



PRESSURE, PRELOAD AND PRECISION: MANAGING ANESTHESIA IN HYPERTROPHIC CARDIOMYOPATHY DURING LAPAROSCOPIC CHOLECYSTECTOMY

Anaesthesiology

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ABSTRACT

Hypertrophic cardiomyopathy is the most common genetic cardiovascular disorder characterized by asymmetric left ventricular hypertrophy with or without left ventricular outflow tract obstruction having a wide range of symptoms ranging from asymptomatic state to sudden cardiac death. Its perioperative management demands prompt maintenance of hemodynamic parameters due to its complex pathophysiology and increased risk of cardiac instability. Laparoscopic surgeries can further deteriorate and amplify anesthetic concerns leading to catastrophic complications. A 71-year-old male patient was scheduled for surgery having suffered from frequent complications of cholelithiasis. We hereby report a successful anesthetic management of a patient with HOCM diagnosed with cholelithiasis who received general anesthesia to undergo laparoscopic cholecystectomy without suffering any complications during and after surgery.

KEYWORDS

Anesthetic Management; Hypertrophic Cardiomyopathy; Left Ventricular Outflow Tract Obstruction.

INTRODUCTION

Hypertrophic cardiomyopathy is an autosomal dominant disorder characterized by hypertrophy of left ventricle with rare involvement of right ventricle. It is associated with left ventricular hypertrophy of interventricular septum leading to periodic LVOTO due to acute exacerbation or precipitation. The symptoms of HOCM include palpitation, dyspnea, arrhythmias like atrial fibrillation, cerebrovascular accident, heart failure and sudden cardiac death to name a few. Carbon dioxide pneumoperitoneum, neuroendocrine stress and patient positioning to facilitate laparoscopic surgery poses a great challenge to the attending anesthesiologist because of the antecedent risk of myocardial ischemia, diastolic dysfunction and dysrhythmias.^{1,2}

CASE REPORT

A 71-year-old male weighing 62kg with no known drug allergies and a past history of arterial hypertension, diabetes mellitus, dyslipidemia and HOCM was scheduled to undergo an elective laparoscopic cholecystectomy. His usual treatment consists of bisoprolol, atorvastatin, finerenone, telmisartan and amlodipine combination, vildagliptin and acarbose. He would experience dyspnea and palpitation during moderate exertion. On examination pre operative ECG shows sinus rhythm with a heart rate of 69/min, right bundle branch block and left posterior fascicular block (fig. 1). Heart rate was 73/min and blood pressure was 110/72 mmHg. Routine blood examination and airway assessment were within normal limits. While a cardiac MRI revealed HOCM with extensive myocardial fibrosis. Transthoracic echocardiography showed findings suggestive of HOCM, grade III systolic anterior motion, LVOTO present with mild MR, TR, AR having an ejection fraction of 65%. Patient was accepted under ASA III and surgery was scheduled after 5 days. The plan of anesthesia and the anesthetic goals were established well before surgery. The main aim was to maintain normal sinus rhythm, reduction in sympathetic activity to reduce inotropy and chronotropy with maintenance of left ventricular filling together with systemic vascular resistance.

So, the patient was premedicated with tab Alprazolam 0.5mg a night before surgery to allay stress and anxiety. Cardiac medications were continued and clear fluids were allowed up to 2 hours prior to surgery. In operating room, standard ASA monitors were established. A central venous cannulation was done in the right internal jugular vein. An arterial line was secured in the right radial artery under local anesthesia to monitor beat to beat variability of blood pressure. An 18G intravenous cannulation was done for administration of fluids and drugs. His baseline vitals were noted with a heart rate of 78/min and blood pressure of 136/78 mm hg and spo₂ of 99% on room air, external defibrillator pads were applied before induction to manage any sort of arrhythmias in intra operative period. Patient was preoxygenated with 100% oxygen for 3 minutes, meanwhile the patient was given

midazolam 1mg to decrease anxiety, ondansetron 4mg, dexamethasone 8mg for anti-emetic prophylaxis. Lignocaine 1.5mg/kg was administered 3 minutes before intubation for attenuation of hemodynamic response to laryngoscopy. Glycopyrrolate 0.2mg was given just before intubation. Induction of general anesthesia was done using etomidate 0.2mg/kg bolus given at 10-15 seconds. Muscle relaxant rocuronium bromide was given at 1mg/kg. Intubation was smoothly done using a size 8mm ID cuffed ET tube. Maintenance was done using nitrous to oxygen at 2:1 and sevoflurane at 0.6%. intravenous lignocaine infusion was started at a rate of 2mg/kg/hr. Ventilation was adjusted to keep end tidal carbon dioxide tension between 35-45mm hg. Ropivacaine 0.375% in 20ml was infiltrated at surgical port site before surgical excision.

