Pediatric Pulmonary Embolism: A Challenge to Both Diagnose and Treat
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ABSTRACT
A 15 year old male with a history of recurrent lymphocytic leukemia was transferred from an outside hospital with worsening respiratory distress. After transfer, he was found to have signs of right heart strain and saddle pulmonary emboli. He was taken for catheter-directed thrombolysis, but suffered from PEA arrest after injection of intravenous contrast. He did not respond appropriately to resuscitation. Pulmonary embolism and the role of catheter-directed therapy are reviewed.

LEARNING OBJECTIVES
1. Review risk factors for pulmonary embolism
2. Review appropriate treatment strategies for pediatric pulmonary embolism

PATIENT PRESENTATION
- 15 year old male with a history of recurrent lymphocytic leukemia was transferred from an outside hospital with worsening respiratory distress.
- PMHs:
  - E/chemotherapy and stem cell transplantation
  - Post-transplant course was complicated by neutropenia and nephrototoxicity, graft versus host disease, deep vein thrombosis treated with lovenox
  - Anticoagulation stopped due to bloody stools
  - He developed sudden onset tachycardia, tachypnea, and hypotension in inpatient rehabilitation
  - Per verbal report, a CT scan was negative for pulmonary embolism (PE)

ON TRANSFER
- Continued deterioration with tachypnea into 40s with O2 sat high 90s on 10L
- Transthoracic echo (TTE) demonstrated moderately dilated right ventricle with moderate to severe tricuspid regurgitation and pulmonary insufficiency, elevated right ventricular pressures, abnormal septal flattening during diastole consistent with right ventricular (RV) volume overload, moderately diminished right ventricular systolic function and under filled left heart structures.
- Dopamine infusion was started
- Heparin infusion started for anticoagulation

FURTHER IMAGING
- Pediatric intensivists attempted to locate the outside CT images but were unable to find the study.
- Transferring physician realized the CT scan had not been completed
- CT scan was obtained and showed findings of right heart strain with central saddle pulmonary emboli

INTERVENTIONAL RADIOLOGY
- Tx: catheter-directed thrombolysis and mechanical clot disruption
- Uneventful induction and intubation on dopamine and epinephrine infusions
- Goin access was obtained and initial angiogram imaging was obtained with injection of 30 mL of contrast over a period of 2 seconds.
  - Initial angiogram imaging showed reflux of dye into the inferior vena cava indicative of significant right heart strain
  - After injection of contrast, blood pressure began to drift down and was unresponsive to rapidly increasing phenylephrine and epinephrine boluses.

RESUSCITATION
- Code was called and patient quickly went into persistent PEA with non-sustained rhythm.
- Received 20 minutes of CPR and appropriate code-dose epinephrine
- Tissue plasminogen activator was injected in attempts to decrease emboli burden.
- He only briefly regained a perfusing rhythm, then again was in PEA
- After 20 minutes of CPR without ability to obtain a sustainable rhythm to facilitate tPA administration, decision made to stop resuscitation. Ventilator turned off and patient extubated
- Sedation with dexmedetomidine continued

PHYSIOLOGY
- Patients without preexisting pulmonary hypertension lack the compensatory right ventricular hypertrophy meant to reduce wall stress in a high afterload state
- Patients with RV failure in the setting of acute PE usually present with syncope, chest pain, cardiogenic shock, hypoxia, and/or cardiac arrest
- Our patient displayed all of these symptoms on initial presentation

RISK FACTORS FOR PEDIATRIC EMBOLISM
- Pulmonary embolism risk calculator includes age, sex, history of cancer, heart failure, or lung disease, vitals included heart rate (HR), systolic blood pressure, respiratory rate (RR), temperature, arterial oxygen saturation, and altered mental status
- Specific risk factors in our patient included history of cancer, elevated HR, RR, hypotension and hypoxia
- Our patient was Class V, very high risk with 30 day mortality near 25%

CATHETER-DIRECTED THERAPY
- Catheter directed therapy (CDT) is an alternative that can avoid the hemorrhagic complications associated with systemic anticoagulation and the sternotomy associated with embolectomy
- Suggestions for CDT in adults include patients with massive PE with contraindications to anticoagulation and/or as a salvage therapy
- Pediatric data is limited on the use of CDT
- Case review of 6 cases of CDT for pediatric PE showed
  - No mortality or treatment related complications
  - No patients remained on lifelong anticoagulation therapy

REFERENCES