DOI: 10.7860/JCDR/2025/78853.21063

Case Report

Anaesthesia Section

Thoracic Anaesthesia in a Patient with Mechanical Mitral Valve: A Case Report

SHILPA SARANG KORE[1], REEM BARKAT KHATIB[2], SHUBHANGI VIJAY HUMANE[3]

ABSTRACT

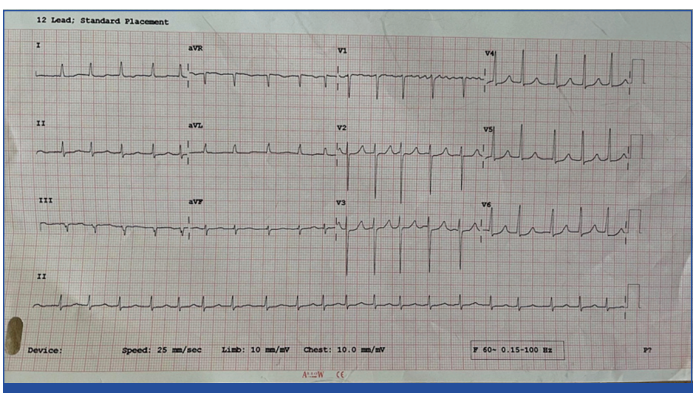
Oesophageal diverticulum is a rare condition characterised by an outpouching of the oesophageal wall, often associated with dysphagia, regurgitation, and a risk of aspiration. Surgical resection, typically via thoracotomy, presents significant anaesthetic challenges, particularly in patients with pre-existing cardiac disease requiring One-lung Ventilation (OLV). Patients with Rheumatic Valvular Heart Disease (RVHD), Atrial Fibrillation (AF), and prosthetic mitral valves pose additional perioperative risks, including haemodynamic instability, anticoagulation management, and pulmonary complications. Hereby, the authors present case of a 49-year-old male with longstanding RVHD, Mitral Valve Replacement (MVR), and left ventricular systolic dysfunction (ejection fraction 35%) who presented with worsening dysphagia, regurgitation, and dyspnoea. Imaging confirmed a 50×49×86 mm oesophageal diverticulum with bilateral pleural effusion. Preoperative optimisation included anticoagulation management, rate control for AF, and pleural drainage. The patient underwent oesophageal diverticulectomy under general anaesthesia with a left-sided double-lumen tube and thoracic epidural analgesia. Intraoperative challenges included transient AF, hypotension requiring vasopressors and inotropes, and desaturation during OLV, all of which were managed with recruitment manoeuvres and apnoeic oxygenation. Postoperatively, anticoagulation was restarted, and the patient was extubated on day two without complications. The present case underscores the importance of meticulous perioperative planning, haemodynamic monitoring, and multidisciplinary coordination in managing complex cardiac patients undergoing thoracic surgery. A tailored anaesthetic approach focusing on oxygenation, cardiac stability, and balancing anticoagulation is crucial for optimal outcomes.

Keywords: Atrial fibrillation, Left ventricular dysfunction, Oesophageal diverticulum, One-lung ventilation, Rheumatic valvular heart disease

CASE REPORT

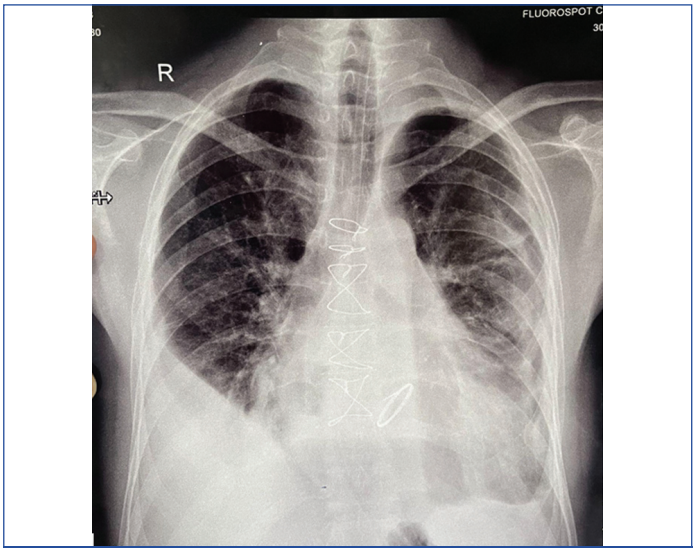
A 49-year-old male presented with a one-month history of worsening nausea, vomiting, dysphagia, productive cough, and dyspnoea while lying supine, classified as Modified Medical Research Council (MMRC) grade 4, which improved when propped up. He had been diagnosed with RVHD at 25 years of age and had been on warfarin 5 mg daily for 24 years. He underwent MVR, left atrial reduction, and tricuspid annuloplasty two years prior. He also had a history of hypertension for 23 years, managed with telmisartan 40 mg and metoprolol 5 mg.

