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Streptococcus anginosus Infective Endocarditis Complicated by a Paravalvular Aortic Abscess in a Patient With a Bicuspid Aortic Valve

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Abstract

We present a case of infective endocarditis (IE) caused by *Streptococcus anginosus* in a 39-year-old man with a previously diagnosed bicuspid aortic valve (BAV). Although *S. anginosus* is part of the normal human microbiota, its involvement in IE is uncommon. The patient presented with a six-week history of nonspecific constitutional symptoms; imaging revealed renal and splenic infarcts, and transoesophageal echocardiography demonstrated aortic valve vegetations with a paravalvular abscess. Blood cultures and molecular testing identified *S. anginosus* as the causative organism. He underwent aortic valve replacement with a mechanical prosthesis and aortic root reduction plasty; intraoperative findings confirmed a ruptured abscess within the left ventricular outflow tract (LVOT). The postoperative course was uneventful, and he completed a six-week course of targeted antimicrobial therapy.

This case underscores the importance of prompt diagnosis and early surgical intervention in patients with BAV who develop IE, particularly when complicated by suppurative lesions, and highlights the pathogenic potential of *S. anginosus*. It also shows that a root-conserving technique was a feasible option in this patient with a mildly dilated aortic root, although its role compared with root replacement cannot be established from a single case.

Categories: Cardiology, Cardiac/Thoracic/Vascular Surgery
Keywords: aortic valve replacement, bicuspid aortic valve, cardiac surgery, infective endocarditis, paravalvular abscess, streptococcus anginosus

Introduction

Streptococcus anginosus belongs to the *Streptococcus milleri* group, also known as the *Streptococcus anginosus* group (SAG) [1,2], which comprises three species: *S. anginosus*, *S. constellatus*, and *S. intermedius*. SAG organisms colonise multiple human anatomical sites, including the oral cavity, GI tract, and genitourinary tract [1,3]. *S. anginosus* and other SAG members are frequent causes of bacteraemia but rarely cause infective endocarditis (IE) [1,2,4]. In a recent study of 5,336 confirmed IE cases, only 72 (1.4%) were attributed to SAG [4].

The pathogenesis of IE requires several concurrent processes. A major factor is alteration of the endocardial and/or valvular tissue [5]. Bicuspid aortic valve (BAV) is the most common congenital valvular heart defect and a major risk factor for IE [6,7]. Approximately half of patients with BAV develop BAV-associated aortic dilatation [7,8], which may require surgical treatment [7,9]. The presence of an endocardial abscess as a complication of IE is a major indication for surgery in patients with BAV [10].

We present a case of *S. anginosus* IE in an otherwise healthy man with BAV, complicated by a paravalvular abscess that ruptured into the left ventricular outflow tract (LVOT) and by embolic events involving the kidney, spleen, and brain. The patient also had a mildly dilated aortic root, which was managed with root reduction plasty during the same operation as aortic valve replacement.

Case Presentation

Our patient was a 39-year-old man who developed a dry cough, fatigue, malaise, and radiating muscle pain. These symptoms were initially mild but progressively worsened until he was admitted to a rural hospital in Greece. His past medical history included a diagnosis of BAV, with no prior surgeries, chronic illnesses, or known allergies. His family history was notable for his father, who died of severe aortic regurgitation. His social history included a remote smoking history (5 pack-years; quit 15 years earlier), no alcohol use, and seasonal work in a hotel. The patient had a dental check-up one month before symptom onset; in accordance with the 2021 American Heart Association (AHA) guidelines [11], no antibiotic prophylaxis was

given. A routine ophthalmological examination revealed Roth spots. Around the same time, a cardiologist identified a BAV, aortic root dilatation, and aortic valve regurgitation on transthoracic echocardiography (TTE). Transoesophageal echocardiography (TOE) was recommended but was not performed at that time. The patient presented to the ER with worsening back pain over six weeks and worsening of his previous symptoms. Abdominal imaging revealed infarcts of the right kidney and spleen, and he was transferred to the University Hospital of Patras for further evaluation (Figure *1*).

