

# Pericardiectomy for Constrictive Pericarditis - A Comprehensive Study Between Total and Subtotal Pericardiectomy by Left Anterolateral Thoracotomy

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## Abstract

**Introduction:** Constrictive pericarditis is a chronic inflammatory process that leads to progressive pericardial fibrosis encasing the heart in a thickened and fibrotic pericardiectomy this leads to impaired diastolic filling of the cardiac chambers, with the elevation of right atrial mean pressure and end diastolic pressure in both ventricles with the end result of reduced cardiac output.

**Aim:** To analyze the perspectives of clinical outcomes and surgical results of pericardiectomy (total or subtotal) done by left anterolateral thoracotomy and to analyze the histopathology of all pericardiectomy specimen to find out the etiology.

**Methods:** The patient population consisted of patients with constrictive pericarditis who had pericardiectomy and confirmed pathologically. Patients were assigned into two groups one with sub-total pericardiectomy (Group I) and lie other with total pericardiectomy (Group II).

**Results:** The mortality rate was similar in the two Groups with two deaths. All the deaths were cardiac related and occur in the perioperative period as a result of low cardiac syndrome. Both the groups of the patients had similar and significant improvement in the New York Heart Association (NYHA) status. The degree of improvement was not significant improvement between the two groups. The mean hospital stay and inotropic support requirements was similar between the two groups. It is of interest to note that 40% of cases are caused by tuberculosis and no obvious cause of pericarditis was identified in the rest of the patients in both the groups.

**Conclusion:** The results of pericardiectomy in terms of improvement in NYHA status and mortality are similar in both types of resection. The combination of chemotherapy and surgery yields good results in the treatment of tuberculous pericarditis.

**Key words:** Pericardiectomy, Tuberculosis, Thoracotomy

## INTRODUCTION

Constrictive pericarditis is a chronic inflammatory process that leads to progressive pericardial fibrosis encasing the heart in a thickened and fibrotic pericardiectomy.<sup>1-3</sup> This leads to impaired diastolic filling of the cardiac chambers,

with the elevation of right atrial mean pressure and end diastolic pressure in both ventricles with the end result of reduced cardiac output.<sup>4</sup> It is an uncommon condition with the largest series reported 363 patients extending over 60 years. medical mortality in centers with experience is well below 5%. Overall 5 years survival rate as high as 70-80% has been reported after resection with curative intent. As a result, an increase in number of patients are now surviving on a long-term basis.<sup>5-7</sup> Their quality of life may be very much treatment of these patients has observational studies and case constrictive pericarditis without symptoms and early death. Today pericardiectomy is the treatment of choice for many chronic constrictive

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pericarditis. Improvement of perioperative management and surgical techniques has resulted in a steady decrease in post-operative mortality. Today, post-operative hospital mortality in centers with experience is well below 5%. Overall 5 years survival rates as high as 70-80% has been reported after resection are now curative intent. As a result, an increase in number of patients are now surviving on long term basis.<sup>8-10</sup>

Their quality of life may be very much influenced by the adequacy of pericardial resections. Surgical management remains only effective treatment available for this potentially curable disorder.

Various approaches and techniques have been suggested. The approaches described for pericardiectomy include left anterolateral thoracotomy, median sternotomy, a U incision with the basis of U lying at the left sternal border (Harrington approach) and bilateral thoracotomy. Pericardiectomy has also been performed with or without the use of cardiopulmonary bypass with each having its proponents. Regardless of the surgical approach, resection of diseased pericardium is essential for minimizing early morbidity and mortality and improving long-term functional results and quality of life. This study was designed to compare two types of surgical technique of pericardiectomy, total and subtotal pericardiectomy by left anterolateral thoracotomy.<sup>11,12</sup>

### **Aim**

To analyze the perspectives of clinical outcomes and surgical results of pericardiectomy (total or subtotal) done by left anterolateral thoracotomy and to analyze the histopathology of all pericardiectomy specimen to find out the etiology.

