

An aortic root abscess in a patient with a bicuspid aortic valve: a case report

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Background

Infective endocarditis is a serious infection associated with high mortality and severe complications, such as heart failure, uncontrolled infection, and embolic events. Certain populations, including individuals with a prosthetic valve and those with native valve disease, such as bicuspid aortic valve, are considered to be more at risk of developing infective endocarditis.

Case summary

A 51-year-old previously healthy male presented with a 2-week history of persistent fever, malaise, and night sweats despite taking a long course of oral antibiotics. Examination was unremarkable; however, blood tests showed elevated inflammatory markers. Three sets of blood cultures revealed coagulase-negative gram-positive cocci (later identified as *Staphylococcus lugdunensis*), and the patient was subsequently started on IV antibiotics. His echocardiography showed a bicuspid aortic valve with severe regurgitation, and an aortic root abscess surrounding a dilated aortic root. In view of the presence of locally uncontrolled infection, the patient was referred for urgent debridement of the abscess and replacement of the aortic valve with tissue prosthesis. Fortunately, after a total of 6 weeks of IV antibiotics and successful operative management, our patient made a complete recovery.

Discussion

The development of an aortic root abscess occurs in 10–40% of cases of aortic valve endocarditis. Clinically, this should be suspected in any patient with endocarditis who fails to improve despite appropriate antibiotic therapy. This case demonstrates that severe infective endocarditis can develop in apparently healthy individuals due to underlying cardiac abnormalities.

Keywords

Infective endocarditis • Aortic root abscess • Bicuspid aortic valve • *Staphylococcus lugdunensis* • Case report

Learning points

- Patients with native valve disease have a higher risk of developing infective endocarditis than the general population.
- Aortic root abscess should be suspected in patients with endocarditis who do not improve despite appropriate antibiotic treatment.
- Whilst echocardiography remains the technique of choice for the initial management of infective endocarditis, multimodality cardiac imaging is useful for non-invasive characterization of the infection and its complications.

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Introduction

A bicuspid aortic valve is a form of congenital heart defect in which two of the aortic valve leaflets fuse during development forming a two-leaflet or bicuspid valve instead of the normal tri-leaflet or tricuspid valve. This is found in approximately 1–2% of the general population and it is twice as common in males than in females.¹ In many cases, this condition will cause no symptoms, however when complications arise, they can be serious and life-threatening. Such complications include aortic stenosis, aortic regurgitation, infective endocarditis, coarctation, and aortopathy that may result in aortic aneurysm, dissection, or rupture.²

This report describes a case of infective endocarditis complicated by abscess formation in a previously healthy male with a bicuspid aortic valve.

Timeline

Initial presentation	Presented with a 2-week history of fever, malaise, chills, and night sweats. Examination unremarkable.
Day 2	Blood cultures turned positive for coagulase-negative gram-positive cocci. Started on IV Teicoplanin 1 g every 12 h for three doses. Transthoracic echocardiography showed a bicuspid, calcified aortic valve, a dilated aortic root, and moderate aortic regurgitation. Peak gradient across AoV of 19.2 mmHg.
Day 4	Final result of initial blood cultures confirmed growth of <i>Staphylococcus lugdunensis</i> sensitive to flucloxacillin. Antibiotics were changed to IV flucloxacillin 2 g every 6 h.
Day 8	Transoesophageal echocardiography revealed an aortic root abscess surrounding a dilated aortic root and a bicuspid aortic valve with severe regurgitation. Normal left ventricular ejection fraction (LVEF).
Day 10	Cardiac computed tomography performed to exclude significant coronary artery disease.
Day 12	Referred for surgical intervention abroad.
Day 24	Debridement of the abscess and replacement of the valve with tissue prosthesis performed. Antibiotics switched to IV Ceftriaxone 2 g daily for total of 6 weeks.
Day 40	Discharged from hospital on home IV antibiotic therapy.
3 weeks post-surgery	Transthoracic echocardiography showed a well-seated prosthetic tissue valve. Peak gradient of 18 mmHg. LVEF estimated at 60%.
7 months post-discharge	Transthoracic echocardiography showed a peak gradient of 14 mmHg. LVEF estimated at 59%.

Case presentation

A 51-year-old Caucasian male, a keen cyclist with no previous medical history, presented to the emergency department with a 2-week history of persistent fever, malaise, chills, and night sweats despite taking a 10-day course of doxycycline. An urgent computed tomography (CT) scan of the thorax, abdomen, and pelvis was performed prior to referral though this showed no evidence of any pathology. The patient was a non-smoker with no history of drug abuse, previous heart surgery, recent invasive procedures, or dental intervention.