On examination, he was afebrile with a pulse of 116 beats per minute, blood pressure of 130/80 mmHg, a respiratory rate of 26 breaths per minute, and an Oxygen Saturation (SpO_2) of 92%. Auscultation revealed bilateral coarse crepitations and loud heart sounds. A 12-lead Electrocardiogram (ECG) showed AF with Rapid Ventricular Rate (RVR) [Table/Fig-1]. Echocardiography revealed an ejection fraction of 35%, global left ventricular hypokinesia, a dilated left atrium, mild Pulmonary Artery Hypertension (PAH), and a normally functioning mitral valve prosthesis.



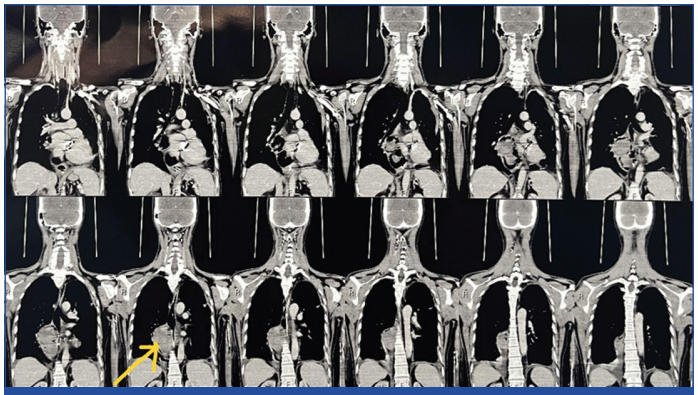
[Table/Fig-1]: 12 Lead ECG showing AF with Rapid Ventricular Rate (RVR).

Chest X-ray showed cardiomegaly, right pleural effusion, left-sided costophrenic angle haziness, sternotomy sutures, and a mechanical mitral valve prosthesis [Table/Fig-2]. Computed Tomography (CT) of the thorax identified a 50×49×86 mm lesion near the lower oesophagus communicating with the lumen, along with bilateral pleural effusion [Table/Fig-3,4]. Barium swallow and upper gastrointestinal endoscopy facilitated further evaluation [Table/Fig-5-7]. Thoracic ultrasound confirmed right pleural effusion (900-1000 cc), from which 600 cc was drained via ultrasound-guided thoracentesis. Laboratory investigations were within normal limits.

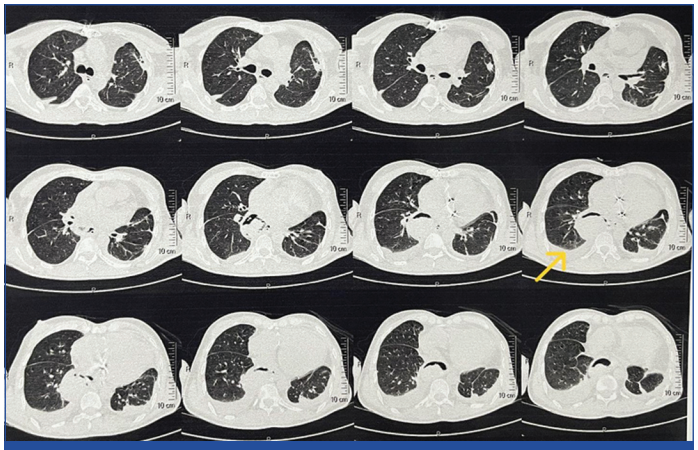


[Table/Fig-2]: Preoperative chest X-ray showing right pleural effusion and mechanical valve prosthesis.

