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Laparoscopic Cholecystectomy in a patient with Restrictive Cardiomyopathy in Atrial Fibrillation - Anaesthetic Concerns!

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Abstract: Restrictive cardiomyopathy is a rare heart muscle disease resulting in impaired ventricular filling, low cardiac output and a propensity for development of heart failure with minimal fluid overload. Anaesthetizing such patients presents considerable challenges. We present the Anaesthetic management of a case of Idiopathic restrictive cardiomyopathy undergoing Laparoscopic cholecystectomy.

Keywords: Restrictive cardiomyopathy, Laparoscopic cholecystectomy, atrial fibrillation

Introduction: Restrictive cardiomyopathy is defined as heart-muscle disease that results in impaired ventricular filling, with normal or decreased diastolic volume of either or both ventricles. Systolic function usually remains normal, at least early in the disease[1]. Laparoscopic cholecystectomy is the surgical technique of choice as it is associated with less post-operative pain, length of hospital stay and costs[2]. However, carbon dioxide insufflation during the intra-operative period increases intra-abdominal and intra-thoracic pressures leading to decreased cardiac output, increased after load and wall stress[3]. These changes are poorly tolerated in individuals with decreased cardiopulmonary reserve. We present the management of a patient with idiopathic restrictive cardiomyopathy in atrial fibrillation, who was successfully managed for laparoscopic cholecystectomy.

Case Report: A 33 year old lady (Wt: 40kg) ASA II, known case of restrictive cardiomyopathy (RCM) for 12 years was scheduled for laparoscopic cholecystectomy. She complained breathlessness on exertion. She was on medications including tab. digoxin 0.25mg once daily, tab. furosemide 20mg twice daily, tab. aldactone 25mg once daily and warfarin 1mg once daily for last 6 months. On examination, her pulse was 72 per min, irregular, blood pressure of 90/60 mm of Hg in left upper limb and elevated jugular venous pressure. Lung fields were clear on auscultation with soft first heart sound and pan systolic murmur heard over apex. Other systemic examination was normal. Chest roentgenogram revealed cardiomegaly with clear lung fields. Her haemoglobin and measured serum potassium was 12.3g% and 3.5mEq/L. Electrocardiogram revealed atrial fibrillation with ventricular rate of 70-80/min. Echocardiogram showed dilated atria with normal sized ventricles,

mild MR, severe TR with mild PAH, fair biventricular function and no intra-cavitatory clots. Mitral valve flow showed an increased E/A ratio (3.3) with a short (129 ms) deceleration time. Ultrasound revealed dilated inferior venacava and hepatic veins. Warfarin was stopped three days prior to surgery and fractionated heparin was instituted subsequently. The last dose of heparin was administered 6 hours prior to time of surgery.

Patient was fasted and premedicated. Under standard monitoring (SpO_2, invasive blood pressure, ECG, end-tidal CO_2 monitor), anaesthesia was induced with air, oxygen and sevoflurane. Trachea was intubated following vecuronium administration and the patient was mechanically ventilated. Under ultrasound guidance, a 7.5F triple lumen catheter was placed in right internal jugular vein. Intra-operative monitoring included electrocardiogram, pulse oximetry, invasive arterial blood pressure, body temperature, capnography and central venous pressure. HR was maintained between 80-90/min with the mean arterial pressure around 65-75mmHg. The baseline CVP was 8mmHg. Head end was elevated to 15-20 degrees, abdominal pressure was maintained between 8-10mmHg, peak airway pressure was maintained at 20mmHg, and the respiratory rate was adjusted to keep end-tidal carbon dioxide between 30-35mmHg. Anaesthesia was maintained with 50% mixture of air and oxygen, end-tidal isoflurane concentration of 0.8% with morphine (10mg), fentanyl (150mcg), paracetamol (1g) and vecuronium boluses as needed. CVP was maintained around baseline during intraoperative period. Total amount of crystalloid administered was 750ml with the duration of anaesthesia was about 90 minutes. Patient had stable haemodynamics intra-operatively, was extubated awake and monitored in high dependency unit. She had an uneventful stay and oral anticoagulants resumed. She was discharged on tab digoxin 0.25mg once daily, tab furosemide 20 mg once daily, tab. aldactone 25 mg and advised to review cardiology outpatient clinic after 6 weeks. She was symptomatically better and clinically graded as NYHA class II.

