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Outcome of Pericardiectomy for Constrictive Pericarditis: Single Center Experience

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Abstract: Background. Constrictive pericarditis is a rare chronic inflammatory disease that impairs diastolic filling, reduces cardiac output, and ultimately leads to heart failure. TB and post-pericardiotomy and idiopathic are the commonest causes. Multimodality imaging are essential for confirming the diagnosis Trans-thoracic echocardiography is the golden method of diagnosis. Computed tomography is another confirmatory diagnostic tool of pericardial thickness. Right side heart Cath and magnetic resonance imaging help in diagnosis of constrictive pericarditis from restrictive cardiomyopathy and confirm diastolic filling dysfunction of the heart. Pericardiectomy is the mainstay therapy, should be early and complete if feasible to provide symptoms relieve and adequate outcome Patients and methods. We retrospectively review medical records of 13 patients operated for pericardiectomy for constrictive pericarditis. Demographic and perioperative data were analyzed. Results. The mean age of patients was 49.9±7.8 years. All of our patients were symptomatic (NYHA class II-IV) with 7 months median duration of symptoms. TB was the commonest cause. Complete pericardiectomy was achieved in 11 patients (84.6%). Cardiopulmonary bypass was conducted in 5 patients (4 for associated cardiac procedure and one for repair of IVC injury). NYHA class improved to class I in 9 patients (75%). We had one case (7.6%) of mortality. The cause of death was sepsis and respiratory failure. Conclusion. Phrenic to phrenic pericardiectomy without bypass is safe and effective for treating constrictive pericarditis.

Keywords: Constrictive Pericarditis, Etiology, Diagnosis, Pericardiectomy

1. Introduction

Constrictive pericarditis (CP) is a chronic inflammatory condition resulting in thickened fibrosed pericardium that consequently impairs diastolic filling and elevates venous pressure and ultimately leads to right heart failure [1]. Various causes were reported. Tuberculosis (TB) is a common cause in developing countries, while idiopathic and post pericardiotomy are more common in developed countries [2, 3]. Pericardiectomy is the only definitive treatment of CP that ameliorates symptoms and improves survival [4]. The aim of this study is to present our experience in surgical management of CP. Total pericardiectomy is the definitive therapy for constrictive pericarditis. its feasibility and safety may require CBP to achieve symptoms free and adequate outcome.

2. Patients and Methods

From 2013 to 2020 pericardiectomy was performed for 13 patients with constrictive pericarditis. Surgical reports and charts were retrospectively reviewed for data relating to clinical presentation, investigations, operative details and postoperative outcome. Demographic, comorbidity, and perioperative data and outcome were investigated. Patients with no previous history of cardiac surgery, irradiation, viral or TB pericarditis were classified as idiopathic.

2.1. Preoperative Workup

Diagnosis was based on clinical signs including: Beck´s triad (muffled heart sounds, tachycardia, and hypotension), Kussmaul sign, ascites, and edema. Chest x ray, ECG, echocardiography and CT were requested for all patients. We relied on these non-invasive methods for diagnosis and catheterization was done for one patient with associated ischemic heart disease.

2.2. Operative Technique

Hemodynamic monitoring was done. Groin is available for emergent CBP through femoral vessels. Median sternotomy is our surgical approach. It provides good access for RV, RA, and great vessels and enable phrenic to phrenic pericardiectomy. The procedure was performed on beating heart. Cardiopulmonary bypass was conducted for concomitant cardiac surgical procedures. Dissection starts from middle line then laterally left and right. If possible, we try to free LV first to avoid pulmonary edema. Dissection plane is identified between the epicardium and fibrotic thickened parietal pericardium keeping attention to coronary vessels. Excision involves anterior pericardium from great vessels to diaphragm and ends 1 cm anterior to right and left phrenic nerves. Incomplete pericardiectomy refers to pericardial excision less than phrenic to phrenic pericardiectomy. In areas of extensive calcifications, we leave islands of pericardial thickening to avoid cardiac injury. Hemodynamic improvement is confirmed by TEE.

2.3. Postoperative Management

Patients were transferred to cardiac surgical ICU. Hemodynamic monitoring, ventilator support, and inotropic support (if needed) were provided.

Statistical analysis. Categorical data were presented as frequencies and percentages, while continuous variables were expressed as mean ± SD or median values.

