

CASE REPORT

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# Anaesthetic management of a case of large ASD with severe pulmonary hypertension—case presentation

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## Abstract

**Background:** Atrial septal defect is the most common acyanotic congenital cardiac anomaly in the adults after bicuspid aortic valve with high prevalence in females. Major challenges in the management of large ASD with severe pulmonary hypertension includes hypoxemia, hypercarbia, hypothermia leading to reversal of shunt (Eisenmenger syndrome), fatal arrhythmias and congestive heart failure.

**Case presentation:** We report the successful management of the case of 44-year-old female patient with large ASD and severe pulmonary arterial hypertension posted for total abdominal hysterectomy with salpingectomy. She had history of palpitations with exertional dyspnoea and history of abnormal uterine bleeding with failed medical treatment. Echocardiography showed large OS-ASD (24 mm) with left to right shunt, moderate TR, severe PAH with estimated RVSP 60 mmHg, LVEF 50% and grossly dilated RA/RV. She underwent total abdominal hysterectomy with salpingectomy under regional anaesthesia with prophylactic use of adrenaline infusion.

**Conclusions:** Cardiac patients for non-cardiac surgery can be managed under regional anaesthesia.

**Keywords:** Atrial septal defect, Abdominal hysterectomy, Pulmonary artery hypertension, Echocardiography, Case presentation

## Background

Atrial septal defect (ASD) is the most common acyanotic cardiac anomaly accounting for 10% of grown-up congenital heart disease (GUCHD) with high prevalence in females. Patients often remain asymptomatic until middle age with predominant symptoms of potential complications of atrial arrhythmias and paradoxical embolism. There are three types of ASD namely ostium primum, ostium secundum, and sinus venosus. Ostium secundum is the most common type with 70% prevalence with male female ratio of 1:2 (Feldt et al. 1971). Large ASD causes shunting of the blood from left to right causing right

ventricular volume overload progressing to right ventricular hypertrophy and pulmonary hypertension (PAH), resulting in atrial fibrillation, congestive heart failure and reversal of shunt (Eisenmenger syndrome). The changes in systemic vascular resistance (SVR) and pulmonary vascular resistance (PVR) play an important role in successful management of ASD patients for non-cardiac surgery. We report successful management of patient with large ASD with severe PAH who underwent total abdominal hysterectomy (TAH) with salpingectomy under combined spinal epidural anaesthesia.

## Case presentation

A 44-year-old female weighing 50kg, known case of hypothyroidism with OS-ASD with severe PAH presented with abnormal uterine bleeding for 6 months, was planned for TAH with salpingectomy in view of failed medical treatment. She had history of palpitations with

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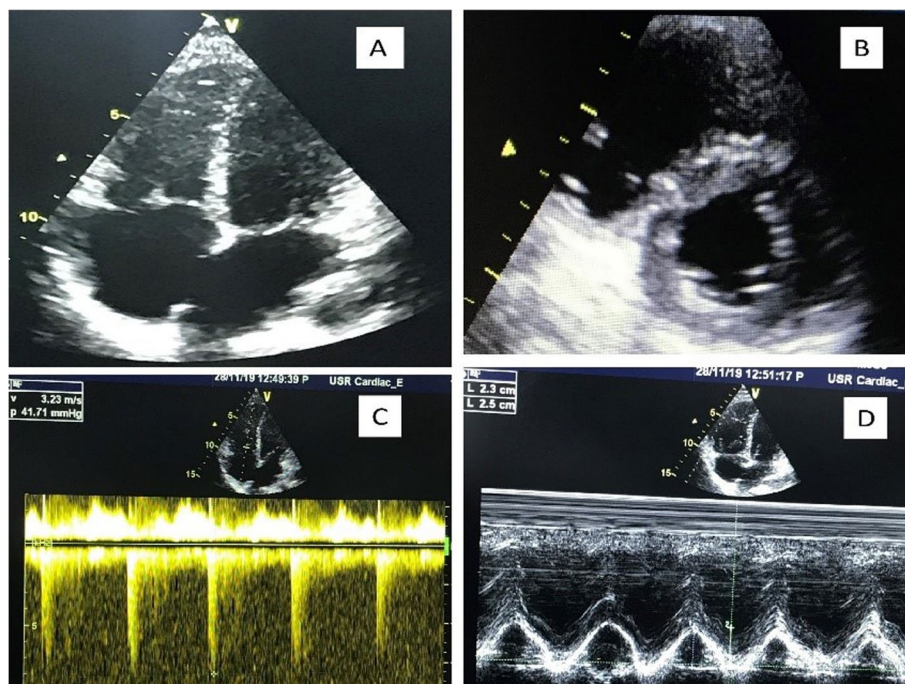
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exertional dyspnoea. Physical examination revealed heart rate 108/min, regular, and blood pressure 140/74 mm Hg with oxygen saturation 98% on room air with normal jugular venous pressure (JVP). The respiratory system is suggestive of bilateral basal crepitations. Cardiovascular examination revealed pansystolic murmur grade 4/6 in pulmonary and mitral area with loud P2. Biochemical and haematological investigations were within normal limit. Chest x-ray suggestive of cardiomegaly and ECG showed sinus tachycardia with P pulmonale. Echocardiography showed large OS-ASD (24 mm) with left to right shunt, moderate TR, severe PAH with estimated RVSP 60 mmHg, LVEF 50% and grossly dilated RA/RV (Fig. 1). She was already on tab sildenafil 20 mg and lasilactone 12.5 mg.

After thorough pre-anaesthetic check-up, written informed and high-risk consent was obtained. Fasting status according to guidelines was confirmed. All the cardiac medications were continued preoperatively. Venous access with 18G secured in preoperative holding area and maintenance fluid in the form of ringer lactate was started. After applying standard ASA monitors, the right radial artery was cannulated, and invasive blood pressure monitoring was initiated. Baseline ABG showed pH/pO<sub>2</sub>/pCO<sub>2</sub>/HCO<sub>3</sub><sup>2-</sup>/BE/Lac/Na<sup>+</sup>/K<sup>+</sup>/Ca<sup>+</sup> = 7.47/103/30/22.3/-0.6/1.53/134/3.39/0.80. Epidural catheter was inserted in L2-L3 intervertebral space after

confirmed loss of resistance to saline under strict aseptic precautions for intraoperative anaesthesia and post-operative analgesia. Low-dose spinal anaesthesia (7.5 mg bupivacaine) with 20 µg fentanyl as adjuvant was given in L3-L4 space to achieve T8 dermatomal level. Intraoperative adrenaline infusion was started in dosages of 0.05–0.1 mcg/kg/min to counteract hypotension. Infusion was tapered and switched off after 1 h. Oxygen supplementation was given via nasal prongs. Intraoperatively, heart rate varied between 60 and 80 beats/min, mean arterial pressure between 80 and 100 mm Hg and oxygen saturation of 98–99%. Total of 600 ml of ringer lactate was given intraoperatively. The urine output was 150 ml, and total blood loss was around 250 ml. Epidural catheter was topped with 0.5% bupivacaine 4 ml (20 mg) over 30 min after 30 min of spinal anaesthesia to maintain motor block up to T8-T10. Second epidural top-up of 20 mg of 0.5% bupivacaine was repeated after 45 min. Transthoracic ECHO was done intraoperatively to monitor ventricular function and intravascular volume status and fluids replaced accordingly. ECHO parameters intraoperatively suggested IVC diameter in range of 1.2–1.4 cm. LVOT VTI was targeted in range of 18–20 cm. Ventricular contractility was preserved with approximately EF- 45–50%. Intraoperatively, ABG suggested pH/pO<sub>2</sub>/pCO<sub>2</sub>/HCO<sub>3</sub><sup>2-</sup>/BE/Lac/Na<sup>+</sup>/K<sup>+</sup>/Ca<sup>+</sup> = 7.31/148/38/19/-6.6/1.26/141/4.10/0.9. The surgery lasted for 2 h, and



**Fig. 1** **A** Apical four chamber view showing large ostium secundum ASD. **B** Parasternal short axis view showing severely dilated right ventricle. **C** PW Doppler at tricuspid valve showing pressure gradient between RA and RV. **D** M mode at lateral tricuspid annulus to measure TAPSE

vitals were maintained within acceptable limits. Postoperatively, analgesia was maintained with epidural top-up of 0.125% bupivacaine infusion and continued for 48 h to target VAS pain score below 4. The patient had an uneventful recovery and was discharged on the 5th postoperative day.

## Discussion

ASD is an opening in the interatrial septum. It accounts for 6–10% of all congenital heart disease. Patients often remain asymptomatic until middle age and present with predominant symptoms of palpitations, exertional dyspnoea, fatigue or atrial arrhythmias (Saxena et al. 2005). Ostium secundum ASD accounts for 70% of cases which involves the fossa ovalis and is midseptal in location (Brickner et al. 2000). Large ASD (>9 mm) may result in a clinically remarkable left-to-right shunt and related alterations in heart due to enhanced pulmonary blood flow. The usefulness of echocardiography is the non-invasive estimation of pulmonary hypertension that helps in stratifying high risk patients presenting for anaesthesia for different surgeries. Preoperative echocardiography is usually limited to patients with symptoms suggestive of underlying cardiorespiratory disease on pre anaesthetic evaluation and often not done in patients with minimal symptoms (Cowie 2010). The other important point to consider is the timing of preoperative echocardiogram as many patients had their evaluation done much earlier than their scheduled surgery due to prolonged surgical waiting times. As a result, underlying pathophysiology of the disease may worsen significantly and can pose unanticipated challenges for the anaesthesiologists. Perioperative point of care echocardiography is now routinely becoming essential monitoring modality among anaesthesiologists considering the complexity of cases nowadays (Cowie 2010). In our case, we also highlighted the importance of screening echocardiography in patients with documented heart disease. Initial echocardiography was done 4 months back and demonstrated large OS ASD with mild pulmonary artery hypertension. Just before surgery, we did a transthoracic echocardiogram in the preoperative area as protocol in our department for patients with confirmed heart disease to verify the previous findings and assessing the progression of disease. The results did confirm the presence and size of ASD, but pulmonary hypertension was severe this time. Pulmonary hypertension is classified as mild (36–49 mmHg), moderate (50–59 mmHg) and severe (60 mmHg) according to right ventricular systolic pressure calculated by echocardiography (Valdes Cruz and Cayre 1999). The echocardiography helps to establish the size and location of the ASD, magnitude and hemodynamic impact of the left to right shunt and the presence and the degree

of pulmonary hypertension (Lee et al. 2009). Perioperative change in SVR can have important implications in patients with ASD (Siu et al. 2001). The magnitude of left to right shunt depends on size of ASD, ventricular diastolic properties and the relative impedance in pulmonary and systemic circulation (Murray et al. 1998).

The anaesthesia technique which has been commonly used in this surgery is general anaesthesia with epidural. However, this technique carries risk of sudden and uncontrolled surges in hemodynamic with possibility of reversal of intracardiac shunt. Also anticipated problems during general anaesthesia in these patients are air embolism during vascular access, heart block, dysrhythmias (5–10%), heart failure and infective endocarditis (Howard-Quijano et al. 2013). We employed regional anaesthesia approach via low dose spinal anaesthesia with epidural anaesthesia along with intravenous infusion of adrenaline to counteract decrease in SVR which may occur immediately after spinal. Adrenaline was preferred as it decreases risk of acute heart failure which would have been detrimental. Supplemental oxygen via nasal prongs was administered as it would be beneficial in severe PAH. The use of epidural permitted us to have better hemodynamic stability and avoiding sympathetic stimulus as may occur during intubation and extubation in GA resulting in detrimental effects on SVR and PVR (Weiss and Hess 2000). Intraoperatively, all factors were avoided which could cause reversal of shunt or increase shunt fraction. We maintained adequate preload and cardiac contractility, near normal heart rate and SVR and PVR with the use of adequate monitoring including echocardiography. Postoperatively, as pain could cause dramatic increase in SVR, adequate analgesia was maintained with epidural. The combined use of spinal and epidural anaesthesia with judicious use of adrenaline can provide better perioperative hemodynamic stability with good analgesia.

## Conclusions

With good preoperative assessment, proper preparation and providing good intraoperative and postoperative analgesia non-cardiac surgeries can be easily performed under regional anaesthesia in patients of large ASD with severe pulmonary hypertension with prophylactic infusion of adrenaline.

## Abbreviations

ASD: Atrial septal defect; GUCHD: Grown-up congenital heart disease; TAH: Total abdominal hysterectomy; PAH: Pulmonary artery hypertension; SVR: Systemic vascular resistance; PVR: Pulmonary vascular resistance; LOR: Loss of resistance; JVP: Jugular venous pressure.

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**Authors' contributions**

VM did the concepts, design, literature search, manuscript preparation and manuscript editing. RG is the guarantor and did the concepts, design, literature search, manuscript preparation, manuscript editing and manuscript review. All the authors have reviewed and approved for submission.

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**Availability of data and materials**

All data is published in this case presentation (supplementary files attached).

**Declarations****Ethics approval and consent to participate**

Informed consent was obtained.

**Consent for publication**

Written informed consent was taken.

**Competing interests**

The authors declare that they have no competing interests.

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