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Percutaneous Removal of a Cardiac Mass in a Patient with Infective Endocarditis: A Case Report

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Abstract

Infective endocarditis (IE) in the pediatric population is uncommon and presents with nonspecific signs. Nonetheless, prompt diagnosis and management are critical given its high mortality rate. We present the case of a 15-year-old boy who initially presented with bilateral multifocal pneumonia and was found to have IE with a right ventricular vegetation. The vegetation was removed percutaneously, obviating a more invasive surgical approach. The patient tolerated the procedure well and rapidly improved following removal of the vegetation. This case report highlights the utility of a novel, minimally invasive approach for the management of cardiac masses.

Keywords
- Vegetation
- angioVac
- infective endocarditis

Introduction

Infective endocarditis (IE) is a potentially lethal condition in children. Though it remains rare with earlier estimated incidence of up to 0.78 per 1,000 cases, recent reports have documented an increase in pediatric IE.[1–4] The development of intracardiac vegetations has been reported in up to 60% of cases, with associated thromboembolic complications in up to 40% of cases and an overall mortality rate of 15%.[3] Timely diagnosis and management are critical for survival.

The presentation of IE in children is typically indolent, requiring a high degree of suspicion. A modified Duke criteria, which categorizes symptoms and diagnostic findings into major and minor criteria has proven effective in aiding with the diagnosis of IE in children.[5] Early initiation of antibiotics is essential; however, roughly one-third to half of all patients are considered high risk and have traditionally required surgery.[6]

Surgical management of IE is associated with a high mortality risk.[6] Recent advances in minimally invasive nonsurgical approaches to management are emerging. The AngioVac aspiration thrombectomy device (AngioDynamics, Latham, New York, United States) is one such advance. It is an aspiration device approved by the Food and Drug Administration (FDA) in 2009 that operates as a venous–venous extracorporeal circuit that removes masses in the cardiovascular system that pose a high risk of embolism and/or hemodynamic compromise in patients who may be at high risk for traditional surgical/percutaneous interventions.[7] The use of this device has seldom been reported for the pediatric population.[8] In this report, we discuss the nonsurgical management and successful use of the AngioVac thrombectomy aspiration system in a pediatric patient with IE complicated by intracardiac vegetation.

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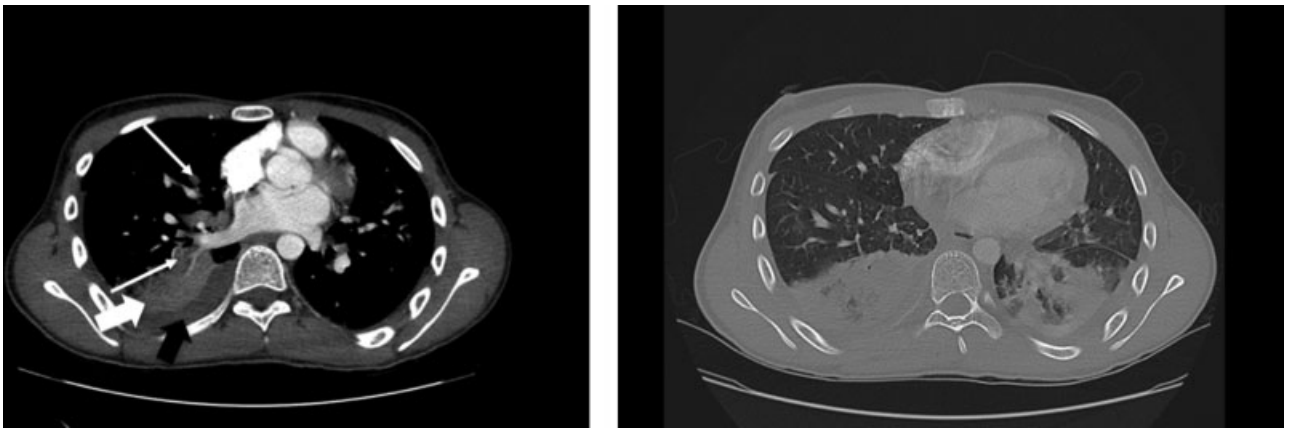

Fig. 1 (**A**) Axial computed tomography angiography image showing right middle and lower lobe pulmonary emboli (small white arrows) with right-sided pleural effusion (large black arrow) and consolidation (large white arrow). (**B**) Computed tomography lung window at a more caudal slice demonstrates bilateral consolidation and pleural effusion.

