

Recurrent Prosthetic Valve Infective Endocarditis Due to Sequential Non-Fermenting Gram-Negative Bacilli after Transcatheter Aortic Valve Implantation in a Patient with Bicuspid Aortic Valve Disease: A Case Report

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ABSTRACT

Background: Transcatheter aortic valve implantation has become an established treatment for severe aortic stenosis, including in patients with depressed left ventricular function in whom surgical risk would otherwise be prohibitive. Prosthetic valve endocarditis is an uncommon but serious complication of the procedure, occurring at a rate of roughly one to three per cent per patient-year of follow-up, and is usually caused by staphylococci, streptococci or enterococci. Infection with non-fermenting gram-negative bacilli such as *Burkholderia cepacia* and *Stenotrophomonas maltophilia* is exceptionally rare in this setting and is difficult to manage because of the intrinsic multidrug resistance of these organisms.

Case presentation: We describe a 47-year-old man with a congenitally bicuspid aortic valve, severe calcific aortic stenosis and severe left ventricular systolic dysfunction (ejection fraction 15-20%) who underwent transcatheter aortic valve implantation with a 30 mm self-expanding valve after stabilisation of decompensated heart failure. Approximately two months later he was readmitted with a fifteen-day history of fever, chills and cough, one of several blood culture sets grew *Burkholderia cepacia*, sensitive to co-trimoxazole and meropenem. He was treated for prosthetic valve endocarditis with a six-week course of susceptibility-guided antibiotics, became afebrile, and was discharged with recovery of ejection fraction to 45-50%. Roughly six weeks after completing this treatment he presented again with low-grade fever, fatigue, digital clubbing, hepatosplenomegaly and severe anaemia (haemoglobin 7.6-8.1 g/dL) with a mixed picture suggestive of anaemia of chronic disease and a possible mild haemolytic component. Two blood culture sets grew *Stenotrophomonas maltophilia*. Echocardiography showed a heterogeneous, thickened perivalvular lesion around the transcatheter prosthesis raising concern for an aortic root abscess, and contrast-enhanced computed tomography demonstrated a splenic infarct consistent with embolisation. He was started on empirical meropenem, vancomycin and gentamicin pending transoesophageal echocardiography and multidisciplinary review, the outcome beyond this point was not captured in the records available for this report.

Conclusions: This case shows that recipients of a transcatheter aortic valve who develop prosthetic valve endocarditis remain at risk of a further, microbiologically unrelated infective episode even after apparently successful treatment. Non-fermenting gram-negative bacilli should be considered in patients who develop recurrent fever after valve intervention, particularly when there has been prior hospitalisation, prolonged antibiotic exposure and indwelling prosthetic material. Species-level identification with formal susceptibility testing is essential, since empirical carbapenem-based regimens may have no activity against *Stenotrophomonas maltophilia*, and multimodality imaging should be pursued without delay when echocardiographic findings around a transcatheter valve are equivocal.

Keywords: *Bicuspid aortic valve, Transcatheter aortic valve implantation, Prosthetic valve endocarditis, Burkholderia cepacia, Stenotrophomonas maltophilia, non-fermenting gram-negative bacilli, Duke-ISCVID criteria, Heart failure with reduced ejection fraction, Case report.*

INTRODUCTION

Bicuspid aortic valve is the most common congenital cardiac malformation, present in approximately one to two per cent of the general population, and predisposes affected individuals to accelerated leaflet fibrosis and calcification with severe aortic stenosis developing at a younger age than is typical for a trileaflet valve. Once severe symptomatic aortic stenosis develops, valve replacement is required, and transcatheter aortic valve implantation has progressively expanded from inoperable and high surgical risk patients to intermediate- and low-risk populations, including patients presenting with acute decompensated heart failure and markedly reduced ejection fraction who can be stabilised medically and then treated percutaneously once a conventional surgical approach carries excessive risk.

Prosthetic valve endocarditis after transcatheter aortic valve implantation is an uncommon but well-recognised complication. Observational cohorts and systematic reviews place the incidence at roughly 0.7 to 3.0 per cent per patient-year, with the highest risk in the first year after implantation, and with paravalvular regurgitation, a low implantation depth, use of more than one prosthesis and vascular access complications identified as predisposing factors [1-4]. Enterococci, staphylococci and streptococci together account for the majority of reported organisms, with enterococcal infection notably more frequent after transcatheter than after surgical valve replacement [5]. Reported in-hospital mortality for endocarditis of a transcatheter valve has been in the order of one-third of affected patients in some series, underscoring the seriousness of this complication [5].

