

Imaging-driven early intervention for BAV-IE with atypical symptoms and severe multisystem complications: a case report

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Case Report

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Abstract

Background

Bicuspid aortic valve (BAV) is the most prevalent congenital cardiac malformation and confers a markedly elevated risk of infective endocarditis (IE). Severe concurrent complications, including perivalvular abscess, ruptured aortic sinus aneurysm, pseudoaneurysm, and complete atrioventricular block (AVB), rarely coexist in a single patient, and afebrile atypical presentations further delay diagnosis. Cardiac computed tomography angiography (CTA) enables comprehensive preoperative anatomical mapping for complex BAV-IE, yet standardized imaging-driven management experience for this extreme disease spectrum remains scarce.

Methods

We report a 59-year-old afebrile male patient presenting with 4 months of exertional dyspnea. Preoperative cardiac CTA with 3D volume rendering was performed to delineate valvular, perivalvular, and aortic root lesions. A composite radical Bentall-based surgical procedure was delivered, with postoperative blood culture and 3-year serial echocardiographic follow-up. All imaging data were anonymized for publication.

Results

CTA confirmed congenital type 0 BAV, IE with perivalvular abscess, 18 mm coronary sinus rupture forming a 5.0×4.5 cm aortic root pseudoaneurysm, and third-degree atrioventricular block. Intraoperative debridement combined with aortic root replacement, multi-valvular repair, and temporary epicardial pacing was completed successfully. *Streptococcus mitis* was isolated from blood cultures. Over three years of follow-up, the mechanical valve remained functionally stable, graft flow stayed unobstructed, and all clinical symptoms completely resolved.

Conclusions

Cardiac CTA with 3D visualization provides definitive preoperative anatomical stratification for multi-complicated atypical BAV-IE. Early radical composite surgery guided by comprehensive imaging yields a favorable long-term prognosis, even in elderly afebrile patients with four concurrent severe cardiovascular complications. This case highlights the irreplaceable role of multimodal cardiac imaging in risk stratification and surgical planning for complex BAV-associated endocarditis.

Background

Bicuspid aortic valve (BAV) affects 1–2% of the general population and is frequently associated with aortic coarctation and congenital coronary artery anomalies [1]. The turbulent hemodynamic profile of BAV predisposes patients to valvular stenosis, regurgitation and infective endocarditis (IE), and the incidence of IE in BAV patients far exceeds that of the general population [2]. Approximately 20–40% of BAV patients develop IE; however, concurrent perivalvular abscess occurs in less than 5% of cases, and the combination of ruptured aortic sinus aneurysm with complete heart block is extremely rare in clinical practice [2].

Streptococcus mitis, a commensal oral flora associated with poor dental hygiene, accounts for 15–30% of IE pathogens, yet severe destructive aortic root lesions induced by this low-virulence organism are rarely reported in the literature [3]. Notably, elderly patients with BAV-IE may not present with typical fever, which often leads to missed diagnosis and delayed intervention [4].

This case presents a unique combination of four life-threatening complications: moderate-severe BAV stenosis, perivalvular abscess, ruptured aortic sinus aneurysm with large pseudoaneurysm, and third-degree atrioventricular block, accompanied by secondary multisystem impairments including pulmonary hypertension and glucose intolerance. Cardiac CTA with three-dimensional reconstruction resolved diagnostic challenges in differentiating true aneurysms, pseudoaneurysms, and abscess extension. We summarize the diagnostic value of preoperative imaging, the composite surgical strategy, and 3-year long-term outcomes, to establish reference standards for radiologists and cardiac surgeons managing similar complex BAV-IE cases.

Case presentation

Patient history

A 59-year-old male patient presented with progressive exertional chest tightness and dyspnea that had lasted 4 months, with symptoms exacerbated by mild daily activity over the preceding 2 months. Rest relieved dyspnea; no fever, palpitations, chest pain, dizziness or gastrointestinal complaints were reported. The patient neglected the initial mild symptoms and did not seek clinical assessment, and experienced unintended 10 kg weight loss within 2 months before admission. Past medical history was unremarkable, with no known congenital heart disease or prior cardiac intervention.

Transthoracic echocardiography performed at an outpatient clinic identified a congenital bicuspid aortic valve, aneurysmal dilatation of the aortic sinus, and moderate pulmonary hypertension, which prompted inpatient admission for comprehensive imaging evaluation.

