Rapid Progression of Bioprosthetic Aortic Valve Endocarditis: From Paraprosthetic Abscesses into Tricuspid Valve Infiltration

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Abstract
We present a case of prosthetic valve endocarditis (PVE) in a 49-year-old gentleman with a history of bioprosthetic valve replacement following infective endocarditis of the aortic valve. He was pyrexial on arrival and electrocardiogram showed complete heart block. Transthoracic echocardiography and transoesophageal echocardiography revealed evidence of multiple echogenic, hypodensities within the paraprosthetic regions of the aortic bioprosthetic valve, suggestive of para-valvular abscesses, and infiltration into the right ventricle via the septal leaflet of the tricuspid valve. Early PVE is often nosocomial and ultimate management include radical debridement and major reconstruction with an expectedly high risk for mortality and post-operative complications.

Keywords
Bioprosthetic valve, infective endocarditis, paraprosthetic abscess, aortic valve, case report

Introduction
Prosthetic valve endocarditis (PVE) is an uncommon complication following surgical valve replacement. We present an unfortunate case of PVE in a patient undergoing regular haemodialysis, and its rapid dissemination within a short duration of time, captured on both transthoracic (TTE) and transoesophageal echocardiography (TOE).

Case Presentation
A 49-year-old gentleman was referred to the cardiology services following persistent fever despite prolonged duration of intravenous antibiotics. The patient was recently diagnosed with end-stage renal failure (ESRF) and was commenced on haemodialysis, using a central venous catheter (CVC), approximately 8 weeks ago. Unfortunately, this was complicated by catheter-related bloodstream infection which the patient was treated for using intravenous vancomycin as blood cultures grew methicillin-resistant Staphylococcus aureus. The concern at the time due to unremitting fever was possible infective endocarditis. A TTE, and later TOE, were performed revealing multiple flailing masses originating from the aortic valve, with associated severe aortic regurgitation (Figure 1). The patient was, thus, referred to the cardiothoracic services and underwent bioprosthetic aortic valve replacement with post-operative anticoagulation for 3–6 months as per guidelines.¹ However, this meant delays in him obtaining an arteriovenous fistula for dialysis purposes during this period, and the patient was reliant on a newly sited CVC.

Unfortunately, the patient presented again to our hospital with 3-months history of lethargy, anorexia and weight loss. By then, it had been 6-months from his previous aortic valve replacement. His vital signs on arrival include a blood pressure of 105/78 mmHg, pulse rate of 42 beats per minute, respiratory rate of 14 per minute and oxygen saturation of 98% on room air and temperature of 38.5°C. Precordial examination revealed no audible murmurs. However, electrocardiogram demonstrated high-degree atrioventricular dissociation (Figure 2).

The patient further deteriorated on day 2 of admission, warranting intubation and mechanical ventilation alongside insertion of a pacing wire. Furthermore, in view of having had a recent valve replacement, an urgent TTE was...
performed revealing evidence of multiple hypodensities within the paraprosthetic regions of the aortic bioprosthetic valve, suggestive of paravalvular abscesses (Figure 3). Further imaging, via a TOE, was performed which demonstrated turbulent flow through the bioprosthetic valve, suggestive of prosthetic obstruction, alongside earlier mentioned abscesses. There was also evidence of a hyperechoic, flailing mass on the bioprosthetic valve, suggestive of a vegetation (Figure 3). Furthermore, although initially missed, there was subtle evidence of septal wall infiltration and possible tricuspid valve involvement from previous echocardiography (Figure 4). Following a rapid deterioration a repeat TTE, and later a TOE (as the patient’s body habitus and ongoing ventilation had resulted in even poorer transthoracic windows) on day 5 of admission were performed, which were able to demonstrate the septal wall and tricuspid valve

**Figure 1.** Transthoracic echocardiography in (a) parasternal long-axis view and transoesophageal echocardiography in (b) mid-oesophageal 120° view, both demonstrating flailing masses (white arrows) arising from the aortic valve, suggestive of vegetation. On colour-flow imaging, there was turbulent jets (red arrows) suggestive of severe aortic regurgitation. (c) Continuous-wave Doppler along the aortic valve showing a triangular-shaped pattern and (d) pulse-wave Doppler on the abdominal aorta demonstrating holo-diastolic reversal flow, both supportive of severe aortic regurgitation. Ao = aorta, LA = left atrium, LV = left ventricle, RV = right ventricle. 478 × 261mm (144 × 144 DPI).

**Figure 2.** Electrocardiogram demonstrating high-degree atrioventricular conduction defect (i.e. complete heart block). 808 × 355mm (72 × 72 DPI).
infiltration clearly (Figure 4). Blood cultures, both from peripheral and CVC sampling, performed on admissions grew *methicillin-resistant Staphylococcus epidermidis* (MRSE), warranting removal of his dialysis CVC and commencement of intravenous vancomycin as the organism was sensitive to it. Early cardiothoracic consult was obtained with plans for emergent redo operation with aortic root debridement and placement of a homograft initially. Unfortunately, the patient deteriorated rapidly, requiring up to three different intravenous vasopressors, and had succumbed to his illness before surgical management could take place.

