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CASE REPORT

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Infective endocarditis following transcatheter mitral valve-in-valve replacement: a clinical case report

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Abstract

Background Transcatheter valve-in-valve replacement (TMViVR) is an alternative option for patients with bioprosthetic valve failure (BVF) who are at high surgical risk. Although infective endocarditis (IE) after transcatheter mitral valve-in-valve replacement is unusual, it is associated with significantly high mortality.

Case presentation An 81-year-old male patient was admitted with intermittent thoracic tightness, chest pain persisting for 3 years, and shortness of breath with nausea for 1 week. Two months prior, he received transcatheter mitral valve-in-valve replacement for recurrent heart failure and severe prosthetic mitral regurgitation. He developed a fever in the early postoperative period after TMViVR, with *Staphylococcus lugdunensis* bacteremia detected. He was discharged from the hospital after the blood culture turned negative following antibiotic treatment. During this hospitalization, prosthetic valve endocarditis was confirmed, resulting in severe prosthetic mitral stenosis and severe pulmonary hypertension. Blood cultures identified *Staphylococcus lugdunensis* again. Despite anti-infective therapy, the patient succumbed to complications from his complex medical history and comorbidities.

Conclusions While transcatheter valve implantation provides an alternative option for dealing with valvular disease, prosthetic valve endocarditis (PVE) as an unusual but catastrophic complication with poor prognosis should be taken seriously. Early detection through echocardiography, especially in high-risk patients presenting with suspicious symptoms, is crucial for timely intervention. Additionally, an appropriate perioperative antibiotic regimen is essential to prevent infection and improve prognosis.

Keywords Infective endocarditis (IE), Transcatheter mitral valve-in-valve replacement (TMViVR), Bioprosthetic valve failure (BVF)

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Introduction

Bioprostheses are increasingly implanted in valve replacement procedures due to their lower thrombogenicity and the absence of a requirement for long-term anticoagulation. Bioprosthetic valve failure (BVF) is a type of structural valve deterioration that limits the long-term durability of these prosthetic valve. Valve replacement emerges as the preferred surgical solution for those with BVF, offering two main options: surgical valve replacement and transcatheter valve replacement. The choice between both implantation techniques depends on individual patient factors such as anticipated patient longevity, the severity of valve dysfunction, comorbidities, potential procedural risks, patient preference and lifestyle [1].

Infective endocarditis (IE) is unusual but catastrophic after transcatheter valve replacement, which is life-threatening and associated with high mortality. However, in terms of the diagnosis and treatment of prosthetic valve endocarditis (PVE) after transcatheter intervention, there still existed several limitations. The atypical presentation and nonspecific symptoms in these patients might lead to delayed diagnosis and treatment. Furthermore, the diagnostic efficacy of the modified Duke criteria and detection rate of prosthetic valve endocarditis via echocardiography were lower in patients received transcatheter valve replacement. What's more, the perioperative antibiotic regimens or treatment strategies remain controversial, due to the lack of clinical trial data in large-scale populations [2–4].

Case presentation

An 81-year-old male patient was admitted to the hospital due to intermittent thoracic tightness, chest pain persisting for 3 years, and shortness of breath with nausea for 1 week. In 2008, he received mitral valve replacement under cardiopulmonary bypass due to infective endocarditis. Since 2017, the patient had routine echocardiographic examinations in our hospital, typically 1 to 2 times per year. In November 2022, an echocardiogram revealed moderate regurgitation of the prosthetic mitral valve. Over the next 4 months, the patient was hospitalized twice for acute exacerbation of chronic heart failure (AE-CHF), with a progressively enlarged left ventricle and worsening prosthetic mitral regurgitation (Supplementary Fig. 1).

In February 2023, the patient underwent preoperative evaluation, during which C-reactive protein (CRP), white cell count and neutrophil ratio were within normal ranges, while procalcitonin (PCT) was mildly elevated (0.11 ng/mL). Before the valve-in-valve procedure, intraoperative transesophageal echocardiography was performed, showing no signs of prosthetic valve infection. The patient underwent transcatheter mitral valve-in-valve replacement with a SAPIEN3 26 mm prosthetic valve. However, during the early postoperative period, the patient developed fever, and blood cultures revealed Staphylococcus lugdunensis bacteremia. After 12 days of Vancomycin and 10 days of Levofloxacin treatment, the patient's blood cultures became negative, and he was discharged with a 7-day course of oral cefixime. A transthoracic echocardiogram was performed before discharge, without significant findings.

