

A Case of Coarctation of Aorta undergoing Bilateral Hernioplasty under Graded EpiduralLalitha R¹, Gayathri Santhanam², Uma R³¹Postgraduate, Department of Anaesthesiology, ACS Medical College & Hospital, Chennai, Tamil Nadu, India²Assistant Professor, Department of Anaesthesiology, ACS Medical College & Hospital, Chennai, Tamil Nadu, India³Professor, Department of Anaesthesiology, ACS Medical College & Hospital, Chennai, Tamil Nadu, India

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Abstract:

A 39-year-old male with a history of coarctation of the aorta, treated with patch angioplasty in 2002, presented with bilateral inguinal swelling and pain, worsening with exertion. Physical examination revealed reducible, doughy swellings in both inguinal regions, each with a positive cough impulse. Blood pressure readings showed a marked difference between the upper and lower limbs, with elevated pressure in the arms. Cardiovascular examination was unremarkable aside from normal heart sounds. His past surgical history included two thoracotomies for haemothorax and wound infection. Laboratory findings were normal. Imaging confirmed bilateral inguinal hernias containing bowel and omentum, and echocardiography showed severe restenosis of the aorta, with associated left ventricular hypertrophy and diastolic dysfunction. The patient was classified as ASA IV, indicating high surgical risk due to his complex cardiac condition. For anaesthesia, a graded epidural block was selected, and close intraoperative monitoring included arterial line placement and continuous blood pressure monitoring. The epidural was carefully administered in increments to achieve a T6 level sensory blockade. Hemodynamic stability was maintained throughout the procedure with close monitoring of vital signs. Sedation was provided with midazolam and fentanyl, ensuring patient comfort. Postoperative plans included ICU monitoring and readiness for inotropic support if required. The patient's stable intraoperative course demonstrated effective anaesthetic management, aligning with the high-risk nature of his cardiovascular profile. This case underscores the importance of individualized anaesthetic planning and vigilant perioperative monitoring in patients with complex cardiovascular comorbidities to ensure a safe and stable surgical outcome.

Keywords: Coarctation of Aorta, Bilateral Hernioplasty, Anaesthesia, Graded Epidural.

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Introduction

Coarctation of the aorta is a congenital cardiovascular defect characterized by the narrowing of the aortic lumen, typically occurring in the upper descending thoracic aorta near the site of attachment of the ductus arteriosus.[1] This narrowing causes significant alterations in blood flow, leading to elevated pressure in the left ventricle (LV) and diminished perfusion to the lower extremities. The hemodynamic consequences of coarctation result in varying degrees of left ventricular pressure overload, which can progress to left ventricular hypertrophy (LVH) and, if untreated, may contribute to long-term cardiovascular morbidity.[2]

Coarctation of the aorta occurs in approximately 0.18 per 1,000 live births, accounting for about 5% of all congenital heart diseases.[3] It demonstrates a

marked male preponderance, with males affected more frequently than females. In addition to left ventricular overload, this condition is often associated with other congenital cardiovascular anomalies, including bicuspid aortic valve, narrowing of the aortic isthmus, complete interruption of the aorta, hypoplasia of the mitral valve, and cerebral berry aneurysm.[4]

These associations can complicate both the diagnosis and management of the condition. The obstructive nature of coarctation leads to elevated afterload in the LV, with the degree of hypertrophy and pressure overload directly correlating to the severity of the narrowing. In patients who undergo repair, the risk of restenosis persists, which may necessitate re-intervention and complicates future surgical or anaesthetic management. The current

case report highlights the anaesthetic challenges in managing a patient who presented to ACS Medical College & Hospital, Chennai, Tamil Nadu with bilateral inguinal hernia and a complex cardiovascular history involving a prior repair of coarctation of the aorta, complicated by restenosis.

Case Report

A 39-year-old male presented with complaints of swelling in both the inguinal regions, persisting for one month. The swelling was associated with dull, aching pain exacerbated by strenuous work. He reported no history of fever, nausea, vomiting, or disturbances in bowel or bladder function. On local examination, the swelling in the right inguinal region measured approximately 3x4 cm, while that in the left measured about 3x2 cm. Both exhibited a positive cough impulse, with the contents being reducible and doughy in consistency, suggesting the presence of bilateral inguinal hernias.