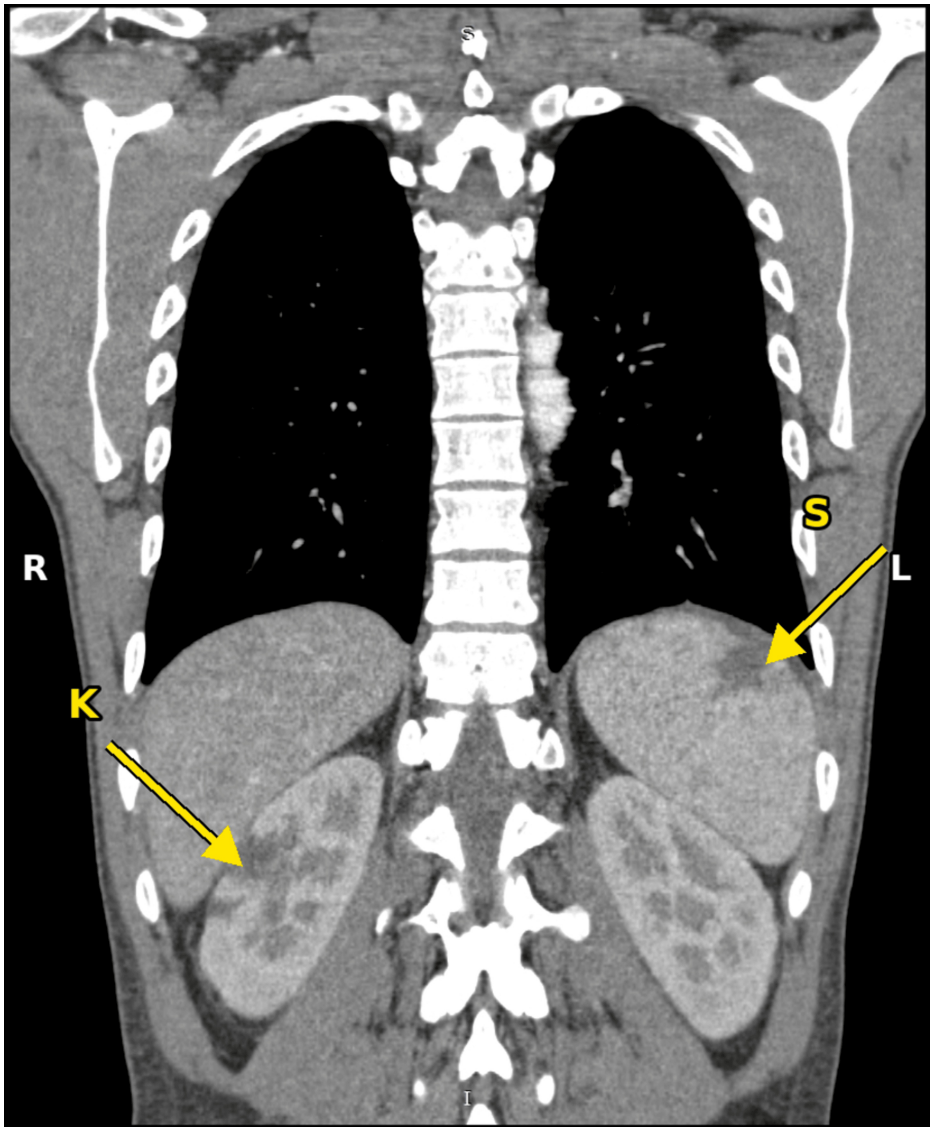


FIGURE 1: Splenic and renal embolic infarcts on contrast-enhanced CT.

Coronal contrast-enhanced CT image demonstrating a wedge-shaped hypoattenuating area in the spleen (arrow S), consistent with splenic infarction, and a hypoattenuating area in the right kidney (arrow K), consistent with renal infarction.

R: right; L: left.

At our ER, he presented with malaise, fatigue, and a four-day history of fever. Physical examination revealed normal breath sounds, normal bowel sounds, a moderate diastolic murmur over the aortic area, and mild lower-limb oedema. Brain CT revealed a hypodense lesion in the frontal horn of the left lateral ventricle (Figure *2A*). Brain MRI with gadolinium revealed a subcortical lesion with gliosis in the same region (Figure *2B*).

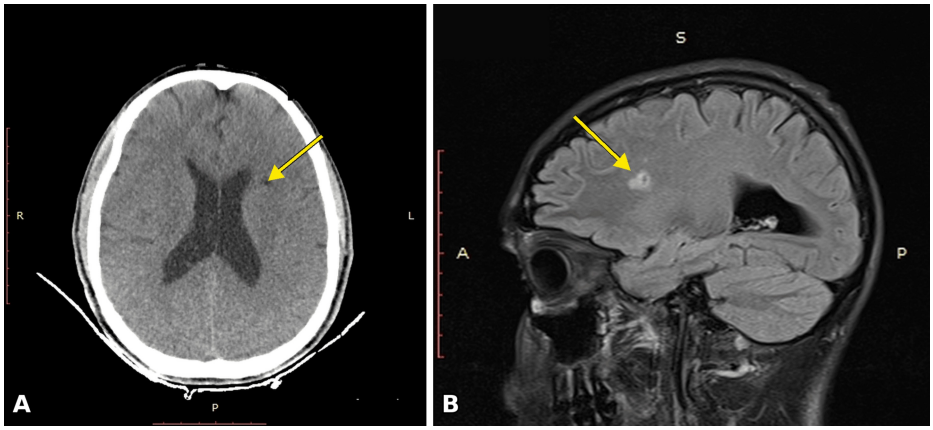


FIGURE 2: Brain imaging showing an embolic lesion.

(A) Axial non-contrast CT image showing a small hypodense lesion adjacent to the frontal horn of the left lateral ventricle (arrow). (B) Sagittal fluid-attenuated inversion recovery (FLAIR) MRI showing a hyperintense subcortical lesion with gliosis in the same region (arrow).