Laparoscopic cholecystectomy was done using 4 surgical ports. Pneumoperitoneum was created with CO₂ at a flow rate of 1L/min to maintain intraabdominal pressure at 8-9mmhg. Patient was kept in reverse Trendelenburg position with right sided up for minimal degrees so as to avoid decrement in cardiac preload. Procedure lasted for 50 minutes and the patient received around 1000ml of balanced salt solution. Patient was given ketamine 0.5mg/kg bolus after gall bladder was removed. Patient also received paracetamol 1gm during the procedure along with intravenous diclofenac 75mg.

Neuromuscular block was reversed with neostigmine 2.5mg and glycopyrrolate 0.5mg. Patient was extubated and shifted to post anesthesia care unit (PACU) for 30 minutes where his vitals and saturation were monitored every 3 minutes. Patient did not have any post operative nausea and vomiting. He was shifted to intensive care unit for 24 hours for monitoring which was uneventful. After 4 hours he was given oral fluids. The pain was managed with paracetamol 1gram TDS. Patient was shifted to the normal ward where he was mobilized and was discharged on fourth post operative day.

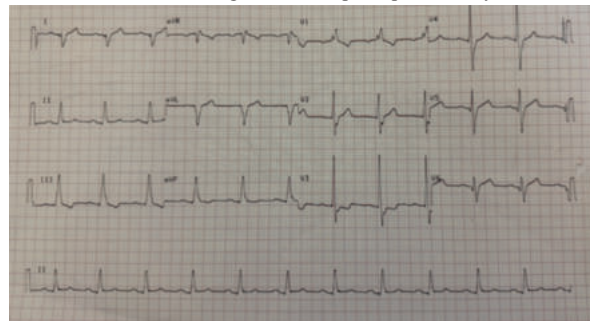


Fig 1. ECG Showing Sinus Rhythm at 69/min with Right Bundle Branch Block and Left Posterior Fascicular Block.

DISCUSSION

HOCM is a mutational disorder of myocardial sarcomere proteins transmitted as an autosomal dominant condition comprising a heterogenous clinical course determined by LVOTO, myocardial ischemia, diastolic dysfunction, impaired coronary vasodilator reserve, remodelling changes, systolic anterior movement of mitral valve causing mitral regurgitation and dysrhythmias.^{3,4}

In the present case, patient was a known case of HOCM who was on beta blocker. The goal is to control limiting heart failure and anginal symptoms, arrhythmias and LVOTO. Decrease cardiac contractility reduces incidence of LVOTO, myocardial oxygen requirement and possibly the ischemia. Therefore, beta blocker remains the mainstay of treatment with the benefits attributed to decrease in HR with prolonged diastolic relaxation and increased passive ventricular filling. It also reduces cardiac chronotropy and inotropy, leading to improve diastolic filling and subendocardial perfusion to the hypertrophied heart. Strategies to maintain normal sinus rhythm, reduced sympathetic activity, filled left ventricle and adequate systemic vascular resistance comprises the crux of peri operative care.

Premedication allay anxiety and sympathetic stimulation. Tachycardia and hypovolemia along with increased contractility may precipitate LVOTO emphasizing the role of proper perioperative hydration. Adequate fluid resuscitation during induction in general anesthesia helps counteract vasodilation. On the other hand hypervolemia may complicate the diastolic dysfunction in heart failure and thus must be avoided. Cardiac loading also helps to minimize the adverse effects of pneumoperitoneum both of which may impair venous return. The cardiovascular effects of pneumoperitoneum are due to the effects of hypercarbia and elevated intraabdominal pressure. The combined effect is to produce sympathetic stimulation and an acute decrease in venous return, which is poorly tolerated by patients of hypertrophic cardiomyopathy. Intraabdominal pressure should be carefully monitored and maintained below 15mmHg, and the duration of pneumoperitoneum should be kept short.

Invasive blood pressure monitoring before induction of anesthesia is essential in detecting hypotensive events. Any decrease in arterial pressure occurring due to systolic anterior motion of mitral valve leaflet and consequent LVOTO was treated with adequate intravascular volume and also by using alpha adrenergic agonists like phenylephrine, 50-100mcg bolus. It is also important to avoid beta adrenergic drugs like dobutamine, dopamine, adrenaline as these worsens LVOTO due to their positive inotropic and chronotropic effects. Mechanical ventilation with high tidal volume and high positive end expiratory pressure is harmful, as it reduces preload and causes greater LVOTO. Etomidate is one of the best options for induction due to the low impact it has on the cardiovascular system. Sevoflurane is a mild myocardial depressant that produces a more modest decrease in systemic vascular resistance than isoflurane or desflurane and only a slight increase in HR or none at all.^{5,6,7}

CONCLUSION

Hypertrophic cardiomyopathy poses many unique challenges regarding conduct of anesthesia and surgery. The anesthesiologist must have a very clear understanding regarding its pathophysiology and implement strategies to prevent the predisposition and exaggeration of left ventricular outflow tract obstruction. Adequate preload, control of sympathetic stimulation, maintaining afterload with normovolemia and normal sinus rhythm are important factors for attaining an uncomplicated laparoscopic cholecystectomy in patients with hypertrophic cardiomyopathy.

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