

Pulmonary Embolism Identification and Workup

1) Do I suspect my patient actually has a PE?

This question is the first and most important to address when working up a patient with a potential PE. Many, more common medical conditions, can precipitate shortness of breath and should always be on a physician's differential. Some examples include: anemia, asthma, COPD exacerbation, heart failure, MI, pneumonia, pleural effusions, pneumothorax and malignancy among others. Given this broad differential it is important for physicians to have a reasonably strong suspicion that a PE is high enough on the differential to warrant the necessary laboratory and imaging studies needed for the diagnosis.



Low density “saddle embolus” seen on CTA

2) What information and tools can I use to assess whether my patient likely has a PE?

Before deciding to run any tests or imaging, start with a good history and physical. PE risk factors can be broken down into Virchow's triad of endothelial injury, circulatory stasis and hypercoagulable state. Some major risk factors include recent surgery, long term hospitalization or immobilization and previous history of blood clots (DVT or PE) or any familial clotting disorders. Other risk factors to consider are use of estrogen-containing medication, pregnancy, prolonged travel >8 hours, excessive physical inactivity, obesity, hypertension and tobacco use. Interestingly it has also been demonstrated in population based case control studies in Denmark that systemic steroids increased venous thromboembolism (VTE) risk two-fold and Venous thromboembolism patients were 2.21 times more likely to have non-O blood type than their control counterparts.

After gathering historical information from your patient it's important to assess their present illness. The most common clinical manifestations of PE found from several studies, include dyspnea at rest or with exertion (73%), pleuritic pain (44%), calf or thigh pain (44%), calf or thigh swelling (41%), cough (34%), >2-pillow orthopnea (28%, and wheezing (21%). The onset of dyspnea is usually rapid: 46% within seconds and 26% within minutes. Signs of a massive PE include increased jugular venous pressure, a right-sided S3, and a parasternal lift.

3) I've taken a detailed history and physical. What other tools can I use to aid in my decision making?

Ultimately the decision to pursue PE workup labs and imaging for a patient should be up to the discretion of the physician and have the patients best interests first. Two commonly employed algorithms used in the emergency department are the Pulmonary Embolism Rule Out Criteria (PERC) and the Wells Criteria. PERC is used to help rule out PE in low risk patients while Wells is often used on patients with higher clinical suspicion. Examples of both scoring systems are shown below. The Wells criteria can be applied in two or three models with scoring examples and suggestions for next steps shown below. There is no consensus on which tier system to apply.

Wells Clinical Probability Assessment
<i>Risk Factors:</i>
Previous VTE (+3 points)
Immobilization or surgery within month (+1.5 points)
Malignancy (+1.0 point)
<i>Signs and Symptoms:</i>
Signs and symptoms of DVT (+3 points)
Hemoptysis (+1 point)
HR >100 (+1.5 points)
Alternate diagnosis is less likely than PE (+3 points)

Wells Three tier:

- **0-1:** low risk
- **2-6:** moderate risk
- **>6:** high risk
- low risk patients: pulmonary embolism rule-out criteria (PERC) can be considered as well as D-dimer
- moderate risk: consider D-dimer or CT pulmonary angiography
- high risk: D-dimer not recommended. Get CTA

Wells Two tier:

- **≤4:** unlikely
- **≥4.5:** likely
- unlikely: consider D-dimer
- likely: consider CTPA

It is also important to recognize that d- dimer levels rise naturally as patients age so age-adjusted dimers are needed in all patients over age 50. A d-dimer result is usually considered negative if it is less than age ×10 for patients aged 50 and older while, for younger patients, the cutoff is fixed at 500 µg/mL. Factors like pregnancy and active cancer or chemotherapy can also elevate D-dimer and diminish its diagnostic value. Patients that test outside the normal D-dimer range and have clinical suspicion for a PE should have a CTA as it is the most sensitive method to detect PE. If CT is unavailable or the patient is in renal failure or has a contrast allergy then a

V/Q scan may be used with average sensitivity is reportedly 77.4% and specificity is 97.7%. The PERC scoring system is similar to Wells and should be applied to patients who score low pretest probability in the Wells criteria first. Any patient that scores 1 point or higher can not be ruled out for PE and should undergo D-dimer testing. These scoring systems are estimates of PE likelihood but can not definitively rule a PE in or out and even a patient with a PERC score of 0 may still have a PE.

PERC rule for pulmonary embolism rule out.

All Variables Must Be Present for <2% Chance of PE
Age <50
Pulse oximetry >94% (room air)
HR <100
No prior PE or DVT
No recent surgery or trauma within prior 4 wk
No hemoptysis
No estrogen use
No unilateral leg swelling

Summary:

- Signs and symptoms of PE may mimic many other pulmonary and cardiac diseases. Keep your differential broad
- Identify all relevant patient risk factors that may make PE more likely over another diagnosis and be aware of the most specific symptoms seen in PE
- Use Wells and PERC to help guide your workup but let clinical judgement and best interests of the patient take precedence.
- I suspect PE from H&P> wells and PERC check for guidance> D-dimer outside normal range for age (no obvious reason for high dimer) > CTA

Reference:

Smith DA. Pulmonary Emergencies. In: Stone C, Humphries RL. eds. CURRENT Diagnosis & Treatment: Emergency Medicine, 8e. McGraw Hill; Accessed July 04, 2021.
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