**Big Categories to Consider:**
- Respiratory
- Cardiac*
- Anemia (Hb<80)
- Neuromuscular (eg: Guillan Barre)
- Metabolic acidosis of any cause

*The most common presentation of MI in patients >85y/o is dyspnea. Effusion and tamponade may also present as dyspnea; use ED U/S!

COPD patients are at higher risk than the general population for PE, CHF, pneumonia, tamponade, pneumothorax and MI.

Rizkallah and colleagues found **20% of COPD exacerbation admissions had PE** (1).

Suspect other processes if your patient with COPD presents **atypically** from their usual episodes, or if they are **not improving** with medical therapies for their exacerbation (2).

**Differential diagnosis of dyspnea**

**MEDICALLY UNEXPLAINED DYSPNEA: “MUD”**

A condition characterized by a sensation of a need to take a deep inspiration or the feeling of an ‘oppressive’ chest plus symptoms of anxiety, in the absence of wheeze, cough, or sputum, ECG, CXR or peak flow abnormalities, and without cardiopulmonary explanations for their dyspnea. It has been called “the IBS of respirology”. Patients are often over-investigated without significant findings. A diagnosis of MUD should not be made on a single ED visit, but should be considered in patients who have had extensive previous work-up for the same symptoms in the past.
Risk factors and tools for investigating PE

**Classic Risk Factors for PE**

**“THROMBOSIS”**
- Trauma/Travel
- Hypercoagulable state/HRT
- Recreational drugs (IVDU)
- Older
- Malignancy
- Birth Control
- Obesity/Obstetrical*
- Surgery
- Immobilization
- Sickness†

*the risk of PE is highest in the first 6 weeks postpartum

†chronic illnesses such as Lupus, CAD, CHF & COPD contribute to risk.

Varicose veins are a risk factor for PE, but when they generate clots, they may be less likely to embolize.

**Note:** 20% of PE patients will have no identifiable risk factors at presentation.

**Suspect PE** when you see RAPID onset of symptoms, dyspnea+/-tachypnea, and pleuritic chest pain. Always be alert to older patients who present atypically.

Overuse of the D-dimer can lead to over-investigation and anticoagulation, unless used wisely and in the correct clinical context.

**Tips for using D-Dimer wisely:**

1) use a high sensitivity assay,
2) test low risk patients,
3) test when you expect it will be negative (to rule out PE),
4) don’t test D-dimer if you plan to order a CT regardless.

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suspected DVT</td>
<td>3.0</td>
</tr>
<tr>
<td>An alternate diagnosis is less likely than PE</td>
<td>3.0</td>
</tr>
<tr>
<td>Heart rate &gt; 100 beats/min</td>
<td>1.5</td>
</tr>
<tr>
<td>Immobilization or surgery</td>
<td>1.5</td>
</tr>
<tr>
<td>in the previous four weeks</td>
<td></td>
</tr>
<tr>
<td>Previous DVT/PE</td>
<td>1.5</td>
</tr>
<tr>
<td>Hemoptysis</td>
<td>1.0</td>
</tr>
<tr>
<td>Malignancy (on treatment, treated in past six months)</td>
<td>1.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Score range</th>
<th>Mean probability of PE</th>
<th>% with this score</th>
<th>Interpretation of risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-2 points</td>
<td>3.6%</td>
<td>40%</td>
<td>Low</td>
</tr>
<tr>
<td>3-6 points</td>
<td>20.5%</td>
<td>53%</td>
<td>Moderate</td>
</tr>
<tr>
<td>&gt; 6 points</td>
<td>66.7%</td>
<td>7%</td>
<td>High</td>
</tr>
</tbody>
</table>

**What about the PERC rule?**

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,
- O2 <95%,
- Tachycardia,
- Surgery or trauma in past 4 weeks.

***THE PERC RULE IS ONLY ACCURATE WHEN APPLIED TO *LOW* RISK PATIENTS***

**What are the Chest X-Ray Findings for PE?** Although the CXR may appear unremarkable, about 75% of patients with PE have findings resulting from the clot, such as an **elevated hemi-diaphragm**, a unilateral **pleural effusion**, **enlarged pulmonary arteries**, and even **infiltrates**. In young patients with pleuritic chest pain, a pleural effusion increases the likelihood of PE.

Uncommon findings of PE (see below) have low sensitivity for detecting PE.

**Uncommon findings for PE include:**
- “Westermark’s Sign” representing a region of oligemia
- or a wedge shaped consolidation aka “Hampton’s Hump”

Pulmonary Embolism work-up in pregnant patients & elderly patients.....and what about thrombolytics?

Is D-dimer useful in pregnancy?
The American Thoracic Society Guidelines (4) state D-dimer should not be used to rule out PE in pregnancy. D-dimer rises in the 2nd and 3rd trimester, and stays high post-partum.

Cutoffs of 1.5x, 2x and 2.2x the local threshold per trimester have been suggested.** However, our experts suggest that only in the first trimester a negative D-dimer may be useful to rule out PE.***

Guidelines for investigating for PE in pregnancy start with evaluation for signs & symptoms of DVT. If these are found, a leg doppler is done.

If no DVT is suspected or found, order a CXR:

- **CXR normal?** -> V/Q scan*
- **CXR abnormal?** -> CT scan

*V/Q scan exposes pregnant women to less radiation than a CT scan for PE (V/Q and CT expose the fetus to similar radiation dosages; both dosages are low and well below background levels.)

What about the elderly? (5)
Consider adjusting the upper limit cutoff for negative D-dimer in patients older than 50: Adjusted upper limit = age x 10

What about a patient on Warfarin? D-dimer can be falsely negative due to anticoagulation.

Do all PE patients need admission? Aujesky and colleagues (6) 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.

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

What about “Massive” PE?
Massive PE: acute PE with sustained hypotension (systolic blood pressure <90 for >15 minutes or requiring inotropic support, not due to another cause), pulselessness, or profound bradycardia. Thrombolysis is indicated in massive PE (7).

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

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 PE with shock is indicated as first line support, but *resuscitate judiciously* as volume expansion may impair RV function.

References: