Case Report

Anesthetic management of an adult patient with uncorrected ventricular septal defect posted for open cholecystectomy

Prajwal Patel HS, Rashmi HD, Usha Devi, Meera Balasubramanyam, Aditi Prabhu

Department of Anaesthesia, Adichunchanagiri Institute of Medical Sciences, Balagangadharanatha Nagara, Mandya District, Karnataka, India.
Correspondence to: Prajwal HS Patel, E-mail: prajwal.patel83@gmail.com

Received January 30, 2015. Accepted February 4, 2015

Abstract

Ventricular septal defect is an acyanotic congenital heart disease, characterized by a left-to-right shunt. The incidence varies between two and six per 1000 live births. It is found in 30% to 60% of all the newborns with congenital heart disease, thus making it one of the most common congenital heart diseases. It can lead to significant hemodynamic changes and patient morbidity and mortality perioperatively, thus posing a challenge to the anesthesiologists. Here, we report the perioperative management of an adult patient with ventricular septal defect and pulmonary stenosis, posted for cholecystectomy, which was successfully managed with general anesthesia and thoracic epidural analgesia.

KEY WORDS: Congenital heart disease, ventricular septal defect, general anesthesia, thoracic epidural analgesia

Introduction

Congenital heart diseases (CHD), can be either cyanotic or acyanotic, complicate approximately 1% of all the live births in the general population and 4% of the offspring of women with CHD.[1] Palliative and corrective surgeries, now being done commonly at a younger age, has improved the survival of such patients. Substantial number of affected infants and children reach adulthood because of successful medical and surgical management[2] or because they have successfully adapted to their particular cardiovascular physiology. The anesthesiologist will, therefore, frequently encounter patients with congenital cardiac problems presenting for noncardiac surgery.[3] The cyanotic CHD present early in childhood, but acyanotic CHD may be relatively asymptomatic till later in life, because of balance between the systemic and pulmonary circulations.[4] Ventricular septal defect (VSD), one of the commonest acyanotic heart diseases, can occur as an isolated defect or as a component of a combination of anomalies. Usually, isolated small- or moderate-sized defects are initially detected in adulthood and can present with significant perioperative morbidity and mortality, if not evaluated carefully and managed meticulously.

We report a case of a 46-year-old woman with VSD, mild pulmonary stenosis, and cholecystitis, posted for cholecystectomy, which was successfully managed with general anesthesia and thoracic epidural analgesia.

Access this article online	
Website: http://www.ijmsph.com	Quick Response Code:
DOI: 10.5455/ijmsph.2015.30012015183	

Case Report

A 46-year-old female patient, weighing 64 kg, with VSD and mild pulmonary stenosis, was posted for cholecystectomy. Preanesthetic evaluation was done in detail. There was a history of one episode of syncopal attack, exertional breathlessness (NYHA grade II), and easy fatiguability. The patient also gave history of chest pain on exertion—walking more than half a kilometer or doing moderate work—suggesting poor exercise tolerance. She was diagnosed with VSD 10 years back. There was no history of orthopnoea or paroxysmal nocturnal dyspnoea or palpitations. The patient did not give any history suggestive of raised pulmonary vascular resistance. She had two normal vaginal deliveries previously, and her personal and family histories were also insignificant.

On clinical examination, her vitals were stable, and airway examination revealed a short neck and Mallampati grade III with adequate mouth opening. On systemic examination, there was a grade III pansystolic murmur in the left lower sternal area with no signs of pulmonary hypertension, congestive cardiac failure, or infective endocarditis. In concurrence with the clinical findings, the 2D-ECHO showed a 6-mm restrictive subaortic VSD, with left-to-right shunt and pressure gradient of 56 mm Hg and mild pulmonary stenosis with a pressure gradient of 34 mm Hg. The heart chambers and other valves were normal, and there was no evidence of associated atrial septal defect, patent ductus arteriosus, coarctation of aorta, or other congenital anomalies. Other laboratory parameters were within normal limits.