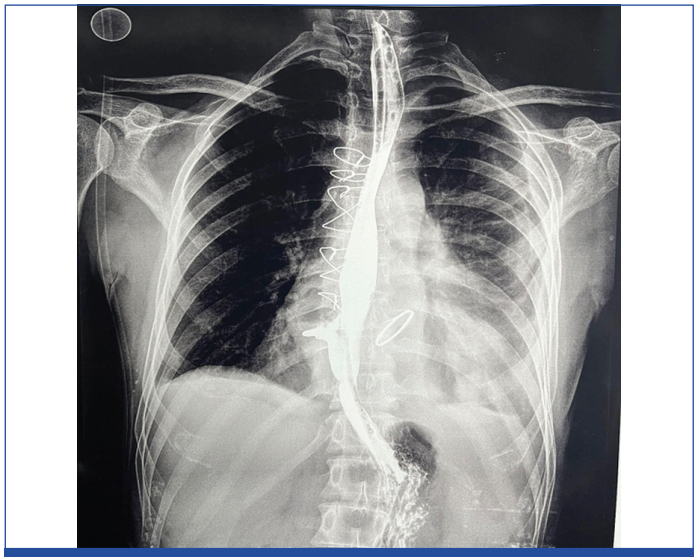
The patient was classified as American Society of Anaesthesiologists III (ASA-III) and was planned for oesophageal diverticulectomy under



[Table/Fig-3]: The CT chest demonstrates a well-defined soft-tissue lesion along right lateral wall of lower one third of oesophagus measuring approximately 50×49×86 mm.



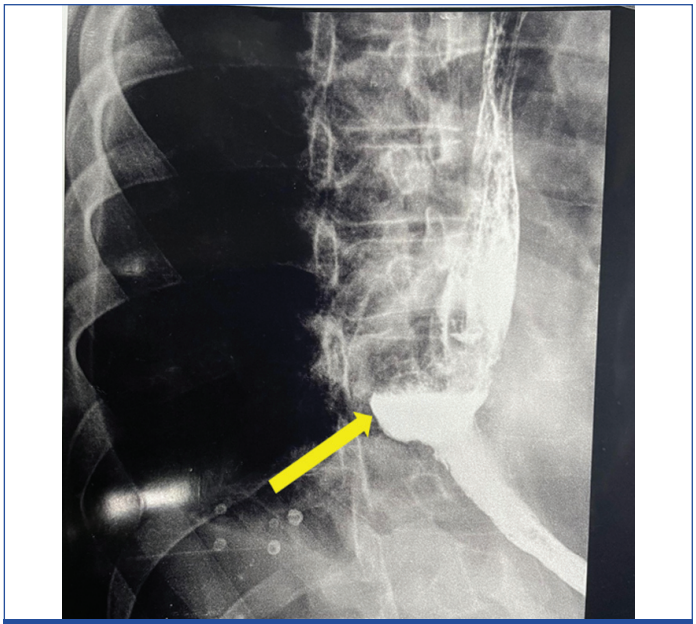
[Table/Fig-4]: The CT image showing pleural effusion, right more than left.