**Discussion**

PVE accounts for 20% of total infective endocarditis cases. Studies have shown higher rates of infective endocarditis in bioprosthetic, versus mechanical valve replacements, highlighting the need for careful patient selection prior to surgery. Although international guidelines recommend the use of bioprosthetic valves ideally in patients over the age of 65–70 years, there has been an increasing interest in implanting such valves in younger patients over the past decade, whilst taking into account comorbidities and patient preference when selecting type of prosthesis. As seen in our case, despite his age, a bioprosthetic valve was felt to be a better option to circumvent the risk and inconvenience of being on long-term anticoagulation.

Early PVE (occurring within 12 months of valve replacement) however remains a unique entity. Risk factors predisposing to its development include concomitant infections from wounds, urinary tract, lungs and intravascular catheter infections. Early PVE is often nosocomial, and common organisms include MRSE, gram-negative bacilli, fungi and other HACEK group organisms. Early PVE rarely affects the leaflets, but instead commonly involves paravascular tissue as it often develops following presence of a nidus for infection (i.e. sewing ring, annulus and sutures which have not endothelialised) leading to abscess formation, valve dehiscence and paraprosthetic leaks and fistula formation.

A unique aspect of our case is the involvement of the tricuspid valve. Although rare, it has been previously reported. As demonstrated in our case, progression of the paravalvular abscesses within the Koch triangle area surrounding the atrioventricular node likely led to fistulisation and dissemination into the right ventricle through the septal portion of the tricuspid valve. Further, imaging using CT would have been useful in our case, to not only visualize the extension of the paravalvular abscess but help visualize tricuspid valve involvement as well. However, the patient was too ill to undergo additional imaging, aside from that done by the bedside. Ideally, our patient should have underwent urgent surgical intervention in view of having early PVE, evidence of obstructive valve lesion, poor response to antibiotics with evidence of dissemination and haemodynamic instability. Such intervention would often include radical debridement and major reconstruction with an expectedly high risk for mortality and post-operative complications.

There were several learning points from our case. Firstly, the patient had delays in AV fistula creation due to ongoing

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**Figure 3.** Transthoracic (a and b) and transoesophageal (c and d) echocardiography revealing evidence of multiple hypodensities surrounding the paraprosthetic regions of the aortic bioprosthetic valve, suggestive of paravalvular abscesses (white arrows), alongside a hyperechoic, flailing mass on the bioprosthetic valve, suggestive of a vegetation (red arrows). Colour-flow imaging also demonstrated turbulent flow (green arrows) through the bioprosthetic valve, suggestive of transvalvular prosthetic obstruction. There was no paravalvular or transvalvular regurgitation or note. Ao = aorta, LA = left atrium, LV = left ventricle, RA = right atrium, RV = right ventricle. 408 × 224mm (144 × 144 DPI).
anticoagulation. However, being a bioprosthetic valve, a much shorter duration of anticoagulation, or no anticoagulation at all would have been reasonable alternatives, although risk of bioprosthetic valve thrombosis would then be present. The option of swapping from warfarin to peri-procedural unfractionated or low-molecular weight heparin during the time of AV fistula creation would have been a reasonable consideration as well as opposed to delaying and leaving the patient on an indwelling central venous catheter whilst having a bioprosthetic valve in situ.

Secondly, this case emphasizes the importance of both patient and clinician education in being vigilant when looking after immunosuppressed patients, such as those with ESRF, with prosthetic valves. As seen in our patient, aside from having an ongoing potential source of infection (CVC), his clinical presentations of sepsis were atypical and subtle, in the form of constitutional symptoms, leading to delays before re-presenting to our hospital.

Conclusion
Although not entirely uncommon, early PVE and paraprosthetic abscesses remain difficult to manage clinically. Rarely, tricuspid valve involvement occurs which complicated further surgical management planning. Early recognition and diagnosis remains key in improving overall prognosis.

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Author Contributions
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Figure 4. Initial transoesophageal echocardiography (TOE) done on day 2 of admission, in the (a) transgastric inflow view at 149° angle showed a hyperechoic mass (white arrows) in the septal portion of the leaflet which was initially missed. Following deterioration, repeat (b) transthoracic in parasternal modified right inflow view and (c) TOE transgastric en-face view at 53° angle were performed on day 5 of admission demonstrated the mass (white arrows) which was far clearer by then. (d) X-plane imaging on TOE was also performed to help delineate that the mass originated from the septal portion of the tricuspid valve, and not the pacing wire (red arrows) inserted several days prior. LA = left atrium, LV = left ventricle, RA = right atrium, RV = right ventricle. 422 × 306mm (144 × 144 DPI).
Data Availability
The data that support the findings of this study are available from UiTM Sungai Buloh but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of UiTM Sungai Buloh.

Ethics Approval
Ethics approval was waived by the Universiti Teknologi MARA (UiTM) Sungai Buloh Ethics Committee due to the nature of the manuscript (i.e. case report). The manuscript DOES NOT report on any animal data or tissue.

Informed Consent
Consent was obtained from the patient to publish details of the case anonymously.

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