Physical examination at presentation was unremarkable with no signs of infection and normal vital signs. Laboratory tests revealed elevated inflammatory markers (C-reactive protein 82 mg/L, erythrocyte sedimentation rate 60 mm/h), but otherwise normal complete blood count, renal, liver, and thyroid function. The electrocardiogram showed a normal sinus rhythm at 82 b.p.m. with no evidence of atrioventricular block. Urinalysis showed microscopic haematuria. Three sets of blood cultures revealed the growth of coagulase-negative gram-positive cocci. The patient was subsequently started on intravenous teicoplanin at a loading dose of 1 g every 12 h for three doses.

Transthoracic echocardiography showed a bicuspid, calcified aortic valve, and a dilated aortic root with a dilated and asymmetric sinus of Valsalva and sinotubular junction (*Figure 1*) ([Supplementary material online](#), Videos S1 and S2). Moderate, eccentric aortic regurgitation was also present ([Supplementary material online](#), Video S3). The aortic root diameter measured 4.8 cm with an aortic root area of 10.8 cm², and the mean gradient across the aortic valve was 10.7 mmHg with a peak gradient of 19.2 mmHg.

At this point, the blood culture and sensitivity report confirmed the growth of *Staphylococcus lugdunensis* sensitive to flucloxacillin. Hence antibiotics were switched to intravenous flucloxacillin 2 g every 6 h.

A transoesophageal echocardiography was performed, which revealed an aortic root abscess surrounding a dilated aortic root and a bicuspid aortic valve with severe regurgitation through both the leaflet coaptation site and the abscess cavity (*Figure 2*) ([Supplementary material online](#), Videos S4 and S5). No vegetations were seen on the valve. Left ventricular systolic function was normal.

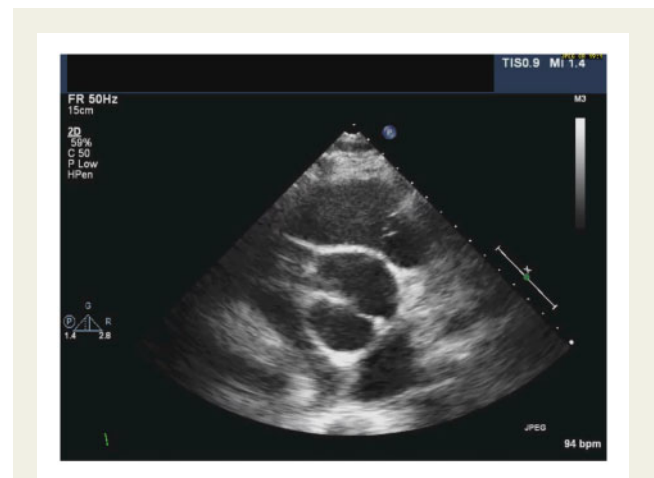


Figure 1 Transthoracic echocardiogram (short-axis view) showing a bicuspid aortic valve.

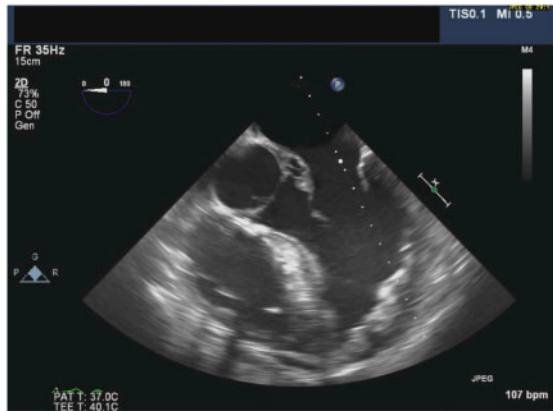


Figure 2 Transoesophageal echocardiogram (five-chamber view/2D) showing the aortic root abscess.

A cardiac CT was then performed for further evaluation, which showed a dilated ascending aorta with a maximum diameter of 45 mm, an aortic root abscess in the left ventricular outflow tract below the level of the aortic valve annulus dissecting caudally into the anterior mitral valve leaflet and cranially up the wall of the ascending aorta along its posterior aspect (about 1 cm in depth), and a bicuspid aortic valve with severe calcification of the leaflets (*Figure 3*). Mild stenosis at the mid-left anterior descending artery due to a calcified plaque was also present (*Supplementary material online, Figure S1*).