Case Report

A 15-year-old boy presented with a medical history significant for high-functioning autism, asthma, and eosinophilic esophagitis. He was in his usual state of health until approximately 2 weeks prior to presentation when he developed upper respiratory infectious symptoms including rhinorrhea, a nonproductive cough, malaise, and fatigue. His symptoms progressed over the following week to include fevers of 104 F associated with 8/10 sharp right-sided, nonradiating chest pain that was worse with inspiration. Of note, other family members also had upper respiratory symptoms, though to a lesser degree. Laboratory evaluation was notable to leukocytosis with an elevated white blood cell count of 22,500 mm^3, and three out of four blood cultures were positive for coagulase-negative staphylococcus (*Staphylococcus hominis*). Chest X-ray demonstrated pulmonary infiltrates consistent with multifocal pneumonia involving the left lower and right middle lobes, and the patient was initiated on intravenous antibiotics.

After 48 hours of initial improvement, the patient developed hemoptysis with worsening fever, tachycardia, and 7/10 pleuritic right-sided chest pain the following day. These symptoms prompted consideration of pulmonary embolism and complications of pneumonia such as empyema. A computed tomography angiography (CTA) was performed which revealed pulmonary emboli in the right lower and right middle lobes, as well as bibasilar lung consolidations and bilateral pleural effusions consistent with multilobar pneumonia (►**Fig. 1A**, **B**). Duplex ultrasound of his lower extremities did not reveal any deep venous thrombosis. Furthermore, CTA and transthoracic echocardiogram showed a 2-cm mass adherent to the chordae tendinae of the tricuspid valve in the right ventricle (►**Fig. 2A–C**).

He was promptly initiated on heparin drip and transferred to our medical center for higher level of care. Initial decision was to take a conservative approach, monitoring the evolution of the cardiac mass with serial echocardiograms while on anticoagulation and intravenous azithromycin, ceftriaxone, and vancomycin. Indeed, the mass remained stable in size over the course of the following week; however, his echocardiogram showed signs of interval development of tricuspid regurgitation and concern for impending valvular compromise. A decision was made to proceed with retrieval of the intracardiac mass for several reasons, including the need to mitigate risk of valvular compromise, to obtain a sample for histopathologic diagnosis, and source control to prevent the risk of distal emboli which could further compromise respiratory function. Given the absence of frank hemodynamic instability, risks outweighed benefits for an open thoracotomy

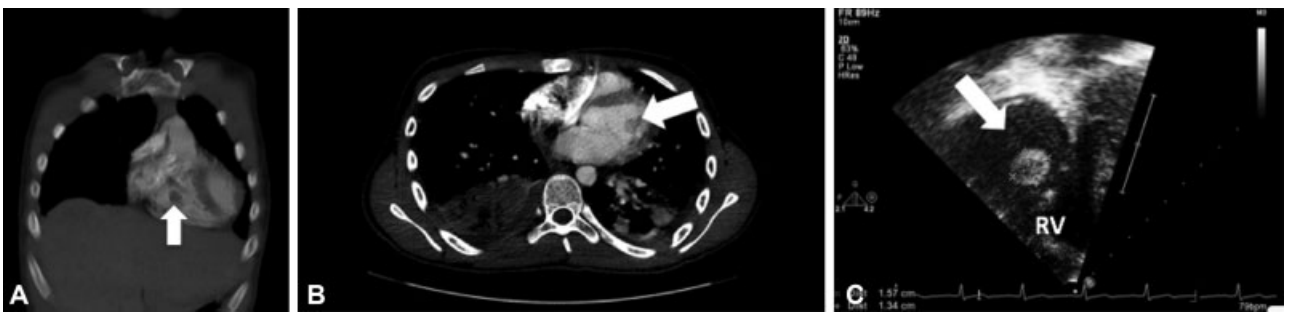

Fig. 2 (**A**) Coronal and (**B**) axial computed tomography angiography demonstrates right ventricular mass/vegetation (large white arrow); (**C**) transthoracic echocardiogram demonstrating mobile circular mass in the right ventricle (arrow), attached to the chordae of the tricuspid leaflets.

