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CASE REPORT

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Percutaneous aspiration of aortic valve vegetation in a patient with aortic valve endocarditis

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Key Clinical Message

Percutaneous aspiration for debulking of vegetations in right-sided infective endocarditis has been well-described, however, this technique can be employed successfully for left-sided vegetations in select high-risk patients.

Abstract

We report a case of percutaneous aspiration of an aortic valve vegetation in a patient with prosthetic valve endocarditis. This novel approach was selected after patient declined surgical intervention for an enlarging vegetation despite antibiotic therapy. The procedure was successful, resulting in the complete removal of solid vegetation without complications.

KEYWORDS

aortic valve, aspiration thrombectomy, endocarditis, percutaneous, vegetation

1 | INTRODUCTION

Prosthetic valve endocarditis (PVE) is a particularly severe form of infective endocarditis (IE) and represents one of the most feared complications of cardiac valve replacement. Despite advancements in PVE management, in-hospital mortality rates remain high, approaching 20%–40%.[1] The management of PVE is generally similar to native valve endocarditis and depends on numerous factors including identity of the infecting organism, vegetation size, presence of heart failure or valve dysfunction, occurrence of embolic events, or evidence of persistent infection despite treatment.[2] In addition to a prolonged course of antibiotics, surgical intervention is a mainstay in the treatment of PVE with approximately 50% of affected patients undergoing valve surgery during their initial hospitalization.[2,3]

When indicated, early surgical intervention is preferred for left-sided IE and has been shown to lower the risk of embolic events and mortality compared to conservative treatment.[4] However, according to a recent analysis, 24% (202 of 836) of patients who met guideline indications for surgery ultimately received nonoperative therapy.[5] Poor prognosis, surgeon declining to operate, or the presence of hemodynamic instability, sepsis, or stroke were the most common reasons for conservative management. Conversely, the presence of abscess, severe aortic insufficiency, and embolic events were associated with a greater likelihood of undergoing surgical intervention.

Recently, the use of endovascular techniques for the management of IE has emerged as an alternative to surgery in select patients.[6] However, its use has been primarily restricted to patients with right-sided IE In the following case report, we present a 75-year-old patient with aortic

valve PVE who was successfully managed using endovascular aspiration of an enlarging vegetation.

2 | CASE HISTORY

A 75-year-old male presented with fevers, chills, and abdominal pain 3 weeks after undergoing dental cleaning. His medical history was significant for severe aortic stenosis requiring aortic valve replacement (AVR) with an Edwards Intuity bioprostethic valve via mini-thoracotomy after patient declined sternotomy 2 years prior. He reported having taken prophylactic amoxicillin prior to his dental procedure given his history of valve replacement.

A CTA of the abdomen revealed infarcts in the spleen and right kidney (Figure 1) concerning septic emboli. Transthoracic echocardiograph (TTE) revealed mobile vegetation on the aortic valve measuring 0.5 × 0.7 cm. Transesophageal echocardiography (TEE) performed the next day confirmed a 1.8 × 0.7 cm mobile vegetation attached to the aortic side of the noncoronary prosthetic cusp (Video S1). Aortic cusp excursion was normal and no aortic regurgitation was evident. Left ventricular systolic function was normal. Blood cultures were drawn and empiric antibiotic therapy with vancomycin and ceftriaxone was initiated. Blood cultures grew Cardiobacterium hominis susceptible to ceftriaxone.

Conservative management with antibiotics was initially selected given the patient's hemodynamic stability and absence of valvular dysfunction or destruction. Surveillance blood cultures were collected and remained negative. However, following 5 days of antibiotic therapy, repeat TTE demonstrated enlarging aortic valve vegetation, now measuring 0.9 × 1.1 cm (Figure 2).

