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Case Report

Anesthetic Management of a High-Risk Patient with Mechanical Valve Prostheses Undergoing Open Cholecystectomy: A Case Report

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ABSTRACT

Worldwide, about 13% of the 200,000 annual recipients of prosthetic heart valves present for various non-cardiac surgical procedures When such cases present, both the anesthesiologist and the surgeon have to deal with the perioperative management of anticoagulation and a host of other issues involved and the potential for hemodynamic compromise. We report the perioperative management of a 65-year-old female with mechanical aortic and mitral valve prostheses, reduced ejection fraction, and pulmonary hypertension requiring cholecystectomy. Comprehensive preoperative optimization, anticoagulation bridging, meticulous perioperative monitoring, and cardiac-stable anesthetic techniques ensured an uneventful intraoperative and postoperative course.

Introduction

The anesthetic management of patients with mechanical aortic and mitral valve prostheses is challenging due to mandatory anticoagulation, increased thromboembolic risk, altered hemodynamics, and frequent coexistence of left ventricular dysfunction and pulmonary hypertension [1-2].

Management of these patients for non-cardiac surgeries is a challenge.

Preoperative evaluation involves cardiac assessment for valvular function, residual pathology, infective endocarditis, functional status, assessment of anticoagulation with risk of intraoperative bleeding, and preparation for reversal of anticoagulant if needed intraoperatively.

We present the successful management of such a high-risk patient posted for open cholecystectomy.

Case Report

A 65-year-old female (61 kg, BMI-27.1 kg/sq m) presented with right upper quadrant abdominal pain for three months. The pain radiated to the right hypochondrium and was associated with intermittent episodes of biliary colic.

She had a history of mechanical mitral and aortic valve replacement (double valve replacement) 3 years back, post which she was on oral warfarin therapy of 2 mg/day. She also reported a prior history of DVT 1 year back. She had no history of breathlessness; her functional status was noted to be NYHA I, METs 4.

On examination, an irregularly irregular pulse of 55 beats per minute, blood pressure 110/70 mmHg, and room air SpO_2 of 98% were noted. Pallor was present. Airway was adequate with Mallampati grade II.

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Cardiovascular examination was positive for audible valve clicks on auscultation, with no murmurs. Neurological examination was inconclusive for any neural deficits, ruling out any impairment due to thromboembolism in the past.

Investigations revealed a hemoglobin of 11.3 g/dL and a platelet count of 3.75 lakh/mm³. The coagulation profile showed PT/INR to be 12.6 sec/1.04 and an APT of 33 sec. Cardiac markers Trop I, CKMB, and all other routine investigations were within normal limits.

ECG showed T-wave inversion in V1–V3, and APCs. An ejection fraction of 45% was noted on echocardiography with LV hypokinesia in the inferior and lateral walls, normally functioning mechanical MVR and AVR, a mild paravalvular leak, and moderate pulmonary hypertension.

The cardiology team advised that Warfarin be withheld at least 3 days prior to the surgery and bridged with LMWH 1 mg/kg. Considering low EF and risk of hemodynamic deterioration with pneumoperitoneum, the plan was changed from laparoscopic to open cholecystectomy. Preoperatively, packed red blood cells, fresh frozen plasma, and protamine were reserved for emergency use in case of undue bleeding during the surgery. She was advised antibiotics for infective endocarditis prophylaxis.

On arrival in the operation theater, monitors were attached as per ASA standards, and premedication was administered. Anesthesia was induced with etomidate 0.3 mg/kg, fentanyl 2 mg/kg, and rocuronium 1.2 mg/kg. A 7mm ETT was secured and anesthesia was maintained with sevoflurane, oxygen, and air. An arterial line in the left radial artery and a central venous catheter in the right internal jugular vein were secured under ultrasound guidance. Neuromuscular block was maintained with intermittent doses of Inj. Vecuronium 1 mg every 30 minutes. Intraoperative blood loss of 650 ml was replaced by packed red cells. Continous ECG monitoring was ensured throughout the surgery to look for signs of any atrial fibrillation.

The patient remained hemodynamically stable. No arrhythmias or hypotensive episodes were noted. A transdermal fentanyl patch releasing the drug at 25mcg/hour was used for postoperative analgesia. Neuromuscular blockade was reversed with Inj. Sugammadex, and the patient was extubated uneventfully. She was shifted to ICU for postoperative monitoring. No cardiac events were reported in the postoperative period. Four hours after the surgery, as the abdominal drains did not show any undue bleeding, it was decided to administer the next dose of LMWH. Warfarin was restarted as per cardiology protocol. The patient was transferred to the ward on postoperative day 2 in stable condition.

