Surgical Treatment of Constrictive Pericarditis: a Single-Center Experience

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ABSTRACT

Introduction: Constrictive pericarditis (CP) is a rare and potentially lethal disease. It is one of the important reasons of the right-sided heart failure, and it requires immediate intervention. The aim of this study was to investigate the short-term and mid-term results in patients who were operated for CP in our hospital center.

Patients and Methods: We evaluated data of 27 patients who underwent pericardiectomy due to CP in our center. Clinical findings, results of imaging modalities, the surgical technique, and the follow-up were retrospectively evaluated.

Results: The mean age of our patients was 49.78 years. The most common symptom was dyspnea. Peripheral edema was the most common sign during the physical examination. The mean pericardium thickness ranged between 3.4 mm and 6.6 mm in diameter. Total pericardiectomy was performed in 15 patients (55.6%), while partial pericardiectomy was performed in 12 patients (44.4%). Pericardiectomy with concomitant cardiac surgery was performed in 5 patients (18.5%). Unfortunately, postoperative mortality occurred in 4 patients (14.8%).

Conclusion: Surgical removal of pericardium is a treatment modality that should be preferred in patients with CP, despite high mortality rates reported in some series.

Key Words: Constrictive pericarditis; pericardiectomy; mortality

Konstriktif Perikarditin Cerrahi Tedavisi: Tek Merkezli Bir Deneyim

ÖZET

Giriş: Konstriktif perikardit (KP) nadir ve potansiyel olarak ölümcül bir hastalıktır. Sağ kalp yetmezliğinin önemli nedenlerinden biridir ve acil müdahale gerektirir. Bu çalışmanın amacı, hastane merkezimizde KP nedeniyle ameliyat edilen hastaların kısa ve orta dönem sonuçlarını araştırmaktır.

Hastalar ve Yöntem: Merkezimizde KP nedeniyle perikardiyektomi uygulanan 27 hastanın verileri değerlendirildi. Klinik bulgular, görüntüleme modaliteleri, cerrahi teknik ve takip sonuçları retrospektif olarak değerlendirildi.

Bulgular: Hastalarımızın yaş ortalaması 49.78 idi. Hastalarımızın en sık görülen semptomu dispne idi. Fiziksel muayene sırasında periferik ödem en sık görülen işaretti. Ortalama perikardiyum kalınlığı 3.4 mm ile 6.6 mm arasında değişmekteydi. Toplam 15 (%55.6) hastada perikardiyektomi, 12 (%44.4) hastada parsiyel perikardiyektomi uygulandı. Eşlik eden kardiyak cerrahi ile perikardiyektomi 5 (%18.5) hastada perfüze edildi. Maalesef postoperatif mortalite 4 (%14.8) hastada meydana geldi.

Sonuç: Perikardın cerrahi olarak çıkarılması, bazı serilerde bildirilen yüksek mortalite oranlarına rağmen KP'li hastalarda tercih edilmesi gereken bir tedavi yöntemidir.

Anahtar Kelimeler: Konstriktif perikardit; perikardiyektomi; mortalite

INTRODUCTION

Constrictive pericarditis (CP) is one of the important reasons of right-sided heart failure, and it requires immediate intervention[1]. Normally, pericardium consists of two layers. The chronic inflammatory process toward these layers causes the pericardium to become rigid and noncompliant. CP is the result of this chronic inflammatory process. It was first described by Lower in 1669[2]. Eventually, the incompliance leads to heart failure[3].

The causes of CP are mostly idiopathic. Viral postcardiotomy or pericarditis due to irradiation may also be seen[4]. Although tuberculosis is a rare cause of pericarditis, it can be seen widely in developing countries[5]. Uremia, neoplasms, and autoimmune disorders are some of the other causes[6].

Cite this arcticle as: İyigün T, Timur B, Kyaruzi M, Kutay V. Surgical treatment of constrictive pericarditis: a single-center experience. Koşuyolu Heart J 2019;22(1):37-41.

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Submitted: 14.11.2018
Accepted: 28.12.2018

In CP, the constrictive physiology bulges the interventricular septum toward the left ventricle, which makes the left ventricular volume to be lower than that of the right ventricle. Thereby, it enhances the ventricular filling, leading to high-end diastolic pressures, low-end diastolic volume, and stroke volume. As the impairment progresses, it leads toward heart failure[7].

