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Case Report

Anaesthesia Section

Anaesthetic Considerations for Neurosurgery in a Patient with Large Atrial Septal Defect and Left Parietal Cystic Glioma: A Case Report

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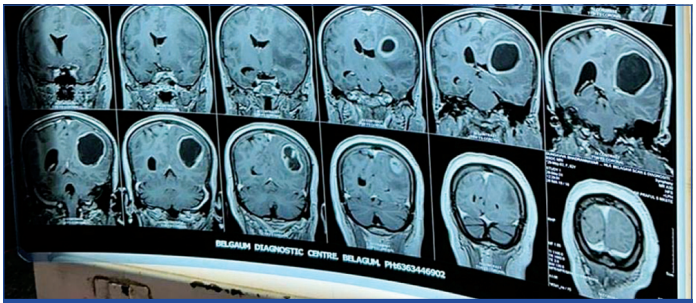
ABSTRACT

Atrial Septal Defect (ASD) can pose unique anaesthetic challenges for patients undergoing non-cardiac surgeries, such as craniotomy. The presence of a shunt can affect haemodynamic stability, oxygenation, and anaesthetic management. The current case report detailing the anaesthetic considerations and management strategies employed for a patient with ASD undergoing craniotomy highlights the importance of careful perioperative planning and monitoring to ensure optimal outcomes. A rare case of a 60-year-old female patient with a large ASD and severe Pulmonary Arterial Hypertension (PAH) who underwent left frontotemporoparietal craniotomy and excision of a left-sided parietal cystic glioma. The patient's medical history included palpitations, exertional dyspnoea, slurring of speech, and right-sided upper and lower limb weakness. Echocardiography (ECHO) revealed a large ostium secundum ASD (3.7 cm) with left-to-right shunt, moderate tricuspid regurgitation, severe PAH, and a left ventricular ejection fraction of 50%. The patient was carefully managed perioperatively by a multidisciplinary team approach. Anaesthetic techniques and medications were selected to minimise haemodynamic instability and Pulmonary Vascular Resistance (PVR). Intraoperative monitoring included monitoring of cardiac function, oxygenation, and ventilation. The patient underwent successful surgery without major complications. This case report highlights the anaesthetic complexities of managing patients with large ASDs and severe PAH undergoing non-cardiac surgery. Careful perioperative planning, multidisciplinary collaboration, and close monitoring are essential to ensure optimal outcomes. Our experience demonstrates that with careful management, patients with complex cardiac and neurological conditions can undergo successful surgery. This case report provides valuable insights into the perioperative management of patients with large ASDs and severe PAH, highlighting the importance of a multidisciplinary approach and careful anaesthetic planning.

Keywords: Craniotomy, Pulmonary artery hypertension, Right bundle branch block

CASE REPORT

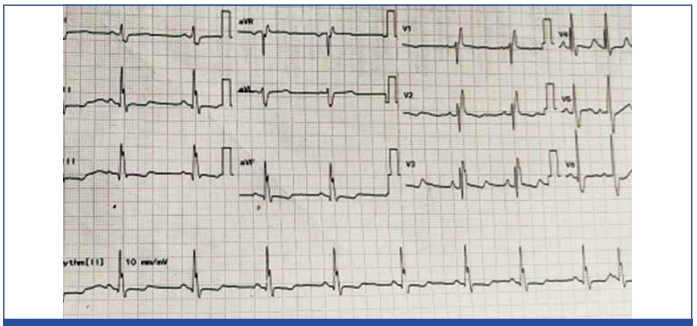
A 60-year-old female patient presented with an eight-day history of slurring of speech and right-sided upper and lower limb weakness and headache for two years. Magnetic Resonance Imaging (MRI) brain revealed a space-occupying lesion measuring 4.1×3.9×2.8 cm in the left parietal region and was diagnosed with a left parietal cystic glioma [Table/Fig-1].