Infection with non-fermenting gram-negative bacilli is a distinctly unusual cause of prosthetic valve endocarditis. *Burkholderia cepacia* complex is an environmental and nosocomial organism classically associated with cystic fibrosis and chronic granulomatous disease, but sporadic case reports describe endocarditis in patients with prosthetic valves or a history of intravenous drug use, and occasionally in patients without any identifiable predisposition [6-10]. It is intrinsically resistant to aminoglycosides and polymyxins, and successful treatment has generally relied on co-trimoxazole, ceftazidime or meropenem, alone or in combination, sometimes together with valve surgery, though isolate-specific susceptibility varies considerably and must guide definitive therapy. *Stenotrophomonas maltophilia* is likewise a ubiquitous, hospital-associated, non-fermenting bacillus, intrinsically resistant to carbapenems through chromosomally encoded L1 and L2 beta-lactamases, endocarditis due to this organism has been reported only a few dozen times worldwide, most often in patients with a prosthetic valve, an indwelling vascular catheter or recent broad-spectrum antibiotic exposure, and carries a mortality that has been estimated at up to

a third of affected patients [11-16]. First-line therapy is generally trimethoprim-sulfamethoxazole, at times combined with a fluoroquinolone, rather than a carbapenem-based regimen.

We are not aware of a previous report describing two sequential episodes of prosthetic valve endocarditis, each caused by a different non-fermenting gram-negative bacillus, in the same patient after transcatheter aortic valve implantation. We present this case, reconstructed from the treating team's serial clinical documentation and structured in accordance with the CARE (CAse REport) guidelines for the reporting of clinical case detail [17], to highlight the diagnostic and antimicrobial challenges that this pattern of infection presents.

Case presentation

Patient information

A 47-year-old man with a known congenitally bicuspid aortic valve, severe calcific aortic stenosis, moderate mitral regurgitation and severe left ventricular systolic dysfunction (ejection fraction 15-20%) was under longitudinal follow-up in a tertiary cardiology unit. He had a history of tobacco use, for which cessation was advised at each admission described below. He had no other comorbidity, substance-use history or family history documented in the records reviewed. He presented with progressively worsening exertional breathlessness, orthopnoea and bilateral lower-limb swelling, in keeping with acute decompensation of chronic heart failure.

First Admission: Decompensated heart failure and transcatheter aortic valve implantation (14 June - 3 July 2021):

On admission he was normotensive (116/74 mmHg) and mildly bradycardic (68 beats/min), with a clear chest and normal heart sounds without an audible murmur. Baseline blood tests (Table 2) showed acute kidney injury superimposed on chronic disease and marked transaminase elevation, both consistent with congestive hepatic and renal dysfunction from decompensated heart failure, both abnormalities improved substantially over the following eleven days as decongestion proceeded. Transthoracic echocardiography confirmed global left ventricular hypokinesia with an ejection fraction of 15-20%, grade 3 diastolic dysfunction, a thickened and calcified aortic valve with a Doppler peak/mean gradient of 100/61 mmHg, moderate mitral regurgitation and severe tricuspid regurgitation with an estimated right ventricular systolic pressure of 55 mmHg (Table 6). Abdominal ultrasonography at admission was unremarkable.

He was managed initially with intravenous diuretics, non-invasive ventilatory support and fluid restriction. After clinical stabilisation, he underwent transcatheter aortic valve implantation on 17 June 2021 with a 30

mm self-expanding, nitinol-frame, supra-annular transcatheter valve (Hydra, Sahajanand Medical Technologies, India), a device available in 22, 26 and 30 mm sizes for annuli of 18-27 mm and reported in multicentre trials to achieve a low rate of significant paravalvular leak [18]. Invasive haemodynamic assessment (Table 3) showed a fall in left ventricular systolic pressure from a pre-dilatation value of 153 mmHg to 105 mmHg after balloon dilatation, with a corresponding rise in aortic systolic pressure from 102 to 109 mmHg, giving a peak-to-peak transvalvular gradient that fell from approximately 51 mmHg at baseline to essentially zero after deployment and confirming relief of the outflow obstruction, the residual difference from the higher Doppler-derived echocardiographic gradient is consistent with the well-recognised phenomenon of pressure recovery, whereby continuous-wave Doppler can overestimate the true net gradient across a stenotic or prosthetic aortic valve. He remained haemodynamically stable thereafter and was discharged on dual antiplatelet therapy (aspirin and clopidogrel), a statin, a loop-diuretic and aldosterone-antagonist combination, an angiotensin-converting enzyme inhibitor and a beta-blocker, with outpatient cardiology follow-up arranged.

