Pulmonary Embolism: Potentially fatal and difficult to diagnose

Introduction

Pulmonary embolism (PE) is a common disease which can sometimes be fatal. Although it affects 300,000 to 600,000 people in the United States each year, it can be hard to diagnose because of its nonspecific signs and symptoms. In pregnancy, PE has been reported to range from 1 case in 200 deliveries to 1 case in 1400 deliveries. It is also most often a complication of deep vein thrombosis (DVT) of the leg. Delays in diagnosing PE often occur because patients present with highly variable clinical presentations. Timely diagnosis and treatment are essential to prevent recurrent thromboembolism and death.

Signs and Symptoms

While the classic presentation of PE is abrupt onset of pleuritic chest pain, shortness of breath, and hypoxia, some patients present with no obvious symptoms. Presenting symptoms may vary from progressive dyspnea to sudden catastrophic hemodynamic collapse. Therefore, PE should be part of the differential diagnosis in patients with respiratory symptoms which cannot be explained by another diagnosis.

Some atypical symptoms of PE include:

- Flank pain
- Hemoptysis
- New onset of atrial fibrillation
- Wheezing
- Productive cough
- Fever
- Seizures
- Syncope
- Decreasing level of consciousness
- Delirium (in elderly patients)

Three primary influences predispose a patient to thrombus formation; these form the so-called Virchow triad, which consist of the following:

- Endothelial injury
- Stasis or turbulence of blood flow
- Blood hypercoagulability

Diagnosis

Patients with suspected PE should be stabilized initially while clinical evaluation and diagnostic workup are ongoing. The practice of using clinical scoring systems to determine the probability of PE is supported by evidence-based literature. Validated clinical prediction rules should be used to estimate pretest probability of PE and to interpret test results. Pretest clinical scoring systems such as Wells criteria and Geneva score should be used to determine a patient’s risk of PE.

Physical signs of PE include:

- Clinical signs and symptoms suggesting thrombophlebitis: 32%
- Lower extremity edema: 24%
- Cardiac murmur: 23%
- Cyanosis: 19%
- S₃ or S₄ gallop: 34%
- Diaphoresis: 36%
- Fever (temperature >37.8°C): 43%
- Accentuated second heart sound: 53%
- Rales: 58%
- Tachypnea (respiratory rate > 16/min): 96%, at least in this reference

Professional society guidelines recommend a combination of pretest probability with elements from the history, physical exam and laboratory results to identify PE.
Risk Stratification:
Based on pretest clinical scoring systems and history and physical exam, patients can be stratified into low, intermediate or high risk for PE. The patient's risk stratification will determine further diagnostic testing options.

D-dimer testing should be used to evaluate patients with lower risk for PE. D-dimer is highly sensitive to the disease and in combination with pretest risk stratification can prevent unnecessary imaging. A normal plasma d-dimer level (ideally, age-adjusted [age x 10 ng/mL] but otherwise <500 ng/mL) provides sufficient negative predictive value for PE and imaging studies are not warranted.1

Depending upon the pretest probability tool being used, d-dimer may be reserved for low probability scores, with imaging performed for intermediate and high probability scores.

For patients with a high pretest probability of PE based on either the clinician's evaluation and experience or a clinical prediction tool, should receive imaging studies. Computed tomographic pulmonary angiography (CTPA) is the preferred method of diagnosis when it is available and there are no contraindications. D-dimer assay should not be obtained in these patients because a negative value would not obviate the need for imaging.1

Although several are fairly nonspecific, other potentially useful laboratory testing in patients with suspected PE include the following:3

- White blood cell count
- Arterial blood gases
- Serum troponin level
- Brain natriuretic peptide
- Ischemia-modified albumin level

Imaging Studies
Useful for the diagnosis of PE under certain circumstances:

- CTA
- VQ
- Ultrasound
- Pulmonary arteriography

Usually done to assess for other causes of symptoms and may have findings suggestive but not diagnostic of PE:

- Echocardiography
- ECG
- CXR

Rarely done in evaluation of possible PE:

- Venography
- MRI

Management of PE
The initial approach taken with patients with suspected PE is dependent on whether or not the patient is hemodynamically stable.2

- Hemodynamically unstable PE (“massive” PE) presents with hypotension; defined as systolic blood pressure <90 mmHg for a period >15 minutes, hypotension requiring vasopressors, or clear evidence of shock
- Hemodynamically stable PE is defined as PE that does not meet the definition of hemodynamically unstable PE. These patients range from patients with small PE and stable BP (“low risk”) to patients with larger PE who have right ventricular dysfunction and borderline BP (sub-massive PE).3

Immediate anticoagulation is necessary for all patients suspected of having either DVT or PE.

Thrombolytic therapy should be started on patients with hemodynamically unstable PE who do not have a high bleeding risk. The role of thrombolytic therapy in patients with non-massive PE but increased risk for deterioration (right ventricular strain, elevated troponin, elevated BNP) is unclear.

Long-term anticoagulation is critical to the prevention of recurrence of DVT or PE.5

Medical Professional Liability
PIAA is the insurance industry trade association that represents entities doing business in the medical professional liability (MPL) field. PIAA’s Data Sharing Project (DSP) is the largest ongoing independent collaborative database of MPL claims and lawsuits. Information from the DSP reveals that pulmonary embolism (PE) is included in the top 10 “Most Prevalent Outcomes for Closed Claims” for the period of 2009-2013 for the three specialties addressed below. This information further emphasizes the need to address risks and vulnerabilities that contribute to a delay in diagnosis and treatment. The term outcome is defined as the medical condition that occurred after a medical encounter and resulted in the chief medical factor that is named in the claim or lawsuit.

- Emergency Medicine (EM): Approximately 31% of the EM closed claims linked with PE resulted in indemnity payments totaling more than $4 million; the average indemnity payment was $439,750
- Internal Medicine (IM): Approximately 34% of the IM closed claims linked with PE resulted in indemnity payments totaling more than $6 million; the average indemnity payment was $345,694
- General and Family Practice (GFP): Approximately 26% of the GFP closed claims linked with PE resulted in indemnity payments totaling more than $9 million; the average indemnity payment was $258,053
Case #1

A 43-year-old male presented to the local ED with complaints of feeling a bit "under the weather." He had experienced a slight cough the day previous, while having "a coughing fit," felt a sharp pain in his left middle back underneath the shoulder blade. Since then the area had been uncomfortable, it had been difficult to take a deep breath because it exacerbated the pain. The patient reported that Tylenol dulled the pain somewhat. He denied discharge or drainage. No abdominal pain, nausea or vomiting and no fever. The patient reported smoking about two packs of cigarettes per week and one cigar every night.

When the patient presented to the ED on 9/8 his vital signs were T 37.9, P 116, R 30, BP 139/90, O2 95%. Upon exam by a PA, the patient was able to move comfortably. He had a significant amount of discolored yellow post nasal drip. There was lymphadenopathy of cervical nodes. Heart rate was a bit tachycardic. Lungs were clear and the patient was able to take fairly deep inspirations without splinting. The patient's pain was reproducible by palpating his mid-thoracic paravertebral area on the left side. The assessment was of left paravertebral, mid-thoracic muscle strain. A prescription was given for Flexeril 10 mg, #10 with no refills, as well as Napsyn 500 mg.

The patient next sought medical care on 9/20 when he presented to his PCP with complaints of low grade fever and a cough, as well as generally not feeling well. On exam, the patient had mild nasal congestion with some pale mucus. His temperature was 37.4 and BP 130/78. The lungs were clear; heart was normal. The EKG showed tachycardia with mild T flattening laterally and the chest x-ray was thought to show pneumonia. The assessment was of ongoing URI with sinus congestion and bronchitis likely. The PCP prescribed Bactrim for 10 days.

The following afternoon, the patient experienced difficulty breathing while at home and went into arrest. An ambulance was called and CPR was initiated. Upon arrival in the ED, the patient was noted to be unresponsive, with pupils fixed and no fever. The patient reported smoking about two packs of cigarettes per week and one cigar every night. The patient's EKG showed a new pattern of flipped T waves in several leads, indicative of right heart strain

Case Resolution

The case was resolved through voluntary settlement.