Our anesthetic plan was general anesthesia with endotracheal intubation, by intravenous induction with a cardiostable induction agent and thoracic epidural analgesia postoperatively. Accordingly, on the day of surgery, a thorough cockpit drill was performed. Anticipating difficult airway, difficult airway cart was kept ready, which consisted of two working scopes with appropriate size Macintosh blades; cuffed endotracheal tubes of sizes 6.5, 7, and 7.5; laryngeal mask airways; proper fitting masks; and stylet. All emergency drugs such as adrenaline, noradrenaline, dopamine, dobutamine, nitroglycerine, and amiodarone were kept ready, and arrangements were made for emergency defibrillation and tracheostomy, along with other resuscitation equipments.

The patient was premedicated with tablet ranitidine (150 mg) and tablet alprazolam (0.5 mg) on the day before surgery. On arrival of the patient to the operation theater, an intravenous (IV) line was secured with a 20-gauge IV cannula in the right forearm, and the first pint of normal saline was started, after ensuring its deairing. Monitors were connected and baseline values of pulse rate, blood pressure, and room air saturation were noted. With the patient in the lateral position and under all aseptic precautions, an 18-gauge epidural Tuohy needle was inserted through the T12–L1 interspace and epidural space confirmed by loss of resistance technique. The 18-gauge epidural catheter was inserted through the needle and fixed at 9 cm. Test dose was given with 2% lignocaine and the position of the catheter confirmed.

Patient was then preoxygenated with 100% oxygen at 10 L/min flow rate for 3 min and premedicated with midazolam injection (0.02 mg/kg IV) and fentanyl injection (1 μg/kg IV). Induction was done with etomidate injection (0.3 mg/kg IV) and sevoflurane (2%). On ascertaining adequacy of bag and mask ventilation, succinylcholine injection (1.5 mg/kg IV) was given. When adequate muscle relaxation was achieved, trachea was intubated with a prestyletted size 7 cuffed endotracheal tube under direct laryngoscopy. Position was confirmed by bilateral equal air entry and presence of $EtCO_2$, and tube was fixed. Anesthesia was maintained with O_2:N_2O of 3:5, isoflurane (0.6%–2%) intermittently, vecuronium injection (1 mg) in incremental doses and intermittent positive pressure ventilation with Bain's circuit. The $EtCO_2$ was maintained between 35 and 40 intraoperatively to avoid hypo/hypercarbia. The patient was hemodynamically stable throughout the surgery, which lasted for 2½ h.

At the end of the surgical procedure, an epidural top up was given with bupivacaine injection (0.5% plain 2 mL) + fentanyl injection (50 μg diluted to 8 cc with normal saline), after confirmation of correct placement of the catheter. Then, the patient was reversed with neostigmine injection (2.5 mg) + glycopyrrolate injection (0.5 mg IV), and gentle oral suctioning was done. The patient was successfully extubated and shifted to the postanesthetic care unit for observation. Throughout the intraoperative period, a close watch was kept on the vital parameters, especially the $EtCO_2$, which were found to be in the normal range. In the postoperative period, the patient was shifted to the intensive care unit for monitoring for the first 24 h. Bupivacaine injection (0.125%; 10 mL) was administered twice daily for epidural analgesia. Further postoperative period was uneventful, and subsequently, the patient was discharged home.

Discussion

VSDs are one of the most common acyanotic congenital heart diseases, accounting for 30% to 60% of all the newborns born with CHDs. The incidence varies between two and six per 1000 live births. VSD can occur as isolated defects or as a component of a combination of anomalies. The defect, when isolated, is usually located in the membranous part of the ventricular septum. Only small- or moderate-sized defects are seen initially in adulthood, as most of the patients with large defects present early in life. The functional disturbance depends on the size of the defect and the status of the pulmonary vascular bed. The spectrum of VSD, which ranges from spontaneous closure to congestive cardiac failure and death in early infancy, includes development of pulmonary vascular obstruction, right ventricular obstruction, aortic regurgitation, and infective endocarditis. Patients with large defects and pulmonary hypertension are more prone for development of pulmonary vascular obstruction (Eisenmenger's syndrome) with symptoms of exertional dyspnoea, chest pain, syncope, hemoptysis, clubbing, erythrocytosis, and cyanosis (right-to-left shunt). Small VSDs usually close spontaneously in most patients.[1]