The patient was then referred for urgent debridement of the abscess and replacement of the valve with tissue prosthesis using 29 mm Magna Ease valve. The abscess cavity was patched with bovine pericardial tissue. Histopathologic evaluation of the excised valvular tissue confirmed the diagnosis of infective endocarditis.

Post-operatively, the patient made an excellent recovery with a well-healed sternotomy and a good exercise tolerance. A repeat transoesophageal echocardiogram was satisfactory showing no complications with the patch, and antibiotics were switched to

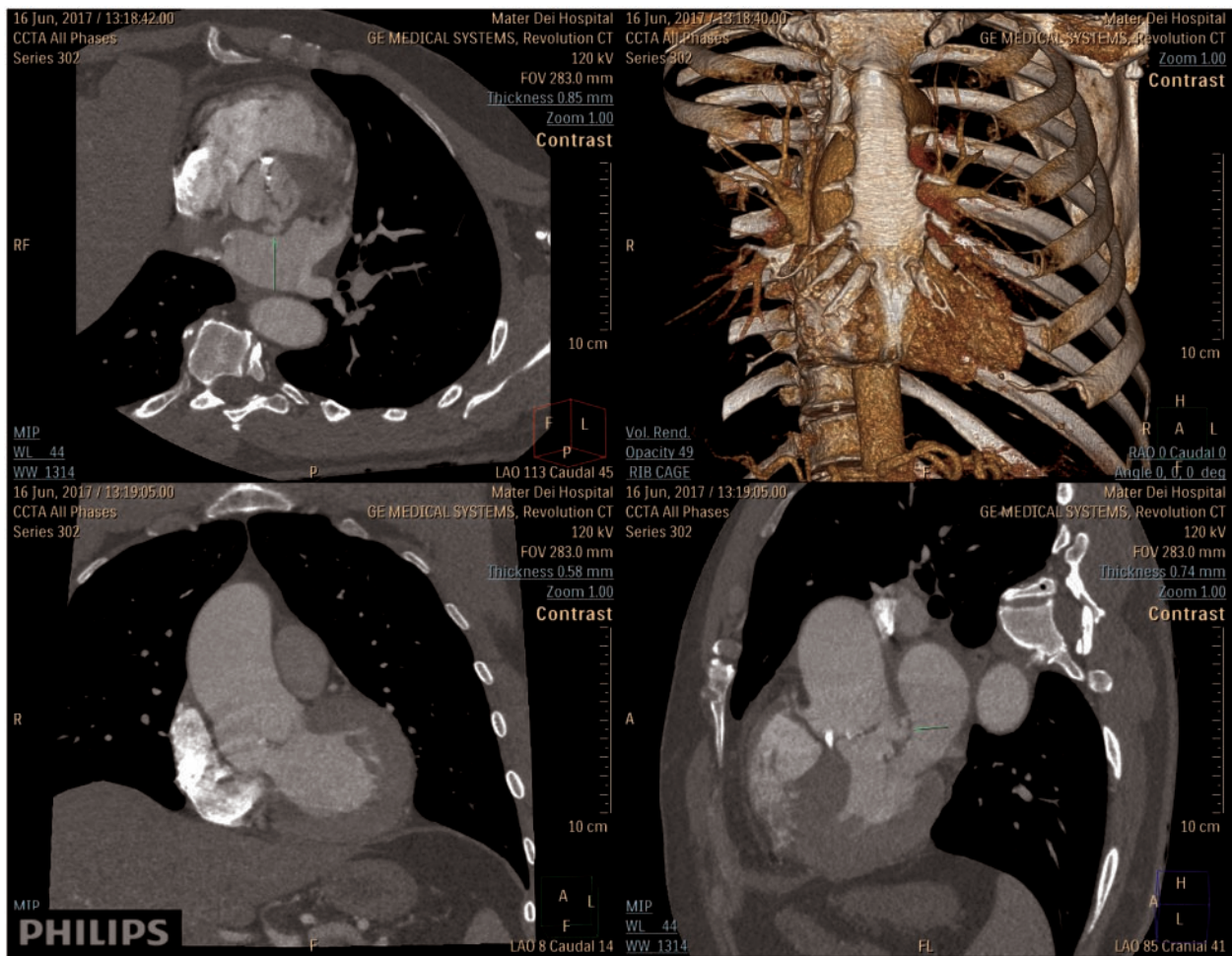


Figure 3 Cardiac computed tomography showing the aortic root abscess.

