

CASE REPORT

Right Atrial and Massive Pulmonary Artery Mechanical Thrombectomy Under Echocardiography Guidance Using the FlowTrieve System

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Introduction: Management of clot in transit in patients with pulmonary embolism, who are candidates for percutaneous intervention, can be challenging. This is a case report of simultaneous right atrial mechanical thrombectomy under echocardiography guidance and pulmonary artery embolectomy under fluoroscopy guidance, using the recently introduced FlowTrieve system (Inari Medical Inc., Irvine, CA, USA).

Report: An 88 year old female, resuscitated from cardiopulmonary arrest near the end of a total right hip arthroplasty, presented for management of suspected massive pulmonary embolism. Her right atrial thrombus was removed under transthoracic echocardiography guidance, and her pulmonary arterial thrombus was subsequently successfully treated under fluoroscopy.

Discussion: The FlowTrieve system can be safely and effectively used under real time transthoracic echocardiography guidance to retrieve clot in transit from the cardiac chambers, in addition to its standard application for the pulmonary artery under fluoroscopy guidance.

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INTRODUCTION

Catheter directed therapies (CDTs) have revolutionised treatment of pulmonary embolism (PE). One popular device used with Food and Drug Administration (FDA) approval for PE is the EkoSonic system (BTG, West Conshohocken, PA, USA).¹ Other currently available devices on the market for off label use in PE are the AngioVac and AngioJet system (AngioDynamics, Latham, NY, USA), and Indigo catheter (Penumbra Inc., Alameda, CA, USA).¹ These devices have their limitations, for example, the AngioJet system has been associated with dysrhythmias and the AngioVac system is large, difficult to manoeuvre to the pulmonary arteries, and is rarely used in modern practice.¹ A new FDA approved mechanical thrombectomy device for treatment of PEs, the FlowTrieve system (Inari Medical Inc., Irvine, CA, USA), has recently been introduced to the market and is increasing in popularity. This case describes an unconventional

application of the new FlowTrieve system to treat a clot in transit in the right atrium under transthoracic echocardiography guidance in addition to the traditionally indicated mechanical pulmonary artery thrombo-embolectomy with fluoroscopy guidance.

REPORT

An 88 year old female with past medical history of atrial flutter and atrial fibrillation on apixaban and severe right hip osteoarthritis had cardiopulmonary arrest for three to five minutes near the end of her elective right total hip arthroplasty. She was started on a norepinephrine bitartrate infusion for haemodynamic stability and a heparin infusion during the cardiopulmonary resuscitation. She was intubated and remained on pressor support, with an elevated systolic blood pressure of 170 mmHg, a heart rate (HR) of 82, and peripheral capillary oxygen saturation (SpO₂) 97% on the ventilator.

Beside transthoracic echocardiography in the intensive care unit (ICU) revealed a large mobile thrombus in the right atrium and clot burden in the proximal main pulmonary artery (PA) (Fig. 1A), as well as right ventricle (RV) strain. Because of the recent surgery the patient was not a candidate for surgical thrombectomy and systemic thrombolysis, and her troponin levels were gradually increasing from 0.13 to 0.91 ng/mL. Therefore, the interventional

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radiology (IR) service was consulted for the treatment of possible massive PE.

At the beginning of the procedure, the patient was tachycardic (103 beats/minute) and hypotensive (84/44 mmHg). A repeat transthoracic echocardiogram in the IR suite confirmed and clearly visualised the heavy burden of clot in both the right atrium as well as its extension to the left PA. The decision was made to perform mechanical thrombectomy.

The right common femoral vein was accessed. Next, pulmonary pressure measurements and a PA angiogram using a 6 Fr, 100 cm Grollman pigtail catheter were obtained, demonstrating a slightly elevated main PA pressure (46/13 mmHg, mean pressure of 23 mmHg). Subsequent digital subtraction imaging in the right anterior oblique projection confirmed thrombus within the left lower lobe PA (Fig. 1B). Given the potential for further embolisation to the PA and in an attempt to minimise the risk of repeat PA thrombectomy, right atrial thrombectomy was initiated first.