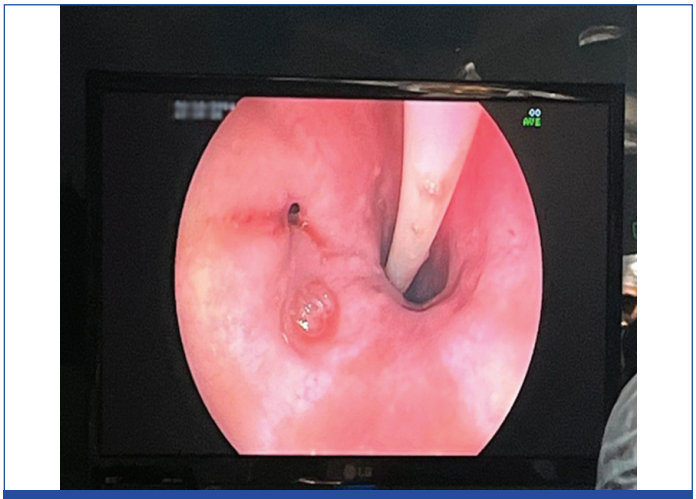
[Table/Fig-5]: Barium swallow showing dilatation of proximal oesophagus.

general anaesthesia with a left-sided Double-lumen Tube (DLT) and thoracic epidural analgesia, following informed consent for high-risk surgery and postoperative ventilation. Warfarin was withheld, and bridging therapy with aspirin 75 mg daily and subcutaneous Low Molecular Weight Heparin (LMWH) 40 mg twice daily was initiated, with the latter stopped 12 hours preoperatively. The Prothrombin Time/International Normalised Ratio (PT/INR) 12 hours after the last LMWH dose were 15/1.26. Metoprolol 5 mg was continued on the morning prior to surgery, and adequate blood and blood products were reserved.

On the day of surgery, the nil by mouth status was confirmed. Two 18G intravenous peripheral accesses were secured. The patient received ondansetron 4 mg, pantoprazole 40 mg, and metoclopramide 10 mg for aspiration prophylaxis, along with hydrocortisone 100 mg, dexamethasone 8 mg, and prophylaxis for infective endocarditis with ampicillin 1.5 g and gentamicin 80 mg.



[Table/Fig-6]: Barium swallow showing narrowing with hold up of barium in lower one third of oesophagus.



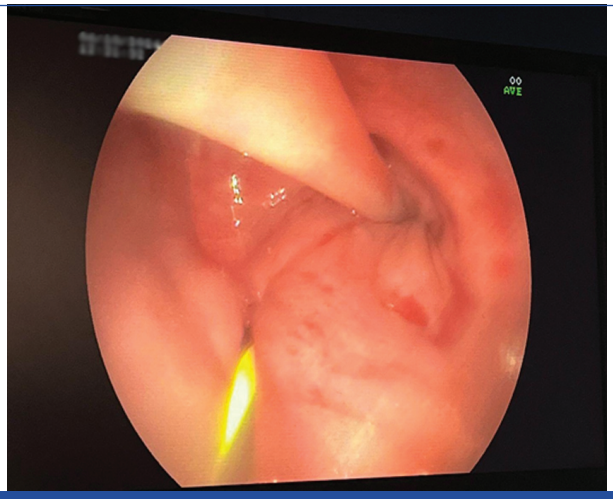
[Table/Fig-7]: Diverticulum opening as seen on endoscopy.

Inside the operating theatre, all standard monitors were attached. Invasive monitoring included a 7 French right internal jugular vein central line placed in a propped-up position under ultrasound guidance, and a 20-gauge right radial artery line, both established under stringent aseptic precautions and local anaesthesia. An epidural catheter was placed between the T8-T9 intervertebral space.