Upon readmission, clinical examination revealed bradycardia (45 bpm), an apical diastolic rumbling murmur, audible third and fourth heart sounds, and mild bilateral lower limb edema. Half an hour after admission, the patient suffered a sudden drop in heart rate, and an urgent blood gas analysis suggested hyperkalemia (6.6 mmol/L). Emergent bedside hemodialysis and temporary pacemaker implantation were performed, and the patient was transferred to the Cardiology Intensive Care Unit (CCU).

The admission laboratory results were notable for elevated PCT (3.69 ng/mL), CRP (167.17 mg/L), and NTproBNP (59595.0 pg/mL), which suggested the possibility of infection and heart failure. Blood culture revealed *Staphylococcus lugdunensis* bacteremia. Transthoracic echocardiogram (TTE) confirmed the existence of prosthetic valve vegetations, while the larger one (dimension 17 mm × 7 mm) located in the posterior leaflet, resulting in severe prosthetic mitral valve stenosis. Severe tricuspid regurgitation and significantly elevated pulmonary arterial systolic pressure (Vmax = 4.8 m/s, PASP = 102mmHg) were also observed simultaneously (Fig. 1, Video 1, Video 2).

Therefore, the patient was diagnosed with prosthetic valve endocarditis and received comprehensive treatment, including antibiotics for infection control, vasopressors, infusion therapy for hemodynamic stability, coagulation disorder correction, bleeding prevention, and atrial fibrillation management. However, on the third day of hospitalization, the patient experienced a sudden drop in blood pressure, confusion, unresponsiveness, and loss of pupillary light reflex. Despite immediate interventions, including continuous vasopressor support, fluid resuscitation, acidosis correction, and heart rate management, the patient deteriorated rapidly and passed away. Given his advanced age, multiple comorbidities, and high surgical risk, open-heart surgery was not recommended, even though his prosthetic valve endocarditis met the surgical criteria.

Discussion

Infective endocarditis following TMViVR is an unusual but catastrophic complication. We reported a case of prosthetic valve endocarditis of a SAPIEN3 26 mm device, which was colonized by *Staphylococcus*