On examination, the patient was conscious, oriented, and afebrile. He was 164 cm tall and weighed 65 kg (body mass index was found to be 24.2 kg/m²). His pulse rate was 82 beats per minute with a regular rhythm and normal volume.

Blood pressure readings showed significant differences between the upper and lower limbs, with the upper limbs recording 150/90 mmHg in both arms and the lower limbs recording 105/70 mmHg in both popliteal arteries. Cardiovascular examination revealed normal heart sounds (S1S2), while the respiratory and central nervous systems were unremarkable, with bilateral air entry present and no focal neurological deficits. Airway assessment placed the patient in Mallampati Grade 2 (soft palate and upper portion of the uvula were visible when the patient opened his mouth wide and protruded his tongue as far as possible).

The patient's past medical history was significant for coarctation of the aorta, for which he had undergone patch angioplasty in 2002 (22 years back). He had also undergone two thoracotomies due to haemothorax and wound infection, highlighting a complex cardiac surgical history. Laboratory investigations were within normal limits, with haemoglobin at 14.5 g/dl, white blood cell count at 6780/ μ L, and platelets at 2.65 lakhs. Coagulation profile, renal function, and liver function tests were also normal.

An ultrasound of the abdomen confirmed bilateral inguinal hernias with defects measuring 4x3 cm on each side, containing bowel and omentum. A chest X-ray showed a double bulge of the aortic arch, and an ECG revealed left ventricular hypertrophy. Echocardiography demonstrated an ejection fraction of 60%, severe restenosis of the coarctation of the aorta, with a velocity across the coarctation ranging from 3 to 5 m/s and a peak gradient of 88

mmHg. Additionally, mild tricuspid regurgitation, grade 1 left ventricular diastolic dysfunction, and mild concentric left ventricular hypertrophy were noted. However, no regional wall motion abnormalities (RWMA) were observed.

Given the patient's complex cardiovascular status, he was classified as ASA IV (patient with a severe systemic disease that is a constant threat to life), indicating a high surgical risk. Informed consent was obtained for potential intraoperative cardiac events, postoperative elective ventilation, inotropic support, and intensive care unit (ICU) monitoring.

The anaesthetic goals included maintaining mean arterial pressure (MAP) and systemic vascular resistance (SVR), continuous intraoperative monitoring of cardiac status via arterial lines, minimizing sympathetic stimulation, ensuring adequate analgesia, and preparing for perioperative inotropic support if needed. The anaesthetic technique involved standard ASA monitors, with baseline vitals recorded from both upper and lower limbs. Intravenous access was secured in both hands using 18 G cannulas, and a right radial artery catheter was placed for continuous beat-to-beat blood pressure monitoring, while non-invasive blood pressure was monitored on the left lower limb.

The anaesthetic approach for this case involved the use of a graded epidural block, performed at the T12-L1 level. The procedure began with the insertion of an 18 G Tuohy needle, followed by the successful catheterization of the epidural space while the patient was in the sitting position.

Once the catheter was secured, the patient was repositioned supine, and supplemental oxygen was administered via a face mask at a rate of 6 litres per minute to ensure adequate oxygenation throughout the procedure. Graded incremental doses of local anaesthetics were administered through the epidural catheter, starting with 6 cc of 0.5% bupivacaine, followed by 6 cc of 2% lignocaine with adrenaline, then an additional 3 cc of 2% lignocaine with adrenaline, and finally another 6 cc of 0.5% bupivacaine.

Each dose was preceded by a negative aspiration test for cerebrospinal fluid (CSF) or blood, confirming correct catheter placement in the epidural space. This careful, stepwise administration allowed for controlled onset of anaesthesia and prevention of potential complications, with a final block height of T6, providing adequate sensory blockade for the procedure. Throughout the surgery, the patient's vital signs were closely monitored, and hemodynamic stability was maintained. His pulse rate remained within the range of 80 to 110 beats

per minute, and blood pressure was well-controlled between 110-130/60-80 mmHg.