Table 1 Definition of infective endocarditis according to the modified Duke criteria**Definite infective endocarditis**

Pathological criteria

- Microorganisms: demonstrated by culture or histological examination of a vegetation, a vegetation that has embolized, or an intracardiac abscess specimen; or
- Pathological lesions: vegetation or intracardiac abscess confirmed by histologic examination showing active endocarditis

Clinical criteria (see [Table 2](#) for specific definitions)

- Two major criteria; or
- One major criterion and three minor criteria; or
- Five minor criteria

Possible infective endocarditis

- One major criterion and one minor criterion; or
- Three minor criteria

Rejected infective endocarditis

- Firm alternate diagnosis; or
- Resolution of symptoms suggesting endocarditis with antibiotic therapy for ≤ 4 days; or
- No pathologic evidence of infective endocarditis at surgery or autopsy, with antibiotic therapy for ≤ 4 days; or
- Does not meet criteria for possible infective endocarditis, as above

Table 2 Definition of the terms used in the modified Duke criteria for the diagnosis of IE**Major criteria**

Blood culture positive for infective endocarditis

- Typical microorganisms consistent with IE from two separate blood cultures:
 - Viridans streptococci, *Streptococcus bovis*, HACEK group, *Staphylococcus aureus*; or
 - Community-acquired enterococci, in the absence of a primary focus; or
- Microorganisms consistent with IE from persistently positive blood cultures:
 - At least two positive cultures of blood samples drawn >12 h apart; or
 - All of three or a majority of ≥ 4 separate blood cultures (with first and last sample drawn at least 1 h apart)
- Single positive blood culture for *Coxiella burnetii* or antiphase I IgG antibody titre $>1:800$

Evidence of endocardial involvement

- Echocardiogram positive for IE
 - Vegetation; or
 - Abscess; or
 - New partial dehiscence of prosthetic valve
- New valvular regurgitation

Minor criteria

- Predisposition such as predisposing heart condition or intravenous drug use
- Fever, temperature $>38^{\circ}\text{C}$
- Vascular phenomena: major arterial emboli, septic pulmonary infarcts, mycotic aneurysm, intracranial haemorrhage, conjunctival haemorrhages, and Janeway lesions
- Immunologic phenomena: glomerulonephritis, Osler's nodes, Roth spots and rheumatoid factor
- Microbiological evidence: positive blood culture but does not meet a major criterion or serological evidence of active infection with organism consistent with IE

intravenous ceftriaxone 2 g once daily to reduce the frequency of administration and facilitate mobilization. The patient received a total of 6 weeks of intravenous antibiotics.

A repeat transthoracic echocardiogram performed 3 weeks post-aortic valve replacement showed a well-seated prosthetic tissue valve with a peak gradient of 18 mmHg, and good global left ventricular systolic function with an ejection fraction estimated at 60% ([Supplementary material online](#), Video S6).

Discussion

Infective endocarditis is a serious infection associated with high mortality and severe complications. It is estimated to affect five in every 100 000 people per year.³ The patients with the highest risk are those that have a prosthetic valve, have a history of previous endocarditis and individuals with untreated cyanotic congenital heart disease. Individuals with other forms of native valve disease, such as bicuspid aortic valve, rheumatic heart disease, and calcific aortic stenosis are considered to have an intermediate risk of developing infective endocarditis.⁴

The main complications associated with infective endocarditis are heart failure being the most common, uncontrolled infection and embolic events. Perivalvular extension is the leading cause of uncontrolled infection occurring in 10–40% of cases of aortic valve endocarditis.⁵ Features that should raise the clinical suspicion of an aortic root abscess include persistent disease activity, i.e. fever and elevated white cell count and inflammatory markers, despite antibiotic therapy or a new atrioventricular block. Hence serial electrocardiograms should be taken throughout admission to monitor the extent of perivalvular disease.⁶

Diagnosing infective endocarditis can be challenging due to the wide variety of clinical presentations. The most common symptom is fever, present in up to 90% of cases and often associated with chills, malaise, anorexia, and weight loss.⁷ Other associated clinical manifestations include new or worsening cardiac murmurs, vascular phenomena, and immunologic phenomena. The diagnosis of infective endocarditis is based on the modified Duke criteria, which are a set of criteria that take into account clinical, biological and echocardiographic findings, as well as blood culture results.⁵ In this case, the patient fulfilled two major criteria (persistently positive blood cultures with microorganisms consistent with infective endocarditis and an echocardiogram positive for infective endocarditis) and one minor criterion (predisposing heart condition), therefore, was classified as definite infective endocarditis as per the modified Duke criteria ([Tables 1 and 2](#)).

