

# SURGICAL APPROACH FOR PERICARDIECTOMY: A COMPARATIVE STUDY BETWEEN MEDIAN STERNOTOMY AND LEFT ANTEROLATERAL THORACOTOMY

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## Abstract.

**Pericardiectomy is the treatment of choice for constrictive pericarditis but the best surgical approach remains controversial. In this study we compared the results of pericardiectomy performed on 66 patients with constrictive pericarditis between 2000 and 2005. Pericardiectomy was performed by median sternotomy in 45 patients and by left anterolateral thoracotomy in 21 patients. All patients were reviewed at 6 weeks post operatively. Both groups of patients were similar in age, sex distribution, NYHA shortness of breath status, aetiology, presenting symptoms and duration of symptoms. Mortality was similar in the two groups with three deaths (14.2%) in the thoracotomy group and two deaths (13.3%) in the median sternotomy group. NYHA status improved in both. In addition inotropic support and postoperative hospital stay were similar between the two groups. There was a higher incidence of wound infections (23.8 versus 6.6%) and pulmonary complications (23.8 versus 13.3%; associated with thoracotomy. In conclusion pericardiectomy improves NYHA status in all patients and mortality rates are similar in both the approaches.**

Key Words: Surgical results, pericardectomy

## INTRODUCTION

constrictive pericarditis is a progressive disease. Surgical management remains the only effective treatment (1,2). Various approaches and techniques have been suggested. The approaches described for pericardiectomy include Left anterolateral thoracotomy (3), Median Sternotomy, a U incision with the base of U lying at the left sternal border (Harrington approach) and bilateral thoracotomy (4). Pericardiectomy has also been performed with (5) and without (6) the use of cardiopulmonary bypass with each having its proponents. Of all the approaches median sternotomy and left anterolateral approaches are widely used.

In this study we reviewed 66 cases of pericardiectomy carried out for chronic constrictive pericarditis and compared the results of pericardiectomy performed by left anterolateral thoracotomy versus median sternotomy without the use of cardiopulmonary bypass with regard to morbidity, mortality and func-

tional outcome.

## MATERIALS AND METHODS

All patients with the diagnosis of chronic constrictive pericarditis who underwent pericardiectomy between Jan, 2000 and December, 2006 at our institute were included in this study. During this period, 66 patients were identified and their data collected retrospectively from the case notes. Pericardiectomy was performed by median sternotomy in 45 patients and by left anterolateral thoracotomy in 21 patients. The decision for the approach was dependent on the operating surgeon's preference. All the patients were reviewed at 6 weeks postoperatively and their clinical status assessed and complications following discharge documented.

Deaths occurring during the 6 weeks follow up period whether prior to or after discharge were included in operative mortality. Following median sternotomy or thoracotomy the pericardium over both the ventricles was excised in all cases. The resection over the left ventricle extended to the left phrenic nerve in all cases and resection beyond the phrenic nerve to the left pulmonary veins was carried

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out when ever possible. The resection of pericardium over the atria and the major vessels was done depending on the adequacy of the exposure and the possibility of developing the cleavage plane. All the operations were performed without cardiopulmonary bypass.

All data are expressed as mean  $\pm$  standard deviation or as percentages. Statistical significance was tested for with paired and unpaired Student's *t*-test or  $\chi^2$  test and a *P* value of less than 0.05 was taken to be significant.

## RESULTS

Both groups of patients were similar in age, sex distribution and New York Heart Association (NYHA) shortness of breath status, aetiology, presenting symptoms and duration of symptoms as seen in Table.1. It is of interest to note that 40% of cases were caused by tuberculosis and no obvious cause of pericarditis was identified in the rest of patients in both groups. None of the patients were operated on during the acute infection phase and no other causative agents apart from tuberculosis were identified.

The mortality rates were similar in the two groups with three deaths (14.2%) in the thoracotomy group and two deaths (13.3%) in the median sternotomy group. All the deaths

were cardiac related and occurred in the perioperative period as a result of low cardiac output syndrome. Both groups of patients had a similar and significant improvement in their NYHA status which improved from  $3.0 \pm 0.8$  to  $1.6 \pm 0.7$  in the thoracotomy group and from  $2.9 \pm 0.7$  to  $1.5 \pm 0.6$  in the median sternotomy group. The degree of improvement was not significant between the two groups. In addition hospital stay postoperatively was similar between the two groups as well as the inotropic support requirement in the perioperative period (Table.2).

However, there was a higher incidence, although not significant, of wound infections in the thoracotomy group in five patients (23.8%) versus one patient (6.6%) in the median sternotomy group. These were infections that required antibiotic treatment or local incision and drainage of wound collection. There was also a higher rate of pulmonary complications in the thoracotomy patients with two having lobar pneumonias requiring antibiotic therapy and two patients required bronchoscopy for retained secretions and a fifth patient had a pleural effusion, which required drainage. In the median sternotomy patients one had a pneumothorax and the other had pleural effusion necessitating drainage.