Oxygen saturation was consistently between 98-100%, and respiratory rate varied from 12 to 26 breaths per minute, all indicating stable

physiological parameters. To ensure comfort and minimize anxiety, sedation was provided with midazolam and fentanyl, contributing to a smooth intraoperative course without significant hemodynamic fluctuations.

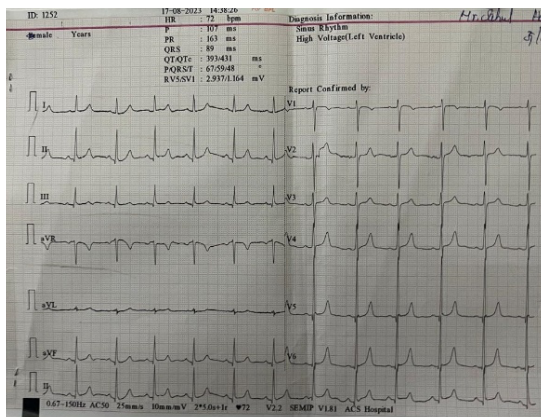
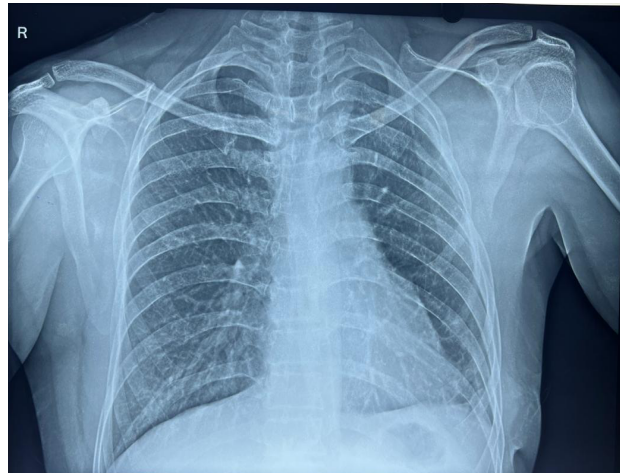


Figure 1: Clinical, radiological images and images of intraoperative monitoring

Discussion

This case report presents a complex scenario involving a 39-year-old male with bilateral inguinal hernia and a significant history of cardiovascular complications, specifically coarctation of the aorta,

treated with patch angioplasty. The patient's previous cardiac surgeries, including thoracotomies due to haemothorax and wound infections, further complicated the management of this case. Inguinal hernias are a common surgical condition, particularly in men (Köckerling & Simons,

2018).[5] They occur when abdominal contents, such as the bowel or omentum, protrude through the inguinal canal due to a weakness in the abdominal wall. The bilateral nature of the hernias in this case, coupled with a reducible, doughy consistency and a positive cough impulse, is typical of inguinal hernias, as described by several studies (Jenkins & O'Dwyer, 2008; Walker et al., 1990).[6,7]

The management of inguinal hernias in adults typically involves surgical repair, which can be performed using either open or laparoscopic techniques (Haladu et al., 2022).[8] While the surgical correction of inguinal hernias is routine, the presence of severe cardiovascular conditions, such as coarctation of the aorta, introduces significant challenges. In this patient, the longstanding history of aortic coarctation, treated with patch angioplasty 22 years prior, complicates the choice of anaesthetic techniques and perioperative management.

Coarctation of the aorta is a congenital condition characterized by the narrowing of the aorta, leading to increased afterload and subsequent complications, such as left ventricular hypertrophy (Alkashkari et al., 2019).[9] Despite surgical correction, patients with a history of coarctation often develop restenosis, as observed in this case, with an aortic gradient of 88 mmHg. Restenosis significantly raises the risk of hypertension and cardiovascular events, making perioperative management crucial. Chen et al. noted the prevalence of restenosis (repair site-diaphragm ratio (RDR) $\leq 70\%$) to be 31% (and significant in 9%, that is RDR $< 50\%$).[10] Other complications include pulmonary hypertension, ventricular dysfunction, conduction disorders, residual shunts, valvular lesions (regurgitation and stenosis), hypertension, and aneurysms (Serfontein & Kron, 2002).[11]