Second Admission: Prosthetic valve endocarditis due to *Burkholderia cepacia* (14 August - 2 October 2021)

Approximately six weeks after discharge, he was readmitted with a fifteen-day history of intermittent fever, chills and rigors accompanied by a dry cough. Examination revealed hepatosplenomegaly and a new grade 2 ejection systolic murmur at the aortic area, a finding does not present at the time of his index admission and therefore of particular concern for infection at the prosthesis. An extensive fever work-up was undertaken (Table 4). Serial blood cultures drawn from multiple peripheral venepuncture sites over successive days were largely sterile, but one set, obtained on 16 August 2021, grew *Burkholderia cepacia*, reported as sensitive to co-trimoxazole and meropenem on the isolate tested. Serological and molecular tests for dengue (NS1 antigen), typhoid fever (Typhi dot), and coronavirus disease 2019 (reverse-transcriptase polymerase chain reaction) were negative, rheumatoid factor was negative, peripheral blood film for malaria was negative, urine culture was sterile, thyroid-stimulating hormone was within the reference range, and chest radiography was unremarkable, abdominal ultrasonography confirmed splenomegaly without a focal lesion. Inflammatory markers declined progressively over the course of treatment, with C-reactive protein falling from 85 mg/L close to presentation to 20 mg/L by the end of the admission, and procalcitonin falling from 2.5 ng/mL to below 0.4 ng/mL. Renal function and serum electrolytes remained stable throughout (Table 4).

Differential diagnosis considered in second admission

Given the combination of prolonged fever, a new murmur, hepatosplenomegaly and a recently implanted prosthetic valve, prosthetic valve endocarditis was the leading clinical concern from the outset. Alternative infective and non-infective causes of prolonged fever were nonetheless systematically excluded, including dengue, enteric fever, coronavirus disease 2019, malaria, urinary tract infection and an autoimmune process (rheumatoid factor negative), as summarised above. The isolation of *Burkholderia cepacia* from blood culture, together with the new murmur and the clinical response to targeted antibiotic therapy, supported a diagnosis of prosthetic valve endocarditis of the transcatheter aortic valve rather than an alternative source of bacteraemia, although a definitive source (for example, an indwelling vascular access device used during the index admission) could not be established from the records reviewed. He was treated with a six-week course of meropenem, vancomycin and co-trimoxazole for prosthetic valve endocarditis, became afebrile approximately two weeks before discharge, and was subsequently discharged in stable condition on 2 October 2021. Repeat echocardiography at discharge (Table 6) showed a marked improvement in ejection fraction to 45-50%, a well-functioning prosthesis with a peak/mean gradient of 18/10 mmHg, mild residual mitral regurgitation and no vegetation, clot or pericardial effusion. He was discharged on extended dual antiplatelet therapy, a statin, a diuretic, an angiotensin-converting enzyme inhibitor and a beta-blocker, with instructions for close outpatient monitoring of blood counts and renal function.

Third Admission: Severe anaemia and prosthetic valve endocarditis due to *Stenotrophomonas maltophilia* (from 15 November 2021)

Roughly six weeks after completing this course of antibiotics, he presented again with low-grade fever, fatigability and cough. Examination revealed a regular pulse of 90 beats/min, blood pressure of 126/72 mmHg, digital clubbing and hepatosplenomegaly, with loud but normal first and second heart sounds and without pallor, icterus, cyanosis or peripheral oedema. Laboratory testing (Table 5) showed severe anaemia with a haemoglobin concentration of 7.6 g/dL, rising to 8.1 g/dL two days later, with a total leucocyte count and platelet count within the normal range.

