



## Case Reports

# Successful management of acute massive pulmonary embolism using Angiovac suction catheter technique in a hemodynamically unstable patient<sup>☆</sup>



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## ABSTRACT

Massive pulmonary embolism with hemodynamic instability is a life-threatening condition requiring immediate treatment. Urgent thrombectomy or thrombolysis is commonly used for the treatment of this condition. However, surgery is associated with high mortality rate and many patients have contraindications to thrombolytic therapy and are at high risk for bleeding. Catheter-based intervention has gained increasing popularity particularly in patients with contraindication to thrombolytic therapy or at high risk for surgical thrombectomy. Catheter-based thrombus removal can be achieved by many means such as suction, fragmentation, extraction or rheolytic thrombectomy. We present a case of an elderly lady who suffered from acute massive pulmonary embolism with hemodynamic compromise successfully treated with AngioVac catheter system (AngioDynamics, Albany, NY) with full recovery.

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## 1. Introduction

Pulmonary embolism (PE) is associated with high mortality and morbidity and can be fatal in up to 10% of the patients [1,2]. PE is considered massive when occlusion of pulmonary artery is >50% of its cross-sectional area resulting in hemodynamic compromise [3,4]. If this obstruction exceeds 75%, the right ventricle has to acutely generate a systolic pressure greater than 50 mm Hg that can lead to right ventricular failure and death. Eighty-five percent of death in patients with massive PE occurs in the first 6 hours [4]. In the case of massive PE, embolectomy [5] or systemic thrombolysis [6] in addition to anticoagulation could rapidly reverse right ventricular failure and cardiogenic shock. However, major contraindications, such as prior surgery, trauma, stroke, or advanced cancer, make approximately one third of the patients with massive PE ineligible for thrombolysis [3,7]. Surgical embolectomy is an effective treatment of this condition but it requires a dedicated team and system in place [5] and is associated with significant morbidity [8]. With the advancement in interven-

tional procedures, catheter-based technology has gained increasing popularity that can combine clot destruction with local thrombolysis [9]. Catheter-based thrombus removal can be achieved by many means such as suction, fragmentation, extraction or rheolytic thrombectomy [10]. We present a case of an elderly lady who suffered from acute massive pulmonary embolism with hemodynamic compromise successfully treated with suction thrombectomy utilizing off-label use of AngioVac catheter system (AngioDynamics, Albany, NY) with full recovery.

## 2. Case

A 66-year-old female with a medical history significant for recurrent endometrial cancer and diabetes mellitus, presented with progressive dyspnea on exertion and generalized body weakness. Examination revealed tachycardia and hypoxia requiring 4 L of oxygen. Respiratory examination was clear to auscultation. Troponin was positive at 0.314 and BNP was 1245. Twelve-lead EKG showed sinus tachycardia and left-axis deviation, with poor R-wave progression. Two-dimensional echocardiogram revealed right ventricular free wall hypokinesis with spared apical contraction (Mc Connells sign) suggestive of acute pulmonary embolism. Subsequent chest CT revealed saddle pulmonary embolus extending

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into right and left pulmonary arteries as well as lobar arteries. Evidence of right heart strain was also present. The patient was given intravenous bolus of heparin and started on continuous heparin infusion. She developed hypotension and tachycardia consistent with cardiogenic shock. Pulmonary angiogram confirmed the diagnosis of saddle embolus in the main pulmonary artery extending into right upper and right lower pulmonary artery [Fig. 1 (a) and (b)]. She was deemed to be not a thrombolytic or surgical candidate. Due to the need for equipment to be setup, the thrombectomy was performed 3 hours later. An 8-French sheath was sutured into the right common femoral artery and a 4-French sheath was sutured in the left common femoral vein and the patient was transferred out of the interventional suite. The second procedure was performed under general anesthesia. Using an Amplatz Stiff wire and serial dilations, the right 8-French venous sheath was replaced by a 26-French Angiovac catheter (Fig. 2) The left 4-French venous sheath was replaced by a 17-French Angiovac circulator tubing. An 8-French long venous catheter was placed in the main pulmonary artery, and was exchanged over the j wire for Angiovac thrombectomy catheter distal to right pulmonary artery (Fig. 3). The embolus