## **MATERIALS AND METHODS**

This study was conducted in Department of Cardiothoracic surgery at Government Rajaji Hospital. The patient population consisted of patients with constrictive pericarditis who had pericardiectomy and confirmed pathologically. The research proposal was approved by the institutional review board of ethical committee for clinical research. These patients all prospectively underwent detailed clinical evaluation, biochemical investigation, chest radiography, computed tomography scan of chest and Echocardiography. The patients subsequently underwent pericardiectomy and confirmed histopathologically. At operation, all had confirmed constrictive pericarditis by surgical intervention assessed by intra-operative central venous pressure (CVP) measurement which shows the adequacy of release of

constriction and pathological confirmation by subjecting to histopathological examination. Post-operative echo and CT scan were taken to assess the outcome. Inclusion Criteria: All patients with the clinical signs and symptoms, chest X-ray, CT chest and Echocardiographic features consistent with the diagnosis of constrictive pericarditis. Exclusion Criteria: Patients with preexisting severe co morbid conditions which may preclude invasive evaluation and surgical treatment. Patients with the Echocardiographic features of thickened pericardium but without clinical features of constrictive pericarditis. Patients with associated rheumatic heart disease.

Clinical profile of the patients were recorded with specific emphasis to signs and symptoms such as dyspnea and New York Heart Association (NYHA) functional class, fever, weight loss, cough, chest pain, palpitation, Ascites, Pedal edema, Jugular Venous Pulse, Painful Hepatomegaly, H/o tuberculosis (TB) and antituberculosis therapy treatment.

All patients underwent pericardiectomy. Patients were assigned into two groups one with sub-total pericardiectomy (Group I) and the other with total pericardiectomy (Group II). Right semi lateral position. Left anterolateral thoracotomy was approached through 5<sup>th</sup> intercostals space. Adhesion released. Pericardial fluids sucked and sent for analysis. Resection of the diseased pericardium starts by first resecting the parietal pericardium and creating a cleavage plane in between, The pericardium is free in the following order: First from the left ventricle (LV) and right ventricle (RV) and the left pulmonary vein orifices from the aorta and pulmonary artery, including the left pulmonary vein orifices from the aorta and pulmonary artery, including the left ventricular outflow tract; and finally from the superior and inferior vena cava. To avoid damage to the phrenic nerves, entire the anterior pericardium was resected within 3 or 4 cm of the phrenic nerves, and then completed the dissection of the pericardium from the diaphragm. Resection is continued till epicardial vessels are visualized and contraction is satisfactory. Thoracotomy is closed after securing complete hemostasis. All patients had left inter costal drainage (ICD), All resected specimen were sent for histopathological confirmations. In total pericardiectomy the pericardium is removed from all the surfaces of the heart Pericardium over anterolateral wall. Posterior wall and diaphragmatic surface of LV removed. Pericardium over right atrium, superior vena cava (SVC), inferior vena cava (IVC) and pulmonary veins were removed. In Subtotal Pericardiectomy resection is not extended beyond the left phrenic nerve. Resection over the right atrium and pulmonary vein were not done.

### **Intra-operative Pressure Study**

All patients had CVP line for CVP monitoring and were recorded before and after resection.

### HPE Confirmation

All resected specimen was sent for histopathological examination to confirm the etiology by macroscopic and microscopic examination.

### Follow Up

All patients were followed one week after discharge and at monthly intervals for the first 6 months and subsequently at 3-month interval for 2 years; Patients symptoms were analyzed and treated accordingly.

Pre-operative and post-operative clinical outcomes were analyzed. Pre-operative, intra-operative and post-operative pressure studies were analyzed. Surgical outcomes in terms of functional recovery analyzed. Intra-operative and post-operative complications studied. Duration of hospital stay after surgery and operative mortality was studied. Operative mortality included in all patients who will die within 30 days of the procedure or during the same hospital admission. At surgery, the operative procedures, time taken for resection and total operating time were recorded.