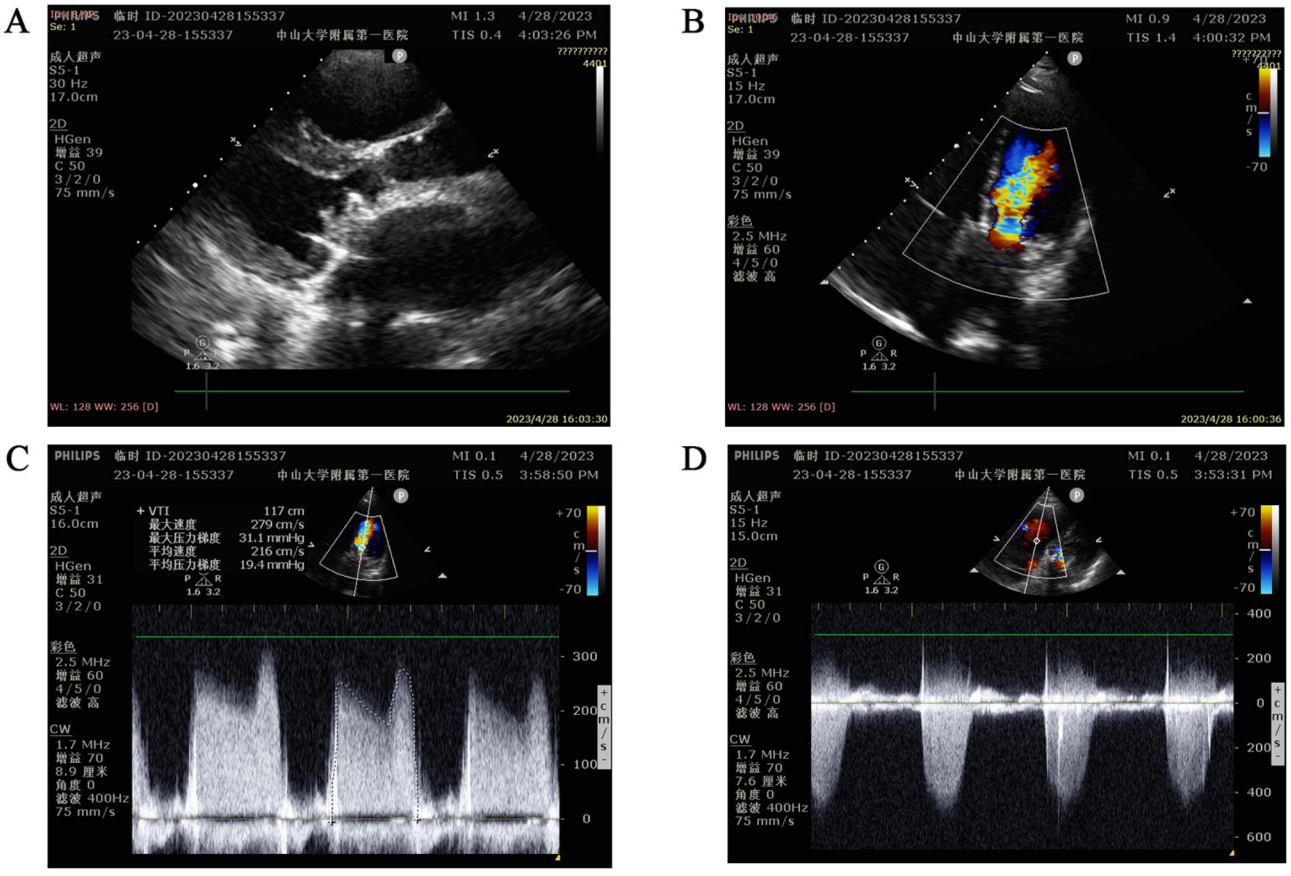

Fig. 1 Bedside transthoracic echocardiography images

(**A**) Bedside transthoracic echocardiography confirmed the presence of prosthetic valve vegetations, with a larger vegetation located on the posterior leaflet, leading to severe prosthetic mitral valve stenosis

(**B**) Color Doppler imaging revealed high-velocity diastolic flow across the prosthetic mitral valve

(**C**) Transthoracic echocardiography demonstrated severe functional prosthetic mitral valve stenosis caused by the vegetations, with a peak pressure gradient of 31.1 mmHg and a mean pressure gradient of 19.4 mmHg

(**D**) Pulmonary arterial systolic pressure, calculated using tricuspid regurgitation velocity, was significantly elevated, measuring approximately 102 mmHg

lugdunensis. In this case, the patient underwent open-heart mitral valve replacement due to infective endocarditis in 2008, then received transcatheter mitral valve-in-valve implantation for bioprosthetic valve failure in February 2023. However, prosthetic valve endocarditis developed shortly after the second surgery.

Bioprosthetic valves are increasingly preferred over mechanical valves due to their lower thrombogenicity and the absence of long-term anticoagulation requirements. However, the bioprostheses has limited durability leading to prone to bioprosthetic valve failure. Bioprosthesis failure can present as stenosis caused by calcification, pannus formation, or, less commonly, thrombosis. It can also manifest as leaflet prolapse or tearing, resulting in significant regurgitation [1, 5].

Bioprosthetic valve failure is a type of structural valve deterioration that compromises the long-term durability of prosthetic valves, and delaying its progression has become a key clinical focus. In patients with mitral bioprosthetic valves, valve degeneration often leads to aggravated heart failure, presenting significant challenges during reoperation, including severe trauma, extensive tissue adhesion, and an elevated risk of bleeding during a second thoracotomy. For high-risk patients or those with contraindications, transcatheter valve-in-valve implantation has emerged as a relatively safe and feasible alternative [6–8].

According to the 2021 ESC Guidelines for the Management of Valvular Heart Disease [9], reoperation remains a Class I recommendation for patients with BVF, while transcatheter valve-in-valve implantation is a Class II recommendation, especially for those with high-risk factors such as advanced age or multiple comorbidities. In recent years, transcatheter mitral valve replacement has been increasingly used in patients with BVF, prior mitral valvuloplasty, or severe mitral annular calcification [10, 11]. However, due to the relatively low incidence of post-operative infective endocarditis and the limited number

of procedures performed, there is still insufficient clinical evidence to guide management. As a result, clinicians may lack experience in addressing the complexities of the disease. The occurrence of postoperative infective endocarditis further complicates treatment and is associated with a poor prognosis.

Prosthetic valve endocarditis is a relatively uncommon complication of valve replacement surgery, but it is associated with high rates of mortality and morbidity. It was reported that infective endocarditis is a rare yet serious complication after transcatheter aortic valve replacement (TAVR), with an incidence of 0.3-2.0 per 100 person-years, comparable to surgical aortic valve replacement (SAVR). However, notable differences exist between SAVR and TAVR. The risk of IE is significantly higher in the early period (< 100 days) after valve replacement compared to the longer term (more than a year post-procedure), with the risk being up to six times greater, as reported in the Swiss TAVR study [12]. In patients with IE following TAVR, common pathogenic bacteria include enterococcus, Staphylococcus aureus, and coagulase-negative staphylococcus. In recent years, the incidence of IE associated with multi-drug resistant bacteria have gradually increased [2, 13, 14].

