EM CASE OF THE WEEK.

BROWARD HEALTH MEDICAL CENTER
DEPARTMENT OF EMERGENCY MEDICINE

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Care Warriors

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Diagnosis of Acute Pulmonary Embolism

A 54-year-old man is evaluated in the emergency department for a 1-hour history of chest pain with mild dyspnea. The patient had been hospitalized 1 week ago for a colectomy for colon cancer. His medical history also includes hypertension and nephrotic syndrome secondary to membranous glomerulonephritis, and his medications are furosemide, ramipril, and pravastatin. On physical examination the temperature is 37.5 °C (100 °F), the pulse rate is 120/min, the respiration rate is 24/min, the blood pressure is 110/60 mm Hg, and the BMI is 30. Oxygen saturation is 89% with the patient breathing ambient air and 97% on oxygen, 4 L/min. Cardiac examination shows tachycardia and an S4. Breath sounds are normal. Chest radiograph is negative for infiltrates, widened mediastinum, and pneumothorax. Serum creatinine concentration is 2.1 mg/dL (185.6 µmol/L). Empiric unfractionated heparin therapy is begun. Which of the following is the best test to confirm the diagnosis in this patient?

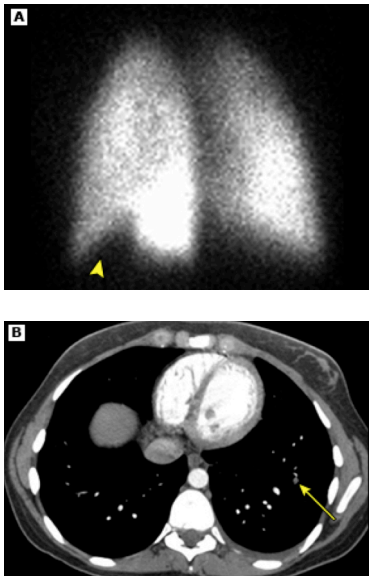
A. Assay for plasma D-dimer

B. CT Angiography

C. Lower Extremity Ultrasonography

D. Measurement of antithrombin III

E. Ventilation/perfusion scan



VQ scan left anterior oblique view perfusion image (A) shows a subsegmental defect (arrowhead) reported as intermediate probability of pulmonary embolism. Chest CT pulmonary angiogram (B) shows a thrombus in one of the left lower lobe pulmonary artery branches (arrow).

EM Case of the Week is a weekly "pop quiz" for ED staff.

The goal is to educate all ED personnel by sharing common pearls and pitfalls involving the care of ED patients. We intend on providing better patient care through better education for our nurses and staff.

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The correct answer is E.
Either ventilation/perfusion scanning or contrast-enhanced CT scanning (if not contraindicated) performed with a specific protocol to detect pulmonary embolism is an appropriate noninvasive test to diagnose acute pulmonary embolism. This patient is at high risk for pulmonary embolism because of his recent hospitalization, cancer, and nephrotic syndrome. A positive ventilation/perfusion scan would confirm the diagnosis of pulmonary embolism in this patient with a high pretest probability for the condition, especially in the absence of parenchymal lung defects on chest radiograph. The probability of pulmonary embolism was very high based on this presentation that included chest pain, dyspnea, recent hospitalization and surgery, active cancer, and a protein-losing nephropathy. A negative D-dimer test would not be sufficient evidence to rule out a pulmonary embolism under these circumstances, and a high D-dimer level would add little to the diagnostic work-up. Decreased antithrombin III levels may result from nephrotic syndrome, and levels are lowered during acute thrombosis, especially during treatment with heparin. Therefore, measuring antithrombin III would add little to the accuracy of the diagnosis of pulmonary embolism or have any implication for immediate management decisions. Lower extremity ultrasonography can disclose asymptomatic deep venous thrombosis in a small percentage of patients presenting with symptoms of pulmonary embolism. However, the yield is relatively low and ventilation/perfusion scanning would have a much higher degree of accuracy. CT angiography is an acceptable modality to diagnose acute pulmonary embolism but requires a significant amount of contrast infusion (as much as a pulmonary angiogram) which would be contraindicated in a patient with an elevated serum creatinine level.

Introduction
Acute pulmonary embolism is a form of venous thromboembolism that is common and sometimes fatal. Pulmonary emboli usually arise from thrombi that originate in the deep venous system of the lower extremities.