3. Results

From 2013 to 2020 pericardiectomy was performed for 13 patients with constrictive pericarditis. Table 1. presents preoperative baseline characteristics. All our patients were symptomatic with NYHA class (II- IV). The main causes of CP were TB and idiopathic (table 2) The main clinical symptoms were dyspnea and lower limb edema. Chest x ray (figure 1), echocardiography and CT chest (figure 2) were diagnostic and revealed thickened, calcific pericardium in all patients. Cardiac catheterization showed extent of coronary artery disease and pericardial calcification in one patient (figure 3). Complete pericardiectomy was achieved in 11 patients (84.6%). Cardiopulmonary bypass was conducted in 5 patients (4 for associated cardiac procedure and one for repair of IVC injury) (table 3)

NYHA class improved to class I in 9 patients (75%). Postoperative data are shown in table 4. We had one case of mortality. The cause of death was sepsis and respiratory failure.

Table 1. *Baseline characteristics.*

Variable	Result
Total no.	13
Age, y	49.9±7.8
Male sex	9 (69.2%)
Clinical picture NYHA	
II	
III	7 (53.8%)
IV	5 (38.4%)
Ascites	1 (7.6%)
Lower limb oedema	9 (69.2%)
Hepatomegaly	13 (100%)
Duration of symptoms (median) months	3 (23%)
Cardiovascular risk factors	7 (53.8%)
DM	
Hypertension	6 (46.1%)
Dyslipidaemia	6 (46.1%)
Preoperative EF (median)	2 (15.3%)
Elevated RVSP	55
Comorbidity	3 (23%)
COPD	
Renal failure	1 (7.6%)

Table 2. *Etiology of CP.*

TB	6 (46.1%)
Idiopathic	4 (30.07%)
Post inflammatory	2 (15.3%)
Post irradiation	1 (7.6%)

Table 3. *Operative data.*

Pericardiectomy	
Complete	11 (84.6%)
Partial	2 (15.4%)
Use of CBP	5 (38.4%)
Mean duration of bypass (min.)	47.4±19.9
Concomitant procedures	
Mitral valve repair	1
Mitral valve replacement	2
Tricuspid valve repair	1
LIMA to LAD	1

Table 4. *Postoperative data.*

Need for inotropes (no.)	6 (46.1%)
Duration of inotropes (median)	19.5
Duration of MV (median), hours	8
Need for blood transfusion	
Number of patients	7 (53.8%)
Number of units (mean)	2
ICU stays (median), days	3
Total hospital stay (median), days	9
Postoperative NYHA class	
I	9 (75%)
II	3
Postoperative CVP (median)	7
Mortality	1 (7.6%)
Complications	
AF	2
Sepsis	1
Respiratory failure	1

