Case Report

Saved by the VAC: Minimally Invasive Removal of a Surely Fatal Right Heart Thrombus in a Patient with Advanced Heart Failure

James Keeton,1 Pedro Engel Gonzalez,2 Julie Cox,3 Robert M. Morlend,2 Alpesh A. Amin,2 Pradeep P. A. Mammen,2 Lynn C. Huffman,2 and Faris G. Araj2

1University of Texas Health Science Center, San Antonio, Texas, USA
2University of Texas Southwestern Medical Center, Dallas, Texas, USA
3Baylor Scott and White Health, Dallas, Texas, USA

Correspondence should be addressed to Faris G. Araj; faris.araj@utsouthwestern.edu

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Intracardiac thrombi are associated with an increased morbidity and mortality due to their unpredictability and embolic potential. Right heart thrombus is infrequently encountered in clinical practice outside the scenario of acute pulmonary embolism with hemodynamic compromise, and even more uncommon is the presence of a massive right heart thrombus. Embolic potential is high, and historically, management has revolved around open surgical removal or systemic thrombolysis. We hereby present a case of a massive right heart thrombus in a high surgical risk patient, which was successfully removed using a percutaneous aspiration device.

1. Introduction

A right heart thrombus (RHT) in transit is an increasingly recognized medical emergency despite its low prevalence because it is associated with a very high mortality, especially if associated with hemodynamic instability, shock, or cardiac arrest [1, 2]. The optimal therapeutic approach is unclear given the absence of randomized control studies. However, the accepted treatment modalities include anticoagulation with systemic thrombolysis or surgical thrombectomy [2, 3]. An emerging treatment option is via catheter-based therapies, but there is still a paucity of data in this area. Critically ill patients are often at high risk of bleeding complications from thrombolytics and can have a forbiddingly high surgical risk. We hereby present a case to illustrate the complexity of treating a critically ill patient who presented with a massive RHT in transit.

2. Case Presentation

A 61-year-old male with a history of inotrope-dependent end-stage nonischemic cardiomyopathy with a severely depressed left ventricular ejection fraction and an implantable cardioverter defibrillator (ICD) presented with bilateral lower extremity edema and seven-pound weight gain. He had no history of atrial fibrillation or venous thrombosis. This was his second hospitalization for acute on chronic decompensated systolic heart failure in a matter of a few months. His examination was notable for a heart rate of 100 bpm, a BP of 85/66 mmHg, and an oxygen saturation of 100% breathing ambient air. He was in no apparent respiratory distress. He had jugular venous distention and a third heart sound, clear lung fields, and bilateral lower extremity pitting edema. He was continued on his inotrope, and treatment with intravenous diuretic therapy was initiated. A transthoracic echocardiogram (TTE) was performed mainly to assess his right ventricular (RV) function since he was being considered for a possible orthotopic heart transplant or left ventricular assist device implant. In addition to severely depressed RV systolic function, he was found to have a new large highly mobile echo density in the right atrium intermittently prolapsing through the tricuspid valve into the right ventricle (Figure 1, Movie 1). The patient had no evidence of infectious signs or symptoms, serial blood cultures
remained sterile, and the elongated serpiginous echocardiographic appearance was more suggestive of thrombus than a vegetation. Systemic anticoagulation with intravenous heparin was initiated, and a surgical consultation was obtained. Doppler ultrasound of the bilateral lower extremities did not demonstrate any deep venous thrombosis, and the TTE did not show that the thrombus was clearly attached to the lead. Testing for Factor V Leiden mutation was negative, as was testing for heparin-induced thrombocytopenia. Age-appropriate cancer screening (colon, prostate) was normal, and computed tomography of the head, chest, and abdomen/pelvis did not show any masses or pathologic lymph node enlargement. Additionally, a bone marrow biopsy was negative for any infiltrative or malignant process.

He was deemed to be too high risk for conventional surgical thrombectomy given his severe heart failure, and we were hesitant to administer systemic thrombolytic therapy given the high embolic and bleeding risk. Despite therapeutic systemic anticoagulation, a subsequent TTE 2 days later did not demonstrate reduction in the right atrial thrombus size. After discussions with the cardiothoracic surgery team and the interventional radiology team, the decision was made to attempt a minimally invasive percutaneous thrombectomy using the AngioVac Aspiration System (AngioDynamics, Latham, NY).

Transesophageal echocardiography (TEE) was performed intraoperatively to confirm persistence of the right atrial thrombus prior to proceeding. Under general anesthesia, venous access was obtained via bilateral femoral veins to perform aspiration and reinfuse the blood. An AngioVac device was advanced to the right atrium in proximity to the thrombus (Figure 2, Movie 2). Subsequently, a 22 cm thrombus (Figure 3) was removed, and no residual thrombus was seen on intraoperative imaging. There were no apparent procedural complications, and the patient was continued on systemic intravenous anticoagulation afterwards. Subsequent cultures of the excised thrombus did not reveal any growth. The patient underwent successful cardiac transplantation three weeks later.

3. Discussion

The incidence of echocardiographically detected RHT in the setting of acute pulmonary embolism (PE) is low, approxi-
suggest that thrombolysis may be superior to anticoagulation and surgical thrombectomy, the data are conflicting [8, 9]. Open surgical thrombectomy is an invasive procedure with restrictions based on surgical risk, which leads to the exclusion of otherwise eligible candidates. Apart from the high procedural mortality [7], this involves scheduling delays and cardiopulmonary bypass.

Percutaneous aspiration thrombectomy represents a novel and less invasive method to address right heart thrombi in select patients. This treatment innovation has previously been utilized for aspiration of DVTs, including thrombi associated with inferior vena cava filters, as well as vegetations, tumors, and foreign bodies [10, 11]. The AngioVac system essentially functions as a venovenous extracorporeal membrane oxygenation circuit connected to a thrombus filter and centrifugal pump. The thrombus is aspirated, passed through a filter, and trapped in a reservoir. Then, thrombus-free blood is returned to the body [11]. Based on a single-center case series, this technique is commonly successful (up to 80%) in the removal of RHT [12]. In comparison to open surgical thrombectomy, and in the appropriately selected patient, percutaneous aspiration thrombectomy is considered a relatively safer procedure with the most common complication being access site bleeding and hematoma [12, 13]. However, there are other practical limitations to consider as well, including the device’s larger profile cannula preventing use in smaller veins, rigidity of the cannula creating difficulty with maneuvering, and lack of operator experience. Additionally, patients with a contraindication to anticoagulation would not be candidates for this therapy [12, 13].

In conclusion, percutaneous aspiration thrombectomy offers a minimally invasive and potentially safer alternative to systemic thrombolysis or open surgical thrombectomy. This method successfully removed a surely fatal massive right heart thrombus in our patient with advanced heart failure, allowing him the opportunity to continue to heart transplant.

Disclosure

This work has been accepted as a poster presentation at the ACC.20 World Congress of Cardiology that will take place in March 2020 in Chicago, Illinois.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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Supplementary Materials

Movie 1: large mobile thrombus in the right atrium prolapsing into the right ventricle. Movie 2: transesophageal echocardiogram (TEE) showing thrombus and aspiration catheter. (Supplementary Materials)

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