than DVT</td>
<td>-2</td>
</tr>
</tbody>
</table>

**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 clinically 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
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.
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.
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