Surgical treatment is required in approximately 50% of cases in the active phase and the three main indications for early surgery are heart failure, uncontrolled infection, and prevention of embolic events.⁸ As part of the pre-operative assessment prior to valvular heart surgery, it is recommended to perform coronary angiography in men aged >40 years, in post-menopausal women and in individuals with at least one cardiovascular risk factor or a history of coronary artery disease to exclude significant coronary artery disease. However, when the patient is haemodynamically unstable or there is the risk of dislodging aortic vegetations during catheterization, non-invasive high-

resolution cardiac CT is the investigation of choice, as was done in this particular case.⁹

Conclusion

Our case demonstrates that individuals with pre-existing heart conditions are at an increased risk of developing infective endocarditis. Due to its silent nature, affected individuals may not be aware of their bicuspid aortic valve and this can lead to a delay in the diagnosis and treatment of more serious and life-threatening conditions. Moreover, perivalvular complications are associated with high mortality, therefore early diagnosis and surgical treatment in such cases is critical to improve outcome.

Lead author biography



Elyse Balzan received her medical degree from the University of Malta in 2017. She subsequently completed the 2-year foundation programme and is currently undergoing specialty training in Internal Medicine at Mater Dei Hospital, Malta.

Supplementary material

[Supplementary material](#) is available at *European Heart Journal - Case Reports* online.

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

Consent: Patient's informed consent for publication has been obtained, in line with the COPE best practice guidelines, and that the individual who is being reported on is aware of the possible consequences of that reporting.

Conflict of interest: none declared.

Questions and Answers from ESC Clinical Case Gallery

Question 1

Which patients have the highest risk of infective endocarditis?

- (1) Patients who are intravenous drug users
- (2) Patients with cyanotic congenital heart disease
- (3) Patients who have recently undergone a dental procedure
- (4) Patient with poor dental hygiene

Correct answer: Patients with cyanotic congenital heart disease

Discussion/feedback:

According to the 2015 ESC Guidelines for the management of infective endocarditis, patients with the highest risk of infective endocarditis are the following:

- (1) Patients with a prosthetic valve or with prosthetic material used for cardiac valve repair: these patients have a higher risk of IE, a higher mortality from IE, and more often develop complications of the disease than patients with native valves and an identical pathogen. This also applies to transcatheter-implanted prostheses and homografts.
- (2) Patients with previous IE: they also have a greater risk of new IE, higher mortality, and higher incidence of complications than patients with a first episode of IE.
- (3) Patients with untreated cyanotic congenital heart disease (CHD) and those with CHD who have postoperative palliative shunts, conduits, or other prostheses.

Question 2

What is the next appropriate imaging investigation in this patient?

- (1) Cardiac magnetic resonance imaging (MRI)
- (2) Cardiac positron emission tomography (PET) scan
- (3) Transoesophageal echocardiography
- (4) Cardiac computed tomography (CT) scan

Correct answer: Transoesophageal echocardiography

Discussion/feedback:

TOE is a Class IB recommendation in (i) all patients with clinical suspicion of IE and a negative or non-diagnostic TTE and (ii) in patients with clinical suspicion of IE when a prosthetic heart valve or an intracardiac is present.

Question 3

As per the modified Duke criteria, what is the probability that this case is infective endocarditis?

- (1) Definite
- (2) Possible
- (3) Rejected

Correct answer: Definite

Discussion/feedback:

This patient fulfilled two major criteria (persistently positive blood cultures with microorganisms consistent with IE and an echocardiogram positive for IE) and one minor criterion (predisposing heart condition), therefore, classified as definite infective endocarditis as per the modified Duke criteria.

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Question 4

What is the in-hospital mortality rate of patients with infective endocarditis?

- (1) 2–12%
- (2) 15–30%
- (3) 35–45%

Correct answer: 15–30%

Discussion/feedback:

The in-hospital mortality rate of patients with infective endocarditis varies from 15% to 30%. Factors that can affect the outcome of the disease include the first organ that was involved, the underlying cardiac disease (if any), the microorganism involved, the presence or absence of complications and the patient's characteristics.

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