Anaemia work-up:

Evaluation for the cause of the anaemia showed normocytic normochromic to microcytic red cells on the peripheral blood film, a positive direct antiglobulin test (2+), with monospecific confirmatory testing reported as awaited at the time of documentation, a mildly elevated lactate dehydrogenase of 240 U/L, an elevated ferritin of 445 ng/mL, a low serum iron of 27

micrograms/dL, and a negative stool occult blood test. This combination is most consistent with an overlapping picture of anaemia of chronic disease, reflected by the raised ferritin and low serum iron in the setting of recurrent infection, together with a possible mild immune-mediated haemolytic component suggested by the positive direct antiglobulin test, the modestly raised lactate dehydrogenase is compatible with either process and is not independently diagnostic. Overt gastrointestinal blood loss was excluded by a negative stool occult blood test, and malaria was excluded on peripheral smear. Two sets of blood culture, drawn on 17 November 2021, both grew *Stenotrophomonas maltophilia*, isolate-specific susceptibility results were not available in the records reviewed. The electrocardiogram at this admission showed normal sinus rhythm with left ventricular hypertrophy, left bundle-branch block and a new first-degree atrioventricular block, with a PR interval of 280 milliseconds, a finding not present on earlier tracings. Echocardiography demonstrated persistent global

hypokinesia with an ejection fraction of 35-40%, a satisfactorily functioning prosthesis with a peak transvalvular velocity of 2.19 m/s and a peak gradient of 19 mmHg, mild mitral and tricuspid regurgitation, and, most notably, a heterogeneous hyperechoic lesion with perivalvular thickening around the transcatheter prosthesis, raising concern for a periprosthetic or aortic root abscess, no discrete vegetation, clot or pericardial effusion was seen on this study (Table 6). Contrast-enhanced computed tomography of the thorax and abdomen showed hepatosplenomegaly with a wedge-shaped, hypo-enhancing lesion in the spleen consistent with splenic infarction, together with incidental calcified pulmonary nodules thought to represent old granulomatous disease unrelated to the acute presentation. He commenced empirically on meropenem, vancomycin and gentamicin while further evaluation, including transoesophageal echocardiography and multidisciplinary endocarditis-team input, was planned. The outcome of this admission beyond this point was not captured in the clinical records available for this report.

Summary tables

Table 1. Summary timeline of presentation, transcatheter aortic valve implantation and two subsequent episodes of prosthetic valve endocarditis due to different organisms

Approximate period	Event	Key findings
Before June 2021	Longitudinal cardiology follow - up	Known bicuspid aortic valve, severe calcific aortic stenosis, moderate mitral regurgitation, severe left ventricular systolic dysfunction (ejection fraction 15-20%).
14 June - 3 July 2021 (admission 1)	Acute decompensated heart failure, transcatheter aortic valve implantation on 17 June 2021	Stabilised with intravenous diuretics, non-invasive ventilation and fluid restriction, 30 mm self-expanding transcatheter valve implanted with satisfactory haemodynamic result, discharged clinically stable.
From 14 August 2021, discharged 2 October 2021 (admission 2)	Prolonged fever with chills and dry cough, first episode of prosthetic valve endocarditis	Blood culture grew <i>Burkholderia cepacia</i> , treated with a six-week course of susceptibility-guided antibiotics, became afebrile, ejection fraction recovered to 45-50% by discharge.
From 15 November 2021 (admission 3)	Low-grade fever, fatigue and severe anaemia, roughly six weeks after completing antibiotics for admission 2	Blood culture grew <i>Stenotrophomonas maltophilia</i> , echocardiography showed a perivalvular lesion suspicious for aortic root abscess, computed tomography showed a splenic infarct, empirical meropenem, vancomycin and gentamicin started, outcome beyond this point not captured in the records reviewed.

Table 2. Laboratory trend during admission 1, showing congestive hepatic and renal dysfunction at presentation with progressive improvement after decongestion and valve implantation

Investigation	14 Jun 2021	16 Jun 2021	25 Jun 2021
Haemoglobin (g/dL)	9.79	10.4	12.77
Total leucocyte count (/mm ³)	6100	not recorded	5850

Platelet count (x10 ³ /microL)	112	150	150
Bilirubin total/direct (mg/dL)	2.61/0.87	2.56/0.77	not recorded
SGPT/SGOT (U/L)	658/583	585/198	not recorded
Urea/creatinine (mg/dL)	51.7/1.27	34/0.96	23.4/1.25
Sodium/potassium (mmol/L)	137.9/4.02	137/3.39	136/4.63
Uric acid (mg/dL)	13.7	10.1	5.58
C-reactive protein (mg/L)	not recorded	not recorded	16

