Pulmonary Embolism

EMC 360
Lecture 31
Cline - chap. 26;

Objectives

Upon completing this lecture you should be able to :

- Discuss the pathophysiology of pulmonary embolism
- Discuss frequency, mortality, and risks for PE
- Discuss the assessment history and physical exam for possible PE
- Discuss the ABGs and EKG found in PE
- Discuss the prehospital treatment of suspected or for possible PE. And what "first responder" treatment may worsen a PE patient?

Pulmonary Embolism (PE)

- Common and potentially lethal disease
- PE not exactly a disease; rather, a complication of DVT
- Diagnosis often missed
- Nonspecific signs and symptoms
- 1/3 of PE patients who survive initial PE subsequently die from a future embolic episode in inadequately treated
- Most PE mortality is within the first few hrs of the PE
- Sudden death
  - PE is second only to sudden cardiac death

Pathophysiology of Pulmonary Embolism

- Abnormal respiratory physiology :
  - Ventilation Disruption
    - Lower tract obstruction due to infection (pneumonia)
  - Disruption in Diffusion (alveoli damage)
  - Disruption in Perfusion
    - Alteration in Blood Flow (PE)
    - Pulmonary Shunting (PE)
- Obstruction of a pulmonary artery
  - Emboli (air, fat, or amniotic fluid; but usually thrombus)
  - Foreign bodies may also cause an embolus

Pathophysiology of PE Risk Factors

- Common factor : increased risk of clot formation
- In mid 1800s, Verchow identified triad of factors leading to pathogenesis of venous thrombosis:
  venous *stasis*, injury to the *intima*, and changes in the *coagulation* properties of the blood
- Clot formation because of :
  - Hypercoagulability (cancer; BCP,…)
  - Venous stasis (post op surgery; long, cramped trip)
  - Endovascular injury (smoking, passive smoking,…)

Origin of Thrombi in PE

- Thrombi originate
  - In deep veins of the lower extremities;
  - May also originate in :
    - Pelvic veins
    - Renal veins
    - Upper extremity veins (rare)
    - Right heart : RA , RV [A fib]

Cardiopulmonary Consequences

Respiratory
- Hyperventilation
- Regional loss of surfactant
- Pulmonary infarction
- Hypoxemia
  - frequent but not universal finding
  - mechanisms (increased alveolar dead space) :
    - ventilation-perfusion mismatch
    - shunting

Hemodynamic
- Reduces the cross-sectional area (dam)
- Increases pulmonary VR, thus, increases RV afterload

Risk Factors of Pulmonary Embolism

- Recent surgery
- Long-bone fractures
- Major trauma (associated with 58% incidence of DVT)
- Pregnant or postpartum (mortality: 1 per 100,000)
- Oral contraceptives (risk is proportional to estrogen strength)
- Congenital (Factor V Leiden)
- Smoking (Passive Smoking and Arterial Endothelial Dysfunction Statistical Data Included American Family Physician, July, 1999 http://www.aafp.org/afp.xml).

Assessment for Possible Pulmonary Embolism

- History
  - Focused History & Physical Exam
    - SAMPLE & OPQRST History
      - Presence of risk factors
      - *Sudden* onset of severe dyspnea and / or
      - *Sudden* onset of severe chest pain
      - Cough, may be blood-tinged [hemoptysis]

Most Common Symptoms of Pulmonary Embolism

- PIOPED study
- Dyspnea (73%)
- Pleuritic chest pain (66%)
  - without any other symptoms or risk factors may occur
- Cough (37%)
- Hemoptysis (13%)
- Atypical symptoms

Atypical Symptoms and Presentations of PE

- Seizures
- Syncope
- Confusion
- Abdominal pain
- "Bronchitis" (fever ; productive cough; wheezing)
- New onset of arrhythmia
  - atrial fibrillation
- Whenever there is any suspicion or high-risk, must consider PE in the differential diagnosis

Physical Exam in Possible Pulmonary Embolism

PIOPED
- Tachypnea (70%)
- Rales (51%)
- Tachycardia (30%)
- Fever may be present in 14%

Massive pulmonary embolism
- Shock […PEA]
- Signs of right sided heart failure
  - JVD
  - Edema of extremities

ABGs in PE

- Low pO2 / hypoxemia
- Low pCO2 / hypocapnia
- And respiratory alkalosis (pH > 7.45)
- Hypoxemia
  - Predictive value of low pO2 is too unreliable
  - In high-risk patients (postoperative)
    - a low pO2 in conjunction with
    - dyspnea : a strong positive predictive value

PE Diagnostic Studies

- CT Xray:
  - spiral CT scan for diagnosis of PE has greatly changed in the early 2000s
    - Sensitivity : greater than 90%
    - Added benefit : alternate Dx suggested in 37% patients
- Electrocardiogram
  - most common ECG abnormalities :
    - tachycardia and
    - nonspecific ST-T wave abnormalities
    - not sensitive or specific enough for diagnosis of PE
  - classic right-heart strain finding of S1-Q3-T3 :
    - in only 20% of patients with proven PE

Management of Possible Pulmonary Embolism

- Support ventilation / treat hypoxia
  - High-flow oxygen or assist ventilations as indicated
  - Intubation may be indicated
- Monitor $_3$ (R/O arrhythmias)
- IV (2 LB) access
- CP protocol if any question of coronary ischemia

Anticoagulation Therapy for PE

- Immediate anticoagulation mandatory for all suspected DVT or PE
  - Heparin IV
    - slows or prevents progression of DVT and reduces pulmonary emboli
    - does not dissolve the existing clot
  - Coumadin PO
- Rarely in shock + acute RV CHF
  - thrombolytic therapy can be considered / remains controversial
  - currently accepted indications
    - hemodynamic instability or
    - right ventricular dysfunction on echocardiography (ultrasound)

Summary

We have discussed :

- Pathophysiology and risk factors for PE
- History and physical exam for possible PE
- Atypical presentations of PE
- ABGs and EKG found in PE
- Prehospital treatment of suspected or possible PE
- The intervention that is contraindicated in the treatment of suspected or for possible PE