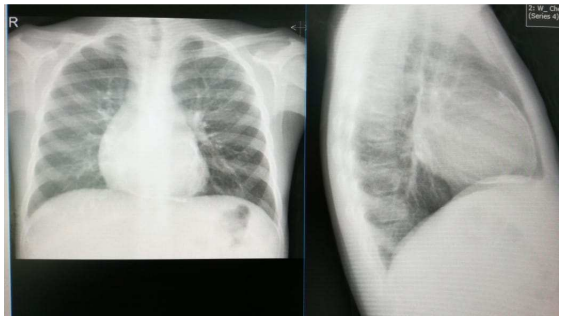

Figure 1. *Plain X ray PA and Lateral heavy calcific pericardium.*

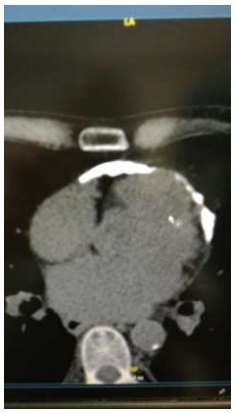

Figure 2. *CT chest calcific pericardium.*

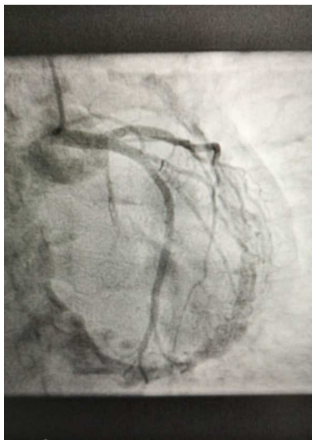

Figure 3. *Cath Image of calcified pericardium.*

4. Discussion

Constrictive pericarditis (CP) is the final result of chronic inflammatory process leading to pericardial thickening and calcification that ultimately impairs cardiac function. The most common causes of CP in western countries are idiopathic or viral pericarditis, followed by post pericardiotomy irritation and mediastinal irradiation. TB is still the predominant cause in developing countries [3, 5] It was the commonest cause of CP in our series followed by idiopathic cause. Other studies from Asian zone confirm this finding [6]. Etiology influences both short and long-term survival. Better prognosis with idiopathic and inflammatory causes while worse results were reported with post irradiation [7]. CP after radiation is associated with serious cardiac disorders including atherosclerosis, valve abnormalities and cardiomyopathy [8]. It is crucial to differentiate CP from restrictive cardiomyopathy to avoid unnecessary surgery. Echocardiography is helpful and combining other diagnostic tools (CT and CMR) can confirm diagnosis [9]. We relied on non-invasive measure for diagnosis. Catheterization was needed for one patient with ischemic heart disease for preoperative coronary angiography. Cardiac catheterization is indicated whenever definitive diagnosis cannot be reached by other non-invasive methods [10].

CT and echocardiography showed pericardial thickening and calcification in all our cases. However, pericardial constriction could occur with normal thickness (but histopathological abnormal) pericardium. Talreja et al reported 26 patients (18%) with normal thickness pericardium of a series of pericardiectomy for CP [11].

Pericardiectomy is the cornerstone surgical therapy for CP. Proper timing of surgery before severe constrictions is crucial for favorable outcome [12]. We believe that pericardiectomy should be performed for symptomatic cases soon after diagnosis. Delayed cases with intractable heart failure and liver impairment have poor outcome. There is ongoing debate about approach, use of CPB, and extent of pericardial excision. We used median sternotomy for all our patients. Median sternotomy provides excellent exposure of heart and great vessels and facilitates pericardiectomy over vena cava and RA as well. Left anterolateral thoracotomy is reserved for purulent pericarditis to avoid risk of mediastinitis and sternal wound infection [13].

Avoidance of cardiopulmonary bypass (CBP) improves results [12]. We think that bypass per se is not the main issue, but concomitant cardiac surgical procedure and severe constrictions requiring bypass are behind poor late outcome. We agree with Chowdhury et al that pericardiectomy with CBP is needed in cases with previous cardiac surgery and severe calcification, for associated cardiac surgery, or in events of cardiac injury or massive bleeding [14]. CPB was conducted in 5 patients of our series (4 for associated cardiac procedure and one for repair of IVC injury).

We adopt the technique of phrenic-to-phrenic pericardiectomy with improvement of symptoms postoperatively. Choi et al reported better long-term survival and greater improvement of RV systolic pressure with radical pericardiectomy (pericardial excision involves posterior pericardium up to coronary sinus and pulmonary veins) when compared with conventional pericardiectomy (phrenic to phrenic pericardial excision). CBP was used in all cases and repair of TV was attempted more frequently without increased risk of bleeding or other complications related to CBP. Hemodynamic support by bypass and ease of repair of cardiac injury if happens are additional advantages [15]. Kim et al pointed out to usefulness of using apical suction device to facilitate excision of pericardium over posterolateral aspect of LV and AV groove instead of conduction CBP [16]. We agree with Zhu et al that the extent of pericardial excision should be decided according to individual conditions [17].

Postoperative in hospital mortality rate of pericardiectomy

varies from 4.4 to 11% [18]. We had one case (7.6%) of mortality who died from respiratory failure and sepsis. Predictors of mortality include preoperative NYHA class, post-irradiation (poor) and post pericardiotomy CP (intermediate) and need for bypass. The most common cause of death was low-output heart failure due myocardial atrophy after prolonged constriction or associated myocardial disease. Other independent predictors of survival are LV systolic dysfunction, PAP, age, s. creatinine, total bilirubin, s. sodium. Pericardial calcification was found in 31% of cases and was not a predictor of mortality [2, 19]. Busch et al found that reduced EF and RV dilatation were independent risk factors of early mortality while COPD, CAD, and renal impairment were risk factors for poor long-term outcome. They recommended liberal TV repair to improve results [20].

5. Limitations

As CP is a quite rare disease, number of patients in our series is limited. Invasive hemodynamic measurements and catheterization data were not assessed. Lastly, our study is a single center and retrospective.

6. Conclusion

Pericardiectomy is safe and effective therapy for symptomatic cases of constrictive pericarditis. Phrenic to phrenic pericardial excision on beating heart is satisfactory. Use of CBP is needed for associated cardiac surgical procedures. Proper timing is crucial for favorable outcome.

Disclosures

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Contributions

EK, OS contributed to this manuscript: surgical procedure, literature research, statistics and writing the manuscript.

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