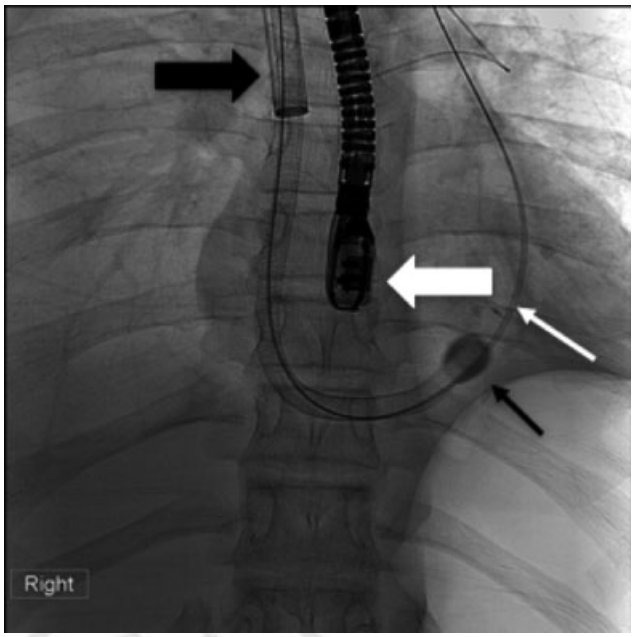

Fig. 3 Intraprocedural fluoroscopic image demonstrates a 22Fr sheath (large black arrow) through a right internal jugular access over a stiff wire (small white arrow) that has been navigated through the right atrium, right ventricle, and into the main pulmonary artery. The AngioVac aspiration cannula (small black arrow) has been advanced over the stiff wire into the right ventricle using transesophageal echo (large white arrow) and fluoroscopic guidance.

and thus decision was made by a multidisciplinary team including cardiothoracic surgery, infectious disease, critical care, and interventional radiology to initially proceed with a less invasive approach given the availability of percutaneous AngioVac aspiration thrombectomy at our institution.

The patient underwent percutaneous retrieval of the entire intracardiac mass using an AngioVac aspiration thrombectomy device. The procedure was performed under general anesthesia in the interventional radiology suite. Under fluoroscopic and transesophageal echo (TEE) guidance, the 22Fr AngioVac cannula was advanced into the right ventricle (►**Figs. 3** and **4**). An extracorporeal circuit containing a filter to trap solid material was set up, with blood recirculated through the 18Fr reperfusion catheter, effectively forming a venous–venous bypass. The mass was removed within 5 minutes of aspiration and trapped in the AngioVac filter (►**Fig. 5**). TEE confirmed complete removal of the mass and immediate resolution of tricuspid regurgitation. The patient tolerated the procedure well, with no immediate complications and negligible estimated blood loss.

He was promptly initiated on unfractionated heparin infusion and transferred from the pediatric intensive care unit to a regular pediatric ward 4 days postprocedure. Histopathology analysis of the aspirated mass demonstrated findings compatible with organizing thrombus, with no infection or malignancy (►**Fig. 6**). Despite these results, the infectious disease team urged treatment for presumed IE given initial presentation which met the modified Duke criteria. Peripherally inserted central catheter (PICC) line was placed for long-term antibiotic therapy with a continuous infusion of oxacillin and he was discharged home 3 weeks after initial presentation with 3-month follow-up confirming return to usual state of health.

