

PULMONARY EMBOLI: A SOMETIMES ELUSIVE CLINICAL ENTITY

A 45 year-old male presented for evaluation following a brief syncopal episode. Over the preceding six weeks, he had noted dyspnea with such activities as walking or climbing stairs, but also occurring at rest. The syncope occurred during an episode of hyperventilation. He was a nonsmoker, but had a history of hypertension, a positive family history of coronary artery disease, and was moderately overweight. He had no history of dyslipidemia or diabetes mellitus. Four months prior to his presentation, he was involved in a motor vehicle accident. Admission medications included metoprolol 25 mg. bid and aspirin 325 mg. qd.

On examination, the blood pressure was 98/72, respiratory rate 16, and the pulse was 84. The patient was comfortable without chest pain or shortness of breath. The chest x-ray was normal. Troponin and CPK levels were normal. Suspecting cardiac ischemia, cardiac catheterization was performed, which showed normal coronary arteries and normal left ventricular function. The patient was reassured and discharged. Following discharge, however, the D-dimer was returned at 5,222 ng/ml. (normal 68-500 ng/ml). An echocardiogram demonstrated a dilated RA and RV. RVSP was 53 mmHg.

The patient was readmitted and a chest CT scan demonstrated evidence of extensive bilateral pulmonary emboli. A venous duplex study demonstrated deep venous thrombosis of the right lower extremity. He was treated with LMWH and discharged on coumadin and LMWH until a therapeutic INR was achieved. All tests for inherited or acquired causes of hypercoagulability (homocysteine, prothrombin 20210 mutation, anticardiolipin Ab, factor V leiden mutation) were negative.

Pulmonary emboli (PE) is a common clinical problem with an incidence of 1 out of 1,000 and a mortality of >15% in the first three months following diagnosis.^{1,2} Risk factors for PE include: inherited causes of hypercoagulability, trauma, surgery and immobilization, cancer, and oral contraceptives. Obesity, smoking, and hypertension are associated with both PE and CAD. And, there is an association between atherosclerosis and venous thrombosis.

The EKG may show the typical S1Q3T3 pattern - indicative of RV strain - but, as in the patient discussed, may show T-wave inversion in V1-V4 or new or incomplete right bundle branch block, also signs of right ventricular dysfunction. Biomarkers may also be useful in the diagnosis or prognostication in PE. Troponin elevation may be indicative of RV micro-infarction and an elevated BNP of RV overload. Therefore, both historical factors and chemical markers may present a picture perhaps more suggestive of an acute coronary syndrome, as clinically suspected in the patient above. One simple clinical model useful to predict PE uses a 12.5 point scoring system based on 7 clinical variables (fig#1).³ A score of <2 and a negative D-dimer was associated with a rate of PE of only 1.5% and a high risk of the score was >6.0. While the D-dimer may be elevated in a variety of conditions, a normal D-dimer has high sensitivity and a high negative predictive value for the *absence* of PE and therefore may preclude the need for chest CT scanning when evaluating patients in the outpatient setting, especially.

Chest CT scanning may also reveal unsuspected reasons for symptoms such as pneumonia or interstitial fibrosis and should be the preferred diagnostic modality of choice in patients with anaphylaxis to contrast agents, in the presence of renal failure or pregnancy, or with patients with a history of prior PE diagnosed by lung scan. The generation of the CT scan available should also be considered when using this imaging technique. Third generation scanners have a 1 mm. resolution whereas first generation scanners have only 5 mm. resolution and may fail to detect 1/3 of PEs, especially in subsegmental pulmonary arteries. The type of scanner available is useful in formulating a diagnostic strategy (fig#2).

LMWH has largely supplanted unfractionated heparin in the acute treatment of PE in stable patients. Thrombolysis (rt-PA, 100 mg. continuously infused over two hours with heparin started after rt-PA infusion), is used in massive PE, and seems to improve right ventricular dysfunction. Open surgical embolectomy may be indicated in certain patients (massive PE and contraindications for thrombolysis; hemodynamic instability) when performed in centers with a dedicated interdisciplinary team committed to 24-hour availability. The two principal indications for inferior vena cava filter placement are clinical failure of anticoagulation with recurrent PE and absolute contraindications for anticoagulant therapy. Oral anticoagulation therapy (INR 2.0-3.0) should be continued for six months when the cause of PE is due to trauma or surgery, but most others should receive indefinite therapy.

Pulmonary emboli has been described as a “great masquerader” and a recent review of this subject notes that “To diagnose PE, one must think of PE as a diagnostic possibility.”¹ Although this patient had trauma four months prior to his presentation and had no abnormal physical findings – no tachycardia, no tachypnea, no physical evidence of DVT – he underscores the importance of considering the diagnosis of this sometimes inscrutable clinical entity.

REFERENCES

- 1 Goldhaber S, Elliott C G. Acute Pulmonary Embolism: Part I. Epidemiology, Pathophysiology, and Diagnosis. *Circulation* 2003;108-2726-2729
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- 3 Wells PS, Anderson DR, Rodger M., Ginsberg JS, Kearon C, Gent M, Turpie AG, Bormanis J, Weitz J, Chamberlain M, Bowie D, Barnes D, Hirsh J. Derivation of a simple clinical model to categorize patients probability of pulmonary embolism: increasing the models utility with the SimpliRED D-dimer. *Throm Haemost*_2000;Mar 83:416-20.
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Proposed diagnostic PE strategy

Adapted from Goldhaber, et al

Figure 1

RULES FOR PREDICTING THE PROBABILITY OF EMBOLISM

Variable

No. of Points

Risk Factors

Clinical signs and symptoms of deep venous thrombosis	3.0
An alternative diagnosis deemed less likely than pulmonary embolism	3.0
Heart rate >100 beats/min	1.5
Immobilization or surgery in the previous 4 weeks	1.5
Previous deep venous thrombosis or pulmonary embolism	1.5
Hemoptysis	1.0
Cancer (receiving treatment, treated in the past six months, or palliative care)	1.0
Clinical Probability	
Low	<2.0
Intermediate	2.0-6.0
High	>6.0

Adapted from Wells et al