# emDocs The EM Educator Series

# The EM Educator Series: Pulmonary Embolism

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Case 1: A 35-year-old male presents with tachycardia and hypoxia. His lungs are clear, and his cardiac exam is normal other than the tachycardia. ECG demonstrates sinus tachycardia, and chest x-ray is normal.

Case 2: A 57-year-old female presents with chest pain that worsens with inspiration. She is also tachypneic and has dyspnea with exertion.

Case 3: A 28-year-old female G2 P1 at 32 weeks presents with pleuritic chest pain and shortness of breath that has worsened over 3 days. Her vital signs are normal, but the ECG reveals right heart strain.

#### **Questions for Learners:**

- 1. What are the major risk factors for PE?
- 2. What are the various types of PE, and how can PE present?
- 3. What is the differential for shortness of breath and normal lung exam/unexplained hypoxia?
- 4. What does risk stratification entail, and what tools are available?
- 5. What diagnostic tools do we have in the ED?
- 6. What is the ED management of PE?
- 7. Who can be discharged, and who requires admission?

#### Suggested Resources:

- Articles
  - o <u>EM Basic</u>
  - o Emergency Medicine Cases Respiratory Emergencies
  - Emergency Medicine Cases PE Part 1
  - o <u>Emergency Medicine Cases PE Part 2</u>
  - o <u>IBCC PE</u>
  - o <u>EMCrit ECG</u>
  - o <u>EMCrit PERT</u>
  - o <u>emDOCs</u>
  - o emDOCs Outpatient Therapy
- Journal Articles
  - o JEM Risk Factors
  - o JEM Diagnostic Approach
  - o US RV Strain
  - o EMJ PE Management

#### **Answers for Learners:**

#### 1. What are the major risk factors for PE?

## Classic Risk Factors for PE: "THROMBOSIS"

Trauma/Travel Hypercoagulable state/HRT Recreational drugs (IVDU) Older Malignancy Birth Control Obesity/Obstetrical (The risk of Pulmonary Embolism is highest in the first 6 weeks postpartum) Surgery Immobilization Sickness Chronic illnesses such as Lupus, CAD, CHF & COPD contribute to risk. Varicose veins are a risk factor for Pulmonary Embolism, but when they generate clots, they may be less likely to embolize Note: 20% of Pulmonary Embolism patients will have no identifiable risk factors at presentation

## 2. What are the various types of PE, and how can PE present?

**Massive Pulmonary Embolism:** acute PE with *sustained* hypotension (systolic blood pressure 15 minutes or requiring inotropic support, not due to another cause), pulselessness, or profound bradycardia.

**Submassive Pulmonary Embolism:** no *sustained* hypotension, but either RV dysfunction (based on echocardiography, CT, BNP, Tropinin or ECG evidence) and/or myocardial necrosis (based on troponin elevation).

#### 3. What is the differential for shortness of breath and normal lung exam/unexplained hypoxia?

- ✓ PE
- ✓ Metabolic Acidosis
- ✓ Anemia
- ✓ Cardiac Tamponade
- ✓ Pulmonary Hypertension

#### 4. What does risk stratification entail, and what tools are available?

There are a number of decision rules that are used as objective aids in the work up of PE. <u>Wells</u> and <u>PERC</u> (Pulmonary Embolism Rule out Criteria) are the two most commonly utilized tools in North American EDs. It is important to understand how the prevalence of PE in your population impacts decision making. Simply put, the prevalence of a disease can be considered the pre-test probability of the patient ruling in for that disease. The maximum suggested prevalence for PE in order to use the PERC rule is 7%. In other words, if there is a high prevalence of PE in your population, PERC may not be applicable.

The PROPER trial out of France, where the prevalence of PE is low, showed that gestalt performed similarly to PERC in terms of 3-month PE rate, but PERC resulted in an 8% decrease in unnecessary CT

scanning, and a 40-minute decrease in ED stay [11]. While studies have suggested that physician gestalt may be as accurate as these decision tools [11,12], there is an argument to be made that even seasoned docs should take the time to calculate these scores because even they can have a tendency to overestimate pretest probability at times.

#### An Algorithmic Approach

Once you have decided to test for PE, our experts suggest starting with Wells to get an idea of the pretest probability.

