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PREOPERATIVE OPTIMISATION OF THE PATIENTS WITH DIURETIC AND CARDIOTONIC PREVENTS LOW CARDIAC OUTPUT SYNDROME AFTER PERICARDIECTOMY FOR CONSTRICTIVE PERICARDITIS

Dr. Ayush Srivastava — Chief Cardiac Surgeon MCh CTVS PGI Chandigarh

Dr Akshit Kansal* — General surgery Resident*Corresponding Author

Dr. Akash Garg — General surgery Resident

ABSTRACT Post pericardiectomy low cardiac output syndrome is major cause for mortality in patients with constrictive pericarditis. **Methods** Patients undergoing pericardiectomy for constrictive pericarditis at TMMC&RC were included in our study. Following pre operative workup, prior to the operation the patients were optimised with diuretics and inotropes infusion. Pre operative infusion of diuretics and inotropes significantly improved the outcomes. The infusion of Lasix and dopamine were started 12 hours prior to the surgery in cases of chronic constrictive pericarditis undergoing pericardiectomy. Major cause of pericarditis was found out to be tuberculosis. Histopathological studies of the pericardium tissue from every patient were performed. All the patients were followed regularly. **Results** Thirty patients undergoing pericardiectomy at TMMC & RC were included in the study. There were two post operative deaths. Tuberculosis of the pericardium (22/30, 73.3%) was the most common histopathologic finding in this study. twenty survivors were in NYHA class I (25/28, 89.3%), and two were in class II (3/28, 10.7%) at the latest follow up. **Conclusions** Low cardiac output syndrome is major cause of mortality after pericardiectomy. Tuberculosis of the pericardium was the most common histopathologic finding in this study. For constrictive pericarditis caused by tuberculous bacteria, systematic antituberculosis drugs should be given. Preoperative pericardial effusion is associated with increased rate of low cardiac output syndrome. Perfect preoperative preparation is imperative to reduce incidence of postoperative low cardiac output syndrome and mortality. This necessitates the use of Lasix 2mg/hr and dopamine 5mcg/hr 12 hours prior to surgery.

KEYWORDS :

Introduction

Pericardium is double walled sac. Superficial is the fibrous pericardium followed by deep two layers of serous pericardium. The parietal layer lines the internal surface of the fibrous pericardium. The visceral layer or epicardium lines the surface of the heart. These two layers are separated by fluid filled pericardial cavity. Constrictive pericarditis is characterised by thickened fibrotic pericardium >4mm on CT/MI; limiting heart's ability to function normally. commonest cause of constrictive pericarditis in developed world is idiopathic. However, infective causes include tuberculosis, viral- Coxsackie and fungal Histoplasma. Apart from infective cause dose dependent mediastinal irradiation is also known to cause constrictive pericarditis. Previous cardiac surgery resulting in constrictive pericarditis has an incidence of about 0.25%. Rare causes of constrictive pericarditis include any tumour of mediastinum, drugs (procainamide, hydralazine), sarcoidosis, amyloidosis, carcinoid syndrome, uraemia, trauma and myocardial infarction.

Low cardiac output syndrome is the main cause of death after pericardiectomy. Early preoperative optimisation with diuretics and dopamine prevents LCOS and early mortality.

Patients and Methods

Study population

Patients undergoing pericardiectomy for constrictive pericarditis, from November 2022 to March 2023, at TMMC & RC were included in the study. Constrictive pericarditis was diagnosed by clinical presentation, chest X Ray, echocardiographic study, chest computed tomographic (CT) scan, and cardiac catheterization, as needed. The patients of constrictive pericarditis present with signs and symptoms of left and right heart failure including dyspnoea, fatigue, weakness, anorexia, peripheral oedema and ascites. Raised jugular venous pressure, hepatosplenomegaly, displaced apex beat, muffled heart sounds, narrow pulse pressure are also found in patients of constrictive pericarditis. Kussmaul's sign and pulsus paradoxus may also be present. Chest Xray indicates pericardial calcification and bilateral pleural effusion. Echocardiography study reveals a severely thickened echo bright or calcified pericardium and cardiac catheterization reveals elevated end-diastolic pressure and the “square root sign” of right ventricular pressure tracing [Epting 2016; Mori 2019; Calderon-Rojas 2020].