The presence of CHD increases the mortality and morbidity in patients undergoing noncardiac surgeries significantly, with the 30-day mortality in patients with major cardiac anomalies being twice than that in patients with minor cardiac anomalies.[5] The critical factor determining prognosis in all the patients undergoing surgery is the degree to which the pulmonary vascular resistance is elevated before the surgery. If the pulmonary vascular resistance is one-third or less of the systemic value, pulmonary vascular disease after surgery is unusual; but, if moderate or severe pulmonary vascular resistance exists preoperatively, it may

progress to pulmonary vascular disease postoperatively. The other factor responsible for bad prognosis is the development of infective endocarditis in patients with CHD. Thus, infective endocarditis prophylaxis is given to selected patients with CHD undergoing surgery according to the recent updated guidelines.[6]

The main goals intraoperatively are (i) maintenance of a balance between the systemic vascular resistance (SVR) and pulmonary vascular resistance (PVR)—hemodynamic stability and (ii) maintenance of normocarbia.

The balance between SVR and PVR is of primary importance as the shunt fraction depends on it. VSD being a left-to-right shunt tends to increase with increase in SVR and decrease in PVR, thus leading to increased pulmonary blood flow, pulmonary hypertension, and consequently reversal of shunt leading to Eisenmenger's syndrome. Thus, to avoid these complications, SVR should be decreased by maintenance of good hypotensive anesthesia. Hyperventilation and hyperoxygenation increase pulmonary congestion in patients with left-to-right shunt and, hence, have to be avoided. Intracardiac catheter insertion may be hazardous as it can provoke serious arrhythmias. Air entering eripheral venous lines may cause paradoxical air emboli.[2] Agents such as ketamine, which lead to increase in SVR, should be avoided. PVR can be increased to reduce the shunt fraction by giving intermittent positive pressure ventilation.

Both regional anesthesia[2,7,8] and general anesthesia[3] have been successfully used in the management of patients with VSD depending on the site, type, and duration of surgery.

Abraham et al.[2] have reported a case of dextrocardia and VSD with situs inversus who was posted for hernioplasty and hydrocelectomy. They have successfully managed the patient with low-dose sequential-combined spinal epidural anesthesia.

Sandhya et al.[7] have reported a case of primigravida with uncorrected pentalogy of Fallot who was successfully managed with labor epidural analgesia with 10 mL of 0.125% bupivacaine and 50 μg of fentanyl.

Solanki et al.[8] have reported a case of a multigravida with uncorrected tetralogy of Fallot posted for cesarean section who was successfully managed with low-dose sequential-combined spinal epidural anesthesia with 2.5 mg (0.5 mL of 0.5%) of hyperbaric bupivacaine + 25 μg fentanyl administered intrathecally and epidural boluses of 3 mL and then 2 mL of plain 0.5% bupivacaine given 10 and 20 min after the intrathecal injection, which was supplemented by fentanyl (100 μg), given via an epidural catheter.

Sharma et al.[3] have reported a case of Eisenmenger's syndrome posted for cleft lip surgery who was successfully managed with general anesthesia by induction with thiopentone and maintenance with isoflurane and vecuronium.

We chose to manage our case of VSD with general anesthesia as it gave us an advantage of delivering intermittent positive pressure ventilation and, thus, increasing the PVR and maintenance of normocarbia.

The induction of general anesthesia was done with etomidate. The intubation response was averted by the use of etomidate, as it is a cardiostable agent. It has little effect on myocardial contractility and hemodynamics and is an excellent agent for the patient with impaired myocardial function.[9] Thus, increase in the SVR and the consequent alteration of the shunt were avoided.