**Table-1**  
Preoperative characteristics of 36 patients with constrictive pericarditis

	Left anterolateral thoracotomy	Median sternotomy
Number of patients	21	15
Age (year)	$24.5 \pm 10$ (range 3-50)	$26.5 \pm 6.77$ (range 10-43)
<i>NYHA class<sup>a</sup></i>		
I	0	0
II (%)	6 (28.5)	14 (26.6)
III (%)	8 (38)	18 (53.3)
IV (%)	7 (33)	13 (20)
<i>Aetiology</i>		
Tuberculosis	9	21
Non-specific	12	24
<i>Main Symptoms</i>		
Dyspnoea	20	45
Abdominal distension	16	29
Chest pain	14	20
Pedal oedema	10	19
Duration of symptoms (months)	$25.52 \pm 19.09$	$18.87 \pm 14.75$
	Range 3 months-7 years	Range 2 months-5 years



**Table-2**  
Postoperative complications and functional status

	Left anterolateral thoracotomy	Median sternotomy
Mortality (%)	30 (14.2)	6 (13.3)
Wound infection (%)	5 (23.8)	3 (6.6)
Inotropic support (%)	13 (61.9)	27 (60)
Pulmonary complications (%)	5 (23.8)	6 (13.3)
Postoperative hospital stay	11.05±5.8	9.07±1.8
NYHA Class at discharge		
I (%)	9 (42.8)	21 (46.6)
II (%)	6 (28.5)	15 (33.3)
III (%)	3 (14.2)	3 (6.6)

## DISCUSSION

The German Surgeon, Rehn in 1913 to resect a constricting pericardium through a left anterolateral thoracotomy with great improvement in his patient condition.<sup>(7)</sup> Subsequent successes were reported by Churchill in 1928, using a curved left parasternal incision and resecting anterior portions of the left third to seventh ribs and their adjacent costal cartilages.<sup>(4)</sup> A number of different operative techniques and approaches have been described since then (8) and despite the experience spanning over 60 years controversy continues as to what constitutes the best approach.

The most commonly used approaches in the present era are the Median sternotomy. It may be carried out using Cardiopulmonary bypass as reported by Copeland et al.<sup>(5)</sup> and Omoto et al. The choice of the approach appears to be of the surgeon's personal preference.

Median sternotomy allows a more radical clearance of pericardium over the right atrium and vanae cavae and it allows extensive pericardial removal using cardiopulmonary bypass. Without cardiopulmonary bypass it is difficult to gain access to the left ventricle, particularly the diaphragmatic surface. Cardiopulmonary bypass aids in the surgical dissection by emptying the ventricular cavities to define clearly the appropriate plane of dissection, and facilitates the management of inadvertent cardiac injury. The disadvantage of using cardiopulmonary bypass is the potential for increased bleeding and other related complications.<sup>(4)</sup> However, there are not many studies suggesting the need for removal of pericardium over the atria and the vanae cavae and normalisation of cardiac hemodynamics has been reported after decortication of the

anterior surface of the ventricles from the atrio-ventricular groove on the right to the left phrenic nerve and the diaphragmatic surface.<sup>(5)</sup> Viola (11) suggested that resection of the pericardium overlying the right atrium and the great veins is not essential. Culliford and colleagues<sup>(8)</sup> suggested that delayed improvement and persistent symptoms are most commonly the result of incomplete decortications. However, outcome is related not only to the extent of the surgery but also to myocardial involvement. Autopsy findings indicate that myocardial fibrosis and atrophy may result<sup>(12)</sup> Long periods of myocardial compression contribute to remodelling of the ventricles with greater involvement of the myocardium in patients with longer duration of symptoms.<sup>(13)</sup> Left anterolateral thoracotomy offers excellent exposure of the anterolateral and inferior aspects of the left ventricle with minimal manipulation and retraction of heart. If necessary the incision can be extended across the sternum and onto the right side of the chest. Fatal bleeding caused by a tear in the right atrium or the venae cavae during surgery performed by left anterolateral thoracotomy has been reported but is not encountered commonly.<sup>(14)</sup>

In our study cardiopulmonary bypass was not instituted in any of the study patients and we were able to achieve a good functional result with adequate pericardial resection through either of the two approaches. However as seen from the results and as expected left anterolateral thoracotomy was associated with higher pulmonary complications and wound infections. It may be therefore argued that in cases of acute infection it may preferred to the transsternal approach because contamination of the sternum can be avoided. On the other hand, although not evident from

our experience the use of median sternotomy allows a more radical pericardiectomy and the use of bypass if required. The mortality of the median sternotomy (13.3%) patients was similar to that of the thoracotomy patients (14.2%) and this is comparable with reported mortality in the literature ranging from 4 to 18%.<sup>(4, 8, 15)</sup>

Although most of the latest reports on this condition (1) suggest that the mean age of the patients at presentation is increasing with a median age of 61 in the period 1985–1995 versus 45 years in the preceding 50 years, we note that the mean age of our cohort is in the mid twenties. This is probably related to the

different aetiology with 40% of our cases caused by tuberculosis while the main identifiable causes in the report by Ling et al.<sup>(1)</sup> were cardiac surgery, pericarditis and mediastinal irradiation accounting for 47% of cases. However with the rising incidence of tuberculosis in the western world this aetiology might change in time.

One limitation of this study might be the small number of patients included. This is however a result of the uncommon nature of this disease. We conclude that the results of pericardiectomy in terms of improvement in the NYHA status and mortality are similar in both the approaches.

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