## RESULTS

The study consists of 30 patients with clinical, surgical techniques and pathological diagnosis of constrictive pericarditis. Males and females are in equal in the ratio of 1:1. The mean duration of symptoms was 7.4 months (range: 1-24 months, median - 5 months). The most common presenting feature was dyspnea and abdominal distension which were present invariably in all patients. Pedal edema was present in 11 patients in first Group I and 6 patients in Group II. Ascites praecox was the next most common (90%) feature, also abdominal distension and loss of appetite was present in the patients. Most patients presented with history of TB. Patients gave history of anti TB treatment for pericardial effusion at the onset of illness. None of the patients of the study group had prior cardiac surgery, mediastinal irradiation, uremia or malignancy as a cause for constrictive pericarditis. On physical examination 30 patients (100%) had elevated jugular venous pressure 18 cm of water. Hepatomegaly was invariable but spleen was one third of the patients (Table 1).

Age group of the patients ranged from 14 to 60 years, with a mean age of 28.15 years in Group I and ranged from 16 to 50 years with the mean age of 30.8 in Group II. The youngest age of the patient was 14 years.  $P = 0.05799$  statistically not significant (Table 2).

Low voltage complexes were seen in Group I and II. Heart size was normal in one third of the patients cardio thoracic ratio (CTR  $\leq 0.50$ ). In remaining two third of the

patients mild to moderate cardiomegaly was present (CTR range: 0.55-0.60). Pericardial calcification was present in 6 patients, (30%) in Group I and one patient in Group II (10%). Calcification was best seen in lateral view. Pleural effusion was present in 12 patients (60%) in Group I and 6 patients in Group II (70%) (Tables 3 and 4).

CT scan of the chest was obtained in all patients with and without intravenous contrast agents, pericardial effusion was present in cases (45%) in Group I and 5 cases in Group II. Effusion was mild in 3 patients (25%) and minimal in 2 patients (20%). Two patients had moderate pericardium effusion with thick strands in the pericardial cavity. Pericardium was thickened more than 10mm in 14 patients (70%) in Group I and in 7 patients (70%) in Group II. The thickness ranged from 4 mm to 35 mm. the median pericardial thickness was 15 mm (Table 5).

**Table 1: Clinical data analysis**

Variables	Group I	Group II
Age (%)	Mean - 28.15 Range - 14-60	Mean - 30.8 Range - 16-50
Sex (%)	Male 11 (55) Female 9 (45)	Male 5 (50) Female 5 (50)
NYHA Class I	Nil	Nil
NYHA Class II	Nil	Nil
NYHA Class III (%)	9 (45)	5 (50)
NYHA Class IV (%)	11 (55)	5 (50)
Ascites praecox	20	10
Pedal edema	11	6
Chest pain	14	8
JVP	16	8
Liver	16	8

NYHA: New York Heart Association, JVP: Jugular Venous Pressure

**Table 2: Age distribution**

Age group	Group I (%)	Group II (%)
<15 years	5 (25)	3 (30)
16-25	9 (45)	4 (40)
26-45	6 (30)	2 (20)
>45	0 (0)	1 (10)

**Table 3: Analysis of electrocardiography**

ECG findings	Group I (%)	Group II (%)
Atrial fibrillation	Nil	Nil
Low voltage complexes	13 (65)	3 (30)

**Table 4: Analysis of CXR**

Chest radiography	Group I	Group II
CTR	$\leq 0.50$ -4 $\geq 0.50$ -12	$\leq 0.50$ -3 $\geq 0.50$ -9
Calcification	2	1
Pleural effusion	12	6

CTR: Cardio thoracic ratio, CXR: Chest X-ray

All patients had significant reduction in CVP both intraoperatively and post operatively as seen from the results (Table 6).

### Analysis of Operative Technique

In all patients, the approach was via left anterolateral thoracotomy. We freed the pericardium in this order. First from the LV and RV. Next the aorta and pulmonary artery, including the left ventricular outflow tract. Then from the LV and RV and left pulmonary vein orifices and finally from the superior and inferior vena cava. During these steps, we set the amplitude of the cautery under 60 mv to avoid causing diathermal dysfunction of the RV during electro cauterization must be taken not to damage the phrenic nerves. Then completed the dissection of the pericardium from the diaphragm. There was no major bleeding from the pericardial edges, nor was there was evidence of phrenic acne injury either perioperatively or post operatively. One patient had RV tear which was sutured immediately. One patient had left pulmonary vein tear which was identified and sutured. None of the 25 patients experienced ventricular fibrillation, so there was no need for cardioversion (Table 7).

