

## Case Report

# Thrombolytic Therapy of Acute Massive Pulmonary Embolism Using Swan-Ganz Pulmonary Artery Catheter

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Acute massive pulmonary embolism (PE) is associated with high fatality, and catheter-directed thrombolytic therapy has been shown to be an efficacious treatment for this condition. We herein report a patient who developed acute massive PE but could not undergo the conventional catheter-directed thrombolytic therapy. A Swan-Ganz pulmonary artery catheter was placed at bedside to initiate immediate thrombolytic infusion, which resulted in dramatic clinical improvement. This report underscores a potential role of thrombolytic therapy via a transjugular pulmonary artery catheter in patients with acute massive PE who could not undergo the conventional catheter-based thrombolytic intervention.

Acute massive pulmonary embolism (PE), a highly fatal condition that is characterized by circulatory collapse or hemodynamic instability, claims more than 150,000 deaths each year in the United States.<sup>1,2</sup> Several researchers, including our group, have reported favorable treatment outcomes of catheter-directed thrombolytic therapy in acute massive PE.<sup>2–6</sup> In this therapeutic modality, an infusion catheter is placed in the pulmonary artery via a

transfemoral venous access for thrombolytic infusion. We herein described a patient with cardiogenic shock due to acute massive PE who could not undergo the conventional catheter-directed thrombolytic therapy due to confounding factors, and the patient underwent successful thrombolytic therapy via a transjugular Swan-Ganz pulmonary artery catheter. The patient consented to the publication of this report.

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*Ann Vasc Surg* 2017; ■: 1–4

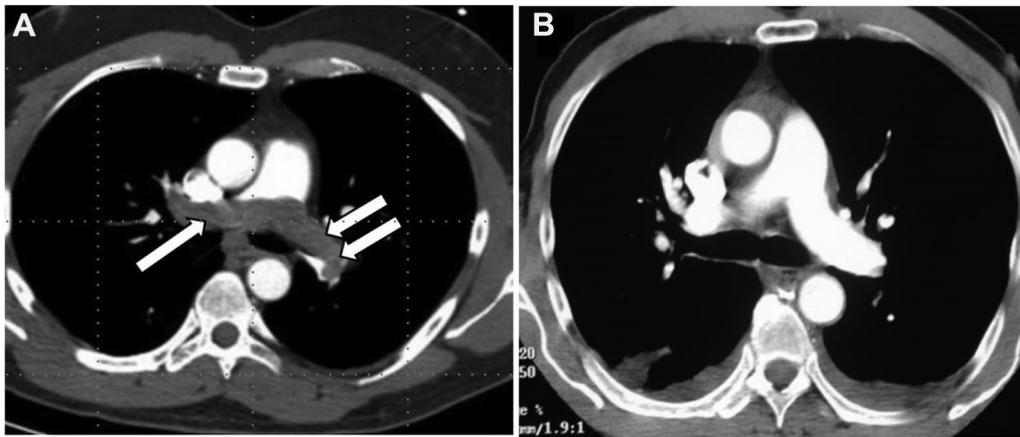
<http://dx.doi.org/10.1016/j.avsg.2017.02.020>

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Manuscript received: June 26, 2016; manuscript accepted: February 17, 2017; published online: ■ ■ ■

## CASE REPORT

A 78-year-old male patient, who was a resident in a skilled nursing facility, developed an acute onset of shortness of breath and progressive chest pain. His vital signs showed a heart rate of 120, respiratory rate of 24/minutes, oxygen saturation of 60% on room air, and blood pressure of 80/45 mm Hg. Chest computed tomography (CT) confirmed the presence of massive PE in the main pulmonary arteries with thrombus extending to bilateral lobar pulmonary arteries (Fig. 1). An echocardiography demonstrated severe right ventricular enlargement with severe systolic dysfunction, with an estimated right ventricular systolic pressure of 52 mm Hg. He was intubated for mechanical ventilation, and systemic heparin administration was initiated along with vasopressor support. Attempts were made to transfer the patient to a tertiary medical facility for catheter-directed thrombolytic therapy, and it was



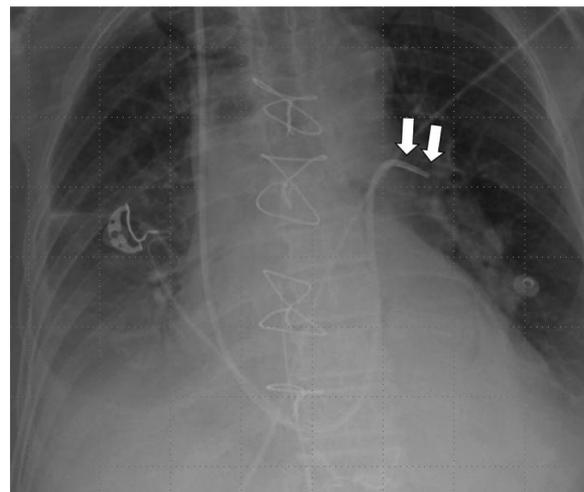
**Fig. 1. (A)** Initial CT scan of the chest revealed acute massive pulmonary embolism involving the right pulmonary artery (*single arrow*) and the left pulmonary artery

(*double arrows*). **(B)** Follow-up CT scan of the chest 6 months later showed complete resolution of the pulmonary embolism.