A 22 Fr Gore Dryseal sheath (W. L. Gore & Associates, Inc., Flagstaff, AZ, USA) was placed at the access site to accommodate the FlowTrieversystem. The FlowTrieversystem includes a 20 F, 95 cm long Trierer20 catheter (Fig. 2A) used for direct clot aspiration via a 60 mL self

locking syringe and a FlowTrieversystem catheter which was not used in this case (Fig. 2B). The Trierer20 catheter was advanced into the right atrium under fluoroscopy and subsequently real time transthoracic echocardiography guidance. A large thrombus was captured (Fig. 3A) and aspirated out of the right atrium with the Trierer20 catheter alone under real time transthoracic echocardiography guidance (Fig. 3B and C) with some residual clot noted (Fig. 3D). Next, the Trierer20 catheter was advanced to the left PA (Fig. 4A). A large amount of clot was retrieved from the left lower lobe segmental PA using the Trierer20 catheter (Fig. 4B), with no residual pulmonary clot visible on angiography after two thrombectomy passes (Fig. 4C). Repeat main PA pressures showed a 35% improvement (28/9 mmHg, mean pressure 15 mmHg). The final transthoracic echocardiography demonstrated substantially reduced right heart thrombus burden with minimal residual clot adherent to the tricuspid valve. Repeat pulmonary angiogram showed complete restoration of pulmonary blood flow to the left lower lobe distal branches.

An Argon Option Elite filter was deployed in the inferior vena cava (IVC) because of a contraindication to anti-coagulation. The patient tolerated the procedure well and was transferred to the surgical ICU with a HR of 103 beats/minute, blood pressure of 167/72 mmHg (note history of

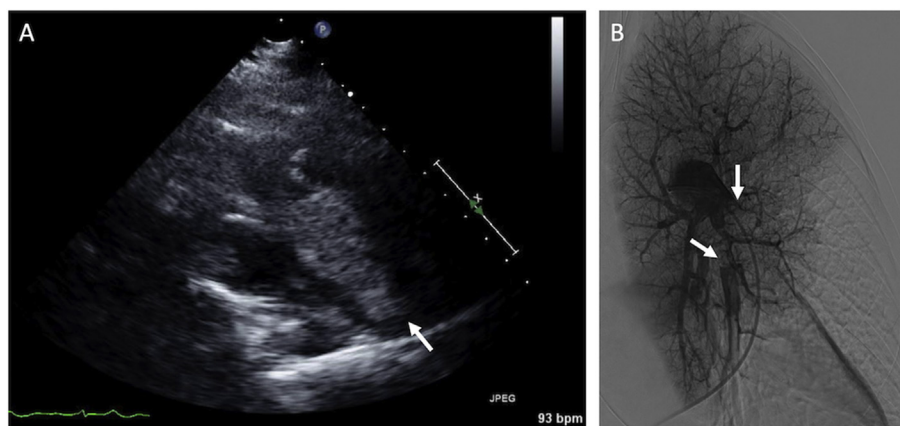


Figure 1. (A) Right atrial and ventricular clot burden shown by transthoracic echocardiogram. The transthoracic echocardiogram shows large mobile thrombi in the right atrium and ventricle (B) The left lung pulmonary emboli. Preliminary angiography showed thrombus within the left lower lobe segmental artery and lack of perfusion distally.