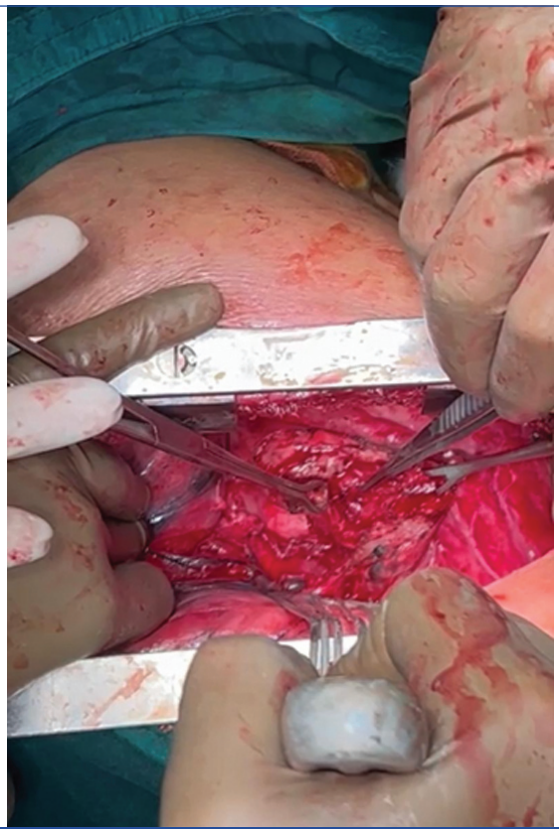
Airway preparation involved infiltration of 2% lignocaine in the anterior tonsillar fossa, a transtracheal block using 3 cc of 4% loxicard, and a bilateral glossopharyngeal nerve block using a 26G Quincke Babcock spinal needle. Anaesthesia induction included pre-oxygenation with 100% oxygen for three minutes, followed by intravenous midazolam (0.02 mg/kg) and fentanyl (2 mcg/kg). Rapid sequence induction was performed with intravenous etomidate (0.3 mg/kg) and rocuronium (1.2 mg/kg) while applying cricoid pressure.

The patient was intubated using a left-sided 37 French DLT with a C-Mac videolaryngoscope, and proper placement was confirmed via capnography and auscultation. Maintenance of anaesthesia was achieved with oxygen, air, sevoflurane, and vecuronium on Volume-Controlled Ventilation (VCV). A 16 French nasogastric tube was inserted, and normothermia was maintained with a nasopharyngeal temperature probe. A test dose of 2% lignocaine with adrenaline was given, followed by 6 mL of 0.25% bupivacaine epidurally before surgery, with subsequent intermittent boluses administered based on vital signs to attenuate the pressor response.

Intraoperatively, the patient developed AF, which reverted to sinus rhythm following an intravenous infusion of 150 mg amiodarone. Concurrent hypotension was managed with a bolus of phenylephrine (1-2 µg/kg), an infusion of nor adrenaline (0.05 µg/kg/min), and inotropic support with an infusion of milrinone (0.5 mcg/kg/min). Arterial Blood Gas (ABG) analysis revealed normal parameters. An attempt at a transabdominal thoracoscopic approach to access the diverticulum was unsuccessful, necessitating a right open thoracotomy [Table/Fig-7,8]. Once the patient was positioned in the left lateral decubitus, DLT placement, right lung isolation, and left lung ventilation were reconfirmed [Table/Fig-9,10]. VCV was set at a tidal volume of 3-4 mL/kg, with Positive End Expiratory Pressure (PEEP) at 5 cm H_2O, and minimal driving pressures. The respiratory rate and fraction of inspired oxygen (FiO_2) were adjusted based on ABG, End-tidal Carbon Dioxide ($EtCO_2$), and SpO_2 values. Ten minutes after repositioning, the patient desaturated to 80%, which was managed with intermittent manual two-lung ventilation using 100% FiO_2, confirming the DLT position, suctioning, reducing the concentration of sevoflurane, and optimising Cardiac Output (CO) with vasopressors and inotropes. A recruitment manoeuvre was conducted on the ventilated lung with a pressure of 20 cm H_2O for 20 seconds, followed by a PEEP of 6 cm H_2O. Apnoeic oxygen insufflation was provided at 3 L/min to the non dependent lung via a suction catheter.



[Table/Fig-8]: Diverticulum opening confirmed via endoscopic guidewire.



[Table/Fig-9]: Diverticulum wall opened and its opening into oesophagus closed with sutures in right lung isolation.

[Table/Fig-10]: Right lung isolated with left sided double lumen tube in left lateral position.

Blood loss was 400 mL, while 600 mL of pleural fluid was drained, and this was replaced with one packed cell volume and restricted crystalloids. At the end of surgery, the DLT was replaced with a single-lumen endotracheal tube. The patient was transferred to the intensive care unit, intubated, and on inotropic support, with analgesia maintained via a continuous epidural infusion of 0.125% bupivacaine. A second dose of ampicillin 1.5 g was administered during the postoperative period to the patient, six hours after the last dose.