R: Right; L: Left; A: Anterior; P: Posterior; S: Superior; I: Inferior.

Blood cultures obtained in the ER were positive for Gram-positive cocci. Given his known BAV and clinical presentation, we suspected IE. TOE, performed using standard 3D assessment [12], showed normal left ventricular size and function; a normal right ventricle, left atrium, and atrial septum; and a mitral valve with normal motility and morphology. The known BAV was confirmed, with a horizontal orientation of the coronary and non-coronary cusps, along with findings typical of endocarditis: three mobile formations adherent to the ventricular surface of the aortic valve, consistent with vegetations (Figure *3*). Two were attached to the valve cusps (a 15 mm filamentous vegetation and a 9.5 × 5.4 mm vegetation); the third (8.5 × 5.5 mm) extended along the aortomitral curtain [13] and was adherent to the septal wall of the LVOT. No aortic stenosis was observed (maximum velocity 1.7 m/s). Severe aortic regurgitation was noted (3+/4+), with a pressure half-time of 234 ms and near-holodiastolic flow reversal in the ascending and descending aorta. The tricuspid valve was normal, with trace regurgitation; the pulmonary valve was normal, without vegetations. The aortic root was dilated (45 mm), with a sinotubular junction diameter of 27 mm and a descending aortic diameter of 22 mm, without calcification.

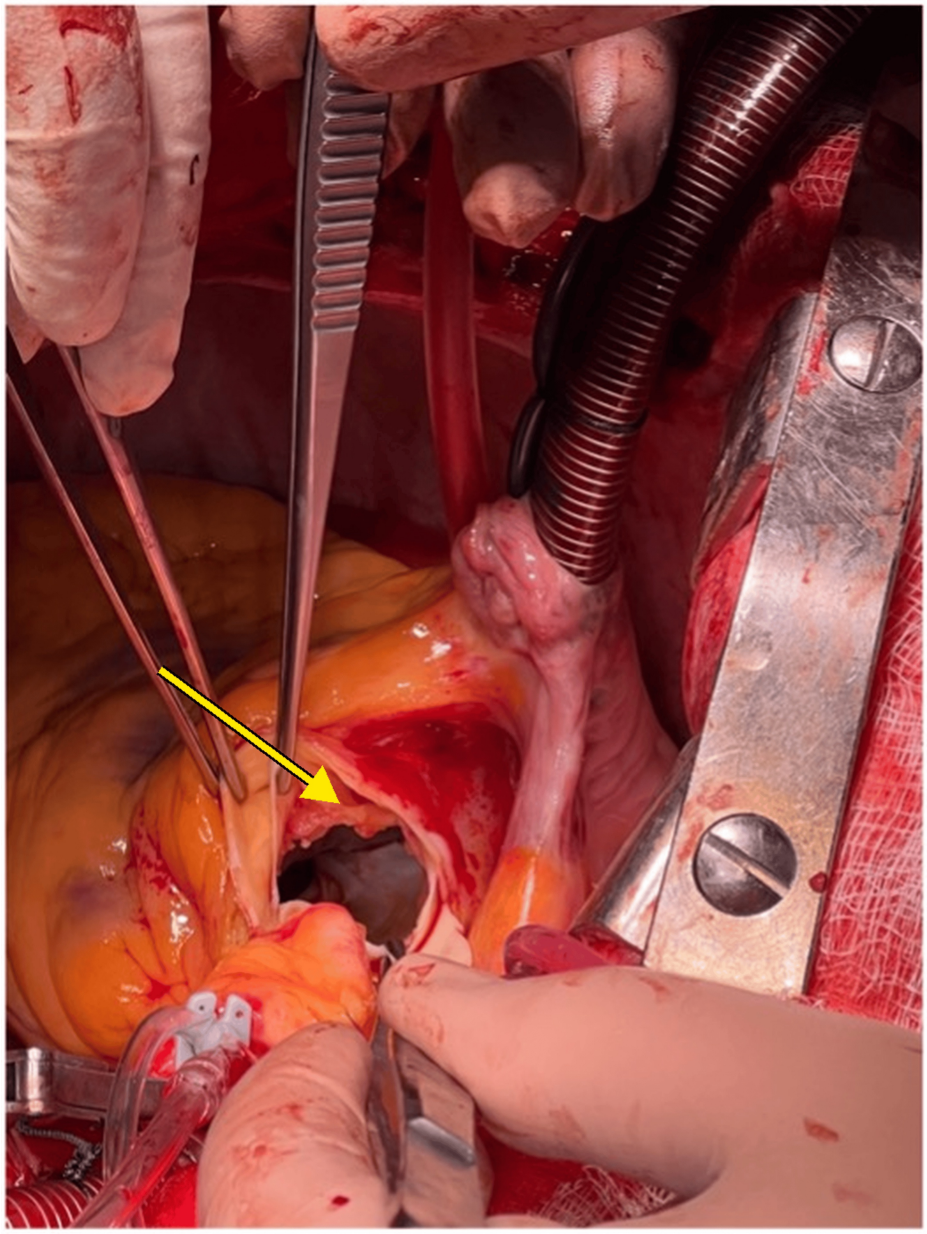


FIGURE 3: Intraoperative view of the aortic valve vegetations.

