A novel percutaneous device to aid in treatment of tricuspid endocarditis

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Abstract

The AngioVac System is used for the removal of thrombus from cardiovascular structures. High risk surgical patients who present with severe valvular disease secondary to endocarditis can be treated with the AngioVac system, hence reducing the risks in these patients. We describe a 56-year-old African American man who presented to the hospital with an infected pacemaker lead. During the lead extraction procedure, residual vegetations of 3.0 × 1.5 cm on the atrial aspect of the tricuspid valve and 1.5 × 1.2 cm on the ventricular aspect were discovered. The AngioVac system was used to decrease the vegetation burden to decrease septic emboli risk and to allow better penetration of antibiotics. Trans-esophageal echocardiography demonstrated a significant reduction (> 80%) in the size of the vegetations. This case illustrates the use of innovative medical technology, the AngioVac system, to remove large vegetations with bacteremia on the tricuspid valve.

Keywords: AngioVac, tricuspid endocarditis, vegetations, trans-esophageal echocardiography

Introduction

The AngioVac System (AngioDynamic, Inc., Latham, New York) consists of 2 components: the AngioVac Cannula and AngioVac Circuit. This new directed suction catheter device is used to perform percutaneous thrombo-embolectomy with decreased mortality rates.[1] It is composed of a cannula and extracorporeal circuit with a filter for pump-assisted removal of intravascular debris that is coupled with a reinfusion catheter for the return of blood (Figure 1).[2] The system also features a self-expanding nitinol funnel-shaped tip that enhances drainage flow and prevents clogging of the cannula (Figure 2).[3] Direct imaging with echocardiography is used for successful catheter deployment to target thromboembolism while simultaneously avoiding iatrogenic injury.

Right-sided native valve infective endocarditis (IE) involves the tricuspid and pulmonic valves and accounts for approximately 10% of all the IE cases.[4] Some common risk factors include injection drug use, infected pacemaker leads of a cardiac implantable electronic device, presence of intravascular devices, such as central line or intra-aortic balloon pump, and underlying right-sided cardiac anomaly.[5] *Staphylococcus aureus* is the most common microbe followed by streptococci, enterococcus, and *Pseudomonas aeruginosa*. In all infective endocarditis cases, surgical consultation is warranted, especially with large vegetations and recurrent infections. However, patients are considered high risk for surgery in some instances due to severe valvular disease. That is what transforms this case into an informative application of the AngioVac device in the setting of contraindications for a surgical approach.

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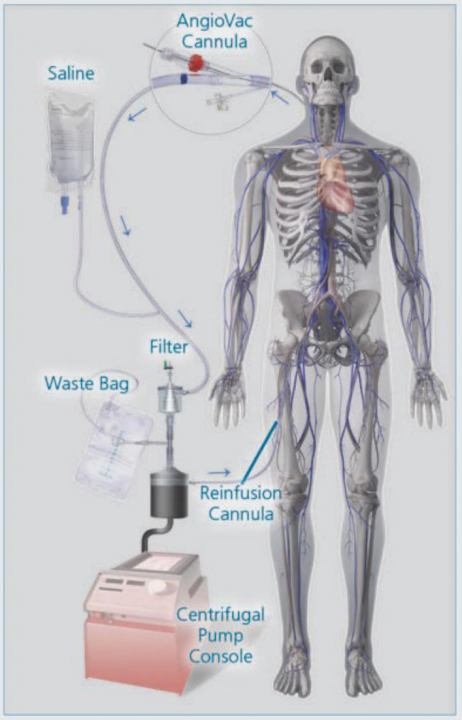

Figure 1. AngioVac Circuit. A cannula and extra-corporeal circuit with a filter removing intravascular debris.