The patient was extubated on postoperative day two without complications. LMWH was restarted that evening, followed by warfarin the next morning. Coagulation studies were monitored daily, with LMWH being ceased by day four. A repeat 2D echocardiogram confirmed normal valve function. The epidural catheter was removed 24 hours after the last dose of LMWH. The patient was discharged after a 10-day hospital stay.

DISCUSSION

The present case highlights the complexities of managing a patient diagnosed with oesophageal diverticulectomy and multiple co-morbidities, such as a prosthetic mitral valve, PAH, AF, decreased ejection fraction of 35%, pleural effusion, and decreased room air saturation, who is posted for open thoracotomy requiring OLV. It illustrates the challenges of OLV with DLT, which impose an additional burden on a compromised heart. Perioperative goals focused on the preoperative optimisation of pulmonary function, pleural drainage, rate control for AF, optimising RV-LV contractile function, preoperative bridging therapy, ensuring adequate analgesia, correcting electrolyte imbalances, and minimising sympathetic stimulation and tachycardia. Preventing excessive or rapid decreases in SVR, avoiding central blood volume overload while maintaining LA preload, and preventing hypoxia, hypoglycaemia, hypercarbia, and acidosis were crucial in reducing pulmonary arterial pressures and myocardial hypoperfusion.

Oesophageal diverticula affect less than 1% of the population, mostly elderly men, and present with dysphagia in 1-3% of cases. Food trapping in the diverticulum increases the risk of regurgitation and aspiration, posing anaesthetic challenges [1]. In the lateral position, gravity shifts perfusion to the dependent lung, while ventilation initially favours the operative lung due to reduced compliance in the dependent lung [2]. Neuromuscular blockade further increases Pulmonary Vascular Resistance (PVR) by limiting lung expansion. This ventilation-perfusion mismatch can cause hypoxaemia, worsened by low FiO_2, high airway pressures, intrinsic PEEP, and vasoconstrictors. Maqusood S, shared a similar case experience in which saturation fell below 92% in a lung decortication case requiring OLV [3]. Similarly, in the present case, following desaturation, the surgeons were informed, one-lung isolation was stopped, FiO_2 was increased, and intermittent two-lung ventilation was resumed. PVR is lowest at Functional Residual Capacity (FRC), promoting blood flow. Lung-protective strategies included low tidal volumes to maintain FRC, increasing FiO_2, intermittent manual two-lung ventilation, confirming DLT placement, suctioning secretions, recruitment manoeuvres, apnoeic oxygen insufflation, and PEEP application to improve oxygenation [4]. Solanki NM et al., employed similar selective lung ventilation strategies in a case of open thoracotomy [2]. ABG monitoring ensured adequate gas exchange and ruled out hypoxaemia.

The RVHD is characterised by chronic inflammation and scarring of cardiac valves. Prolonged reduced LV filling in longstanding MS leads to LV atrophy, dysfunction, and a low fixed CO state [5].

Tachycardia, which shortens diastolic filling, is poorly tolerated, making perioperative control of heart rate and blood pressure crucial to prevent myocardial hypoperfusion. Chronic pulmonary hypertension due to prolonged LV pressure elevation causes RV hypertrophy, dilation, and failure, necessitating the prevention of increased pulmonary artery pressure. Fluids should be administered cautiously to avoid pulmonary oedema, while hypoxia, acidosis, hypercarbia, lung hyperexpansion, and nitrous oxide should be prevented [5]. Invasive arterial and central venous pressure monitoring aids real-time haemodynamic assessment [6]. Hypotension was managed with blood transfusions, vasopressors, and inotropes to support cardiac output [7]. Similar preoperative strategies for RVHD have been explained by Holmes K et al., Peter AM, Paul A et al., and Vijaysingh PS and Sasturkar KV [8-11]. AF reduces diastolic filling time, coronary perfusion, and cardiac output [12]. Managing AF and its haemodynamic instability is critical to preventing thromboembolism, stroke, and organ dysfunction. Preoperative rate control and electrolyte balance correction are essential. Intraoperative AF management depends on heart rate and blood pressure, requiring the availability of β-blockers, calcium channel blockers, amiodarone, phenylephrine, nor adrenaline, milrinone, and a defibrillator. Kumar et al., managed intraoperative AF via synchronised cardioversion [13]. However, in present case, pharmacological cardioversion with amiodarone was employed as present patient was haemodynamically stable, as further explained by January CT et al., Nathanson MH et al., and Liao H-R et al., [14-16]. Hypoxaemia-induced pulmonary vasoconstriction and increased intravascular volume can elevate RV pressure, predisposing to AF, emphasising the need for careful oxygenation and fluid management.