The bicuspid aortic valve is exposed through an aortotomy, showing vegetative tissue on the valve (arrow).

Given the clinical suspicion of IE, empirical antibiotic therapy was initiated with vancomycin, gentamicin, and ceftriaxone. Following the TOE findings, the diagnosis was confirmed according to the modified Duke criteria referenced in the 2015 European Society of Cardiology (ESC) guidelines, with two major criteria met (positive blood cultures and TOE findings consistent with IE). Antibiotic therapy was narrowed to ceftriaxone and gentamicin for 16 days. Blood cultures thus provided the initial evidence of Gram-positive bacteraemia, while species-level identification of *S. anginosus* was obtained a few days later by PCR.

The patient underwent aortic valve replacement with a mechanical prosthesis (25 mm SORIN Bicarbon bileaflet valve; Sorin Group Italia S.r.l., Saluggia, Italy) and aortic root reduction plasty for the mildly enlarged aortic root. Preoperative CT angiography showed an aortic root diameter of 44 mm; the root was plicated along a horizontal plane and reduced to 39 mm, as confirmed by postoperative CT angiography and TOE (Figure *4*). Intraoperatively, a ruptured abscess cavity was found within the LVOT (Figures *5*-*6*) and closed with a continuous suture (Figure *7*). Surgery was completed without complications.

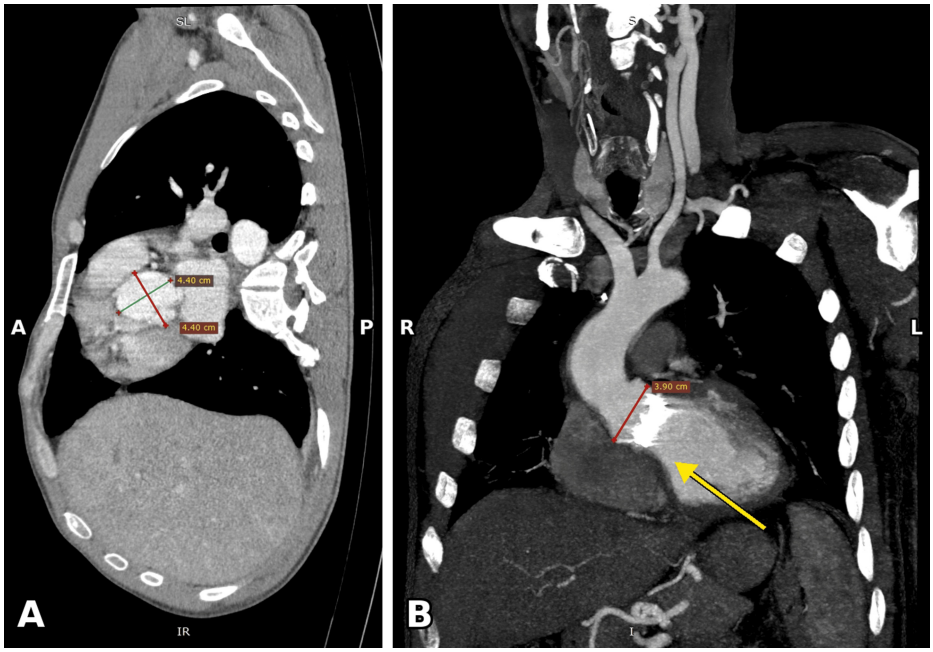


FIGURE 4: Aortic root dimensions before and after root reduction plasty.

(A) Preoperative sagittal CT image showing an aortic root diameter of 44 mm (measurement lines). (B) Postoperative coronal computed tomography angiography (CTA) image (maximum intensity projection) showing a reduction in the aortic root diameter to 39 mm (measurement line) and the mechanical aortic valve prosthesis (arrow).

R: Right; L: Left; A: Anterior; P: Posterior.

