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Anaesthesia Management in Mitral Paravalvular Leak Closure Using AVP II Device Percutaneously – Case Report

Maitri Shah[1], Namrata Kothari[1]

Abstract

Mitral paravalvular leak (PVL) is a complication following mitral valve replacement that can cause heart failure and haemolysis. Percutaneous closure using the Amplatzer Vascular Plug II (AVP II) device is a less invasive alternative to surgical repair. Anaesthetic management presents challenges due to patient comorbidities, hemodynamic instability, and the need for precise imaging guidance. We report a case of percutaneous mitral PVL closure under anaesthesia, detailing preoperative assessment, intraoperative hemodynamic monitoring, transoesophageal echocardiography (TEE) guidance, and post-procedure care. Considerations include anaesthesia technique selection, anticoagulation management, and potential complications such as arrhythmias and embolization. This case highlights the crucial role of anaesthesiologists in optimizing patient outcomes in structural heart interventions. By addressing perioperative challenges, anaesthesiologists enhance the safety and success of these procedures, contributing valuable insights to anaesthesia management in interventional cardiology.

Keywords: Anaesthesia, Mitral valve (MV), Paravalvular leak (PVL), Device closure procedure (DCP), Amplatzer Vascular Plug II (AVP II), Transoesophageal echocardiography (TEE)

Introduction

Paravalvular leak (PVL) is a recognized complication following surgical or transcatheter valve replacement, typically due to an incomplete seal between the prosthetic valve and surrounding tissue. The incidence is reported to be 2–10% for aortic valves and 7–17% for mitral valves [1]. PVLs are more frequent in mechanical prostheses than bioprosthetic valves, due to factors such as suture dehiscence, calcification, or endocarditis [2].

Mild PVLs are often asymptomatic, but moderate to severe leaks can result in heart failure, haemolysis, or infective endocarditis, necessitating intervention [3]. Redo cardiac surgery is associated with a high operative mortality (15–20%) and reduced long-term survival [3]. Therefore, percutaneous device closure (DCP) has emerged as a less invasive and increasingly preferred option with significantly lower morbidity and mortality (<5%) [4].

Various closure devices have been used, including the Amplatzer Vascular Plug II–IV, Occlutech plugs, and septal occluders [5]. Accurate preprocedural imaging using cardiac CT, 3D transoesophageal echocardiography (TEE), and sometimes 4D flow MRI is essential for assessing anatomy and guiding intervention [6, 7].

Case Report

We present the case of a 71-year-old gentleman with multiple comorbidities, including diabetes, hypertension, hypothyroidism, chronic atrial fibrillation, anaemia, and ischemic heart disease. He presented with NYHA Class III heart failure symptoms, having been admitted four times in the past six months for decompensated heart failure. He had a history of mitral valve replacement with a 27 mm St. Jude mechanical valve in 2008 and prior CABG.

On examination, the patient appeared cachectic, with hypotension, elevated JVP, pallor, and pedal oedema. Auscultation revealed basal crepitations, wheezing, and a pansystolic murmur. Investigations confirmed moderate PVL with a regurgitant jet in the anterolateral direction, an ejection fraction of 40%, severe left atrial dilation (87 mm), and pulmonary artery pressures of 68/28 mmHg. The patient was on chronic warfarin therapy, diuretics, beta-blockers, statins, and thyroxine.

Given the high risk of redo surgery, a percutaneous PVL closure was planned using an AVP II device. After preoperative optimisation, and general anaesthesia induction with etomidate, midazolam, fentanyl, and atracurium, the procedure was performed under fluoroscopic and TEE guidance. A transseptal puncture was performed and a 10×7 mm AVP II device was deployed across the defect.

Post-procedural TEE confirmed proper device placement, with elimination of the mitral regurgitation and a reduction in pulmonary artery pressures. The patient was extubated in the cath lab and transferred to ICU. Oral anticoagulation was restarted, and the patient was discharged on post-procedure day 4 with significant symptomatic improvement at follow-up.

[1]Department of Anaesthesia, Lilavati Hospital & Research Centre, Mumbai, Maharashtra, India.

Address of Correspondence
Dr. Namrata Kothari,
Department of Anaesthesia, Lilavati Hospital & Research Centre, Mumbai, Maharashtra, India.
E-mail: drnamrata.kothari@gmail.com

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Procedure & Anaesthetic Management

Anaesthetic management in percutaneous PVL closure is complex due to the patient's comorbidities, the potential for hemodynamic instability, and the need for high-quality imaging. Etomidate was chosen for induction to avoid hypotension in a patient with reduced ejection fraction. Atracurium was used for muscle relaxation given the patient's impaired renal function. Noradrenaline was titrated to maintain mean arterial pressure (MAP) above 60 mmHg.

Careful fluid management and CVP monitoring were crucial to prevent pulmonary congestion. The use of general anaesthesia enhances patient immobility and image acquisition for 3D TEE, critical for device deployment and leak closure.

Arrhythmias are a known complication during transseptal puncture and device manipulation; amiodarone was kept ready, and defibrillator pads were applied prophylactically. The entire procedure was conducted with a heart team approach in a hybrid lab setting.

Discussion

PVL is a serious but treatable complication after mitral valve replacement, particularly in patients with mechanical prostheses. Contributing factors include infection, tissue fragility, annular calcification, and suture dehiscence [2]. Clinical symptoms vary from fatigue and dyspnoea to haemolysis and recurrent heart failure.

Diagnostic confirmation relies on 2D TTE and detailed 3D TEE imaging, with 4D flow MRI providing hemodynamic insights in select cases [6, 7]. In this case, a heart team approach and multimodal imaging were crucial in selecting percutaneous device closure as the best option, avoiding the higher risks associated with surgical redo [3, 4].

Anaesthetic goals include maintenance of stable hemodynamics, avoidance of excessive fluids, and readiness to treat complications such as arrhythmias, embolization, or valve dysfunction [8, 9]. The use of balanced anaesthesia, careful drug selection, and appropriate monitoring contributed to procedural success in our patient.

Current evidence supports the use of AVP II for mitral PVL closure, with high technical success, symptomatic relief, and a favourable safety profile [5].

Conclusion

Percutaneous PVL closure with the AVP II device is a less invasive and effective treatment for symptomatic mitral PVLs, especially in high-risk surgical patients. Successful outcomes depend on meticulous preoperative evaluation, experienced imaging guidance, and vigilant anaesthetic management. Anaesthesiologists play a central role in ensuring intraoperative stability, recognising complications early, and contributing to overall procedural success.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his/her consent for his/her images and other clinical information to be reported in the Journal. The patient understands that his/her name and initials will not be published, and due efforts will be made to conceal his/her identity, but anonymity cannot be guaranteed.

Conflict of interest: Nil **Source of support:** None

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