- 1. If <2, use PERC
- 2. If 2-4, send D-dimer
- 3. If >4, consider a CTPA

Use Well's criteria to assess pretest probability for Pulmonary Embolism:

Clinical signs of symptoms of DVT +3 points

PE is #1 Diagnosis or equally likely +3 points

*Heart rate > 100 +1.5 points* 

Immobilization at least 3 days, or surgery in the previous 4 weeks +1.5 points

Previous, objectively diagnosed PE or DVT +1.5 points

*Hemoptysis* +1 *point* 

Malignancy with treatment within 6 months, or palliative +1 point

#### PERC Rule to help decide which low risk patients need a work-up for pulmonary embolism

The "Pulmonary Embolism Rule-Out Criteria" (PERC) is a step 2 decision support for excluding PE. If **none of the eight** PERC features are present in a patient that has been deemed low risk by Well's criteria or by clinical gestalt, then no further tests are indicated.

#### PERC RULE: "HAD CLOTS"

Hormones (estrogen) Age >50 DVT or PE history Coughing up blood (hemoptysis) Lower extremity swelling 02 <95%

## Tachycardia Surgery or trauma in past 4 weeks The PERC rule is only accurate when applied to LOW risk patients.

## 5. What diagnostic tools do we have in the ED?

**CXR.** While decades ago we depended more so on CXR and ECG to help in the diagnosis of PE, their utility has recently become less important. Nonetheless, findings on chest X-ray and ECG may aid in your decision making. The main role of a chest X-ray is to rule out alternative diagnoses. Beware of diagnosing pneumonia based on an infiltrate, as a pulmonary infarct from PE can look similar. The chest X-ray is often normal in PE. The classic findings are raised hemidiaphragm, pleural effusion, <u>Westermark's sign</u> and Hampton's hump. The latter are usually identified in retrospect after the diagnosis of PE has already been made.

**POCUS** is a great adjunct to the clinical exam and is helpful in determining if there are signs of right ventricular strain (RV-strain). POCUS can assist in making important decisions regarding diagnosis and treatment sometimes faster than CT scans. Use this to your advantage!

Certain EKG findings may help you to consider the diagnosis in the right clinical context. The most common EKG finding in PE is **tachycardia**. The most specific EKG finding is **anteroinferior TWIs**. **STE in V1, RBBB and right-axis deviation** are among others.

#### 6. What is the ED management of PE?

7. Who can be discharged, and who requires admission?

#### Thrombolysis is indicated in massive PE.

Our experts *do not* recommend thrombolysis in submassive PE. However, some experts believe that lytics are\_indicated if there is evidence of **present or developing circulatory or respiratory insufficiency**; or **moderate to severe RV injury**.

**Finally:** Fluid resuscitation in Pulmonary Embolism with shock is indicated as first line support, but \*resuscitate judiciously\* as volume expansion may impair RV function.

"Given the lack of evidence, anticoagulation treatment decisions for patients with subsegmental PE without associated DVT should be guided by individual patient risk profiles and preferences [Consensus recommendation]."

Once diagnosed, PE therapy begins with **anticoagulation**. LMWH (Fragmin or Enoxaparin) or Fondaparinux for at least 5 days *and* the INR=2.0-3.0, plus **Warfarin** 

Aujesky and colleagues reported outpatient management for PE was not inferior to management in hospital, for hemodynamically stable patients with no significant comorbidity, who could be safely anticoagulated, and closely followed as outpatients.

-Literature suggests **outpatient treatment is non-inferior, particularly with novel oral anticoagulants**. Recurrent thromboembolism, risk of bleeding, and incidence of major adverse outcome are **similar** in patients treated as outpatient versus inpatient.

**sPESI, PESI, and ESC possess strong literature support for outpatient PE stratification**, with adequate sensitivity for predicting low risk adverse event.

The HAS-BLED score and Outpatient Bleeding Risk Index allow assessment of bleeding risk.

Patient compliance, presence of psychosocial barriers, or alternative need for admission should be considered in patient disposition. Consideration of these important aspects with risk stratification and use of NOAC therapy can allow for safe, efficacious treatment as outpatient.