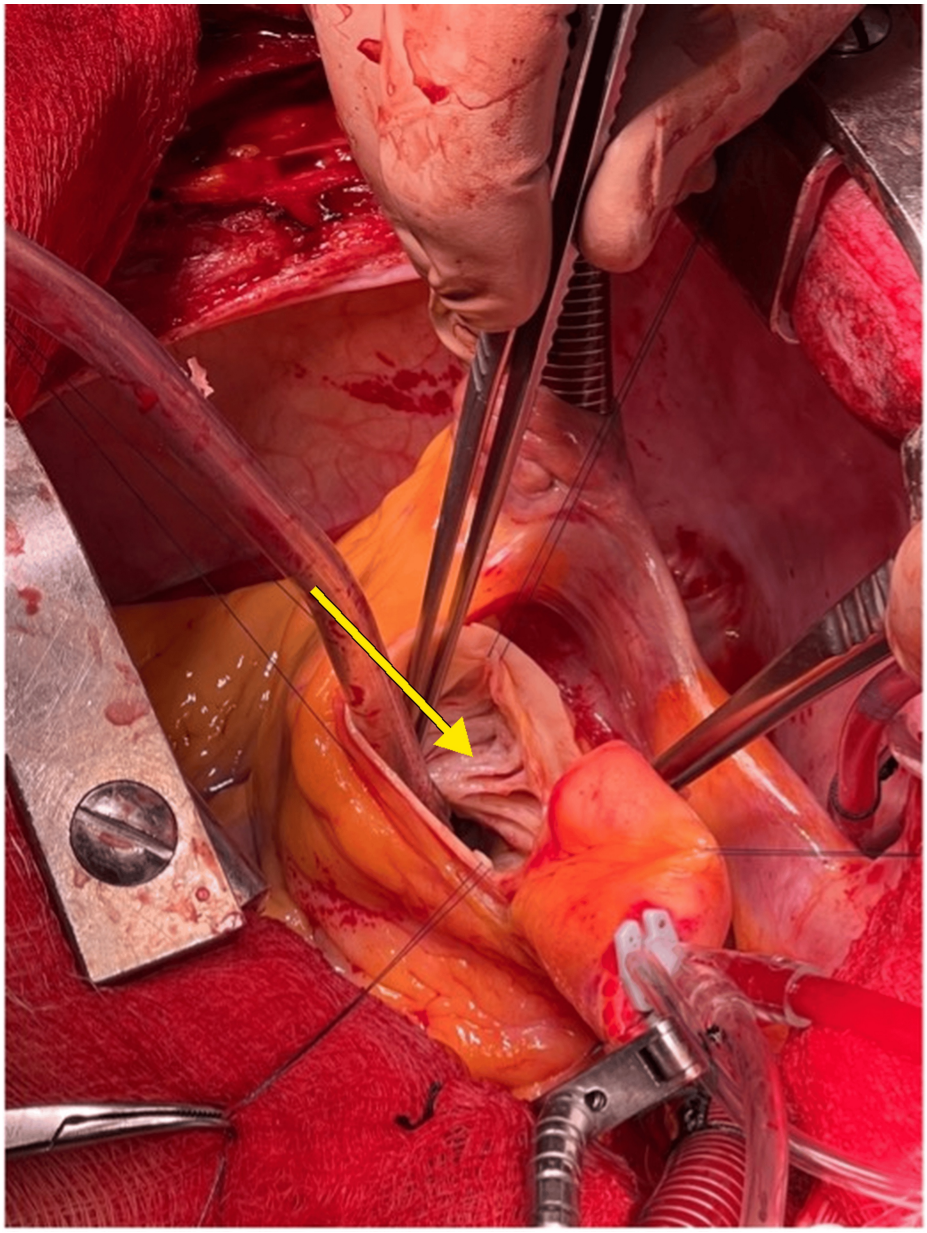


FIGURE 5: Intraoperative view of the ruptured abscess cavity within the LVOT (I).

View through the aortotomy, looking down towards the left ventricular outflow tract. With the aortic valve cusps retracted, the opening of the ruptured paravalvular abscess cavity is visible beneath the valve (arrow).

LVOT: Left ventricular outflow tract.