Preoperative cardiac CTA imaging protocol and findings

Non-contrast and contrast-enhanced cardiac CTA (Philips scanner, slice thickness 0.61–0.81 mm) with post-processed 3D volume rendering was performed to fully characterize the cardiac anatomy. Key imaging diagnoses were confirmed as follows:

Congenital type 0 bicuspid aortic valve with leaflet thickening, calcification, and commissural fusion

Infective endocarditis with valvular vegetations and extensive perivalvular abscesses

Ruptured aortic sinus aneurysm (18 mm tear between left and right coronary sinuses)

Large aortic root pseudoaneurysm (5.0 × 4.5 cm) containing organized mural thrombus

Mild ascending aortic dilatation; coronary artery ostia without displacement

All multiplanar reformatted CTA slices and volumetric 3D reconstructions are compiled in Figure 1. All patient identifiers were completely removed from imaging panels before publication.

Intraoperative procedure and surgical findings

After excluding absolute surgical contraindications, the patient underwent a single-stage composite radical cardiac surgery: modified Bentall aortic root replacement with a mechanical prosthetic valve, debridement and repair of ruptured aortic sinus aneurysm, ascending aorta replacement, myocardial bridge release combined with coronary artery bypass grafting, mitral and tricuspid valvuloplasty, and temporary epicardial pacemaker implantation for pre-existing third-degree atrioventricular block.

Intraoperative gross inspection confirmed all CTA imaging findings: calcified, stenotic bicuspid leaflets covered by multiple friable vegetations; purulent perivalvular abscess tracking into the aortic root tissue; an 18 mm sinus rupture communicating with a 5 cm thrombosed pseudoaneurysm; the coronary ostia retained their normal anatomical position with no mass compression.

Postoperative diagnosis, microbiology and follow-up

Postoperative serial blood cultures returned positive for *Streptococcus mitis*, confirming the etiological diagnosis of streptococcal IE. The definitive composite clinical diagnosis was established:

Congenital bicuspid aortic valve complicated by infective endocarditis and perivalvular abscess

Ruptured aortic sinus aneurysm with aortic root pseudoaneurysm

Multi-valvular lesions, chronic cardiac insufficiency, moderate pulmonary hypertension

Third-degree atrioventricular block

Impaired glucose tolerance

Postoperative recovery was uncomplicated, and the temporary pacemaker was removed after resolution of the high-grade atrioventricular block. Regular outpatient echocardiographic surveillance was maintained for 3 years. At the latest follow-up, the prosthetic mechanical valve function was normal, aortic root graft fixation was stable without stenosis or leakage, and the patient's exertional tolerance and quality of life were markedly restored. Baseline dyspnea completely resolved, and body weight remained stabilized.

Discussion

This 59-year-old male case represents an extremely rare phenotype of BAV-associated IE, distinguished by three unique clinical and imaging features that differentiate it from previously published cohorts: First, severe destructive aortic root pathology induced by *Streptococcus mitis* is uncommon. Most literature identifies *Staphylococcus aureus* and other viridans streptococcal subspecies as the primary pathogens that cause extensive perivalvular tissue necrosis [3,7]. While *S. mitis* is generally regarded as low-virulence oral commensal, combined turbulent hemodynamics caused by BAV and age-related blunted immune response synergistically facilitated deep tissue infection and sinus rupture in this patient [14]. Second, the synchronous occurrence of four independent life-threatening cardiovascular complications (perivalvular abscess, sinus aneurysm rupture, large pseudoaneurysm, complete heart block) is barely documented in existing peer-reviewed case series [8,9]. Most published BAV-IE cases present only one or two concurrent lesions, which makes this multi-lesion case a valuable reference for radiologists to recognize overlapping imaging manifestations. Third, the afebrile, insidious clinical presentation without the classic infectious fever created a major diagnostic pitfall, which is consistent with the attenuated inflammatory response frequently observed in elderly patients with cardiac infection [4]. Isolated unexplained exertional dyspnea and rapid unintentional weight loss should trigger urgent cardiac imaging screening for underlying BAV-IE, even in the absence of fever.

Core diagnostic value of preoperative cardiac CTA

Transthoracic echocardiography serves as the first-line screening tool for valvular endocarditis, yet it is limited in delineating the full extension of perivalvular abscess, measuring sinus rupture size, and defining the spatial boundaries of pseudoaneurysm. In this case, cardiac CTA combined with multiplanar reformation and 3D volumetric reconstruction overcomes these limitations.