Additionally, impaired diastolic ventricular filling and dilated right atrium, inferior vena cava and hepatic veins are also found on echocardiographic study. On Doppler echocardiography, increased E:A ratio (rapid early filling and diastasis) and decreased inspiratory flow reduction in the hepatic veins is seen. Surgical and pathological findings were reviewed to confirm the preoperative diagnosis. Radical pericardiectomy was completed via subxiphoid approach video assisted thoracoscopic surgery (VATS). Pulmonary artery catheter, cardiac output (CO) and venous oxygen saturation of haemoglobin of the patients were continuously measured. Low cardiac output syndrome is defined as cardiac index (CI) of less than 2.2 L/min/m2. Perioperative death was defined as death within 30 days of the operation or during the same hospital admission [Calderon-Rojas 2020; Guerrero Orriach 2019; Gatti 2020].

Histopathologic investigation

The pericardium specimen isolated from every patient was sent for Histopathologic studies. On the basis of the study the post operative intervention was manoeuvred accordingly.

Follow up

All survivors discharged from hospital were monitored. Patients were monitored clinically and appropriate investigations were done as required. All survivors were contacted by telephone or interviewed directly at the outpatient department at the last follow up.

Statistical analysis

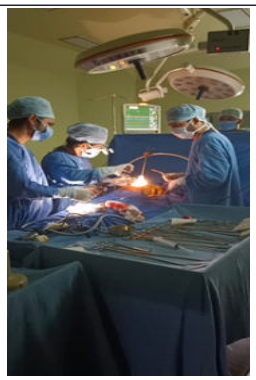
All analyses were completed using IBM SPSS version 24.0 software (IBM SPSS Inc., USA). Continuous variables are reported as mean/median based on kurtosis/skewness tests. The Fisher's and Chi-square tests, Kruskal-Walls test or Wilcoxon rank-sum test, as appropriate, were used to evaluate relationships between the preoperative, selected intraoperative, and postoperative variables. The relationships with perioperative risk factors were assessed by means of contingency table methods and logistic regression analysis.

Ethics approval

After necessary approvals from the Institutional Ethical Committee TMMC and RC the study was undertaken from November 2022 to February 2023.

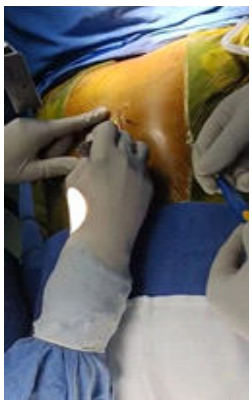
Total number of patients included in the study	30
Number of patients survived	28(93.3%)
Morality	2(6.7%)

Dr Ayush Srivastava and Team performing pericardiectomy using subxiphoid approach Video Assisted Thoracotomy Surgery (VATs)



Subxiphoid VATs uniport for pericardiectomy for constrictive pericarditis

Subxiphoid incision being given in midline



Intra operative picture of pericardiectomy via subxiphoid VATs approach showing thickened pericardium

Intraoperative picture of pericardiectomy for constrictive pericardiectomy by VATs uniport subxiphoid approach showing dissection of pericardium being done

Results

Pre operative and operative data

Thirty patients undergoing pericardiectomy at TMMC & RC were included in the study from November 2022 to February 2023. After necessary preoperative investigations the patients were planned for the pericardiectomy. Preoperative optimisation in form of infusion of Lasix 2mg/hr and dopamine 5mcg/hr was done in each patient undergoing pericardiectomy for constrictive pericarditis.

Mortality

There were two post operative deaths. The cause of mortality was independent of the intervention.

Pathological classification of constrictive pericarditis

The pericardium specimen isolated from every patient was sent for Histopathologic studies. Tuberculosis of the pericardium (22/30, 73.3%) was the most common histopathologic finding in this study. Addedly, 26.6% of patients (8/30) had the histopathologic finding of chronic nonspecific inflammatory changes.