Discussion

The indolent nature of IE makes it a difficult condition to diagnose, thus a high degree of suspicion is necessary. The

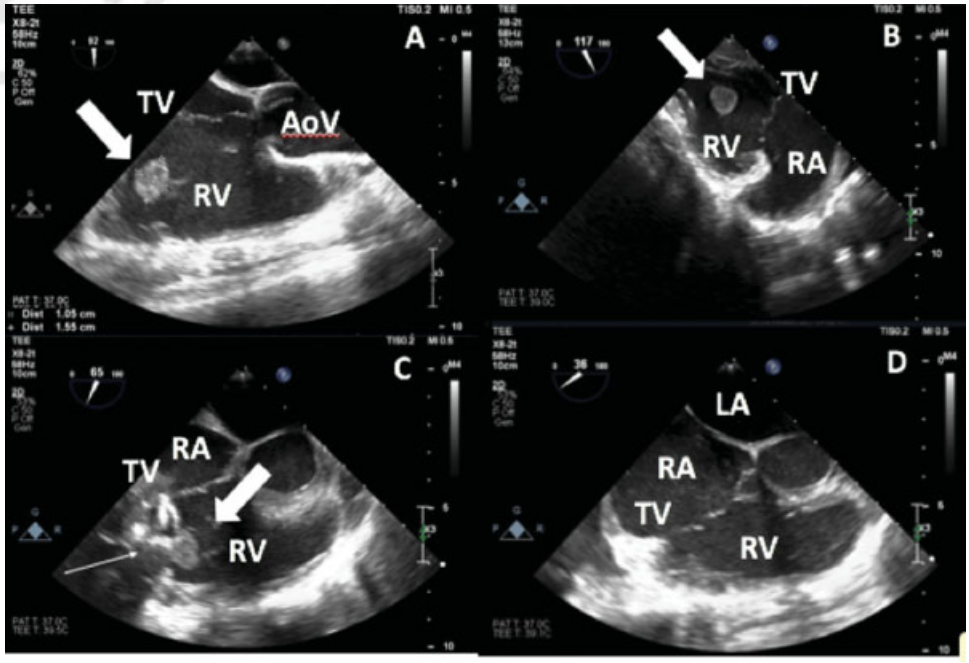

Fig. 4 Transesophageal echo images demonstrating (**A**) short axis and (**B**) transgastric view demonstrating the mobile mass (thick arrows) attached to the tricuspid valve; (**C**) a stiff wire (thin arrow) is seen crossing the tricuspid valve for stable positioning of the AngioVac cannulae. (**D**) Short axis view demonstrating successful extraction of the mass.

Fig. 5 AngioVac filter postprocedure showing the cardiac mass that was aspirated from the right ventricle in two separate pieces.

latest guideline on the management of IE in children was published in 2015 and advocates the use of a modified Duke criteria, relying on defined major and/or minor criteria.[2] In our case, the patient met one major criteria with evidence of a tricuspid vegetation on echocardiogram. He also satisfied three minor criteria—positive coagulase-negative *Staphylococcus* blood cultures prior to initiation of antibiotics, vascular phenomena with development of septic pulmonary emboli, and persistent fevers. Though the microorganism isolated from his initial blood culture, *Staphylococcus hominis*, has been shown as a potential cause of IE, it is not considered a typical causative agent and thus satisfies minor rather than major criteria for diagnosis.[9] The broader class of coagulase-negative *Staphylococcus* organisms are however becoming a more common cause of IE. It should also be noted that right-sided endocarditis as in this case is more difficult to diagnose by blood culture because the organisms tend to be filtered in the lungs.[2]

Management of uncomplicated cases involves appropriate tailoring of antibiotics. However, for patients who are at high risk of developing complications including those with difficult to treat organisms such as fungi and *Staphylococcus aureus*, left-sided IE, large vegetations (>1 cm), systemic emboli, prosthetic valves, heart failure, and poor response to antimicrobial therapy, immediate surgical management is recommend.[2,6] The decision to pursue surgical intervention is not made lightly, considering reported surgical mortality rates of up to 25%.[6] Hence consideration of emerging techniques such as aspiration thrombectomy and percutaneous snare vegetectomy that may potentially provide a lower risk profile in the management of IE complications is of high value. Despite its attendant risks, a surgical approach is best suited for patients with hemodynamic instability; however, for patients who are hemodynamically stable but considered high risk for progression such as the patient in this case who had interval development of tricuspid regurgitation, a percutaneous approach is prudent, if available.