Accurate quantitative measurement of the 18 mm rupture tract and 5.0×4.5 cm pseudoaneurysm, which guides the scope of surgical debridement.

Clear differentiation between native true aortic sinus aneurysm and post-infectious thrombus-lined pseudoaneurysm is required to avoid surgical misjudgment.

Preoperative mapping of coronary ostial positions to prevent iatrogenic coronary artery injury during Bentall aortic root replacement.

Comprehensive visualization of secondary ascending aortic dilatation and pulmonary hypertension enables complete multi-system risk stratification.

This case confirms that cardiac CTA is an essential complementary imaging modality for all complex, multi-complicated BAV-IE cases before surgical planning, which is consistent with the current consensus guidelines for cardiovascular imaging [2,5].

Surgical management and long-term prognosis

Conventional single-valve replacement is the standard therapy for uncomplicated BAV-IE; however, this patient required a composite radical operation integrating aortic root replacement, multi-valvular repair, coronary artery bypass grafting and temporary pacing due to diffuse cardiac involvement [10,11]. Aggressive intraoperative debridement of all abscesses and necrotic tissue was critical to eliminate residual infection, which likely contributed to superior 3-year survival and functional outcomes compared with historical cohorts receiving surgery for aortic root infection [12].

Long-term postoperative care requires individualized anticoagulation regimens for mechanical prostheses in accordance with contemporary IE management guidelines [17]. Clinicians should also recognize that rapid weight loss in elderly cardiac patients results from the combination of cardiac cachexia and chronic infectious catabolism, which requires concurrent nutritional support in addition to antimicrobial and surgical intervention [18].

Limitations

This study is a single-center retrospective case report, which limits the generalizability of its findings to broader patient populations. Based on isolated case data, we cannot establish an optimal timing threshold to define "early imaging-guided intervention" for multi-complicated BAV-IE. Prospective multi-center research is required to develop formal standardized diagnostic and therapeutic workflows.

Conclusions

In patients with congenital bicuspid aortic valve, atypical afebrile infective endocarditis can progress to develop severe concurrent perivalvular abscess, aortic sinus rupture, large pseudoaneurysm and complete heart block, without presenting the classic fever symptom. Cardiac CTA integrated with three-dimensional volumetric reconstruction provides comprehensive, accurate preoperative anatomical characterization that directly guides radical composite cardiac surgery. Early imaging-driven aggressive surgical intervention achieved excellent long-term functional recovery at the 3-year follow-up for this high-risk patient. This case reinforces that multimodal cardiac CT imaging plays a central role in

diagnosis and interventional planning for complex congenital aortic valve infectious complications, and provides a standardized imaging reference for radiologists and cardiothoracic surgeons managing similar rare multi-lesion BAV-IE presentations.

Declarations

Ethics approval and consent to participate

This retrospective study was conducted at The First Affiliated Hospital of Guangxi Medical University, and the study protocol was approved by the hospital's research ethics committee (Reference Number: 2026-E0323). The study complied with the principles of the Declaration of Helsinki, and informed consent was waived due to the anonymous use of electronic medical records.

Consent for publication

The patient provided signed written consent for all anonymized clinical data and de-identified imaging panels to be published in BMC Medical Imaging. No protected health information or patient identifiers appear within the manuscript or figures.

Availability of data and materials

Raw cardiac CTA DICOM imaging datasets are securely stored in the institutional radiology PACS archive. Anonymized reformatted images and 3D rendering files supporting this case are available from the corresponding author upon reasonable formal request.

Competing interests

The authors declare that they have no competing financial or non-financial interests related to this manuscript.

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Authors' contributions

QLH and FLH equally contributed to drafting the original manuscript, collecting clinical and imaging data, and completing post-processing of cardiac CT images. LLL designed the imaging evaluation framework,

critically revised the manuscript for important intellectual content, and supervised all research activities. All authors read and approved the final submitted manuscript.