Tuberculosis is the most common cause of constrictive pericarditis in developing countries. Early pericardiectomy can avoid the development of cardiogenic cachexia, severe hepatic insufficiency, and myocardial atrophy

Constrictive pericarditis due to Tuberculosis	22(73.3%)
Constrictive pericarditis due to other inflammatory Causes	8(26.7%)

Results of follow up

The survivors were discharged and monitored to the end date of the study. Twenty survivors were in NYHA class I (25/28, 89.3%), and two were in class II (3/28, 10.7%) at the latest follow up.

Discussion

Constrictive pericarditis results in a decompressed heart. Pericardiectomy would result in a marked, sustained haemodynamic improvement as cardiac filing and stroke volume is increased. However, it is paradoxical that most of the patients rapidly develop worsening cardiac function, often leading to death.

Thickening of the pericardium oppresses the heart, making the heart diastolic phase restricted, right atrial pressure and left and right ventricular end diastolic pressure increased, vena cava blood flow blocked, high venous pressure, low cardiac output, a result the patients are in a state of high blood volume and tissue oedema. Long-term compression of the heart by the thickened pericardium and added myocardial ischemia, the heart denaturates and atrophies. The heart has poor adaptability to the haemodynamic changes [Fang 2020; Vlasov 2020; Acharya 2018]. Post pericardiectomy as the heart is relieved of the constriction, a large amount of blood flows back and the preload of the heart increases, which leads to the occurrence of heart failure or malignant arrhythmia which can even precipitate to cardiac arrest.

The patients with low cardiac output usually have a long history, a large amount of ascites and peripheral edema before operation, and the cardiac function was mostly in grade III and IV. The patients with constrictive pericarditis should be operated as soon as possible after diagnosis to reduce the incidence of low cardiac output syndrome amongst the patient. Additionally, low cardiac output syndrome is the main cause of death after pericardiectomy. Added to the general condition of constrictive pericarditis patients, serious myocardial damage, compromised myocardial contractility adds to the misery. This necessitates perfect preoperative preparation which is very important to reduce incidence of postoperative low cardiac output syndrome and mortality.

Surgical intervention in form of resection and dissection of conglutinated and thickened pericardium is the only effective treatment to relieve the mechanical restraint of the heart. As a result of pericardial resection there is massive increase in venous return and blood volume in a short time period. However, the long-term bound heart has weakened contractility due to myocardial "disuse" atrophy, fibrosis, decreased compliance, myocardial ischemia and malnutrition, and the heart cannot adapt to it. Therefore, the fluid volume and speed of infusion should be reduced as much as possible, so that heart is temporarily in the state of low volume load and

gradually adapt to the change following pericardiectomy. In addition, monitoring CVP has guiding significance for postoperative treatment. After pericardiectomy, the heart is in a high-volume load state in a short period of time, and there is no concern of low blood volume [Vlasov 2020; Fang 2020]. As the mechanical restraint of the heart is released, the systolic force of the heart cannot bear a large amount of venous return blood volume in a short period of time. At this time, large amount of diuresis becomes a feasible and necessary measure, which also is one of the key points for further improvement of cardiac function after operation. Moreover, the problem of renal congestion and low renal vascular perfusion still exists. Proper use of diuretics reduces the blood volume and cardiac volume load and indirectly reduces renal congestion, increasing renal vascular perfusion pressure promoting diuresis. In some patients a short-term decline in CVP is seen after the narrowing is relieved, which then rises sharply.

During and after the operation continuous invasive monitoring of arterial and venous pressure, control of fluid volume, large amount of colloidal solution, active diuresis, cardiotonic drugs, and vasoactive drugs should be applied aggressively to avoid further aggravating burden causing heart failure.

Before operation, aggressive diuretics and cardiotonic were used to decrease the amount of intraoperative and postoperative return heart blood. The drug regimen included infusion of 2mg/hr Lasix and dopamine 5mcg/hr 12 hours prior to the surgery. This preoperative optimisation is necessary to prevent the low cardiac output syndrome after pericardiectomy due to constrictive pericarditis.

Conclusions

Preoperative optimisation of the patients with diuretics and cardiotonic is necessary to prevent low cardiac output syndrome and mortality after pericardiectomy. In our study tuberculosis of the pericardium was the common histopathological finding. In our study Lasix 2mg/hr and dopamine 5mcg/hr were used 12 hours prior to the surgery continuously for the optimisation of the patients.

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