Although the presence of a mechanical prosthetic mitral valve necessitates lifelong anticoagulation to prevent thromboembolism, it also increases the risk of perioperative bleeding if not withheld prior to surgery. Anticoagulation was therefore discontinued according to the American Society of Regional Anaesthesia and Pain Medicine (ASRA) guidelines, as similarly explained by Jalali Y et al., Umesh G et al., and Nath SS and Parashar S [5,17,18]. The risk of thromboembolism from with holding warfarin in patients with a mechanical valve prosthesis and AF varies between 1% and 20% in various studies [6,16]. Infective endocarditis prophylaxis should be administered to all patients with prosthetic heart valves pre- and postoperatively, as followed in the present case and noted by Umesh G et al., [17].

Thoracotomy causes severe pain due to wound retraction and intercostal nerve irritation [2,18]. Postoperative thoracic epidural analgesia improves breathing, coughing, and secretion clearance, allowing early extubation, thereby enhancing respiratory mechanics and reducing myocardial strain and arrhythmia risk, as employed by Solanki NM et al., and Maqusood S [2,3]. Poor analgesia leads to respiratory complications such as pneumonia, atelectasis, and ARDS, while effective analgesia prevents these issues, ensuring early mobilisation.

CONCLUSION(S)

The present case report highlights the successful management of a patient with left ventricular systolic dysfunction due to RVHD with MVR, requiring anticoagulation and OLV for oesophageal diverticulectomy. A thorough preoperative assessment, optimisation of cardiopulmonary status, a well-planned anaesthesia strategy, and the anticipation and prompt management of complications were crucial for improving prognosis. This required the highly coordinated efforts of a multidisciplinary team, including anaesthesiologists, surgeons, cardiologists, pulmonologists, and intensivists, to mitigate the risk-benefit profile for a favourable outcome.

REFERENCES

[1] Constantin A, Constantinoiu S, Achim F, Socea B, Costea DO, Predescu D. Esophageal diverticula: From diagnosis to therapeutic management—narrative review. J Thorac Dis [Internet]. 2023;15(2). Available from: https://jtd.amegroups.com.

[2] Solanki NM, S Engineer, N Shah, N Mistry, Soundarya T Thoracotomy: An overview of perioperative anesthetic management Journal of Anaesthesia and Pain. 2024:5(2):35-41 Doi:10.21776/ub.jap.2024.005.02.02

[3] Maqusood S, Chakole V, Bele A, Dash S, Shedge S. One-lung ventilation with double-lumen tube in decortication of lung abscess: A case report. J Clin Diag Res. 2025;19(1):UD04-UD06. Doi: https://doi.org/10.7860/JCDR/2025/73601.20484.

[4] Purohit A, Bhargava S, Mangal V, Parashar VK. Lung isolation, one-lung ventilation and hypoxaemia during lung isolation. Indian Journal of Anaesthesia. 2015;59(9):606-17. Doi: 10.4103/0019-5049.165855.

[5] Jalali Y, Jalali M, Števlík J. Perioperative management of valvular heart disease in patients undergoing non-cardiac surgery. J Clin Med. 2024;13(11):3240. Doi:10.3390/jcm13113240.

[6] Prakash J, Yadav N, Priti M, Meena K, Kumar K, Kumar A. Perioperative management of a patient with rheumatic heart disease undergoing emergency laparotomy: A case report. Ann Int Med Den Res. 2018;4(5):AN05-AN07.

