

Segmental Epidural Anaesthesia with Ropivacaine for Umbilical Hernia Repair in a Patient with Severe Cardiac Dysfunction: A Case Report

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ABSTRACT

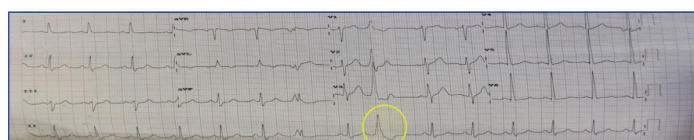
Ischaemic Heart Disease (IHD) remains a leading cause of morbidity and mortality, particularly among elderly patients with reduced Left Ventricular Ejection Fraction (LVEF). Managing these patients during non cardiac surgeries presents significant challenges due to heightened risks of intraoperative myocardial ischaemia, arrhythmias and heart failure. The present case report presents the anaesthetic management of a high-risk 77-year-old male with a severely reduced LVEF of 25%, hypokinesia of the inferolateral and inferoseptal walls, grade 2 diastolic dysfunction, moderate calcific aortic stenosis and mild aortic regurgitation, who underwent elective umbilical hernia repair. Non cardiac surgeries in such patients are particularly challenging due to the increased risks of intraoperative myocardial ischaemia, arrhythmias and heart failure. Segmental epidural anaesthesia with 0.2% ropivacaine was chosen to minimise cardiovascular stress while avoiding the risks associated with general or spinal anaesthesia. The primary goals included optimising myocardial oxygen supply, maintaining haemodynamic stability and preventing spinal hypotension and cardiac complications. The patient remained haemodynamically stable throughout the procedure without any perioperative cardiac events. The present case underscores the effectiveness and safety of segmental epidural anaesthesia with low-concentration ropivacaine for high-risk cardiac patients undergoing non cardiac surgery. It highlights the importance of tailored anaesthetic strategies to ensure successful outcomes in this vulnerable population.

Keywords: Anaesthetic, Hypotension, Left ventricular function, Stroke volume

CASE REPORT

A 77-year-old male presented to the surgery outpatient department with complaints of swelling in the umbilical region for more than three years and was scheduled for elective repair of an umbilical hernia. He experienced symptoms consistent with New York Heart Association (NYHA) grade II and had a Metabolic Equivalent Score (METS) of less than IV. However, he had no known history of co-morbidities such as hypertension, diabetes mellitus, bronchial asthma, or stroke, having ceased smoking and alcohol consumption 35 years earlier.

On examination, the patient's pulse was 85 beats per minute, with 4-5 missed beats and his blood pressure was 110/70 mmHg. Cardiovascular examination revealed a pan-systolic murmur, while respiratory and abdominal examinations were unremarkable. His airway was evaluated as Mallampati class 2. Preoperative investigations included an Electrocardiogram (ECG) showing Ventricular Premature Contractions (VPCs) [Table/Fig-1]. Based on these findings, a 2D echocardiogram was advised, which revealed an LVEF of 25%, with hypokinesia of the inferolateral and inferoseptal walls, grade 2 diastolic dysfunction, moderate calcific aortic stenosis and mild aortic regurgitation. Blood tests, including CK-MB and troponin I levels, were within normal limits. The patient was deemed fit for anaesthesia under American Society of Anaesthesiologists (ASA) grade II, with high-risk consent and postoperative Intensive Care Unit (ICU) and ventilator consent obtained.



[Table/Fig-1]: Electrocardiogram showing Ventricular Premature Contractions (VPCs).

Anaesthetic management: Given the patient's compromised cardiac function, segmental epidural anaesthesia was chosen over general and spinal anaesthesia to reduce cardiovascular strain. Informed consent was obtained. The patient was kept nil per os for six hours for solids and clear liquids were permitted up to two hours preoperatively in accordance with the Enhanced Recovery After Surgery (ERAS) protocol. A segmental epidural block was administered at the T12-L1 level using an 18G Tuohy needle and a catheter was placed 10 cm deep. After confirming correct placement with a test dose of 3 mL of 2% lignocaine with adrenaline, 7 mL of 0.2% ropivacaine with 50 mcg of fentanyl was administered, achieving an adequate block from T6 to L2. The block was maintained with 4 mL of 0.2% ropivacaine with 25 mcg of fentanyl every 45 minutes.