Table 3. Invasive haemodynamic assessment during transcatheter aortic valve implantation

Procedural stage	Aortic systolic/diastolic pressure, (mean), mmHg	Left ventricular systolic/diastolic pressure, (mean), mmHg
Pre-dilatation (baseline)	102/73 (86)	153/20 (54)
After valve deployment	95/72 (82)	116/20 (32)
After balloon dilatation	109/76 (89)	105/23 (31)

Table 4. Fever work-up and laboratory trend during admission 2 (prosthetic valve endocarditis due to *Burkholderia cepacia*)

Investigation	16 Aug	27 Aug	16 Sep	22 Sep	28 Sep
Haemoglobin (g/dL)	10.1	10.4	9.8	12.15	13.1
Total leucocyte count (/mm ³)	6283	7252	4973	8969	7679
Platelet count (x10 ³ /microL)	146	210	151	232	156*
Bilirubin total/direct (mg/dL)	0.47	0.61	0.6/0.2	0.17/0.15	0.4/0.2
SGPT/SGOT (U/L)	123/75	167/91	61/38	124/61	75/39
Procalcitonin (ng/mL)	2.5	0.26	0.22	0.38	not recorded
Urea/creatinine (mg/dL)	26/0.84	17/0.9	29/1.08	28/1.12	28/1.1
Sodium/potassium (mmol/L)	131/4.1	130/5.3	132/4.5	129/4.2	129/4.2

*Recorded in the source document as 1.56, given the preceding and subsequent platelet counts, this almost certainly reflects a transcription artefact (most likely a decimal-point or units error for approximately 156 x10³/microL) rather than a true, clinically silent fall to a critically low level, and is presented here as documented with this caveat noted.

Table 5. Laboratory investigations during admission 3 (severe anaemia and prosthetic valve endocarditis due to *Stenotrophomonas maltophilia*)

Investigation	16 Nov 2021	18 Nov 2021
Haemoglobin (g/dL)	7.6	8.1
Total leucocyte count (/mm ³)	7730	8390
Platelet count (x10 ³ /microL)	149	162
Bilirubin total/direct (mg/dL)	not recorded	1.02/0.76
SGPT/SGOT (U/L)	not recorded	118/125
Urea/creatinine (mg/dL)	34/1.09	not recorded
Sodium/potassium (mmol/L)	127/4.07	not recorded

Uric acid (mg/dL)	6.6	not recorded
Lactate dehydrogenase (U/L)	240	not recorded
Viral markers (HIV, hepatitis B/C)	non-reactive	not recorded

Table 6. Echocardiographic parameters before valve implantation and during the two episodes of prosthetic valve endocarditis. LV, left ventricular, RVSP, right ventricular systolic pressure, PG, peak gradient

Parameter	Before implantation (14 Jun 2021)	After treatment of admission 2 (3 Oct 2021)	Admission 3 (Nov 2021)
Left ventricular ejection fraction	15-20%	45-50%	35-40%
Interventricular septum (mm)	20	not recorded	16
LV internal diameter, diastole (mm)	54	not recorded	57
LV internal diameter, systole (mm)	49	not recorded	39
Posterior wall thickness (mm)	19	not recorded	17
Left atrial diameter (mm)	45	not recorded	40
Aortic root diameter (mm)	35	not recorded	42
Aortic valve/prosthesis gradient	Peak/mean 100/61 mmHg (native)	Peak/mean 18/10 mmHg (prosthesis)	Peak velocity 2.19 m/s, peak gradient 19 mmHg
Mitral regurgitation	Moderate	Mild	Mild
Tricuspid regurgitation / RVSP	Severe, RVSP 55 mmHg	Not significant	Mild, PG 4 mmHg
Perivalvular / vegetation findings	Not applicable	No vegetation, clot or effusion	Heterogeneous hyperechoic lesion with perivalvular thickening, no discrete vegetation, clot or effusion

Table 7. Organisms isolated and antimicrobial therapy given during the two episodes of prosthetic valve endocarditis

Admission	Organism isolated	Reported susceptibility	Antimicrobial therapy given
2 (Aug-Oct 2021)	<i>Burkholderia cepacia</i>	Sensitive to co-trimoxazole and meropenem on the isolate tested, one of several blood culture sets obtained was positive, the remainder sterile	Meropenem, vancomycin and co-trimoxazole for six weeks
3 (from Nov 2021)	<i>Stenotrophomonas maltophilia</i>	Not stated in the records reviewed, two of two blood culture sets were positive	Empirical meropenem, vancomycin and gentamicin pending further evaluation