In this case report, we demonstrate the feasibility of percutaneous aspiration of an intracardiac vegetation using the AngioVac aspiration system in a patient with IE, obviating the need for a more invasive procedure. Though the AngioVac aspiration thrombectomy device has been FDA approved since 2009, only a few reports have described its use in the pediatric population.[8] In 2016, we reported our early institutional experience with the AngioVac device in which we

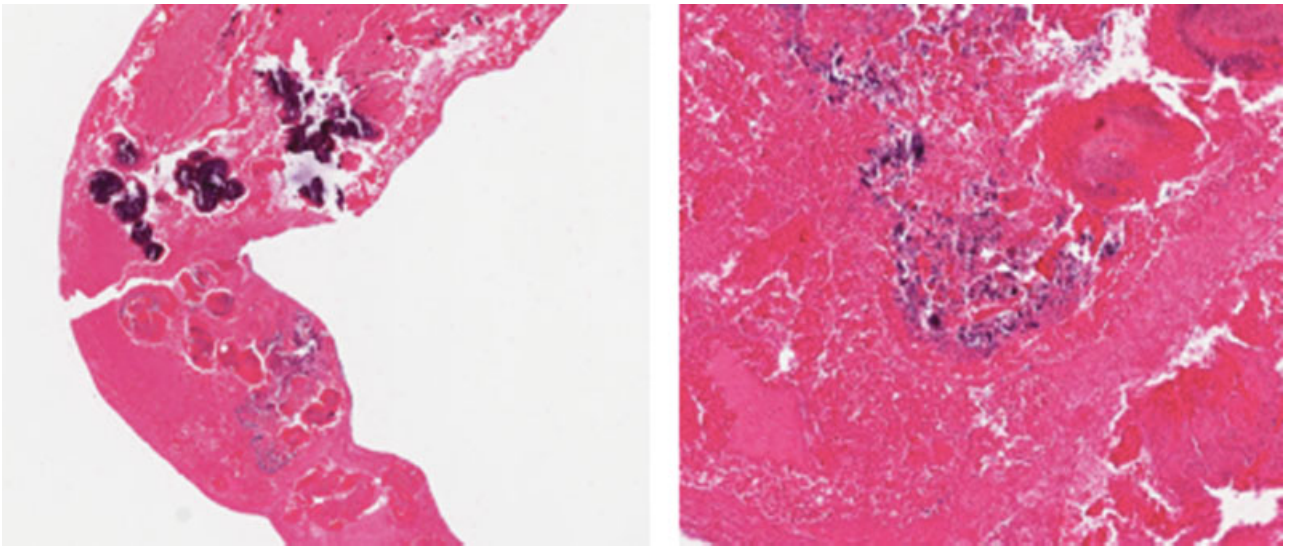

Fig. 6 Histopathologic analysis with hematoxylin and eosin staining at ×26 and ×200 magnification demonstrating bland thrombus, no evidence of infection, or malignancy.

encountered a single major procedure-related complication of pulmonary emboli in 1 out of 16 patients and a single minor complication of access site hematoma.[10] These findings corroborated an earlier report from a different medical center which demonstrated no major complications, only minor access site hematoma in seven patients.[11] Though these reports were based on an adult population, the results should be applicable to appropriately selected children.

Though more data are needed, we believe that percutaneous aspiration thrombectomy may be considered as part of the treatment paradigm for appropriately selected pediatric patients with IE and right-sided intracardiac masses. The main limitations of the use of the AngioVac system are availability of the device and local expertise. In the pediatric population, one must also consider the size of peripheral access vessels for the introduction of the large diameter aspiration and reperfusion cannulas limiting its current use to older children. It is conceivable that smaller caliber, low profile aspiration, and reperfusion cannulas may be developed in the future for use in younger children. We recommend considering percutaneous aspiration thrombectomy as a bridge or potential alternative to a more invasive surgical approach in appropriately selected patients.

Conclusion

Percutaneous aspiration thrombectomy is a safe and efficient method for the removal of intravascular masses in the pediatric population, and may play an important role as a bridge or potential alternative to more invasive surgical options.

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Conflict of Interest
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