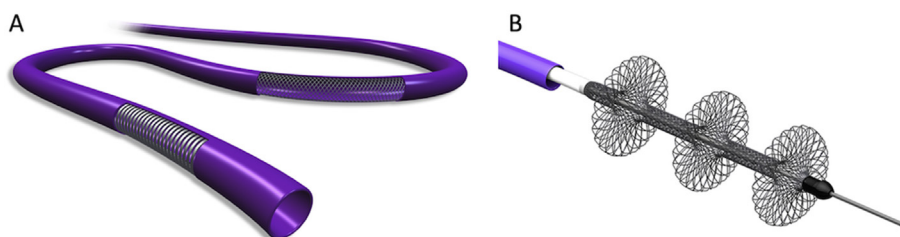


Figure 2. The FlowTrieversystem (A) The FlowTrieversystem consists of a 20 Fr, 95 cm catheter, called the Trierer20 catheter, which is placed through the right heart into the pulmonary artery. The Trierer20 catheter can be used by itself to perform suction thrombectomy or can be used as a guide through which the FlowTrieversystem catheter is advanced (B) The FlowTrieversystem catheter has a trio of self-expanding nitinol mesh disks near the tip of the catheter that are unsheathed to engage for mechanical clot capture and retrieval through the Trierer20, disrupt, and extract the thrombus while simultaneously aspirating and withdrawing this through the Trierer20 catheter.

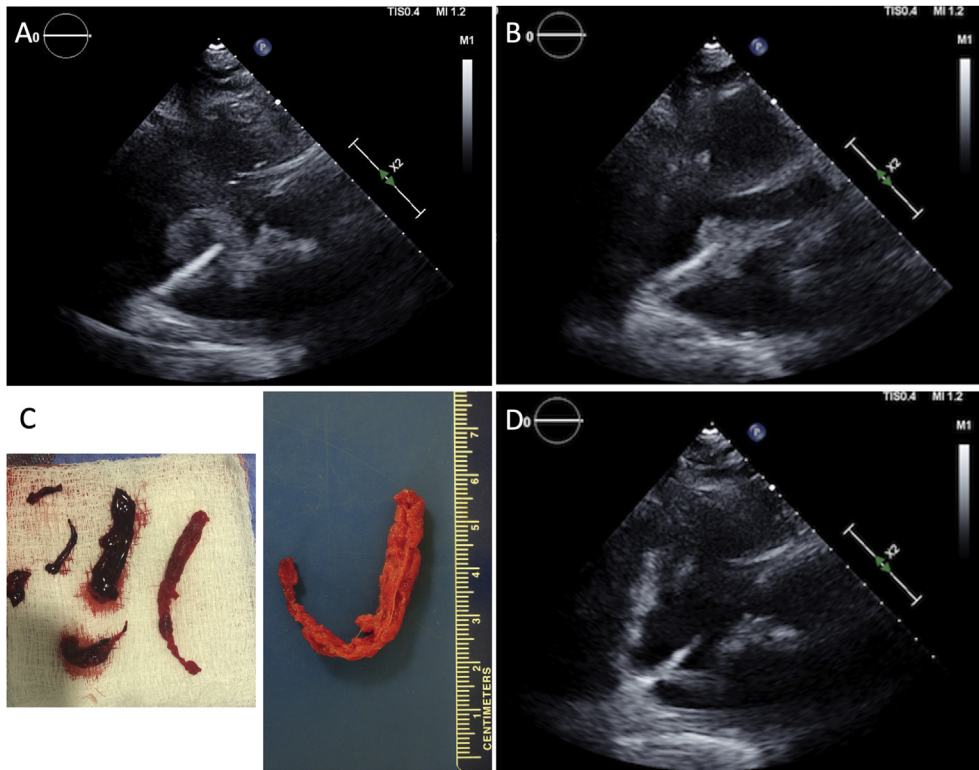


Figure 3. (A) The Trier20 catheter, part of the FlowTrier system was advanced into the right atrium and seen to directly engage thrombus under transthoracic echocardiogram guidance (B) The clot was trapped at the tip of the Trier20 catheter and carefully retrieved into the sheath (C) Picture of the thrombus removed from the right atrium (D) The right atrial and ventricular thrombi were successfully removed, resulting in a substantially reduced right heart thrombus burden with minimal residual thrombus probably adherent to the tricuspid valve.