Application of the 2023 Duke - ISCVID diagnostic framework

Applying the 2023 Duke-International Society for Cardiovascular Infectious Diseases (Duke-ISCVID)

criteria retrospectively to this case was informative, while acknowledging that this classification was not necessarily applied prospectively by the treating team and that some source imaging (transoesophageal

echocardiography, computed tomography angiography or 18F-fluorodeoxyglucose positron emission tomography) was not available for review [19-21]. In admission 2, a single positive blood culture for an organism not among the most typical causes of endocarditis, together with fever and a new regurgitant murmur, would most conservatively be classified as 'possible' infective endocarditis on microbiological and clinical grounds, with the strong clinical response to targeted antibiotics providing supportive, if retrospective, evidence in favour of a true prosthetic valve infection. In admission 3, two independently obtained blood culture sets both grew *Stenotrophomonas maltophilia*, satisfying a microbiological major criterion, and echocardiography demonstrated a new perivalvular abnormality around the prosthesis, satisfying an imaging-based major criterion, albeit derived from transthoracic imaging alone, which has reduced sensitivity around a transcatheter valve frame. Together with fever and a vascular phenomenon (splenic infarction, a minor criterion), this combination would be classified as 'definite' infective endocarditis by clinical criteria, supporting the treating team's working diagnosis and management as documented.

DISCUSSION

This patient's course illustrates an unusual and clinically instructive pattern: two temporally separate episodes of prosthetic valve endocarditis affecting the same transcatheter aortic valve, each due to a different, rare, intrinsically multidrug-resistant, non-fermenting gram-negative bacillus, within roughly five months of implantation. Neither *Burkholderia cepacia* nor *Stenotrophomonas maltophilia* is a typical cause of transcatheter valve endocarditis, in which enterococci, staphylococci and streptococci predominate [5,22], and their sequential occurrence in a single patient does not appear to have been previously described in the literature we reviewed. Several features of this patient's course plausibly contributed to his vulnerability to nosocomial, non-fermenting organisms. He required a prolonged period of hospital care around the time of decompensated heart failure and valve implantation, followed by a further extended admission for treatment of the first infective episode, with associated indwelling vascular access and repeated broad-spectrum antibiotic exposure. Both *Burkholderia cepacia* complex and *Stenotrophomonas maltophilia* are environmental organisms that colonise hospital water systems, respiratory equipment and intravascular devices, and prior antibiotic exposure, particularly with agents to which these organisms are intrinsically resistant, is a recognised risk factor for subsequent infection [11,13,23]. It is plausible that treatment of the first episode, while successful in eradicating *Burkholderia cepacia*, altered the patient's local microbial flora in a way that favoured later colonisation and bloodstream invasion by

Stenotrophomonas maltophilia, although this sequence cannot be confirmed from the available records and remains speculative. The choice of antimicrobial therapy in this case merits particular comment. *Burkholderia cepacia* complex is generally susceptible to co-trimoxazole, ceftazidime and meropenem, although susceptibility is variable between isolates and confirmatory testing is essential [6-10], and the regimen used in admission 2 was concordant with the reported sensitivity of that isolate. *Stenotrophomonas maltophilia*, in contrast, is intrinsically resistant to carbapenems by virtue of chromosomally encoded L1 and L2 beta-lactamases, and first-line treatment is usually trimethoprim-sulfamethoxazole, at times combined with a fluoroquinolone such as levofloxacin, rather than a carbapenem-based regimen [12-16]. The empirical inclusion of meropenem once *Stenotrophomonas maltophilia* had been isolated in admission 3 would not be expected to contribute meaningfully to bacterial clearance unless the specific isolate demonstrated in vitro susceptibility, which is uncommon and was not documented in the records reviewed. This underlines a broader teaching point of this report: once a non-fermenting gram-negative bacillus is identified in a patient with suspected endocarditis, early infectious-disease consultation and isolate-specific susceptibility testing should guide definitive therapy rather than reliance on typical class activity, and empirical regimens should be reviewed and narrowed or redirected as soon as species identification is available.