The mortality rate was similar in the two groups with two deaths. All the deaths were cardiac related and occur in the perioperative period as a result of low cardiac syndrome. Both the groups of the patients had similar arid significant improvement in the NYHA status (Table 8).

## DISCUSSION

Interest in the diagnosis and treatment of constrictive pericarditis was greatly stimulated in the United States by Churchill's report on pericardiectomy in 1929.<sup>13</sup> Since then this disease has come to be recognized in its early phases. Surgical treatment has been rendered more effective and less hazardous by improvements in methods of management and by technical advances providing for a more adequate correction of the cardiac construction. The condition is not a common one, and its etiology remains obscure. Increasing experience with surgical procedures employed for conditions of the heart should contribute to a better understanding of the genesis of constrictive pericarditis. Until the etiological factors are sufficiently known to enable the employment of preventive measures, the direct surgical attack remains the most satisfactory method of relieving symptoms and prolonging life.<sup>14</sup>

Patients with constrictive pericarditis have reduced diastolic filling. They present with congestive cardiac failure. They are diagnosed by CT scan magnetic resonance imaging with pericardium thickness 73 mm in size.

**Table 5: Analysis of CT scan**

CT scan	Group I	Group II
Pericardial effusion	9	5
Pericardial thickening	4-10 mm (6) 10-20 mm (10) >20 mm (4)	4-10 mm (3) 10-20 mm (3) >20 mm (4)
Calcification	5	3

CT: Computed tomography

**Table 6: Analysis of pre-operative, intra-operative, post-operative CVP pressure study**

CVP pressure	Pre-operative CVP	Intra-operative CVP	Post-operative CVP
Group I	15-18 cm h 20	9-11 cm h 20	5-18 cm h 20
Group II	15-17 cm h 20	10-11 cm h 20	6-9 cm h 20

CVP: Central venous pressure

**Table 7: Analysis of post-operative, intra-operative requirement, complications and functional status**

Complications and functional status	Group I	Group II
Post-operative inotrope	All	All
Post-operative ventilation	4	3
Wound infection	2	1
Post-operative hospital stay	14.2 days	15.1
NYHA functional Class 1	12	5
ii	8	5
iii	Nil	Nil
iv	Nil	Nil
30 days mortality	1	1

NYHA: New York Heart Association

**Table 8: Analysis of post-operative NYHA classification**

NYHA classification	Group I (%)	Group II (%)
Class 1	14 (70)	9 (90)
Class 2	6 (30)	1 (10)

NYHA: New York Heart Association

Tb pericarditis is treated by CAT 1-6 months with intense treatment 2 months and 4 months - 2 drug regimes. Patients with pericardial effective need corticosteroid slowly for 3 months.

Patients anterolateral thoracotomy with complete removal of pericardium offer the best treatment for contraction and effective pericarditis. By median sternotomy pericardium attached over the SVC, IVC, right atrium can be removed.<sup>15</sup>

The mortality rate were similar in the two groups with two deaths. All the deaths were cardiac related and occur in the perioperative period as a result of low cardiac syndrome. Both the groups of the patients had similar arid significant improvement in the NYHA status. The degree of improvement was not significant improvement between the two groups. The

mean hospital stay and inotropic support requirements was similar between the two groups. It is of interest to note that 40% of cases are caused by TB and no obvious cause of pericarditis was identified in the rest of the patients in both the groups. None of the patients were operated on during the acute infectious phase and no other causative agents apart from TB were identified. However, although not significant, wound infections were present in three patients in Group I (23%) versus one patient (6.6%) in the Group II. These were treated with antibiotics and drainage of wound infection. Here was lesser degree of complications in both the groups patients requiring antibiotic therapy and two patients required bronchoscopy for retained secretions and two patients had a pleural effusion, which required drainage.

## CONCLUSION

The results of pericardiectomy in terms of improvement in NYHA status and mortality are similar in both types of resection. The combination of chemotherapy and surgery yields good results in the treatment of tuberculous pericarditis. TB is the most common etiology while the others non-specific.

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