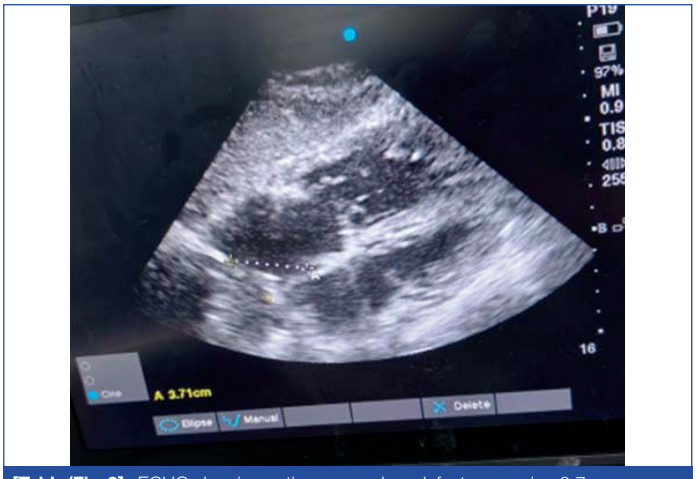
[Table/Fig-1]: Left parietal cystic glioma.

She also had a one-year history of generalised weakness, intermittent palpitations, and breathlessness on exertion (NYHA Grade II). Electrocardiogram (ECG) revealed a Right Bundle Branch Block (RBBB) and right axis deviation [Table/Fig-2].

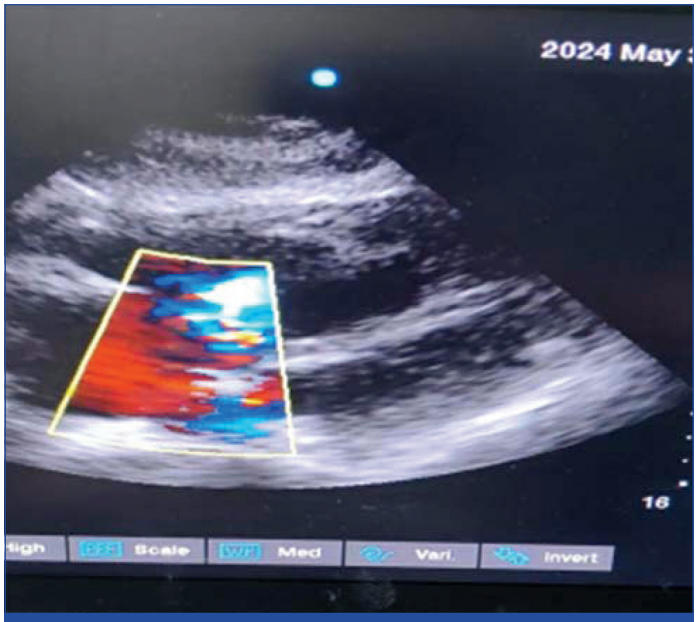
Preoperative 2D Echocardiography (ECHO) revealed a large ostium secundum ASD measuring 3.7 cm with left to right shunt, dilated right atrium, right ventricle, pulmonary artery and inferior vena cava along with severe Pulmonary Artery Hypertension (PAH) [Table/Fig-3,4].



[Table/Fig-2]: ECG showing RBBB.



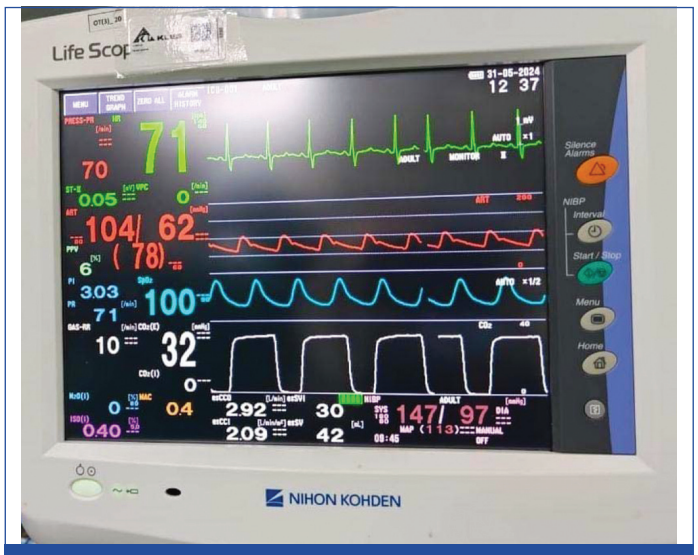
[Table/Fig-3]: ECHO showing ostium secundum defect measuring 3.7 cm.



