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CASE REPORT
Structural intervention

Endocarditis of the forgotten valve: vacuum-assisted aspiration (AngioVac) of the eustachian valve: a case report

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Background Eustachian valve endocarditis (EVE) is a rare entity that traditionally has been treated with antibiotics or surgery, if refractory to antibiotic treatment.

Case summary A 64-year-old man presented with right shoulder pain and new-onset hypoxia. His blood cultures were positive for methicillin-sensitive staphylococcal aureus (MSSA) 1 month ago and he was treated with antibiotics at that time. Blood cultures during this admission were again positive for MSSA. Trans-oesophageal echocardiogram showed a large independently mobile echogenic density consistent with vegetation (3.0 × 1.6 cm) on the eustachian valve (EV). The patient was a poor surgical candidate due to his multiple co-morbidities, and therefore, a non-invasive procedure called AngioVac® was selected.

Discussion In the setting of infective endocarditis refractory to antibiotics, the large-bore percutaneous mechanical aspiration (AngioVac®, AngioDynamics, Latham, NY, USA) system is gaining increasing momentum as the treatment of choice over standard surgical intervention for debulking large vegetations. AngioVac® has provided a minimally invasive and effective measure especially in those unable to tolerate surgery. The novel percutaneous technique is linked to great success in right-sided endocarditis, with the tricuspid valve accounting for a majority of the cases. However, in rare instances, the EV may be involved. To our knowledge, we report the first case of EVE treated with AngioVac®.

Keywords Endocarditis • Eustachian valve • *Staphylococcus aureus* • AngioVac® • Case report

ESC Curriculum 2.2 Echocardiography • 4.11 Endocarditis

Learning points

- The eustachian valve (EV) is a non-functional embryonic remnant that may remain in 25% of people.
- AngioVac® can be used for debulking vegetations and source control of EV endocarditis in patients unable to tolerate surgery.

Introduction

Bacterial endocarditis is caused by bacteraemia that involves infection of the endocardial lining of the heart and is associated with high mortality. Infective endocarditis (IE) is typically caused by staphylococcal bacteraemia but can also be associated with streptococcal, enterococcal, and to a lesser degree Gram-negative or fungal pathogens. The majority of IE, roughly 80–90%, involves the left side of the heart, with right-sided IE (RSIE) accounting for only 5–10% of all cases.[1] Right-sided infective endocarditis is seen predominately in the setting

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of intravenous drug use, cardiac implantable device, or in the presence of underlying right-sided cardiac anomaly. A majority of these cases involves the tricuspid valve followed by the pulmonic valve. However, a rare presentation of RSIE involves the eustachian valve (EV). This valve is a non-functional embryonic remnant that functions to direct foetal oxygenated blood towards the foramen ovale and typically regresses after birth, but it may remain in 25% of people.[1]

If IE is left untreated, further complications may ensue, such as progressive valvular insufficiency leading to congestive heart failure, development of myocardial abscess, and septic emboli. Therefore, early recognition of systemic symptoms is critical and those with risk factors should be thoroughly investigated. Trans-oesophageal echocardiogram (TEE) is used as the diagnostic modality alongside positive blood cultures. The therapy involves an extended antibiotic course and surgical intervention if refractory to antibiotics. AngioVac®, a percutaneous vacuum-assisted aspiration system has gained increased notoriety as a minimally invasive modality for evacuation and debulking of large vegetations.[2]

Timeline

Time	Events
One month prior to presentation	The patient was diagnosed with community-acquired pneumonia with positive blood and urine cultures for methicillin-sensitive staphylococcal aureus (MSSA). He was treated with i.v. vancomycin and discharged on oral cephalexin
Day 1	The patient presented to the hospital with right shoulder pain and new-onset hypoxia. His blood cultures were collected
Day 2	Transthoracic echocardiogram (TTE) was obtained and cardiology as well as infectious disease were consulted
Day 3	Blood cultures were positive for MSSA bacteraemia. Trans-oesophageal echocardiogram showed vegetation on the eustachian valve
Day 4	The tunnelled catheter was replaced with a temporary dialysis catheter
Day 6	The patient underwent valvular aspiration with AngioVac®
Day 9	Repeat blood cultures were negative
Week 7	The patient completed a high-dose antibiotic (cefazolin) course
Week 8	Follow-up blood cultures were negative. The patient was doing well