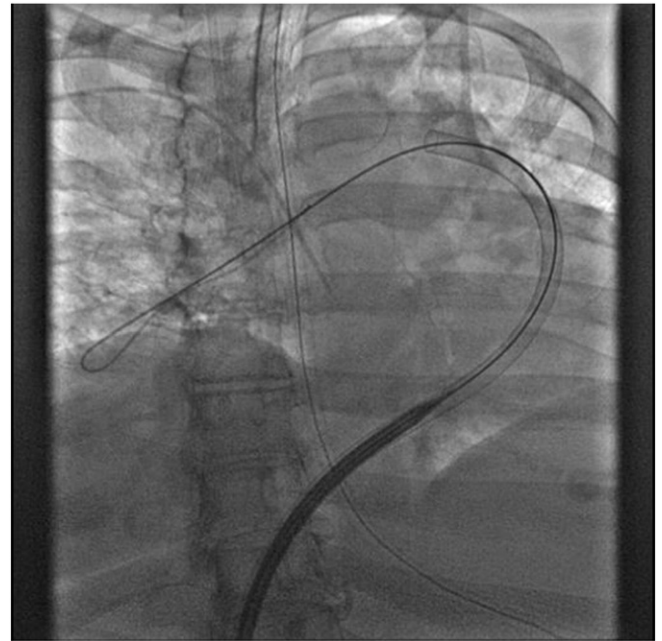


Fig. 2. Guide wire extending through the clot.

was partially removed by suction. Then central venous access was gained through internal jugular vein and a 6-French pigtail catheter was directed to the right ventricle. DSA mode right ventricular angiogram confirmed partial removal of large saddle embolus from pulmonary arteries (Fig. 4). Next, 10-mg of tPA was administered into the pulmonary artery through the pigtail connector. At the end of procedure the sheaths were withdrawn and hemostasis was achieved using manual compression. The patient remained in critical condition during the procedure requiring pressor support. She was observed in the ICU after the procedure where she made a rapid recovery and was discharged 7 days later. Follow-up echocardiogram showed resolution of right ventricular hypokinesia. On subsequent visits, she was fully ambulatory and stable without any symptoms on oral anticoagulation.

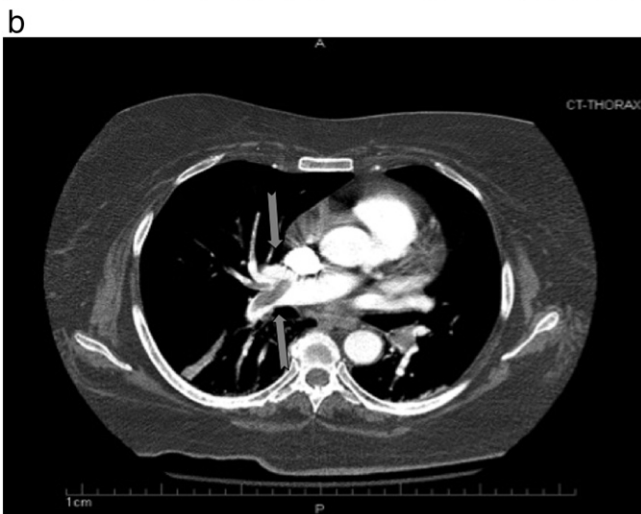
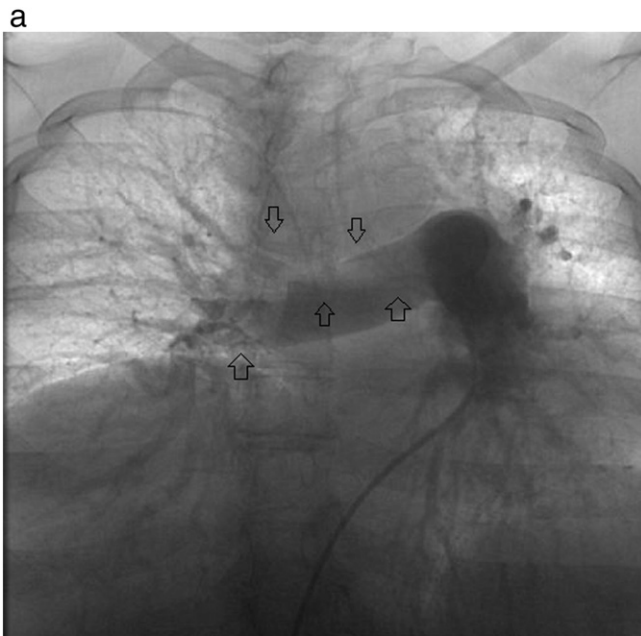


Fig. 1. (a) Pulmonary angiogram showing saddle embolus in right and left pulmonary arteries. (b) CT of chest showing the saddle embolus.