[Table/Fig-4]: Colour Doppler showing left-to-right shunt.

Left ventricular ejection fraction of 50%. On examination, the patient was haemodynamically stable with a pulse rate of 65 beats per minute and blood pressure of 110/80 mmHg. Airway assessment revealed adequate mouth opening (three finger breadths), Mallampati Grade II, and normal neck mobility, suggesting no anticipated difficulty in airway management. Chest auscultation revealed normal vesicular breath sounds with equal air entry on both sides. Cardiovascular examination revealed a mid-systolic murmur best heard in the tricuspid area. A cardiology consultation was obtained, and the patient was deemed high risk for anaesthesia in view of her cardiac findings. Neurological examination showed reduced power (Grade 3) in the right upper and lower limbs, without any cranial nerve involvement. Routine blood investigations were within normal limits.

Preoperative preparation: After a thorough pre-anaesthetic check-up, written informed and high-risk consent were obtained. Fasting status as per the guidelines was confirmed [1]. An arterial line was secured under ultrasound guidance, allowing for beat-to-beat blood pressure monitoring after administering 2% lignocaine subcutaneously. A large-bore 18-gauge intravenous cannula was inserted, and normal saline was started. Standard non-invasive monitors, including ECG, pulse oximetry, End-Tidal Carbon Dioxide (EtCO2), and temperature monitors, were attached. Non-invasive cardiac output monitoring was done with estimated Continuous Cardiac Output Monitoring (esCCO) [Table/Fig-5].



[Table/Fig-5]: Monitoring with estimated continuous cardiac output and Pulse Pressure Variation (PPV).

Anaesthetic induction and maintenance: The patient received prophylactic levetiracetam 500 mg i.v. Anaesthetic induction was achieved with glycopyrrolate 0.2 mg, midazolam 1 mg, and fentanyl 150 mcg i.v., followed by etomidate 10 mg i.v., xylocaine 60 mg i.v., and vecuronium 5 mg i.v. The airway was secured with a cuffed endotracheal tube (size 7.5) after confirming bilateral equal air entry. Anaesthesia was maintained with oxygen, air, and isoflurane {Minimum Alveolar Concentration (MAC) 0.5}, supplemented with a dexmedetomidine infusion at a rate of 0.5 mcg/kg/hr for stable haemodynamics.

Haemodynamic management: Mean Arterial Pressure (MAP) was maintained between 65-70 mmHg, heart rate between 70-80 bpm, oxygen saturation at 100%, and EtCO2 between 33-36 mmHg. Intravenous fluids were administered judiciously, with regular monitoring of urine output, blood loss, PPV, and non-invasive estimated Continuous Cardiac Output (esCCO) monitoring.

Intraoperative event and recovery during the procedure: A transient episode of atrial fibrillation occurred, characterised by a heart rate of 111 bpm and a blood pressure drop to 74/40 mmHg, which resolved spontaneously without intervention.

Postoperative care: The patient was extubated smoothly after adequate reversal of neuromuscular blockade. Postoperative vitals were normal, and the patient was monitored in the Intensive Care Unit (ICU) for one day. Adequate analgesia was ensured with paracetamol, and the patient started oral feeds after six hours. The patient was discharged on the fifth postoperative day without any new complaints.