Intraoperative medications included 50 mcg of fentanyl for sedation and 4 mg of ondansetron to prevent nausea. Fluid management was restricted to 400 mL, with blood loss of 200 mL and urine output of 100 mL. The patient remained haemodynamically stable throughout the two-hour procedure. Postoperative monitoring in the recovery room was uneventful and the patient was later transferred to the ward.

DISCUSSION

The IHD, also known as Coronary Artery Disease (CAD), remains a leading cause of morbidity and mortality worldwide due to the narrowing or blockage of coronary arteries from atherosclerosis, which compromises myocardial perfusion and leads to a spectrum of cardiovascular complications [1]. A critical marker of cardiac function, LVEF, reflects the heart's ability to pump blood effectively [Table/Fig-2] [2]. Patients with an LVEF under 35% face heightened risks of heart failure, arrhythmias and other serious cardiovascular complications, particularly during surgical interventions. In this context, managing patients with IHD and reduced LVEF during non

cardiac surgeries presents significant challenges due to their limited cardiac reserve and susceptibility to intraoperative myocardial ischaemia, arrhythmias and haemodynamic instability.

Classification	Male LVEF (%)	Female LVEF (%)	ACC clinical classification
Hyperdynamic	—	—	>70%
Normal	52%-72%	54%-74%	50%-70% (midpoint 60%)
Mildly abnormal/dysfunction	41%-51%	41%-53%	40%-49% (midpoint 45%)
Moderately abnormal	30%-40%	30%-40%	30%-39% (midpoint 35%)
Severely abnormal	<30%	<30%	<30%

[Table/Fig-2]: Gender differences and ACC clinical criteria [2].
*LVEF: Low ventricular ejection fraction; ACC: American college of cardiology

The anaesthetic strategies for such patients prioritise maintaining haemodynamic stability, optimising myocardial oxygen supply and minimising oxygen demand to reduce the risk of arrhythmias and myocardial dysfunction [3]. General Anaesthesia (GA) poses several risks for these patients due to the potential for sympathetic stimulation, which can lead to hypertension and tachycardia during airway management. Inhalational and intravenous agents used during GA may cause hypotension, while positive pressure ventilation may reduce venous return, decreasing cardiac output and heightening the risk of hypoxia and acidosis [4]. Although spinal anaesthesia can be effective, it may cause abrupt hypotension due to sympathetic blockade [5].

Segmental epidural anaesthesia [6] is a reliable and versatile technique that offers precise control over haemodynamics through the slow administration of local anaesthetics, making it especially suitable for high-risk cardiac patients. By ensuring haemodynamic stability during surgery, it minimises surgical stress and reduces the release of proinflammatory cytokines. This approach provides effective postoperative analgesia via an epidural catheter, allowing for the extension of anaesthetic duration and supporting faster recovery of gastrointestinal function compared to GA. Additionally, it avoids airway manipulation, reduces the risk of pulmonary complications and lowers the risk of deep vein thrombosis and pulmonary embolism, making it a safer and highly advantageous option.

The present study involved a 77-year-old male with severe cardiac dysfunction, with an LVEF of 25%, undergoing umbilical hernia repair. Segmental epidural anaesthesia was employed, a technique known for its precise control over haemodynamics through the slow administration of local anaesthetics. This choice was motivated by the desire to maintain haemodynamic stability during surgery, thereby minimising surgical stress and reducing the release of proinflammatory cytokines.