Presentation
The classic presentation of a PE is the abrupt onset of pleuritic chest pain, shortness of breath, cough, and hypoxia. However, acute PE's often present with a wide variety of features, from no symptoms to shock or even sudden death.

Risk Factors
Venous stasis, hypercoagulable states, immobilization, surgery/trauma, pregnancy, OCP's/Estrogen replacement, malignancy, acute medical illness, IV drug abuse, drug induced lupus anticoagulant, hemolytic anemia's, heparin-associated thrombocytopenia, homocystinemia, homocystinuria, hyperlipidemias, phenothiazines, thrombocytosis, varicose veins, venography, venous pacemakers, first few days of Warfarin therapy, IBD

Indicators (PIOPED II study)
Travel for 4 or more hours in the past month, surgery in the last 3 months, malignancy esp. lung cancer, current or past hx of thrombophlebitis, trauma to the lower extremities and pelvis during the past 3 months, smoking, central venous instrumentation within the past 3 months, stroke/paresis/paralysis, prior PE, HF, COPD

Diagnosis
For most patients with suspected PE who are hemodynamically stable, it is suggested to use an approach that combines clinical and pretest probability assessment, D-dimer testing, and definitive diagnostic imaging. Definitive imaging includes computed tomographic pulmonary angiography and less commonly, ventilation perfusion scanning or other imaging modalities. For patients that are hemodynamically unstable and whom definitive imaging is unsafe, bedside echocardiography or venous compression ultrasound may be used to obtain a presumptive diagnosis of PE to justify the administration of potentially life-saving therapies.

For a list of educational lectures, grand rounds, workshops, and didactics please visit ***BrowardER.com*** and **click** on the ***"Conference"*** **link**.

All are welcome to attend!

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Determining Pretest Probability of PE

Wells Criteria:

- Clinical symptoms of DVT-3 pts
- Other diagnoses are less likely than PE-3 pts
- HR>100-1.5 pts
- Immobilization 3 or more days or surgery in the previous 4 weeks-1.5 pts
- Previous DVT/PE-1.5 pts
- Hemoptysis-1 pt
- Malignancy- 1 pt
    - Low <2
    - Intermediate 2 to 6
    - High >6

Low Probability of PE (PTP<15%, Wells score <2)

PERC Rule is applied to determine whether or not diagnostic evaluation with D-dimer is indicated. In adult patients with a low PTP of PE, a negative D-dimer test yields a 99% negative predictive value in patients aged 60-80 y.o. but only a 21-31% NPV in patients older than 80 y.o. For patients who fulfill all eight PERC criteria, no further testing is required. For patients who do not fulfill all eight criteria, further testing with D-dimer is indicated. Exception to PERC Rule applies to inpatients and the critically ill. When the D-dimer level is <500 ng/mL, no further testing is required. A D-dimer ≥500 ng/mL, diagnostic testing should be done, preferably with a CTPA.

PERC Rule

- Age<50
- HR<100 bpm
- Oxyhemoglobin sat ≥95%
- No hemoptysis
- No estrogen use
- No prior DVT or PE
- No unilateral leg swelling
- No surgery/trauma req hospitalization within past 4 wks

Intermediate Probability of PE (Wells score 2-6)

When the D-dimer is <500 ng/mL, PE is likely excluded and no further testing is generally required however some experts will proceed with diagnostic imaging is select patients, such as those with limited cardiopulmonary reserve or those in whom the PTP was in the upper zone of intermediate, i.e. Well's score 4-6. When D-dimer level is ≥500 ng/mL, diagnostic imaging should be performed, preferably a CTPA.

High Probability of PE (Wells score >6)

For patients in whom the probability of PE is high or in whom the suspicion is low or moderate and the D-dimer is ≥500 ng/mL, CTPA should be performed. When imaging is indicated, CTPA is the imagining modality of choice. V/Q scan is reserved for patients in whom the CTPA is contraindicated for example, patients with a hx of mod to severe contrast allergy, high risk of contrast nephropathy (eGFR<30), hypotension, advanced heart failure, or inability to tolerate CT scanning due to morbid obesity or difficulty in lying flat. V/Q scan may also be indicated when CTPA is inconclusive or when additional testing is needed due to a high clinical suspicion of PE despite negative imaging.

ABOUT THE AUTHOR

This month's case was written by Ashley Shanblatt. Ashley is a 4th year medical student from NSU-COM. She did her emergency medicine rotation at Broward Health North in November 2017. Ashley plans on pursuing a career in Family Medicine after graduation.

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