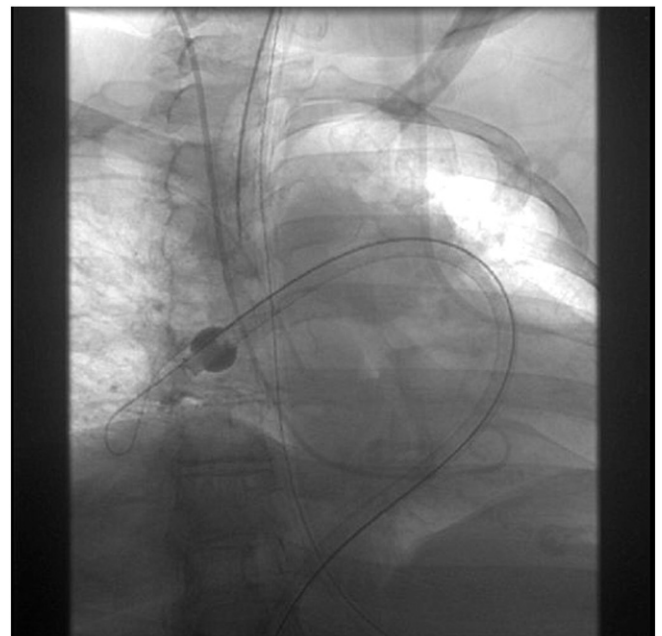


Fig. 3. Balloon and catheter traversed through the clot.



**Fig. 4.** Residual clot shown on repeat pulmonary angiogram following suction. Note the reduced size of clot.

### 3. Discussion

Angiovac system consists of Angiovac circuit, an extracorporeal bypass tubing system and Angiovac cannula, which is intended for venous drainage during extracorporeal bypass. The cannula has a balloon-actuated, expandable, funnel-shaped distal tip to facilitate flow, as well as to remove undesirable intravascular material during the performance of extracorporeal circulation as clots, thrombus tumor, myxoma and vegetations. Todoran et al. [11] reported the successful use of Angiovac cannula for the removal of intraatrial septic thrombus. To our knowledge there has been no case reported in the literature regarding suction embolectomy of a massive pulmonary embolism resulting in hemodynamic instability using Angiovac.

Massive pulmonary embolism leading to unstable vital signs warrants either systemic thrombolysis with anticoagulation [12], surgical thrombectomy [3] or catheter-based thrombolysis [9]. Thrombolysis is effective in patients both stable and unstable patients as compared to anticoagulation alone [13]. However, thrombolysis is associated with bleeding that can occur in 14% of patients [14] with a risk of cerebral hemorrhage up to 3% [15]. Surgical embolectomy is effective in patients with absolute contraindication to systemic thrombolysis [5] but is associated with high morbidity and mortality [16]. In one of the studies the case fatality for surgical embolectomy has been reported to be 39%–40% in unstable patients and between 23% and 27% in stable patients [8]. Our patient was a poor candidate for thrombolysis and surgery due to extensive metastatic cancer [7] and comorbidities. She had a large saddle embolus extending into her right and left pulmonary arteries with hemodynamic instability with very high risk for death without thrombus removal [4,6,17]. Surgery was also deemed to be risky considering her fragile state. She had a great respond to suction embolectomy with full recovery. Our case showed that off-label use of Angiovac suction catheter device provides a novel technique to remove large emboli effectively as an alternative method to other catheter-based devices. Further investigations in clinical trials are needed in order to prove usefulness of this device in treating patients with life-threatening pulmonary embolism. Our case is the first reported case describing details about the use of this device. Searching the literature, we found only one

abstract published about the use of this device in six patients with massive pulmonary embolism without reporting any detail about the outcome. AngioJet rheolytic thrombectomy is one of the most commonly used catheters for thrombolysis in patients with massive pulmonary embolism with some success up to 92% [18–21]. Recently, an ultrasound-assisted catheter-directed thrombolysis (USAT) has been shown to be superior to anticoagulation alone in patient with PE [22]. Mechanical breakdown and thrombolysis in subacute massive pulmonary embolism using a simple multipurpose catheter to break down thrombus have also been successful in these patients [23]. The choice of using specific catheter for thrombus removal in patients with massive PE should depend on the availability of the device and expertise of the operator.

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