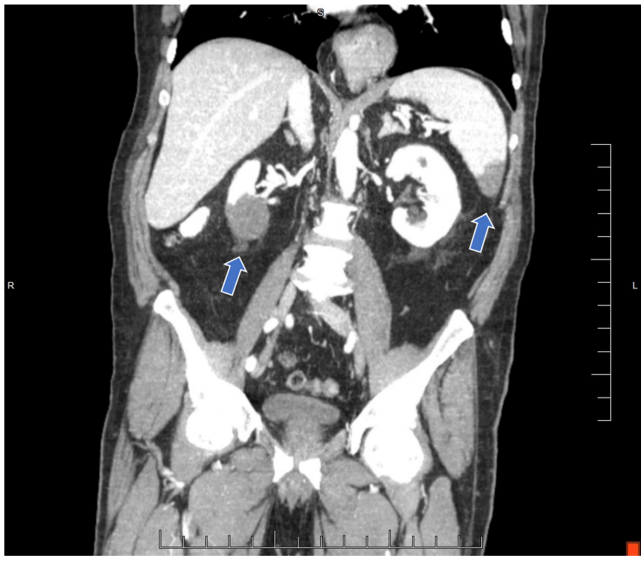

FIGURE 1 CTA of the abdomen and pelvis demonstrating splenic and renal infarcts (arrows).

Given the enlarging vegetation despite tailored antibiotic therapy, surgical intervention was recommended. However, the patient again declined sternotomy, and repeat AVR via mini-thoracotomy was felt to be too high risk. After extensive discussions between our multi-disciplinary team and the patient in which multiple treatment options were considered, endovascular catheter-directed aspiration of the vegetation was chosen as an alternative approach.

3 | METHODS

The procedure was performed in a hybrid operating room with members of the surgical team present. Pre-procedural TEE confirmed the presence of the enlarging vegetation. A 6 French sheath was placed into the left common femoral artery. A 25 mm loop snare was advanced through the sheath and deployed in the mid-abdominal aorta. A 9 French sheath was placed in the right common femoral artery. An 8.5 French steerable introducer (Agilis NxT^{tm}, St. Jude Medical) was advanced through the sheath within the right common femoral artery. The steerable sheath was negotiated through the snare in the abdominal aorta and advanced around the aortic arch into the ascending aortic arch. An 8 French aspiration catheter (Indigo Cat-8^{tm}, Penumbra Inc.) was then advanced through the steerable introducer to the level of the bioprosthetic valve. Using both fluoroscopic and TEE guidance, the steerable sheath was used to help negotiate the angled aspiration catheter off the aortic wall and onto the vegetation (Video S2). With the aspiration catheter in position, the catheter was connected to suction. Real-time TEE was used to ensure adequate positioning of the aspiration catheter and timing of suction to capture the large vegetation without damaging the functioning leaflet. This was repeated until the catheter engaged the vegetation on the leaflet and the motion of the leaflet temporarily stopped. Additionally, blood flow through the aspiration catheter stopped and it became clear that the vegetation had "corked" within the catheter tip. The aspiration catheter was then retracted and removed from the patient with suction on. The capture filter of the aspiration catheter demonstrated successful retrieval of organized vegetation (Figure 3). A TEE performed immediately after the procedure revealed a functional aortic valve with no evidence of residual vegetation (Figure 4) (Video S3). The snare and sheaths were removed.

4 | CONCLUSION AND RESULTS

The procedure was tolerated well without complications. The patient was discharged the following day, hemodynamically and neurologically intact, to complete