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Figures

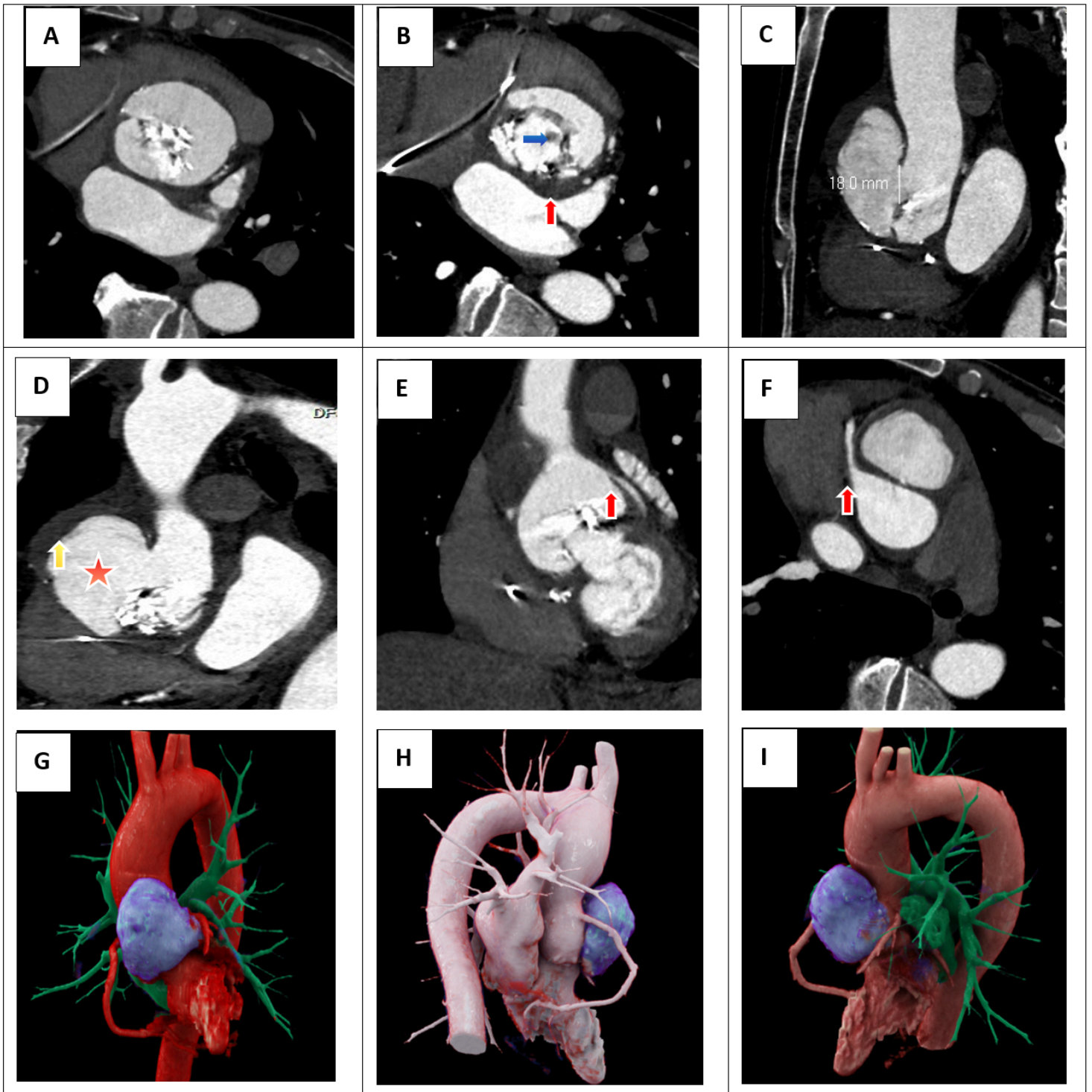


Figure 1

Multiplanar reformatted cardiac CTA images (A–F) and three-dimensional volumetric rendering models (G–I) of complex bicuspid aortic valve infective endocarditis. A: Axial CTA slice demonstrating type 0 congenital bicuspid aortic valve with diffuse leaflet calcification and thickening. B: Axial slice showing valvular vegetation (blue arrow) and the adjacent perivalvular abscess cavity (red arrow). C: Sagittal reformatted view marking the 18.0 mm rupture tract between the left and right coronary aortic sinuses. D: Sagittal view displaying a giant aortic sinus aneurysm (red asterisk) lined with layered mural thrombus.

(yellow arrow).E: Oblique coronal reformatted image confirms an undisplaced left coronary artery ostium (red arrow). F: Oblique coronal slice shows the normal anatomical position of the right coronary artery ostium (red arrow).G–I: 3D volumetric rendering from anterior, lateral, and posterior perspectives; purple volumetric segmentation delineates the large aortic root pseudoaneurysm, and pulmonary arterial branches are reconstructed in green to demonstrate the spatial anatomical relationships between the pseudoaneurysm, the native aortic root, and the surrounding mediastinal structures.