Case presentation

A 64-year-old male with a past medical history significant of end-stage renal disease on haemodialysis via a tunnelled catheter and bilateral hydronephrosis with bilateral nephrostomy tubes presented with right shoulder pain and hypoxia. The patient denied having any fevers, night sweats, or weight loss. Physical examination was not significant for a heart murmur, Janeway lesions, Osler nodes, Roth spots, or splinter haemorrhages. He was diagnosed with community-acquired pneumonia at an outside facility 1 month prior with positive blood and urine cultures for methicillin-sensitive staphylococcal aureus (MSSA). At that time, he was treated with intravenous vancomycin and transitioned to oral cephalexin on discharge for 10 days. He reported compliance with antibiotics. Repeat blood cultures were positive for MSSA in two samples. Trans-oesophageal echocardiogram demonstrated an ejection fraction of 60–65% and a large independently mobile echogenic density consistent with vegetation (3.0 × 1.6 cm) on the EV (*Figure 1*).

The patient was initially started on broad-spectrum antibiotics with vancomycin and cefazolin, but effectively de-escalated to ceftriaxone per culture sensitivities. The tunnelled catheter was replaced with a temporary dialysis catheter. A Structural Heart Team approach was undertaken. Given his actively persistent bacteraemia and multiple co-morbidities, he was considered a high-risk candidate for surgery. Therefore, he was deemed a candidate for percutaneous vacuum-assisted mechanical aspiration (AngioVac®). He was brought to the hybrid operating room, placed under general anaesthesia, intubated, and intraprocedural TEE was performed. A 26 Fr Gore DrySeal sheath was inserted via the right internal jugular vein and a 17 Fr left femoral venous return cannula was inserted via the standard modified Seldinger technique. The patient was fully heparinized with activating clotting times of >250 s. A standard C20 AngioVac® cannula was prepared and inserted into the 26 Fr sheath (see Supplementary material online, *Video S1A*). Using fluoroscopic and TEE guidance, the C20 cannula was advanced towards the mass, and using a combination of two-dimensional, X-plane, and three-dimensional imaging, the entire vegetative focus was aspirated from the EV (see Supplementary material online, *Video S1B* and *C*). No foci were seen on the tricuspid valve or pulmonic valve (see Supplementary material online, *Video S1D*). Once the procedure was complete, all access sites were closed using a figure of eight stitch with adequate haemostasis. Repeat blood cultures were finally negative within 24–48 h of the procedure. He was transitioned to high-dose cefazolin and he completed a 7-week course. One week after completing the antibiotics, the patient came for a follow-up visit and was doing well. He had no new symptoms or issues. Repeat blood cultures were negative.

Discussion

Eustachian valve endocarditis (EVE) is a rare entity, with the first reported case documented in 1986. Since then, roughly 37 cases have been reported in the literature.[3] This rare presentation is mostly attributed to the low prevalence of EV in adults. As such, EVE is treated in a similar fashion as other RSIE presentations. According to current guidelines and recommendations, IE is diagnosed by echocardiogram and positive blood cultures. The therapy involves a prolonged 2- to 6-week course of antibiotics.[4] This is typically followed by repeat blood cultures and echocardiogram to assess for resolution.

Oftentimes, IE remains refractory to antibiotics, or the patient becomes haemodynamically unstable. The 2015 European Society of Cardiology guidelines stipulate that surgery may be pursued to remove and replace damaged heart valves in the setting of consistent fevers, positive blood cultures 7–10 days post-antibiotic initiation, persistent tricuspid valve vegetations larger than 20 mm, and right heart failure secondary to tricuspid regurgitation.[5] Following US FDA approval in 2014 for percutaneous removal of undesired material from the intravascular system, AngioVac® has gained increased notoriety as a means of effective and minimally invasive alternative to surgical intervention, especially in high-risk surgical candidates.[5] The system is a percutaneous transcatheter aspiration system that functions to suction out blood and debris through an inline filter before being returned to the body. By doing so, it debulks large and persistent vegetations, allowing for decreased bacterial load, increasing antibiotic efficacy, and reducing the risk of recurrence.[1]

The efficacy of AngioVac® was again illustrated in Schaerf *et al.*,[6] who studied 20 candidates with high surgical risk who demonstrated

Figure 1 Eustachian valve endocarditis. A 45° mid-oesophageal short-axis trans-oesophageal echocardiogram view demonstrating a large 3.0 cm × 1.6 cm vegetation (within the dashed circle) that is localized on the eustachian valve.