Discussion: Restrictive cardiomyopathy is characterized by restrictive filling and reduced diastolic volume of either or both ventricles with normal or near-normal systolic function and wall thickness. It may be idiopathic associated with other disease e.g. amyloidosis, endomyocardial disease.

The condition usually results from increased stiffness of the myocardium that causes pressure within the ventricles to rise precipitously with only small increases in volume. Cardiac output is usually low and maintained by increased filling pressures and tachycardia[4] Anaesthetizing patients with restrictive cardiomyopathy for laparoscopic surgery presents considerable challenges. Laparoscopic surgery, although often perceived as "keyhole surgery" by many patients, can present significant hemodynamic challenges during the intraoperative period[5]. Insufflation of the abdomen with carbon dioxide is required for surgical exposure and produces an increase in intra-abdominal pressure. The pneumoperitoneum compresses the arterial and venous vasculature, increasing the systemic vascular resistance and decreasing preload to the heart. In addition, absorbed carbon dioxide can increase HR, systemic vascular resistance, and mean arterial pressure. Most patients can compensate for these alterations but in patients with restrictive cardiomyopathy, this could further decrease filling and cardiac output with significant haemodynamic effect. The hemodynamic consequences from CO_2 insufflation and patient positioning during these procedures are well

documented in healthy patients and patients with severe cardiac disease. These concerns also apply to patients with restrictive cardiomyopathy but currently no criteria exists to risk-stratify these patients for laparoscopic versus open procedures[3]. Thus, weighing these risks and benefits becomes a part of the anaesthesiologist's role in managing these patient populations and deciding which patients can safely undergo laparoscopic procedures.

When general anaesthesia is considered, drugs and techniques that cause decreased venous return, bradycardia, or decreased contractility should be avoided[4]. We anaesthetized our patient using vecuronium as a relaxant and opioids to avoid higher requirement of inhalational anaesthetic agent which could depress myocardium and further cardiac output. We preferred invasive monitoring as intra-operatively biventricular failure is common in these patients and even small volume shifts may greatly affect cardiac output[4].

Nishida and Taniguchi administered general anaesthesia for a subtotal gastrectomy in a 52 yr old man with restrictive cardiomyopathy[6] and in the other case, for a mitral valve replacement in a 48 yr old female[7]. Both the cases were managed with invasive monitoring and inotropic support, but in both the cases improvements in cardiac output occurred with the administration of PGE1 by reducing the left ventricular afterload. However, we did not use inotropes in this patient as she had stable haemodynamics probably due to balanced anaesthetic technique, CVP guided volume replacement and use of low intra-abdominal pressure during insufflation. Oliver and Nuttal recommended inotropic support in these patients when there is a risk of death from low cardiac output [8]. As our patient was maintaining stable haemodynamics intra-operatively, we did not use any inotropic/inodilator though we kept infusion of dobutamine and milrinone readily available.

Subarachnoid or epidural block was avoided in this patient because the decreased venous return resulting from sympathetic block may cause deterioration of cardiac output and also for the laparoscopic procedures require a higher level of sensory blockade which these patients poorly tolerate. Maitra and colleagues advocated the role of combined sciatic-femoral nerve block in patients with restrictive cardiomyopathy without invasive monitoring for lower limb procedures[4]

Conclusion: In patients with restrictive cardiomyopathy in atrial fibrillation, laparoscopic cholecystectomy can be successfully performed by adequate oxygenation and controlled ventilation with general anaesthesia, CVP guided volume replacement, maintenance of the insufflation pressure <10 mm Hg, vigilant monitoring, continuous communication with the surgeon and have the flexibility to convert to an open procedure if necessary. Inotropes are warranted only when there is haemodynamic instability during peri-operative period.

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