Case #2

A 33-year-old pregnant patient with an EDC of 12/21 and a known uterine leiomyoma, was admitted to the hospital on 10/9 by a covering OB/GYN, with a complaint of right lower quadrant pain, which was intermittent but moderately severe. The patient was also experiencing intermittent contractions. It was felt the pain was most likely due to the leiomyoma. She was given IM Demerol for pain and IV hydration. Her OB/GYN saw her the next morning, at which time she had no discomfort. She was not having uterine contractions and had reassuring fetal heart tones by monitor. She wanted to go home and was discharged on bed rest, with a plan to see her OB/GYN in one week.

The next day, the patient was seen in the office, at which time she was experiencing irregular contractions and was moderately tender over the fibroid. She was re-admitted to the hospital on Friday. She reported no leg pain or leg swelling. She was placed on a Morphine PCA, was taken off Terbutaline and placed on Nifedipine 20 mg every 6 hours. An ultrasound of the abdomen was normal, with the exception of the previously mentioned fibroid. The OB/GYN then left town for the weekend.

On Saturday, the patient reported to the covering physician that she was "feeling much better." On Sunday, the patient complained of some right upper quadrant pain and right leg cramping. Although the nurses reported a slightly positive Homan's sign at 01:30 and 09:02, the covering OB/GYN noted no Homan's sign but some slight tenderness of the right leg. The chart noted “no sign of DVT” but recommended vigilance in watching for DVT.

On Monday, the primary OB/GYN returned and saw the patient at about 08:30, at which time she reported no leg cramping. She mentioned some breathlessness, but the patient attributed it to the Morphine PCA. On exam, she had tenderness over the fibroid on the right side but the exam was otherwise normal. The OB/GYN did not document an examination of the lower extremities.

That evening, the on-call OB/GYN was called by the nursing staff at about 21:00, as the patient reported palpitations followed by shortness of breath. Oxygen and IV fluid were started. Chest X-ray and EKG were normal. At 22:00 the patient again experienced some shortness of breath and her oxygen sats dropped to 91%, accompanied by a drop in BP. At
At this time the on-call OB/GYN called the hospitalist and perinatologist. The differential at this time included pulmonary embolus and myocardial infarction. At 21:45, the troponin came back at 0.39. The patient was complaining of retrosternal, pleuritic chest pain. She also had some calf pain.

The patient was taken to the OR, at which point the baby was successfully delivered. Immediately upon delivery, the patient became hypotensive, then bradycardic. CPR was attempted. She first responded to Atropine and Epinephrine, then Dopamine; however, she repeatedly went pulseless. After a 35 minute resuscitative effort, the patient was pronounced at 01:33.

A post-mortem determined the cause of death to be PE as a result of DVT. When the pulmonary artery was opened it revealed a single, non-adherent, coiled, 14 inch long, saddle embolus almost occluding the right and left pulmonary artery branches.

**Issues in the Case**

- While the physician was adamant that he had conducted a physical exam of the patient’s lower extremities, and found them to be unremarkable, he failed to document this fact. His assertion was further weakened when the patient’s autopsy noted a 4 cm difference in the patient’s leg size.

- The physician failed to completely review the physician and nursing notes from the weekend. Had he done this he would have appreciated signs and symptoms of a DVT that were noted on the medical record.

- The physician did not notice that the patient’s medical record reflected positive Homan’s signs on several occasions over the weekend. Had the physician noted the positive Homan’s signs he may have ordered a compression ultrasound to diagnose the DVT or at a minimum considered additional testing.

- The physician failed to order Heparin which would have stopped the clot from breaking off and causing serious injury to the patient.

**Case Resolution**

The case was resolved through voluntary settlement.