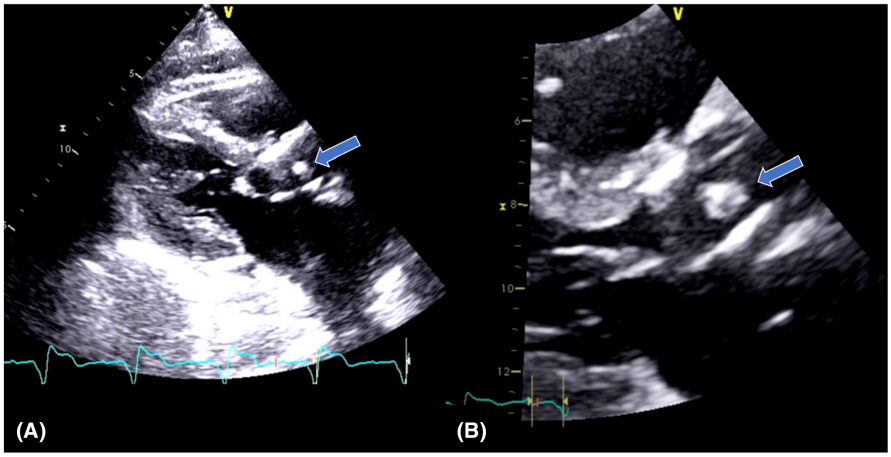

FIGURE 2 TTE obtained on admission (A) and following initiation of antibiotic therapy (B) demonstrating vegetation (arrows) on the non-coronary cusp of the prosthetic aortic valve. Despite antibiotic therapy, the vegetation grew from 0.5 × 0.7 cm to 0.9 × 1.1 cm in the parasternal long-axis view.

FIGURE 3 (Central). Aortic valve vegetation; organized and intact following mechanical aspiration.

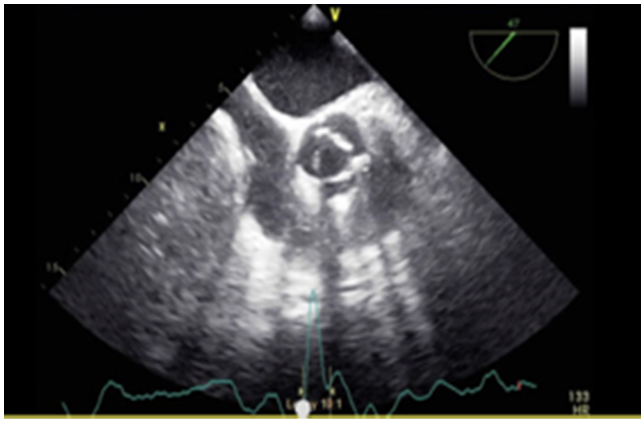

FIGURE 4 TEE obtained following successful vegetation aspiration showing functional aortic valve leaflet.

a six-week course of antibiotic therapy. Repeat TTE 5 months later showed a well-functioning aortic valve without vegetation.

5 | DISCUSSION

We presented a case of left-sided PVE that was managed via aspiration thrombectomy in a patient who declined repeat surgery on his prosthetic aortic valve. At the time of initial presentation, conservative management with antibiotic therapy was recommended given that our patient did not meet significant indications for operative management beyond having a large, >10 mm vegetation by TEE (COR IIb recommendation). Recommendations for valve surgery in left-sided PVE are listed in Table 1. Unfortunately, our patient's vegetation grew significantly by TTE despite appropriate antibiotic therapy. Surgery was ultimately recommended given that prior studies have shown that the presence of enlarging vegetations has been associated with an increased risk for future complications and embolic events, independent of blood culture results.[7] An endovascular approach was considered only after the patient refused to undergo a traditional sternotomy.

Endovascular techniques are becoming increasingly common options in the management of IE. The efficacy of this technique for removing or debulking right-sided vegetation due to IE has been described in multiple publications ([6,8]). In the majority of these cases, AngioVac (Angiodynamics), a large bore percutaneous filtration device, was used to achieve either complete removal or a significant reduction in the size of the vegetation.[8] When compared to right-sided IE, endovascular management of left-sided IE is significantly more difficult and higher risk. At the time of this publication, there has been only one published case documenting the use of AngioVac for a left-sided heart valve abnormality.[9] In that case, a patient with obstructive shock from a large left atrial and mitral valve thrombosis underwent a trans-septal approach for thrombectomy. Furthermore, to our knowledge, there are no prior reports describing the use of percutaneous aspiration techniques in the management of aortic valve endocarditis.