The echocardiographic findings in admission 3 also illustrate a recognised diagnostic limitation. The stent frame of a transcatheter valve can produce acoustic shadowing and reverberation artefact that reduces the sensitivity of transthoracic and even transoesophageal echocardiography for vegetations and abscess cavities, so that a heterogeneous or thickened perivalvular appearance, as seen in this patient, is suggestive but not conclusive for infection. The 2023 revision of the modified Duke criteria by the International Society for Cardiovascular Infectious Diseases elevated computed tomography and 18F-fluorodeoxyglucose positron emission tomography with computed tomography to major imaging criteria, reflecting their particular value in prosthetic valve endocarditis when echocardiography is equivocal, and this revised framework has been shown to improve diagnostic sensitivity compared with earlier versions of the criteria, albeit with some reduction in specificity [19-21,24,25]. Multimodality imaging of this kind, together with transoesophageal echocardiography, would have been a reasonable next step in this patient's evaluation and was reportedly being planned at the time of the last available documentation.

The wedge-shaped splenic lesion identified on computed tomography is consistent with embolic infarction, a well-recognised complication of both native and prosthetic valve endocarditis, and provides

a further, independent line of evidence in favour of an active endovascular infective process at the time of admission 3. The concurrent severe anaemia, with a mixed picture of a positive direct antiglobulin test, raised ferritin and low serum iron, is compatible with an overlap of anaemia of chronic disease and a mild immune-mediated haemolytic component, formally distinguishing the relative contribution of each would have required a reticulocyte count, haptoglobin and a directed search for schistocytes on the blood film, none of which were documented in the records reviewed. A new first-degree atrioventricular block in this context always warrants attention, since progressive conduction disease can be an early marker of periannular extension of infection toward the conducting tissue, and its emergence alongside the perivalvular echocardiographic abnormality would support closer surveillance for abscess formation and, if confirmed, may ultimately influence the decision between continued medical therapy and surgical intervention.

Strengths and limitations

This report draws on detailed, contemporaneous laboratory, microbiological, echocardiographic and cross-sectional imaging data recorded across three separate hospital presentations, which allowed a comparatively granular reconstruction of the patient's course. It has, however, the inherent limitations of a case compiled from sequential clinical summaries rather than a single continuous chart. The administrative header fields of some of the source documents were internally inconsistent, in particular, one interim summary recorded an admission date that predated the events described in its own narrative by several months, most likely reflecting reuse of an original hospital registration date on a document template rather than a true admission date. We have anchored the timeline presented here to the dates attached to individual investigations and to the clinical narrative rather than to these header fields. A further source document contained a resting echocardiogram reported as entirely normal on a date that could not be reconciled with the remainder of the clinical picture, because this finding was discordant with the patient's well-documented severe valvular and ventricular disease and could not be verified, it has been excluded from the synthesised case data rather than reported as fact. Transoesophageal echocardiography, cardiac computed tomography angiography and positron emission tomography were not available for review, and confirmatory monospecific antiglobulin testing and reticulocyte indices for the anaemia work-up were reported as pending at the time of the last available documentation. Finally, the last available record was a case summary written during an active admission rather than a discharge summary, so the definitive outcome of the third presentation, including the results of any further imaging, the specific antimicrobial

regimen ultimately used against *Stenotrophomonas maltophilia*, and whether surgical intervention was required, could not be determined and is not reported here.

CONCLUSIONS

A patient with a bicuspid aortic valve and severe left ventricular dysfunction who underwent transcatheter aortic valve implantation developed two sequential episodes of prosthetic valve endocarditis within five months, first due to *Burkholderia cepacia* and subsequently due to *Stenotrophomonas maltophilia*, each an unusual and intrinsically multidrug-resistant, non-fermenting gram-negative organism. The case highlights that recovery from one episode of transcatheter valve endocarditis does not eliminate the risk of a further, microbiologically distinct infection, that antimicrobial therapy for non-fermenting gram-negative organisms must be guided by isolate-specific susceptibility rather than assumed class activity, and that multimodality imaging, applied within the current Duke-ISCVID diagnostic framework, should be pursued without delay when echocardiographic assessment of a transcatheter valve is inconclusive.

Declarations

Ethics approval and consent to participate

Not applicable to this single case report beyond the consent described below.

Availability of data and materials

The de-identified clinical data supporting this report are held in the patient's hospital records and are available from the corresponding author on reasonable request, subject to institutional data-protection requirements.

Competing interests

The authors declare that they have no competing interests.

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