**Case #3**

A 65-year-old male with a long history of hypertension called his PCP to report that two days earlier, while taking his usual walk, he suddenly became quite light-headed, blacked-out, and awoke on the ground in a pile of soft snow. He was able to walk back to the house, but felt short of breath and “woozy.” The patient reported that he remained in bed for two days because he felt very poorly and short of breath with any exertion. He denied chest pain, cough, fever, chills, nausea or vomiting. However, he noted his blood pressure was quite low at 90/50. The PCP asked the patient to stop his anti-hypertensive medications and to see him the next day.

At the office visit the following day, the patient had a normal cardiogram and his BP was 130/80. The PCP suspected cardiac abnormalities and ordered an outpatient echocardiogram and Holter monitor. During the next three days, the patient continued to show improvement and remained his exercise tolerance. Although he stacked wood and shoveled snow, his echocardiogram showed significant right ventricular dysfunction, so a spiral CT was ordered to rule-out pulmonary embolus. The CT report was received that night and revealed multiple pulmonary emboli, including one large embolus with a near total obstruction of the right pulmonary artery. The patient was called and was asked to report to the ED for further evaluation.

At the ED, the patient was alert, in no acute distress, BP 152/98, P 60, PO2 84m, pH 7.43. The EKG suggested an anterior wall ischemia with a normal troponin. The PCP consulted with the cardiology service and it was decided to treat the patient with TPA, as well as normal anticoagulation with Lovenox. TPA therapy of 100 g IV over 2 hours, plus Lovenox.

**References**


30 mg, followed by 1 mg/kg subcu q12h was initiated around midnight. At 01:45 the patient reported feeling dissociated with left-sided hemiparesis. He was given Protamine in an attempt to reverse the Lovenox. The CT showed a right occipital lobe hemorrhage.

The patient was transferred to a tertiary care center where he underwent two craniotomies. After extensive therapy, the patient was left with moderate to severe cognitive communication deficits in the area of memory, orientation, problem solving and abstract reasoning.

**Issues in the Case**

- Because the patient was hemodynamically stable and had survived a major PE eight days previously, he did not meet the criteria for initiation of a thrombolytic
- The risks of thrombolytic therapy in a patient several days after the initial event outweighed the benefits of the treatment
- There was a delay in diagnosing the patient’s PE. The CT scan was not ordered until over a week after the initial event
- The physician failed to provide the patient and his wife with adequate information concerning the risks and benefits associated with TPA fibrinolytic therapy sufficient to allow them to make an informed choice about going forward with the treatment

**Case Resolution**

The case was settled through ongoing post-mediation negotiations.

**Conclusion**

Pulmonary embolism is a common disease which can be hard to diagnose due to its nonspecific signs and symptoms. Timely diagnosis and treatment are critical to prevent recurrent thromboembolism and death. Because of the difficulties in diagnosing PE, it should be part of a patient’s differential diagnosis when a patient presents with respiratory symptoms which cannot be adequately explained with another diagnosis.

---

**Patient Safety: How Communication Failures Can Affect Your Patients and Your Practice**

**November 30, 2016 12:00 pm**

This webinar will examine how communication is a key part of patient safety in the office practice through review of data related to miscommunication failures and exploring ways to prevent these failures.

**Objectives:**
- Examine data related to communication failures
- Understand how communication is a key part of patient safety in the office practice
- Identify ways to prevent communication failures

**Documentation Risks and How to Address Them**

**December 14, 2016 12:00 pm**

Documentation in the EHR is a challenge for most practices. Documentation is the driver for many competing priorities which the practice is dependent: quality and reimbursement. So where does risk fit in? Join us to identify where practices need to be aware of the risks and offer strategies to reduce these risks.

**Objectives:**
- Identify the risks associated with documentation
- Identify which key areas may impact documentation from a risk perspective
- Develop strategies to improve documentation from a risk perspective

Register today at www.medicalmutual.com

If you are new to our webinars and would like to access our archives please send an email to alopez@medicalmutual.com.

Our Wednesday Webinars will resume in February 2017. Please check our website for details.
The articles in this newsletter seek to raise the consciousness of clinicians who must apply their own experience, intuitions, and medical judgments to arrive at optimal care decisions. They do not constitute legal advice or practice standards. If you have any questions on any of the topics addressed by this publication, you should seek a qualified legal opinion.