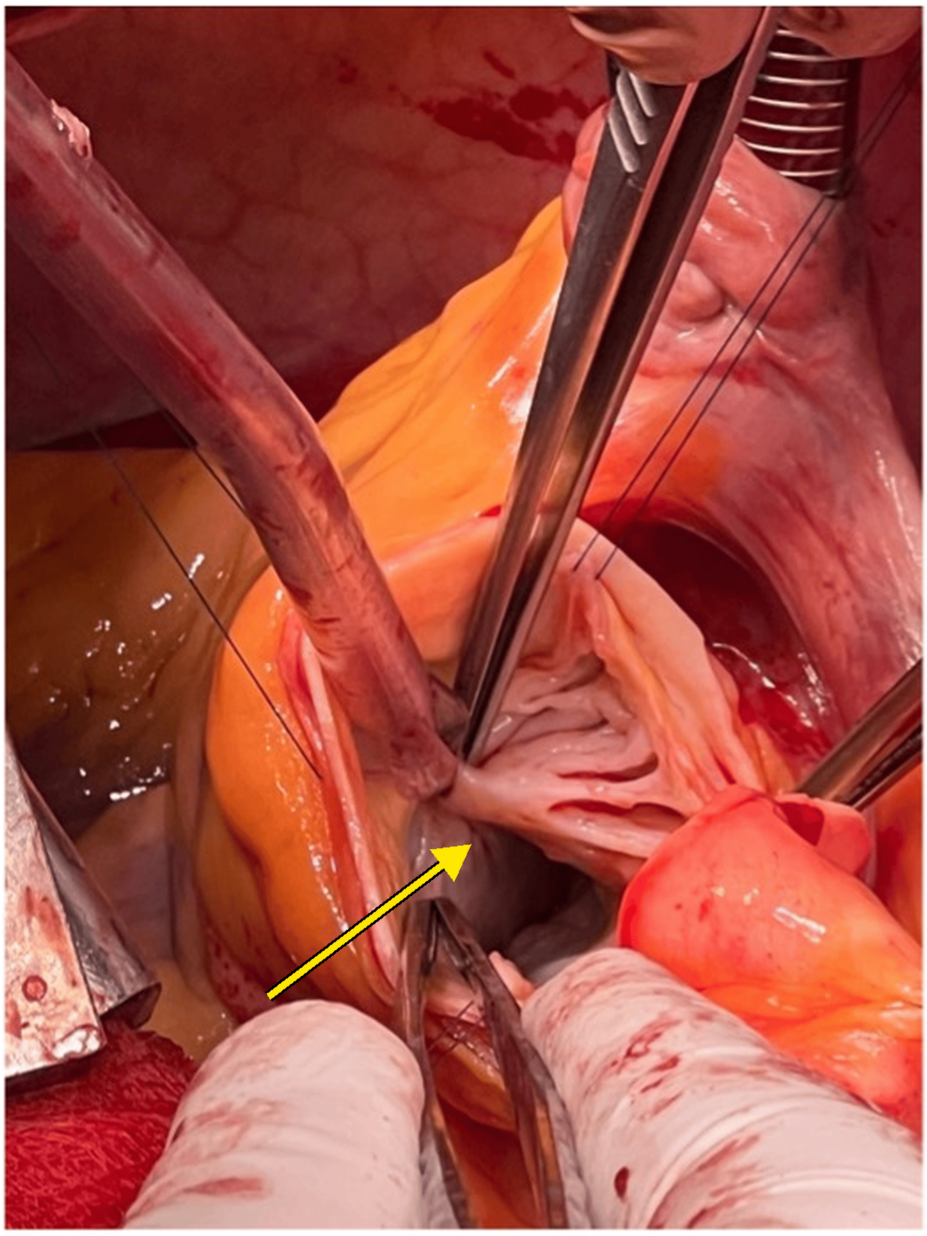


FIGURE 6: Intraoperative view of the ruptured abscess cavity within the LVOT (II).

View through the aortotomy from a different angle, showing the abscess cavity below the level of the aortic valve cusps (arrow).

LVOT: Left ventricular outflow tract.

