PULMONARY EMBOLISM (PE)

(Last updated 07/23/2019; Reviewed by: S Chandralekha Kruthiventi MD.)

PRESENTING COMPLAINT: Dyspnea (shortness of breath), chest pain, and hemoptysis

FINDINGS

- **A** Check airway
- **B** ↑ RR, increased work of breathing
- **C** ↑ HR, N, or ↓ BP, Circulatory collapse with shock and PEA arrest in severe cases.
- **D** Variable altered (V,P,U,D)*
- **E** Cyanosis, increased sweating, syncope
- **L<sub>PC</sub>** ↑ D-dimer, CBC, type and crossmatch, baseline PT/APTT, ABG - ↑ pH, respiratory alkalosis-low pAO2 in severe cases
- **U<sub>PC</sub>** Unremarkable lung fields, if submassive or massive RV dilatation, McConnell’s sign (regional right ventricular akinesia/ hypokinesia); non-compressible femoral vein if DVT

*V (verbal), P (pain), U (unconsciousness), D (delirious)

U<sub>PC</sub> (point of care ultrasound)  L<sub>PC</sub> (point of care labs)

OTHER HISTORY

- Pre-disposing conditions
  - Immobilization, reduced mobility, recent surgery (< 3 months), malignancy, heart failure, obesity, smoking, female, use of oral contraceptives, hormonal therapy, prior history or family history of DVT/PE, air travel, pregnancy, cancer, chronic leg edema
- **Symptoms**: Sudden onset dyspnea/tachypnea, pleuritic pain, cough, chest pain +/-, hemoptysis
- **Signs**: Pleural friction rub, loud pulmonic component of second heart sound, pale skin, JVD +/-, tachycardia, RV S3, signs of deep vein thrombosis (edema, erythema, tenderness in calf, thigh, or arm), often masked by underlying COPD or CHF

DIFFERENTIAL DIAGNOSIS

- Acute coronary syndrome, pneumothorax, aortic dissection, pneumonia, ARDS, atelectasis, amniotic fluid embolism, septic emboli

OTHER INVESTIGATIONS

- **Labs**: D-Dimer, ABG, ↑ Troponin, ↑ BNP
- **Monitoring**
  - **ECG**: nonspecific ECG changes, S1Q3T3, sinus tachycardia, RV strain patterns, RBBB
  - Blood pressure, oxygen saturation
• Imaging
  o **ECHO:** direct visualization of free floating thrombus, regional right ventricular dysfunction with right ventricular free-wall akinesia/hypokinesis in the presence of normal apical contractility, McConnell’s sign specific for acute PE
  o **CT-PA:** if contraindicated, consider isotope scintigraphy/VQ
  o Venous duplex ultrasound of calf/thigh/arm
  o **Echo:** RV diameter/LV diameter > 0.9 or RV systolic dysfunction indicates at least submassive PE if hemodynamically stable or massive PE if shock
  o **Doppler ultrasonography** of leg to rule out deep vein thrombosis: non-compressible venous segment and USG chest - pleural effusion
  o **Clinical probability**
    ▪ Modified Wells score: PE unlikely (< 2), moderate risk (2-6), high (> 6)
    ▪ Massive PE defined by Systolic blood pressure < 90 mm for at least 15 minutes or requiring vasopressor support, pulselessness or profound bradycardia (heart rate < 40 bpm with shock)

• Suggested Diagnostic Approach
  o If PE unlikely per Modified Well's score (< 2) + D-dimer negative, PE ruled out; otherwise, CT-PA and treat based on results

• Consult: ECMO, cardiovascular surgery, interventional radiology, pulmonology

THERAPEUTIC INTERVENTIONS

• Treatment
  o Oxygen therapy, IV access, ECG monitoring, monitor and treat pain and anxiety, initial bed rest (semi-Fowler’s position)
  o If PE intermediate/high probability (e.g. Wells score ≥2) and no contraindications, start anticoagulant treatment while waiting for confirmatory tests
  o **IF MASSIVE PE, consider emergent systemic thrombolysis**
    ▪ Low molecular weight heparin (LMWH) or IV unfractionated heparin (UFH) or fondaparinux
    ▪ Monitor APTT if using UFH: goal 60-90 sec
    ▪ Monitor platelet count if high suspicion for HIT: 4 T score, work up and switch to direct thrombin inhibitors
    ▪ Consider one of the following: dabigatran, rivaroxaban, apixaban, edoxaban

• **Massive PE** with consecutive shock, pulselessness or bradycardia, consider:
- Systemic Thrombolysis with tPA
  - If low or acceptable risk of bleeding complications
  - 100 mg over 2 hours (half-dose [50 mg] maybe effective)
- Vasopressors: Norepinephrine, vasopressin +/- dobutamine, epinephrine
- Thrombectomy: If thrombolysis contraindicated, consider surgical or catheter embolectomy
- Intubation and mechanical ventilation if necessary to maintain oxygenation: Risk of cardiac arrest with intubation, minimize induction agents, avoid apnea/acidosis, avoid vigorous positive pressure
- Consider ECMO

**Submassive PE:** No clear short or long-term benefit of thrombolytic treatment

- Close monitoring first 24 hours

**ONGOING TREATMENT**

**Further Treatment**

- Interventional/catheter directed thrombolysis and surgical options if persistent instability after fibrinolysis or contraindication to thrombolysis
- Start oral warfarin overlapping with LMWH/UFH/Fondaparinux therapy (goal INR: 2-3), OR continuing LWMH better outcomes in cancer patients OR dabigatran, rivaroxaban, apixaban, edoxaban
- Consider IVC filter if lower extremity DVT and contraindication to anticoagulation or if bleeding complications; consider long-term anticoagulation if recurrent DVT

**CAUTION**

- **Complications:** Bleeding, heparin-induced Thrombocytopenia (HIT), skin necrosis (if starting warfarin without overlapping LMWH/UFH/Fondaparinux), RV failure, chronic thrombotic pulmonary hypertension

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