TABLE 1 AHA recommendations for early valve surgery in left-sided prosthetic valve endocarditis.

Indication	Evidence
Early surgery is indicated in patients with symptoms or signs of heart failure resulting from valve dehiscence, intracardiac fistula, or severe prosthetic valve dysfunction	Class I: Level of evidence B
Early surgery should be done in patients who have persistent bacteremia despite appropriate antibiotic therapy for 5–7 days in whom other sites of infection have been excluded	Class I: Level of evidence
Early surgery is indicated when IE is complicated by heart block, annular or aortic abscess, or destructive penetrating lesions	Class I: Level of evidence B
Early surgery is indicated in patients with PVE caused by fungi or highly resistant organisms	Class I: Level of evidence B
Early surgery is reasonable for patients with PVE who have recurrent emboli despite appropriate antibiotic treatment	Class IIa: Level of evidence B
Early surgery is reasonable for patients with relapsing PVE	Class IIa: Level of evidence C
Early surgery may be considered in patients with mobile vegetation>10 mm	Class IIb: Level of evidence C

The Penumbra system, a percutaneous mechanical thrombectomy device was chosen to extract the aortic valve vegetation. The Penumbra system includes a reperfusion catheter that is advanced to the proximal tip of a thrombus, or, in our case, vegetation, and attached to continuous vacuum suction.[10] The aspiration catheter was advanced through a snare which had been placed in the abdominal aorta in anticipation of having to use the snare to pull off adherent or fibrotic vegetation. In the end, this was not needed as the vegetation came off the valve cleanly with suction aspiration. Despite the vegetation being larger than the lumen of the aspiration catheter, the vegetation was sucked into the catheter, presumably taking on the elongated shape through the catheter, and came out completely intact.

Due to the risk of vegetation fragmentation and embolization, the Sentinal device (Boston Scientific) was considered but was not available at the time and it was felt that waiting to obtain authorization to use the device would result in significant delay in patient care. Therefore, a decision was made to proceed without distal protection. However, these devices should be considered in future cases as they may decrease the risk of stroke associated with vegetation fragmentation and embolization.

Currently, there are no guideline indications for the use of percutaneous aspiration devices in the management of IE. While numerous studies suggest a potential role for percutaneous vegetation aspiration in right-sided IE, we present the first case utilizing this technique for aortic valve IE. In our patient with a large, persistent, and enlarging aortic valve vegetation despite adequate antibiotic therapy and negative blood cultures, the use of mechanical aspiration with the Penumbra system resulted in complete removal of the vegetation without embolization, compromise of the valve, or need for further intervention.

While further studies are needed to establish the safety and efficacy of percutaneous aspiration for left-sided endocarditis, this is the first case establishing the feasibility of this technique. In patients with aortic valve endocarditis who are deemed too high risk for, or refuse, operative management, percutaneous aspiration may provide an alternative to conservative therapy.

AUTHOR CONTRIBUTIONS

Anthony Louis Cioci: Conceptualization; methodology; writing – original draft; writing – review and editing. **Anneka Hutton:** Conceptualization; writing – original draft. **Slee Yi:** Conceptualization; writing – original draft. **George Khoriaty:** Conceptualization; methodology; writing – original draft; writing – review and editing. **Gary Gottlieb:** Conceptualization; data curation; investigation; writing – review and editing. **Richard Cartledge:** Conceptualization; methodology; writing – original draft; writing – review and editing. **Mark Rubenstein:** Conceptualization; methodology; supervision; writing – original draft; writing – review and editing.

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CONFLICT OF INTEREST STATEMENT

There are no relationships with industry to disclose.

DATA AVAILABILITY STATEMENT

Data sharing not applicable to this article as no datasets were generated or analyzed during the current study.

CONSENT

Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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