Case Presentation: Catheter-Directed Thrombolytic Therapy for Pulmonary Embolism

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Pulmonary venous thromboembolism (PE) is a common and often life-threatening condition. Anticoagulation is the mainstay of therapy for most patients, with thrombolytic therapy historically reserved for patients with life-threatening hypotension or cardiac arrest. However, some patients remain at higher risk of morbidity and mortality, and recent studies have suggested a role for systemic or catheter-directed thrombolytic therapy in selected patients. We present a case of a patient who presented with an intermediate-risk PE who was successfully treated with catheter-directed thrombolytic therapy.

Case Report
A 59-year-old man with a history of chronic obstructive pulmonary disease (COPD) presented by emergency medical services (EMS) to another hospital with four days of progressively worsening and refractory shortness of breath, left-sided chest pain, and right leg swelling. On EMS arrival, his oxygen saturation was 60 percent on ambient air, and he was in moderate respiratory distress. He was placed on 15L/min of oxygen by a non-rebreather facemask and transported to the emergency department. There, his pulse was 105 beats per minute, blood pressure 130/80, and breathing 28 to 32 times per minute. A CT angiogram revealed extensive bilateral pulmonary emboli with evidence of right ventricular strain (Figure 1). His troponin and BNP were elevated at 0.16 ng/mL and 480 pg/mL, respectively. An echocardiogram confirmed a severely dilated right ventricle with severely decreased right ventricular systolic function, moderate pulmonary hypertension, and a highly mobile echodensity at the right ventricular side of the tricuspid valve with extension toward the right ventricular outflow tract (RVOT) consistent with a thrombus (Figure 2a). An ultrasound of his right lower extremity revealed deep vein thrombosis (DVT) in the popliteal and superficial femoral veins. He had an inferior vena cava (IVC) filter placed and unfractionated heparin was initiated. His physicians consulted the PE team at UPMC for assistance, and he was ultimately transferred for further management of his pulmonary embolism.

On arrival at UPMC, he was tachycardic, normotensive, and required 10 L/min of oxygen by nasal cannula. Based on his combination of RV strain, elevated BNP and troponin, and severe hypoxia, as well as his age and underlying COPD, he was thought to have a high risk of morbidity and between 10 and 25 percent risk of death in 30 days based on his PE severity index (PESI) score. A multidisciplinary discussion of the PE team led to a recommendation for catheter-directed thrombolytic therapy.

The patient proceeded to the catheterization laboratory, where a pulmonary angiogram revealed significant bilateral clot burden (Figure 3). Right-heart catheterization revealed moderate pulmonary hypertension. EKOS EndoWave Infusion Catheters (EKOS Corporation, Bothell, Wash.) were placed into the pulmonary arteries and RVOT (Figure 4). He was treated with continued low dose intravenous heparin and a 12-hour infusion of tissue plasminogen activator (tPA). Over the subsequent few days, his oxygen requirement returned to his baseline of 4L/min by nasal cannula. A repeat echocardiogram showed reduced pulmonary pressures and improved RV function, as well as complete resolution of the RV thrombus (Figure 2b).

Conclusion
Some patients with PE who initially present with normal blood pressure remain at risk for later decompensation with complications, including cardiac arrest and death, despite therapy with anticoagulation. Recent studies have suggested that selected patients with this type of “submassive” or “intermediate-high risk” PE may benefit from a more aggressive treatment strategy, including pharmacomechanical catheter-directed therapy. This case highlights the possible benefit of this approach.

Figure 1. Axial (Panel A) and Coronal (Panel B) images from the thoracic CT angiogram that confirm the presence of bilateral large, acute, occlusive pulmonary embolism, with a greater clot burden in the right main pulmonary artery (solid white arrow).
Figure 2. TTE revealed RV dilatation, an estimated pulmonary artery systolic pressure of 51 mmHg and a thin, serpiginous, highly mobile echodensity at the right ventricular side of the tricuspid valve with extension toward the right ventricular outflow tract (RVOT) consistent with a thrombus that was 3.5 cm x 0.3 cm in size (Panel A). After tPA, the thrombus was no longer visible (Panel B).

Figure 3. PA angiogram revealed poor perfusion to a large region of the RLL and a hazy filling defect in the right lower lobar PA consistent with a large PE.

Figure 4. EKOS catheters in place in the bilateral PA. A 6 cm catheter extends into the RLL artery, and an 18 cm catheter extends distally into the LLL artery, and proximally reaches the RVOT, in an effort to provide lysis for the RV thrombus in addition to the PE.