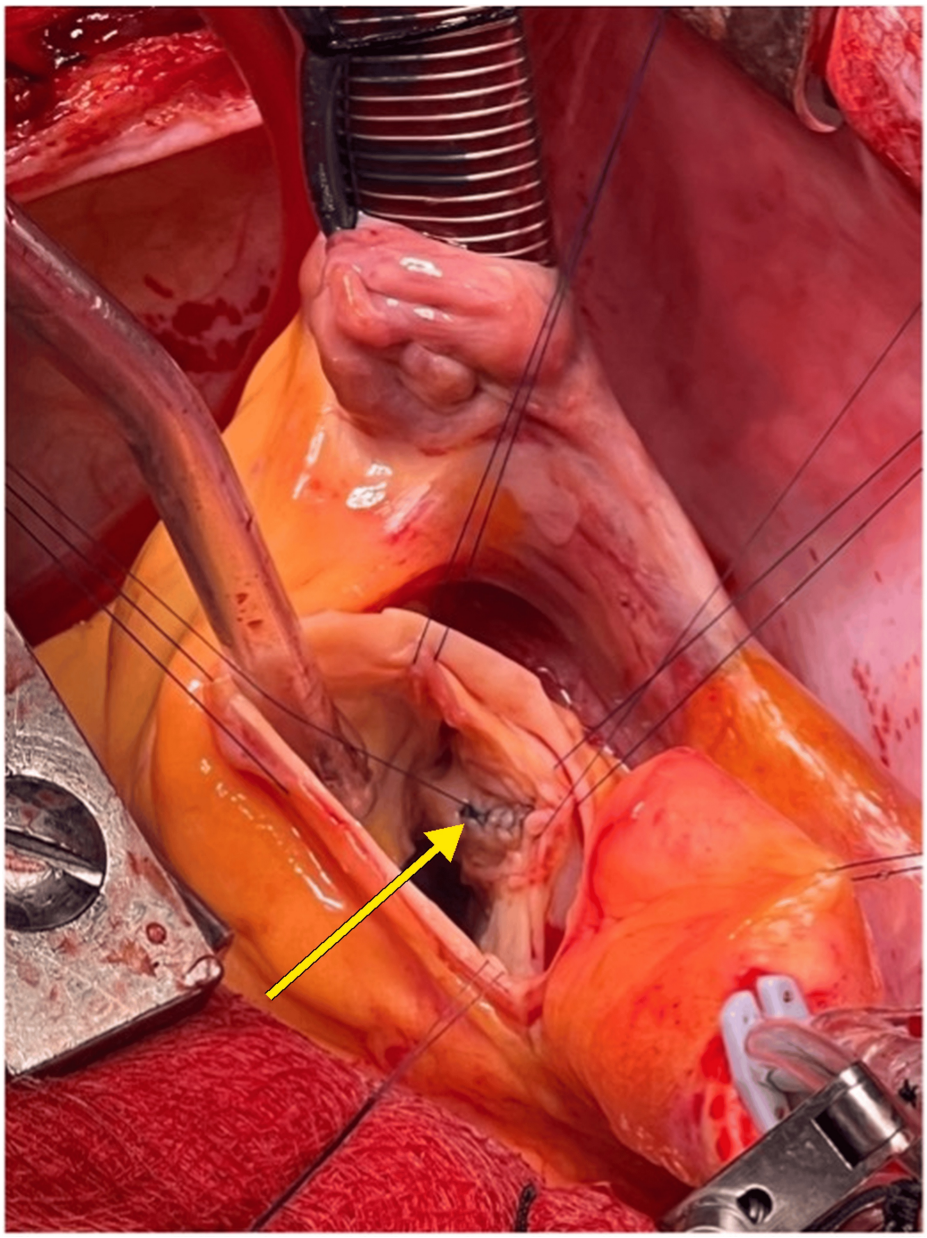


FIGURE 7: Intraoperative view following repair of the LVOT abscess cavity.

View through the aortotomy. The abscess cavity in the left ventricular outflow tract was closed with a continuous suture (arrow) before implantation of the mechanical valve prosthesis.

LVOT: Left ventricular outflow tract.

The patient was transferred to the cardiac ICU and weaned from mechanical ventilation on the same day. He was mobilised on postoperative day one and transferred to the cardiothoracic ward on day two.

In summary, antimicrobial therapy was administered in three phases: empirical vancomycin, gentamicin, and ceftriaxone on admission; targeted ceftriaxone and gentamicin for 16 days; and three weeks of postoperative therapy, during which daptomycin was added as prophylaxis against surgical site infection after prosthetic valve implantation. The total duration of antibiotic therapy was six weeks, in line with the 2020 American College of Cardiology (ACC)/AHA guidelines [9]. He recovered fully without complications and was discharged upon completion of therapy.

Discussion

IE and SAG microbiology

The *Streptococcus milleri* group, also known as SAG, is a heterogeneous group comprising three species: *S. anginosus*, *S. constellatus*, and *S. intermedius* [2]. SAG organisms are Gram-positive, catalase-negative cocci and non-motile facultative anaerobes with typically small colonies (≤0.5 mm) and variable haemolysis patterns. Most *S. anginosus* strains are non-spore-forming cocci arranged in pairs and chains and are negative for several exoenzymes, including β-D-fucosidase and neuraminidase [14]. SAG species form part of the normal oral, gastrointestinal, and genitourinary flora and are often associated with purulent infections [3]; they were first recovered from dental abscesses and remain frequently isolated from dental caries and periodontal disease. There is growing evidence linking the oral microbiome more broadly to the pathogenesis of cardiovascular disease [15]. This group has a proclivity for pyogenic and systemic infections with abscess formation [16]. SAG is a rare cause of IE, but when it occurs, it has been associated with suppurative complications such as myocardial abscess and purulent pericarditis. 16S ribosomal RNA (rRNA) gene sequencing is the preferred method for identifying viridans streptococci-like organisms in suspected endocarditis [2]. *S. anginosus* is the most frequently identified causative SAG species in endocarditis [4], with the highest prevalence (68.75%) among patients aged 18-34 years [14].

IE is a multisystem disease resulting from infection, usually bacterial, of the endocardial surface. More than half of contemporary IE patients are over 50 years of age, and approximately two-thirds are men. Congenital heart disease increases IE risk, and streptococci and staphylococci together account for approximately 80% of cases. IE requires the simultaneous occurrence of several factors: alteration of the valve surface to create a site for bacterial attachment, bacteraemia with an organism capable of colonising valve tissue, and formation of an infected vegetation. Bacteraemia is common after dental procedures and even routine activities such as toothbrushing and chewing. Vegetations typically form near the coaptation line of a valve leaflet, on the atrial surface of atrioventricular valves or the ventricular surface of semilunar valves, and infection may progress to leaflet perforation or a valve ring abscess with fistula formation [5]. In an experimental rat model, *S. anginosus* produced infective vegetations in 40 of 43 animals (93%) three days after intravenous inoculation, with significantly higher vegetation bacterial density and bacteraemia rates than *S. constellatus* or *S. intermedius*, suggesting that *S. constellatus* and *S. intermedius* are more associated with abscess formation, while *S. anginosus* is more associated with endocarditis itself. Early surgical intervention should be considered when *S. anginosus* endocarditis is diagnosed, given its suppurative complications and high mortality [2].

Beta-lactams remain the treatment of choice for SAG infections, as most strains remain susceptible to penicillin [16]. For penicillin-susceptible *S. anginosus* endocarditis, standard therapy is aqueous crystalline penicillin G or ceftriaxone for four weeks, or a combination of penicillin G or ceftriaxone with gentamicin for two weeks, which is also highly effective [5,17].

BAV and aortopathy

BAV is the most common congenital valvular heart defect, with a reported prevalence ranging from 0.3% to 2% and a male predominance of approximately 3:1 [7,8,18].