The 2023 ESC Guidelines for the Management of Endocarditis recommend prophylactic antibiotics for four high-risk groups: (1) patients with a history of IE; (2) patients with surgically or transcatheter-implanted prosthetic valves or any material used for cardiac valve repair; (3) patients with congenital heart disease; and (4) patients with ventricular assist devices used as destination therapy [9]. In this case, the patient received bioprosthetic mitral valve replacement 15 years ago due to infective endocarditis. Multiple high-risk factors, combined with poor basic health, led to recurrent prosthetic valve endocarditis shortly after transcatheter valve-in-valve implantation.

In this case, the blood culture identified *Staphylococcus lugdunensis*, an opportunistic pathogen commonly found on the skin, which can colonize prosthetic devices and lead to infection. The recurrent infective endocarditis (IE) in this patient, along with his poor underlying health, highlighted the challenges in managing such infections, which ultimately led to a fatal outcome.

This case underscores the importance of early diagnosis of prosthetic valve endocarditis (PVE), particularly in patients undergoing transcatheter valve procedures, who often cannot tolerate open-heart surgery. Although rare, post-procedural IE can significantly impact prognosis and treatment outcomes. Early identification of suspicious signs, such as fever, new heart failure and systemic embolism, along with timely treatment, may help reduce mortality. Clinicians and echocardiographers must be vigilant in recognizing clinical signs of IE and understanding its associated risk factors. In patients at elevated risk for IE, careful attention should be given to identifying valvular vegetations, as well as secondary valve stenosis or regurgitation during echocardiography. However, in patients with prosthetic valves, transthoracic echocardiography (TTE) exhibited limited sensitivity for detecting IE vegetations and abnormal perivalvular abscesses [3, 4]. In these cases, transesophageal echocardiography (TEE) should be promptly performed to confirm the diagnosis, facilitating early detection and timely intervention. Additionally, antibiotic prophylaxis should be considered for high-risk patients, although the optimal postoperative anti-infective protocols remain debated, especially in the presence of multiple comorbidities.

Conclusion

Prosthetic valve endocarditis after transcatheter valve implantation is an unusual but catastrophic complication with poor prognosis. For patients at high risk of infective endocarditis or those presenting with concerning symptoms such as fever, heart failure, or systemic embolism, prompt echocardiography, including TEE if needed, should be performed for early diagnosis. Additionally, an appropriate perioperative antibiotic regimen is crucial for preventing infection and improving outcomes.

Abbreviations

TMViVR	Transcatheter valve-in-valve replacement
IE	Infective endocarditis
BVF	Bioprosthetic valve failure
PVE	Prosthetic valve endocarditis
TTE	Transthoracic echocardiogram
TEE	Transesophageal echocardiography
CCU	Cardiology Intensive Care Unit
PCT	Procalcitonin
CRP	C-reactive protein
TAVR	Transcatheter aortic valve replacement
SAVR	Surgical aortic valve replacement
AE-CHF	Acute exacerbation of chronic heart failure

Supplementary Information

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Supplementary Material 1: Supplementary Fig. 1: Timeline of past medical history. IE, infective endocarditis; MVR, mitral valve replacement; AF, atrial fibrillation; CKD, chronic kidney disease; AE-CHF, acute exacerbation of chronic heart failure; PVE, prosthetic valve endocarditis; TMViVR, transcatheter valve-in-valve replacement

Supplementary Material 2: Video 1: Parasternal long-axis view. Prosthetic mitral valve vegetations are visible in the parasternal long-axis view, with a larger vegetation located on the posterior leaflet, exhibiting marked mobility during the cardiac cycle

Supplementary Material 3: Video 2: Apical 4-chamber view. The apical 4-chamber view highlights the presence of prosthetic mitral valve vegetations, with marked mobility during the cardiac cycle

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ZJW: Image and clinical data acquisition; ZJW and LSY analyzed and interpreted the patient data, wrote and edited the manuscript; YFJ guided the analysis of this case; YFJ and LJ contributed to the manuscript review and editing.

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Data availability
The images and data used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Declarations

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Not applicable.

Consent for publication
Informed written consent was obtained from the patient's authorized representative for the publication of this case report and any accompanying images.

Competing interests
The authors declare no competing interests.

Clinical trial number
Not applicable.

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