The use of isoflurane for maintenance of general anesthesia along with short-acting narcotic such as fentanyl and skeletal muscle relaxant such as cisatracurium has been advocated.[3] Accordingly, our case was maintained with isoflurane to achieve hemodynamic stability and normocarbia throughout the procedure.

The main concerns in the postoperative period for such cases are the risks of bleeding, dysrhythmias and thromboembolic events. Hence, the patients have to be nursed in the intensive care unit postoperatively with special attention given to alleviation of pain and maintaining hemodynamic stability. To achieve these goals, in the postoperative period, our patient was shifted to the intensive care unit for monitoring for the first 24 h. Bupivacaine injection (0.125%; 10 mL) was administered twice daily for epidural analgesia. In cases of pulmonary hypertension, oral pulmonary vasodilators such as sildenafil and nitric oxide may be useful.[10]

Conclusion

As the incidence of adults with CHD coming for noncardiac surgeries is on a rise, it is vital for the anesthesiologists to understand the pathophysiology of the cardiac lesion and tailor the type and mode of anesthesia accordingly. The main concerns of hemodynamic stability and normocarbia have to be addressed in all cases along with the postoperative pain management and risks of bleeding dysrhythmias and thromboembolic events. There are no evidence-based guidelines for the perioperative management of adults with CHD. Large-scale clinical trials are required to elucidate the optimal anesthetic management of these challenging patients.

References

1. Child JS, Aboulhosn J. Congenital heart disease in adult. In: *Harrison's Principles of Internal Medicine*, 18th edn, Vol. 2, Longo DL, Kasper DL, Jameson JL, Fauci AS, Hauser SL, Loscalzo J (Eds.). New York: McGraw-Hill, 2012. pp. 1920–8.
2. Abraham B, Shivanna S, Tejesh CA. Dextrocardia and ventricular septal defect with situs inversus: Anesthetic implications and management. Anesth Essays Res 2012;6(2):207–9.
3. Mohindra R, Beebe DS, Belani KG. Anaesthetic management of patients with congenital heart disease presenting for non-cardiac surgery. Ann Card Anaesth 2002;5:15–24.
4. Sharma A, Parasa S, Gudivada K, Gopinath R. Differential cyanosis and undiagnosed Eisenmenger's syndrome: The importance of pulse oximetry. Anesth Essays Res 2014;8(2):233–5.
5. Stayer S. Anesthesia for the patient with congenital heart disease undergoing non-cardiac surgery. Patient with CHD for non-cardiac surgery. SPA Refresher Course April 2010:1–10.

6. Allen UD; Canadian Paediatric Society, Infectious Diseases and Immunization Committee. Infective endocarditis: Updated guidelines. Paediatr Child Health 2010;15(4):205–8.
7. Sandhya K, Shivanna S, Tejesh CA, Rathna N. Labour analgesia and anaesthetic management of a primigravida with uncorrected pentalogy of Fallot. Indian J Anaesth 2012;56(2):186–8.
8. Solanki S, Jain A, Singh A, Sharma A. Low-dose sequential combined spinal epidural anesthesia for cesarean section in patient with uncorrected tetralogy of Fallot. Saudi J Anaesth 2011;5(3):320–2.
9. Gottlieb EA, Andropoulos DB. Anesthesia for the patient with congenital heart disease presenting for noncardiac surgery. Curr Opin Anaesthesiol 2013;26:318–26.
10. Cannesson M, Earing MG, Collange V, Kersten JR. Anesthesia for noncardiac surgery in adults with congenital heart disease. Anesthesiology 2009;111:432–40.

How to cite this article: Patel PHS, Rashmi HD, Devi U, Balasubramanyam M, Prabhu A. Anesthetic management of an adult patient with uncorrected ventricular septal defect posted for open cholecystectomy. Int J Med Sci Public Health 2015;4:1023-1026

Source of Support: Nil, **Conflict of Interest:** None declared.