Discussion

Patients with double mechanical valve replacements represent a uniquely vulnerable cohort in

whom even minor hemodynamic perturbations can precipitate major complications. The presence of both aortic and mitral prosthetic valves results in a relatively fixed cardiac output state, making the maintenance of adequate preload, controlled ventricular afterload, and a stable heart rate crucial for ensuring optimal transvalvular flow [3]. Consequently, anaesthetic management requires careful preoperative assessment and planning, with particular emphasis on maintaining haemodynamic stability throughout the perioperative period.

A major perioperative challenge is anticoagulation management. Mechanical prostheses confer a lifelong risk of valve thrombosis and systemic embolization; consequently, any interruption of anticoagulation must be minimized. Coordination with cardiology team is crucial to balance thrombotic risk against surgical bleeding by reviewing anticoagulation history, current INR, and recent echocardiography to evaluate prosthetic valve function, ventricular performance, and pulmonary artery pressures.

Pulmonary hypertension significantly increases the risk of right ventricular failure. Care should be taken to avoid hypoxia, hypercarbia, and high airway pressures, as these can further increase pulmonary vascular resistance. Anaesthetic induction and maintenance should be planned to minimise sympathetic stimulation and avoid sudden changes in systemic vascular resistance, helping to maintain adequate coronary perfusion—an important consideration, particularly in patients with a mechanical aortic valve [4].

As atrial fibrillation is common and adequate ventricular filling is crucial for maintaining cardiac output, preserving sinus rhythm and preventing tachyarrhythmias are important perioperative priorities.

The creation of pneumoperitoneum to undertake a laparoscopic surgery as planned initially in this case poses significant risks, like increased intra-abdominal pressure during CO2 insufflation can reduce venous return, elevate afterload, and impair ventricular filling—effects that are poorly tolerated in individuals with fixed valvular orifices and diastolic-dependent prosthetic mitral flow.

Carbon dioxide absorption further contributes to hypercarbia and sympathetic activation, potentially provoking tachycardia, pulmonary hypertension, and arrhythmias [5]. Therefore, it was decided to proceed with an open approach and thereby maintain the safest possible cardiovascular conditions throughout the procedure.

Our goal here was to devise a strategy for careful anticoagulation management, avoidance of tachycardia,

maintenance of stable preload and afterload, watching for any evidence of pulmonary hypertension and arrhythmias, and avoidance of abrupt hemodynamic swings at induction and emergence to ensure a successful outcome.

The primary goals of intraoperative management were to maintain cardiovascular stability and avoid haemodynamic fluctuations that could adversely affect prosthetic valve function. Etomidate was selected for induction because of its favourable cardiovascular profile and minimal haemodynamic effects [6]. An arterial line was placed to allow continuous beat-to-beat blood pressure monitoring. Mechanical ventilation was carefully managed to avoid hypercarbia and excessive airway pressures, thereby minimising the risk of increased pulmonary vascular resistance and perioperative arrhythmias.

Throughout the procedure, care was taken to avoid tachycardia in order to maintain adequate diastolic filling across the prosthetic mitral valve. Smooth emergence was prioritized to avoid sympathetic surges that could trigger arrhythmias or increase myocardial oxygen demand.

Postoperative care requires vigilant monitoring in an intensive care setting. Continuous haemodynamic monitoring is essential in the postoperative period to detect early signs of cardiovascular instability. Anticoagulation should be restarted as soon as it is safe to do so, with careful consideration of the competing risks of prosthetic valve thrombosis and postoperative bleeding.

Patients should also be monitored closely for pulmonary oedema, which may occur as a result of impaired diastolic filling or perioperative fluid shifts. Overall, postoperative management should focus on maintaining haemodynamic stability, preserving prosthetic valve function, and promoting safe recovery in this high-risk patient population with limited physiological reserve.

Conclusion

The anaesthetic management of patients with double mechanical valve replacements is challenging because of their dependence on stable haemodynamics, altered transvalvular flow dynamics, and increased risk of thromboembolic and arrhythmic complications. This case underscores the importance of thorough preoperative assessment, vigilant intraoperative monitoring, and coordinated postoperative care to maintain cardiovascular stability and ensure optimal prosthetic valve function. Careful selection of anaesthetic agents, avoidance of abrupt haemodynamic changes, and timely resumption of anticoagulation are key elements of safe perioperative management. Ultimately, successful outcomes in these complex patients rely on a well-planned, multidisciplinary approach tailored to their unique physiological and surgical needs.

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