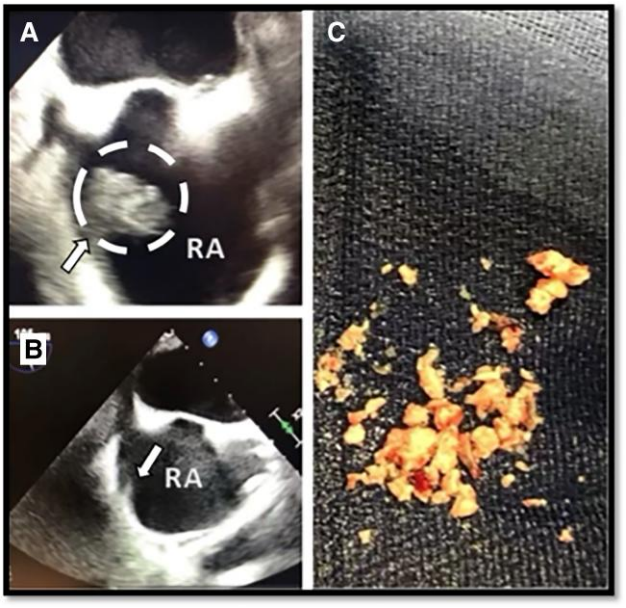

Figure 2 Successful valvular aspiration and debulking of eustachian valve vegetation. (*A*) Trans-oesophageal echocardiogram surveying the large vegetation (located within the dashed circle) and eustachian valve (indicated by the arrow). (*B*) Trans-oesophageal echocardiogram post AngioVac® shows no further residual mass. (*C*) Suctioned vegetation collected from the AngioVac® filter.

cardiac device IE vegetations refractory to medical therapy. A more recent meta-analysis and systemic review study presented an overview of 301 patients who underwent AngioVac®-assisted aspiration. This study showed the successful outcomes of right-sided vegetation removal, bacteraemia clearance, and relatively low complications in candidates with high surgical risk.[2] All these accounts demonstrated a successful debulking of RSIE vegetations in the tricuspid valve or pulmonary valve, but none illustrated application in EVE. Exploiting

this, we replicated the successful debulking of EV vegetation by AngioVac® (*Figure 2C*).

Conclusions

The EV, although thought to be benign, in the appropriate clinical scenario predisposes patients to endocarditis and merits aggressive therapies. The current case provides evidence that with a Structural Heart Team approach, AngioVac® provides another tool in the armamentarium with respect to successful management of large vegetations in patients who are not candidates for surgical intervention. Further studies are needed to understand the utility of AngioVac® in the current paradigm for the management of endocarditis.

Lead author biography

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Supplementary material

Supplementary material is available at *European Heart Journal – Case Reports*.

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Slide sets: A fully edited slide set detailing this case and suitable for local presentation is available online as Supplementary data.

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Data availability

The data underlying this article are available in the article and in its online supplementary material.

References

1. Shmueli H, Thomas F, Flint N, Setia G, Janjic A, Siegel RJ. Right-sided infective endocarditis 2020: challenges and updates in diagnosis and treatment. *J Am Heart Assoc* 2020;**9**: e017293.
2. Mhanna M, Beran A, Al-Abdouh A, Jabri A, Sajdeya O, Al-Aaraj A, *et al.* AngioVac for vegetation debulking in right-sided infective endocarditis: a systematic review and meta-analysis. *Curr Probl Cardiol* 2022;**47**:101353.
3. Hasan S, Blanco A, Faluk M, Nasser H. Eustachian valve endocarditis: a case report on an under diagnosed entity. *J Community Hosp Intern Med Perspect* 2020;**10**:145–148.
4. Chan Pei Loon J, Chao C, Younger JF, Dahiya A, Atherton JJ, Jalali H, *et al.* Eustachian valve endocarditis: case report and literature review. *Australas J Ultrasound Med* 2018;**21**: 29–35.
5. Starck CT, Dreizler T, Falk V. The AngioVac system as a bail-out option in infective valve endocarditis. *Ann Cardiothorac Surg* 2019;**8**:675–677.
6. Schaerf RHM, Najibi S, Conrad J. Percutaneous vacuum-assisted thrombectomy device used for removal of large vegetations on infected pacemaker and defibrillator leads as an adjunct to lead extraction. *J Atr Fibrillation* 2016;**9**:1455.