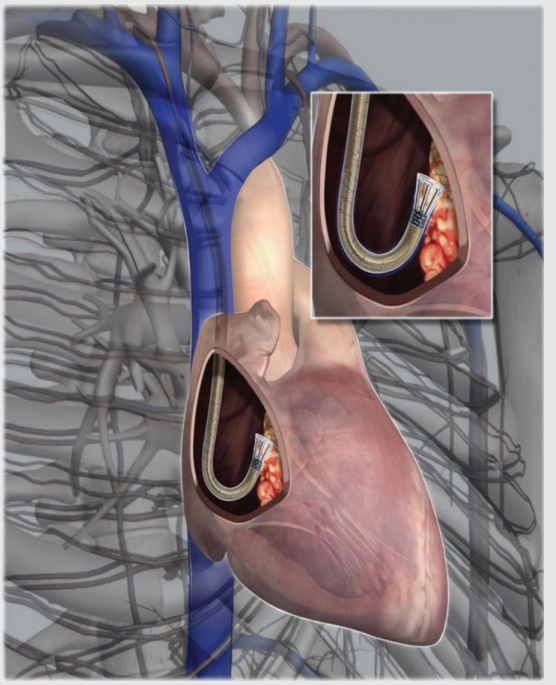

Figure 2. AngioVac Device. A self-expanding funnel to remove various vegetations burdens.

Case

An African-American man, age 56, initially presented to the hospital due to fluid draining from his pacemaker site, fever, chills, and diarrhea. He had a history of hypertension, diabetes mellitus, chronic kidney disease, heart failure with reduced ejection fraction, and recurrent implantable cardio-defibrillator infections. On initial work-up, he tested positive for *Clostridium difficile* colitis, and the blood culture grew *Pseudomonas aeruginosa*. Subsequently, he underwent the lead extraction procedure during which residual vegetations of 3.0 × 1.5 cm on the atrial aspect of the tricuspid valve and 1.5 × 1.2 cm on the ventricular aspect were identified by transesophageal echocardiography (TEE) (Figure 3). A decision was made to use a minimally invasive approach for removal of the vegetations with AngioVac assistance, due to his co-morbidities making him a high-risk surgical case. The purpose of this procedure was to decrease the vegetation burden to reduce further septic embolization and to allow better penetration of antibiotics into the

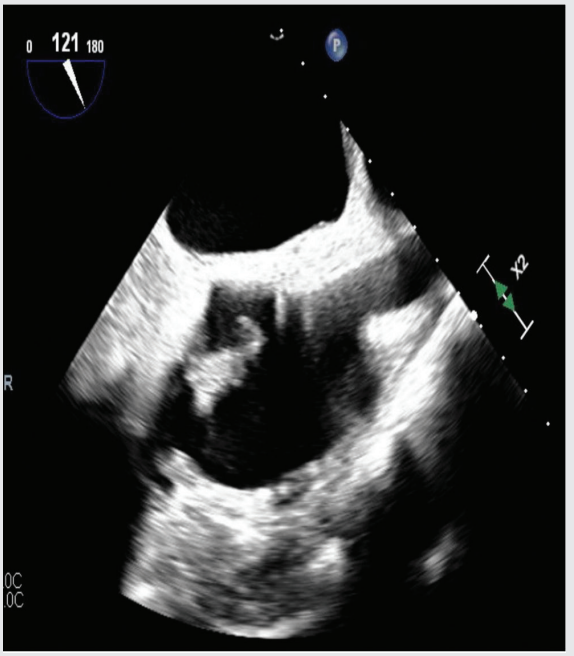

Figure 3. TEE before procedure. Vegetations on tricuspid valve: 3.0 × 1.5 cm and 1.5 × 1.2 cm.

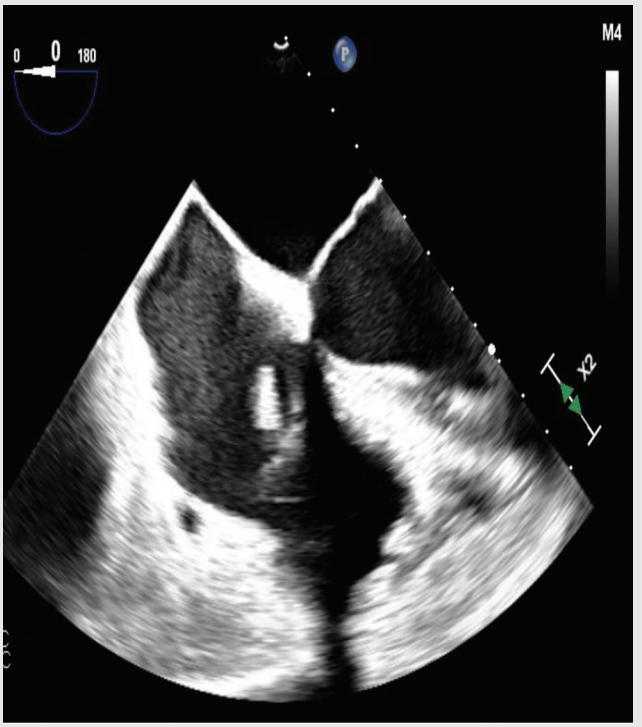

Figure 4. TEE after procedure. Significant reduction (>80%) of vegetations post-procedure.