The current study underscores the use of low-dose 0.2% ropivacaine, an amide local anaesthetic specifically developed to reduce cardiac and central nervous system toxicity while maintaining an effective sensory block with minimal motor blockade [7]. Furthermore, segmental epidural anaesthesia provides effective postoperative analgesia via an epidural catheter, extending anaesthetic duration and supporting faster recovery of gastrointestinal function compared to GA. This approach also avoids airway manipulation, reducing pulmonary complications and lowering the risk of deep vein thrombosis and pulmonary embolism.

In a study by Mudhelli S, segmental epidural anaesthesia was utilised for inguinal hernia repair in a patient with Mitral Valve Prolapse (MVP), a condition characterised by moderate left ventricular dysfunction [8]. Both studies highlight the advantages of segmental epidural anaesthesia in maintaining haemodynamic stability and avoiding the complications associated with spinal or GA. The present study also involves the use of segmental epidural anaesthesia due to its ability to provide precise haemodynamic control and reduce stress on the cardiovascular system. It specifically highlights the use of 0.2% ropivacaine, which offers superior haemodynamic stability,

minimal motor block and low cardiotoxicity, providing a tailored approach to perioperative management for patients with severe cardiac dysfunction.

Furthermore, the present study incorporated fluid restriction and the addition of fentanyl for enhanced analgesia, reflecting a more detailed perioperative management strategy.

Okeyemi A et al., conducted a study that shares significant similarities with the present findings, particularly in utilising segmental epidural anaesthesia for high-risk cardiac patients [9]. Both studies emphasised the importance of precise haemodynamic control through careful administration of local anaesthetics, making this technique especially suitable for elderly patients with severe cardiac dysfunction, with an LVEF of 25% in the present study and 30% in the former study. Both studies also implemented careful fluid management and avoided preloading with intravenous fluids to prevent cardiovascular complications.

The present study used 0.2% ropivacaine, known for its superior haemodynamic stability and minimal motor blockade, while Okeyemi A et al., study employed 0.5% bupivacaine. Furthermore, the focus on umbilical hernia repair contrasted with the above-mentioned study, which involved bilateral total knee replacement and utilised dopamine infusion for haemodynamic support. Despite these differences, both studies demonstrated the efficacy of segmental epidural anaesthesia in maintaining haemodynamic stability, reducing surgical stress and ensuring successful outcomes with minimal complications in patients with severe cardiac dysfunction [9].

Ropivacaine, a long-acting amide local anaesthetic, is a pure S-enantiomer known for its good haemodynamic stability compared to other local anaesthetics, along with reduced risks of cardiotoxicity and neurotoxicity. Its lower lipid solubility makes it less likely to penetrate large, myelinated motor nerve fibres, resulting in less motor blockade and better cardiac stability. In clinical practice, ropivacaine at concentrations of 0.2%, 0.5% and 0.75% has been introduced, with claims of providing effective analgesia with minimal motor block, particularly in labour epidurals [8]. Studies suggest that 0.2% ropivacaine can offer high-quality analgesia with modest motor blockade [10,11].

Fentanyl was added to enhance analgesia and minimise stress-induced sympathetic activation. Fluid management plays a critical role in patients with reduced LVEF, as excessive fluid can lead to pulmonary congestion, peripheral oedema and exacerbate heart failure. In the present study, fluid intake was carefully restricted and elastic crepe bandages were applied to prevent venous pooling, thereby reducing the likelihood of hypotension and ensuring that haemodynamic stability was maintained during the perioperative period. These strategies align with those employed in other studies that focus on the importance of careful fluid management to avoid exacerbating cardiovascular complications in high-risk cardiac patients [12].

CONCLUSION(S)

The choice of segmental epidural anaesthesia helped maintain haemodynamic stability, reduce myocardial oxygen demand and minimise the risk of perioperative cardiac complications with low concentration of ropivacaine, as opposed to general or spinal anaesthesia. The present case underscores the importance of individualised anaesthetic planning in high-risk cardiac patients and highlights the advantages of regional anaesthesia in mitigating perioperative cardiovascular stress.

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