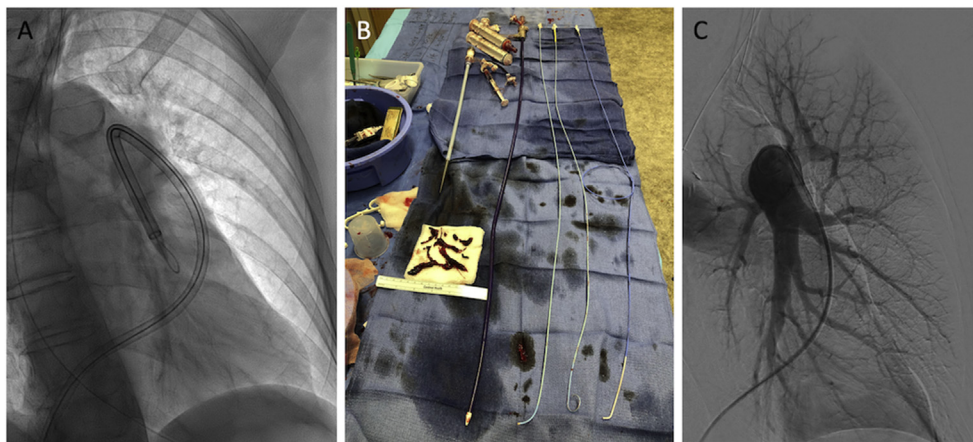


Figure 4. Pulmonary artery thrombectomy (A) The right panel shows the Trier20 catheter advanced into the left lower lobe segmental artery, suction applied, and thrombi extracted from the left pulmonary artery (B) The middle panel shows the Inari device and retrieved clots (C) The left panel shows restored patency of the left lower lobe segmental artery after suction thrombectomy.

hypertension), and SpO₂ of 100% on a ventilator with FiO₂ of 100%.

DISCUSSION

This case demonstrated safe application of the FlowTrier device for mechanical thrombectomy within the atrium.

This undescribed application for right atrial thrombectomy in addition to its traditional use within the PA was successful as demonstrated by rapid normalisation of right atrial and PA pressures and blood pressure without the need for perfusion set up in management of clot in transit and PE at the same time.

Although administration of systemic thrombolytic agents reduces morbidity and mortality in patients with massive PE,² the short term clinical improvements are tempered by an increased risk of major and intracranial bleeding.³ Mechanical thrombectomy (MT) is an alternative treatment approach, that when applied expeditiously, can restore blood flow as fast as or faster than thrombolytics alone. MT has the advantage of being used to delivery adjunctive thrombolytic therapy or stand alone treatment in patients with contraindications to thrombolysis.⁴ The FlowTrieversystem is the only device on the market with FDA approval for management of PE.

The recently published multicentre single arm FLARE IDE study (FlowTrieversystem Pulmonary Embolectomy Clinical Study) demonstrated the safety and effectiveness of the FlowTrieversystem in intermediate risk PE.⁵ While this study and prior published case reports focused solely on PE cases,^{5–8} this is the first case where the system was used under transthoracic echocardiography guidance for MT of right intra-atrial thrombus. The use of echocardiography provided an easy modality for real time observation of atrial clot removal, and had the added benefit of avoiding radiation exposure and large volume contrast injections in this critically ill patient with uncertain renal function after experiencing prolonged hypotension during her pulseless electrical activity (PEA) arrest. In the authors' experience, the FlowTrieversystem is easier to manoeuvre than other thrombectomy devices and results in comparable or less blood loss than the AngioJet and Penumbra systems. This patient showed an instant and marked decrease in the clot burden with reperfused distal blood flow and immediate haemodynamic recovery.

CONCLUSION

The FlowTrieversystem can be safely and effectively used with real time transthoracic echocardiography to retrieve thrombi in the right atrium in addition to its approved application for PA thrombo-embolism.

CONFLICT OF INTEREST

None.

FUNDING

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