[7] Sehgal A, Sasidharan S. Anesthetic management of a patient with prosthetic heart valve for non-cardiac surgery: A case report. Indian J Med Res. 2020;9(2).

[8] Holmes K, Gibbison B, Vohra HA. Mitral valve and mitral valve disease. BJA Educ. 2017;17(1):01-09.

[9] Peter AM. Valvular heart disease for non-cardiac surgery- anaesthetic management. South Afr J Anaesth Analg. 2022;28(5)Supplement:S30-S36.

[10] Paul A, Das S. Valvular heart disease and anaesthesia. Indian Journal of Anaesthesia. 2017;61:721. Doi: 10.4103/ija.IJA_378_17.

[11] Vijaysingh PS, Sasturkar KV. Anaesthetic management of a patient with rheumatic valvular heart disease posted for fixation of acetabulum fracture. Indian Journal of Applied Research. 2024;14(4):39-40.

[12] Karamchandani K, Khanna AK, Bose S, Fernando RJ, Walkey AJ. Atrial fibrillation: Current evidence and management strategies during the perioperative period. Anesth Analg. 2020;130(1):02-13. Doi: 10.1213/ANE.0000000000004474.

[13] Kumar A, Mathew S, Srinivasan NM. Intraoperative management of atrial fibrillation in a patient with restrictive cardiomyopathy. Anesthesia, Essays and Researches. 2013;7(3):396-98. Doi:10.4103/0259-1162.123265.

[14] January CT, Samuel Wann L, Alpert JS, Calkins H, Cigarroa JE, Cleveland JC, et al. 2014 AHA/ACC/HRS guideline for the management of patients with atrial fibrillation: A report of the American College of Cardiology/American Heart Association Task Force on practice guidelines and the Heart Rhythm Society. Circulation. 2014;130(23):e199-e267. Doi: 10.1161/CIR.0000000000000041.

[15] Nathanson MH, Gajraj NM. The peri-operative management of atrial fibrillation. Anaesthesia. 1998;53:665-76. https://doi.org/10.1046/j.1365-2044.1998.465-az0558.x.

[16] Liao H-R, Poon K-S, Chen K-B. Atrial fibrillation: An anesthesiologist's perspective. Acta Anaesthesiologica Taiwanica. 2013;51(1):34-36. ISSN 1875-4597, https://doi.org/10.1016/j.aat.2013.03.010.

[17] Umesh G, Verma S, Jasvinder K. Anesthetic management of a patient with prosthetic heart valve for non-cardiac surgery: A case report. Cases J. 2008;1:196. Doi:10.1186/1757-1626-1-196.

[18] Nath SS, Parashar S. Perioperative management of patients with prosthetic heart valves-a narrative review. Annals of Cardiac Anaesthesia. 2022;25(3):254-63. | Doi: 10.4103/aca.aca_109_21.

PARTICULARS OF CONTRIBUTORS:
1. Associate Professor, Department of Anaesthesiology, Dr. D. Y. Patil Hospital and Research Centre, Pune, Maharashtra, India.
2. Junior Resident, Department of Anaesthesiology, Dr. D. Y. Patil Hospital and Research Centre, Pune, Maharashtra, India.
3. Associate Professor, Department of Anaesthesiology, Dr. D. Y. Patil Hospital and Research Centre, Pune, Maharashtra, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Reem Barkat Khatib,
Junior Resident, Department of Anaesthesiology, Dr. D. Y. Patil Hospital and Research Centre, Pune-411018, Maharashtra, India.
E-mail: reemkhatib97@gmail.com

PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Feb 24, 2025
- Manual Googling: Apr 24, 2025
- iThenticate Software: Apr 26, 2025 (8%)

ETYMOLOGY: Author Origin

EMENDATIONS: 6

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. Yes

Date of Submission: **Feb 23, 2025**
Date of Peer Review: **Mar 24, 2025**
Date of Acceptance: **Apr 28, 2025**
Date of Publishing: **Jun 01, 2025**