DISCUSSION

The ASD is a prevalent congenital heart condition, and its development can lead to the reversal of the shunt. ASDs can be categorised based on their anatomical characteristics, as well as the size of the defect [2]. Spontaneous closure is observed in most defects smaller than 3 mm, while around 80% of defects ranging from 3-8 mm tend to close naturally. However, defects measuring 9 mm or larger typically remain unclosed [3]. In the case of the patient mentioned, they presented with a defect measuring 3.7 cm in diameter. The extent of the left-to-right shunt is determined by the size of the ASD. In this particular case, the presence of a large ASD led to a significant left-to-right shunt that had noticeable clinical implications. As the shunt continued to progress, the patient experienced right heart failure and pulmonary venous hypertension due to irreversible changes in the blood vessels and an increase in PVR. Consequently, at the time of her presentation, the patient was already suffering from exertional dyspnoea, pulmonary hypertension, and right heart failure. The progression of ASD can lead to pulmonary hypertension. This condition is categorised as mild (36-49 mmHg), moderate (50-59 mmHg), or severe (>60 mmHg) based on the measurement of right ventricular systolic pressure using ECHO [4]. During surgery, if pulmonary artery pressure increases further due to increased PVR or other factors, it can result in a pulmonary hypertensive crisis, leading to decreased cardiac output and hypoxemia. Therefore, the main objective of anaesthetic management in patients with pulmonary hypertension is to reduce PVR and maintain Systemic Vascular Resistance (SVR). To prevent an increase in PVR, it is important to correct acidosis, avoid hyperventilation, avoid stimulation of the sympathetic nervous system, maintain normothermia, and minimise intrathoracic pressure. When considering anaesthesia for patients with ASDs, it is crucial to prevent the rise in SVR as it could potentially exacerbate shunting.

Perioperative hypothermia can also lead to an increase in PVR, which worsens pulmonary hypertension. In order to reduce PVR, we continuously monitored the patient's body temperature to maintain normal levels throughout the operation. Midazolam was given as a premedication to reduce sympathetic stimulation

and minimise SVR impact. We carefully controlled the infusion of dexmedetomidine to maintain adequate depth of anaesthesia and stable haemodynamics throughout the intraoperative period. Fluid administration was tailored using esCCO and PPV, with vigilant urine output monitoring to avoid fluid overload. In ASD a left-to-right shunt is typical, but right-to-left shunting can occur, leading to the entry of air into the systemic circulation and potentially causing a paradoxical cerebral air embolism. The use of Positive End-Expiratory Pressure (PEEP) in mechanical ventilation can increase the likelihood of this complication. Therefore, in this particular case, we opted not to apply PEEP. As a result, we closely monitored the administration of medication through the patient's peripheral or central i.v. lines to prevent the introduction of air.

Cystic gliomas in adults most commonly present as Glioblastoma (GBM) with fluid-filled components visible on imaging [5]. While cystic features are less common in adult gliomas compared to paediatric cases, their presence may hold clinical and prognostic significance. On MRI, cystic GBMs often display well-defined cystic cavities with enhancing mural nodules and relatively less peritumoral oedema compared to non-cystic counterparts. Cyst fluid from GBMs has been shown to contain extremely high levels of cytokines such as Interleukin (IL)-6 and IL-8, comparable to those found in brain abscesses, suggesting a role for inflammation in cyst development and possibly tumour behaviour [6]. There is no established evidence to suggest a direct link or causal association between ASD and the development of cystic gliomas. From a surgical perspective, cystic components may assist in tumour debulking by relieving mass effect and providing clearer dissection planes. Complete excision of both the mural nodule and cyst wall is often pursued, followed by standard chemoradiotherapy.

CONCLUSION(S)

This case highlights the successful anaesthetic management of a patient with both a large ASD and severe pulmonary hypertension undergoing complex brain surgery. Such cases are rare and challenging due to the high risk of haemodynamic instability and potential for complications like air embolism. Our approach focused on maintaining stable blood pressure and oxygen levels, carefully choosing anaesthetic drugs that are gentle on the heart and lungs, and using advanced monitoring tools like esCCO and pulse pressure variation to guide fluid therapy. By avoiding factors that could increase pulmonary pressure, such as stress, acidosis, or excessive ventilation, we were able to safely navigate the intraoperative period. This case reinforces the importance of teamwork, detailed planning, and individualised care in managing patients with both cardiac and neurological issues. With the right strategy, even high-risk patients can have smooth surgical outcomes.

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