BAV has a complex, incompletely understood genetic basis, generally following an autosomal dominant pattern with incomplete penetrance; it may occur in isolation or as part of syndromes such as Turner, Loeys-Dietz, and Marfan syndromes [6]. First-degree relatives of patients with BAV have a substantially higher prevalence of the condition, which supports echocardiographic screening of affected families [6].

BAV also displays substantial phenotypic heterogeneity in leaflet fusion patterns and the number of raphes, which has been linked to differing patterns of aortic dilatation [8]. Altered flow haemodynamics and wall shear stress related to specific BAV phenotypes are thought to contribute to the associated aortopathy, alongside intrinsic abnormalities of the aortic wall itself [8]. Overall, BAV and its associated aortopathy remain incompletely understood entities with substantial genetic and phenotypic heterogeneity [6,8].

Surgical aspects

Surgical decision-making in patients with BAV and aortopathy depends on symptom status, valve function, aortic diameter, and individual patient risk [7,9]. Current guidelines recommend surgery in asymptomatic patients with BAV when the aortic sinuses or ascending aorta reach 5.5 cm, or at diameters above 5 cm in the presence of additional risk factors at experienced centres [9,19]. In symptomatic patients undergoing aortic valve replacement, concurrent aortic repair is recommended when the aorta exceeds 4.5 cm [9]. The choice of procedure depends on the location of dilatation: supracoronary graft replacement for ascending aortic disease, arch replacement with circulatory arrest for arch involvement, and a Bentall procedure, or, rarely, valve-sparing root replacement, for root dilatation [7,9].

In our case, the patient underwent aortic valve replacement with aortic root reduction plasty rather than root replacement. The root measured 44 mm on preoperative CT, just below the 4.5 cm threshold for concomitant aortic repair [9], and in the setting of active infection with a paravalvular abscess, we aimed to avoid the longer operative time and added risk of a more extensive root procedure. This reflects a growing trend towards individualised, conservative management of mildly dilated aortic roots, reserving root replacement for patients in whom the risk of future dilatation or dissection clearly outweighs the added

surgical risk of a more extensive procedure [7,9]. As the cellular and molecular mechanisms of bicuspid aortopathy progression remain incompletely defined, an individualised surgical approach for each patient remains the most reasonable strategy [7,8]. A limitation of this report is the lack of long-term follow-up data; therefore, the durability of the root reduction in this patient could not be assessed.

Nearly half of patients with IE are considered high-risk and require surgical intervention [10]. Paravalvular abscess is associated with increased in-hospital mortality and is a major indication for surgery [10]. A meta-analysis of six studies, including 1,982 patients with IE with and without aortic root abscess, found a significant association between root abscess and in-hospital mortality and a modest association with long-term mortality [10].

Conclusions

BAV and its associated aortopathy remain heterogeneous and complex clinical entities. Management, particularly when complicated by aortopathy or IE, requires an individualised approach that weighs valve morphology, aortic dimensions, and patient-specific surgical risk.

In this patient, a root-conserving surgical strategy was feasible and was followed by a favourable early postoperative course; however, as this is a single case without long-term follow-up, it does not support broader recommendations on the choice between root reduction plasty and root replacement. The case also underscores the importance of prompt diagnosis and timely surgical intervention when IE is complicated by a paravalvular abscess. Multidisciplinary management in specialised centres remains essential for optimising outcomes in these complex cases.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Evdokia Klavdianou, Efthymia Rouska, Antonios Charokopos, Nikolaos Logothetis, Pantelis Kyrousis, Nikolaos Charokopos

Acquisition, analysis, or interpretation of data: Evdokia Klavdianou, Efthymia Rouska, Antonios Charokopos, Nikolaos Logothetis, Pantelis Kyrousis, Nikolaos Charokopos

Drafting of the manuscript: Evdokia Klavdianou, Efthymia Rouska, Antonios Charokopos, Nikolaos Logothetis, Pantelis Kyrousis, Nikolaos Charokopos

Critical review of the manuscript for important intellectual content: Evdokia Klavdianou, Efthymia Rouska, Antonios Charokopos, Nikolaos Logothetis, Pantelis Kyrousis, Nikolaos Charokopos

Supervision: Evdokia Klavdianou, Efthymia Rouska, Antonios Charokopos, Nikolaos Logothetis, Pantelis Kyrousis, Nikolaos Charokopos

Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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EK, NL, and PK collected the clinical data, reviewed the literature, and drafted the manuscript. ER and NC were involved in the patient's clinical management, supervised the work, and critically revised the manuscript. AC advised on the case report structure and literature search strategy and critically revised the manuscript. All authors have reviewed and approved the final manuscript. Written informed consent for publication of this case report and accompanying images was obtained from the patient. Grammarly was used for language editing and Zotero for reference management. Claude (Anthropic) was used to prepare the final figures, including removing patient-identifying information, adding arrows, and combining images into composite figures. All content was reviewed and verified by the authors, who take full responsibility for the final manuscript.

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