remaining infection. An access was obtained at the right common femoral vein and the right internal jugular vein (IJV). The first venotomy was serially dilated followed by placement of a 19 Fr reinfusion cannula through the IJV. The second venotomy was serially dilated followed by placement of a Gore 26 Fr dry seal sheath into the inferior vena cava. The AngioVac circuit was connected, and the AngioVac Catheter was advanced into the right atrium. The circuit was then begun, and debulking of the vegetations was performed. The trans-esophageal echocardiography showed a significant reduction, greater than 80%, in the size of the vegetations (Figure 4). The AngioVac system was stopped, and filtered blood without bacteria was returned to the patient by perfusion. Post-operatively, no complications were noted, and the patient left the operating room in stable condition.

Discussion

In patients with right-sided infective endocarditis (IE), tricuspid valve endocarditis is more common than pulmonic valve endocarditis. Fever is the most common symptom, in addition to chills, weight loss, headache, malaise, dyspnea, night sweats, and abdominal pain. Moreover, septic pulmonary emboli are common in patients with tricuspid involvement (up to 75% cases) and can cause cough, pleuritic chest pain, dyspnea, and hemoptysis.[6] The cardiac examination should focus on heart murmurs and/or jugular venous distension, and the pulmonary examination should focus on variations in breath sounds and the presence of crackles. A focal neurological examination should be performed, and the abdominal examination should include any pain related to an infarction, any evidence of septic emboli, and back pain. The most common imaging is chest radiography, which demonstrates septic pulmonary emboli in more than half of cases, in addition to abscesses and pleural effusions.[7]

The initial evaluation for patients for IE includes blood cultures and trans-esophageal echocardiography (TEE) to visualize the vegetation burden. Blood cultures from three different sites (spaced 30–60 minutes from each other) are obtained prior to the initiation of antibiotic therapy. Successful management of the tricuspid endocarditis requires parenteral antibiotic therapy and removal of any indwelling intravascular devices, such as the infected pacemaker lead in our case. Some common indications for the surgical approach to remove vegetations include large vegetation size (>20 mm), recurrent septic pulmonary emboli, highly resistant organisms, or persistent bacteremia despite targeted antibiotics.[8] Patients who are considered high risk for surgery due to co-morbidities or vegetation burden may warrant an alternative approach.

The AngioVac device uses a venovenous bypass circuit for percutaneous thrombectomy. It has been used in patients with iliocaval thrombus, pulmonary embolus, and right heart thrombus who fail medical therapy or have high surgical risk. A recent study found that iliocaval and right heart thrombi were more frequently retrieved by AngioVac thrombectomy with 100% and 60% success rates, respectively; pulmonary embolus retrieval had a 33% success rate.[9] Another study reports the AngioVac device case series describing the outcomes in evacuating large caval thrombi and intracardiac masses in patients

with pulmonary embolism who had no complications, such as pulmonary hemorrhages, strokes, or myocardial infarctions.[2] Finally, a case report with a similar presentation as ours used the AngioVac aspiration device to remove a right atrial thrombus from a high surgical risk patient for open removal with no complications, confirming the safety and efficacy of this procedure for the treatment of intracardiac and intravascular masses.[10] Hence, our case illustrates the use of innovative medical technology, the AngioVac device, to effectively remove large vegetations with bacteremia on the tricuspid valve.

Conclusions

The AngioVac Device is used to remove various materials, such as vegetations, thrombi, or emboli. Infective endocarditis is a prevalent disease, with tricuspid valve involvement being more common in intravenous drug users and patients with infected intravascular lines. Treatment varies depending on surgical risk and severity of the disease. Using the AngioVac system has opened an alternative approach for high surgical risk patients. Our case used this innovative medical technology, the AngioVac device, to effectively remove large vegetations with bacteremia on the tricuspid valve and provide a good example of how innovation is integral in the development of medical treatment.

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