determined that it would take 8 hours to coordinate this interventional therapy. Owing to rapid deterioration of his hemodynamic condition, a 7-French introducer sheath was placed in the right jugular vein under ultrasound guidance, which was followed by the placement of a Swan-Ganz pulmonary artery catheter. Catheter tip balloon floatation was performed which allowed the catheter to be advanced to the pulmonary artery under the guidance of electrocardiographic tracing. Once a portable chest X-ray confirmed the appropriate position of the catheter (**Fig. 2**), 50 mg of recombinant tissue plasminogen activator or Alteplase (rt-PA, Genentech, San Francisco, CA) was administered through the distal lumen of the Swan-Ganz catheter. Continual infusion of Alteplase was maintained at 1 mg per hour. Hemodynamic improvement was noted 3 hours following the initiation of thrombolytic infusion. He was eventually transferred to a tertiary medical facility 7 hours later, whereby a CT scan showed significant resolution of his PE. As his hemodynamic status continued to improve, a conventional thrombolytic therapy was deemed unnecessary. The transjugular thrombolytic infusion was therefore stopped. He was extubated 2 days later and maintained on daily oral anticoagulation therapy. A follow-up CT scan of the chest 6 months later showed complete resolution of PE (**Fig. 1**). The patient was doing well without any respiratory symptoms at 1-year follow-up.

## DISCUSSION

Catheter-directed thrombolytic therapy has gained increased acceptance as a life-saving therapeutic armamentarium in patients with acute massive PE, as numerous studies have demonstrated its therapeutic clinical efficacy.<sup>2-7</sup> The outcome of this case is notable as this is the first report highlighting the



**Fig. 2.** The position of a Swan-Ganz pulmonary artery catheter was confirmed by a portable chest X-ray (*double arrows*).

utility of a Swan-Ganz catheter for pulmonary artery thrombolytic infusion in a patient who was unable to undergo the conventional catheter-directed thrombolytic therapy for acute massive PE.

Cardiogenic shock with hemodynamic instability and right ventricular dysfunction are the hallmark features of acute massive PE. Transthoracic echocardiography is useful in recognizing right ventricular dysfunction, which is associated with grave prognosis.<sup>8</sup> This diagnostic modality provided confirmatory diagnosis in our patient. In this circumstance, prompt therapeutic intervention must be initiated to improve the patient's survival. Several studies have demonstrated the clinical efficacy of

catheter-directed thrombolytic therapy in acute massive PE, with improvement of right ventricular dysfunction.<sup>8,9</sup> We have similarly reported our experience of catheter-directed thrombolytic therapy in massive PE with a remarkable 6-month survival rate of 91%.<sup>3,5,6</sup> In our previous reports, catheter-directed thrombolytic therapy was performed via a transfemoral venous access in which rt-PA was delivered with 1 mg per hour of infusion rate.

In our patient, who was a nursing facility resident and developed acute massive PE, efforts to transfer this patient to a tertiary facility were met with logistical challenges. We therefore placed a Swan-Ganz pulmonary artery catheter at bedside for immediate thrombolytic infusion, which resulted in remarkable hemodynamic improvement. Although placement of a Swan-Ganz pulmonary artery catheter is a commonly performed procedure in critically ill patients, one must pay close attention in this clinical situation due to high risk of arrhythmia in patients with underlying cardiogenic instability. The placement of the Swan-Ganz catheter through the right atrium and ventricle must be performed swiftly under electrocardiographic monitoring. Once the Swan-Ganz catheter is positioned in the pulmonary artery by means of electrocardiographic tracing confirmation, thrombolytic infusion can then be performed. By delivering rt-PA via this pulmonary artery catheter, we effectively converted this diagnostic monitoring device into a life-saving therapeutic infusion device to dissolve his acute massive PE.

We administered rt-PA bolus of 50 mg followed by a continuous infusion rate of 1 mg per hour, and the infusion rate was based on our published experience.<sup>5,6</sup> Available published guidelines for PE thrombolysis recommended a dosage of 100 mg of rt-PA via peripheral infusion over 2 hours.<sup>4</sup> Although thrombolytic therapy can lead to a risk of major hemorrhage that varies from 6% to 15%,<sup>1,7,8,10,11</sup> many studies support the use of bolus rt-PA as the benefit of thrombolysis outweighs the potential hemorrhagic risk, particularly in the event of myocardial infarction or acute massive PE with shock.<sup>9–11</sup> A published guideline by the British Thoracic Society similarly recommended a bolus dose of 50 mg of rt-PA in patients with massive PE.<sup>4</sup>

Although our report demonstrated the success of thrombolytic infusion via a pulmonary artery catheter, caution must be taken as this pharmacologic delivery technique should not be considered as the primary treatment modality for patients with acute massive PE. Potential limitations of this treatment must be recognized. First, the insertion of the Swan-Ganz catheter into the

pulmonary artery is done in a blinded fashion without fluoroscopic guidance. Although electrocardiographic tracing can be used to determine the position of the catheter tip, the catheter tip may cause inadvertent ventricular stimulation resulting in cardiac arrhythmia which could result in rapid hemodynamic deterioration particularly in these critically ill patients. Second, conventional thrombolytic catheter insertion is done under fluoroscopic guidance which enables the catheter to be specifically placed in either the right or left pulmonary vasculature to maximize drug delivery with greater thrombolytic concentration. However, a bedside Swan-Ganz catheter tip is positioned without fluoroscopic guidance, which does not permit the catheter tip placement in any specific laterality. Finally, a Swan-Ganz catheter requires a 7-French introducer sheath while conventional thrombolytic therapy can be performed with a 4-French sheath. This large sheath size may incur a higher risk of hemorrhagic complication for continuous thrombolytic infusion.

In summary, our report shows that a Swan-Ganz pulmonary artery catheter can be used successfully for thrombolytic therapy in patients with acute massive PE. This may serve as a useful armamentarium in critically ill patients who could not undergo the conventional transfemoral thrombolytic therapy for acute massive PE in a timely fashion.

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