The patient's blood pressure discrepancies between the upper and lower limbs – 150/90 mmHg in the arms and 105/70 mmHg in the popliteal arteries – are consistent with this condition, indicating that blood flow is impaired to the lower extremities (Agasthi et al., 2020; Goudevenos et al., 2002).[12,13] Left ventricular hypertrophy, observed on ECG and echocardiography, is a consequence of chronic pressure overload due to coarctation and restenosis (Egbe et al., 2021).[14] Additionally, mild tricuspid regurgitation and grade I diastolic dysfunction further complicated the patient's cardiovascular status.

These findings necessitate careful intraoperative monitoring and anaesthetic management to prevent further cardiovascular decompensation. Given the patient's complex cardiovascular history, anaesthetic management required meticulous

planning to minimize the risk of intraoperative complications. The American Society of Anaesthesiologists (ASA) classification of ASA IV indicates that the patient's condition posed a constant threat to life, necessitating advanced preparation for potential perioperative cardiac events (Apfelbaum et al., 2020).[15] The choice of a graded epidural block as the primary anaesthetic technique was appropriate for several reasons.

Firstly, epidural anaesthesia provides effective sensory blockade while allowing for the preservation of cardiovascular stability by avoiding the significant hemodynamic changes associated with general anaesthesia, especially in patients with significant cardiac disease (Butterworth et al., 2013).[16] In this case, the careful stepwise administration of local anaesthetics allowed for controlled onset of anaesthesia, avoiding sudden hypotension, which could have exacerbated the patient's pre-existing cardiovascular compromise. Continuous intraoperative monitoring was essential in this high-risk patient. Arterial line placement in the right radial artery allowed for beat-to-beat blood pressure monitoring, a crucial intervention given the patient's blood pressure gradient and the risk of perioperative hypotension or hypertension. This approach aligns with recommendations for invasive hemodynamic monitoring in patients with complex cardiovascular histories (Cannesson et al., 2011; Fleisher Lee et al., 2014; Marshall et al., 2024).[17-19]

Maintaining hemodynamic stability was critical throughout the procedure. The goal was to sustain mean arterial pressure (MAP) and systemic vascular resistance (SVR) to ensure adequate perfusion, particularly given the patient's restenosis and diastolic dysfunction. Throughout the surgery, vital signs remained stable, with pulse rates between 80 and 110 beats per minute and blood pressure controlled within 110-130/60-80 mmHg. Oxygen saturation remained within normal limits, and respiratory rate fluctuated between 12 and 26 breaths per minute.

These stable parameters reflect the efficacy of the chosen anaesthetic technique and the careful intraoperative management. Additionally, sedation with midazolam and fentanyl helped alleviate anxiety and ensure the patient's comfort without significantly affecting cardiovascular function. These medications are commonly used in conjunction with regional anaesthesia to provide sedation and analgesia, contributing to a smooth intraoperative course (Benzoni & Cascella, 2023).[20] The perioperative management of the present case was in line with recommendations from Saugel et al. and Thompson et al.[21, 22]

Conclusion

The anaesthetic management of this 39-year-old male with bilateral inguinal hernia and significant cardiovascular history, including coarctation of the aorta with severe restenosis, required a carefully tailored approach. Given the high surgical risk and ASA IV classification, the choice of a graded epidural block proved to be an optimal anaesthetic strategy. It provided effective sensory blockade while preserving hemodynamic stability, avoiding the potential adverse effects of general anaesthesia in a patient with compromised cardiac function. Continuous intraoperative monitoring, particularly with arterial line placement, enabled real-time assessment of cardiovascular parameters, allowing for prompt management of any fluctuations. The use of sedation with midazolam and fentanyl contributed to patient comfort without significantly impacting cardiovascular status. This case underscores the importance of individualized anaesthetic planning and vigilant perioperative monitoring in patients with complex cardiovascular comorbidities to ensure a safe and stable surgical outcome.

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