Surgical treatment of CP is the most effective treatment. However, it is an operation that both surgeons and patients avoid because of high mortality rates during the postoperative period. Even in experienced centers, mortality rates are higher than 6%[8]. There are series with mortality rates as high as 23%[9].

The aim of this study was to investigate the short-term and mid-term results in patients operated due to CP in our hospital.

PATIENTS and METHODS

We evaluated the data of patients who underwent pericardiectomy due to CP in our center. Between 2011 and 2018, we operated 27 patients with CP who were diagnosed by a physical examination, echocardiographic findings, or computed tomographic findings. Demographic and operative data were evaluated. Clinical findings, results of imaging modalities, the surgical technique, and follow-up were retrospectively evaluated. The study was approved by the institutional ethics committee (3.10.2018/3-6)

Surgery

All patients underwent median sternotomy. During surgery, 12 patients were on-pump operated, whereas 15 patients were off-pump operated. Total pericardiectomy was performed starting from the ascending aorta through the left ventricle, and the pulmonary artery to the right ventricle, in order to relieve the cardiac outflow tracts. Afterwards, pericardiectomy continued through atria (left and right) to the vena cava (superior and inferior). During partial pericardiectomy, decortications were generally terminated on the left side as soon as the left atrioventricular groove was reached after mobilization and retraction of the left phrenic nerve. On the right side, the decortications were limited to the right atrioventricular groove.

RESULTS

A total of 27 patients underwent surgery for CP. The mean age of our patient population was 49.78 years (18-80 years). Twenty-one patients were male, and six were female. Dyspnea was the most common symptom in our patient population. Peripheral edema was the most common sign during the physical examination. Preoperative characteristics of the patients are summarized in Table 1.

The most common etiological factor in our study population was idiopathic (n= 16). Tuberculosis (n= 5) was the second leading cause. Pericardiectomy was performed in three patients secondary to radiotherapy as the result of pulmonary malignancy. One of our patients had rheumatoid arthritis, one patient had uremic pericarditis, and one patient had pericardial mesothelioma. Etiological factors of our patient population are summarized in Table 2.

Table 1. Preoperative characteristics

Variables		Results
Mean age (years)		49.79 (18-83)
Sex	Male	21
	Female	6
Symptoms (no of patients, %)	Dyspnea	24 (88.9%)
	Chest pain	4 (14.8%)
	Palpitation	2 (7.4%)
	Fatigue	2 (7.4%)
Signs (no of patients, %)	Edema	14 (51.9%)
	JVD	9 (33.3%)
	HSM	5 (18.5%)
	Ascites	3 (11.1%)
	Pericardial knock	2 (7.4%)
	Pulsus paradoxus	1 (3.7%)

JVD: Jugular venous distension, HSM: Hepatosplenomegaly.

Table 2. Etiological factors

Etiological factor	No. of patients (%)
Idiopathic	16 (59.2%)
Tuberculosis	5 (18.5%)
Malignancy/Radiotherapy	3 (11.1%)
Uremia	1 (3.7%)
RA	1 (3.7%)
Mesothelioma	1 (3.7%)

RA: Rheumatoid arthritis.

Smoking was found in 15 of our patients, a normal sinus rhythm was observed in 23 patients, and atrial fibrillation was seen in 4 patients. Electrocardiographs of the patients revealed a low QRS voltage (Figure 1). Chest X-Rays and computed tomography images of 10 patients revealed calcific pericardium (Figure 2). The pericardium thickness ranged between 3.4 mm and 6.6 mm in diameter. Preoperative echocardiographic results revealed pericardial edema, biatrial dilatation, respirational variations, and paradoxical septum movements in most of our patients.

Total pericardiectomy was performed in 15 patients, whereas the remaining 12 patients had undergone partial pericardiectomy. Concomitant cardiac surgery with pericardiectomy was performed in 5 patients, where 1 patient underwent coronary artery bypass grafting (CABG), 1 patient underwent the CABG + AVR (aortic valve replacement), 1 patient underwent the AVR + MVR

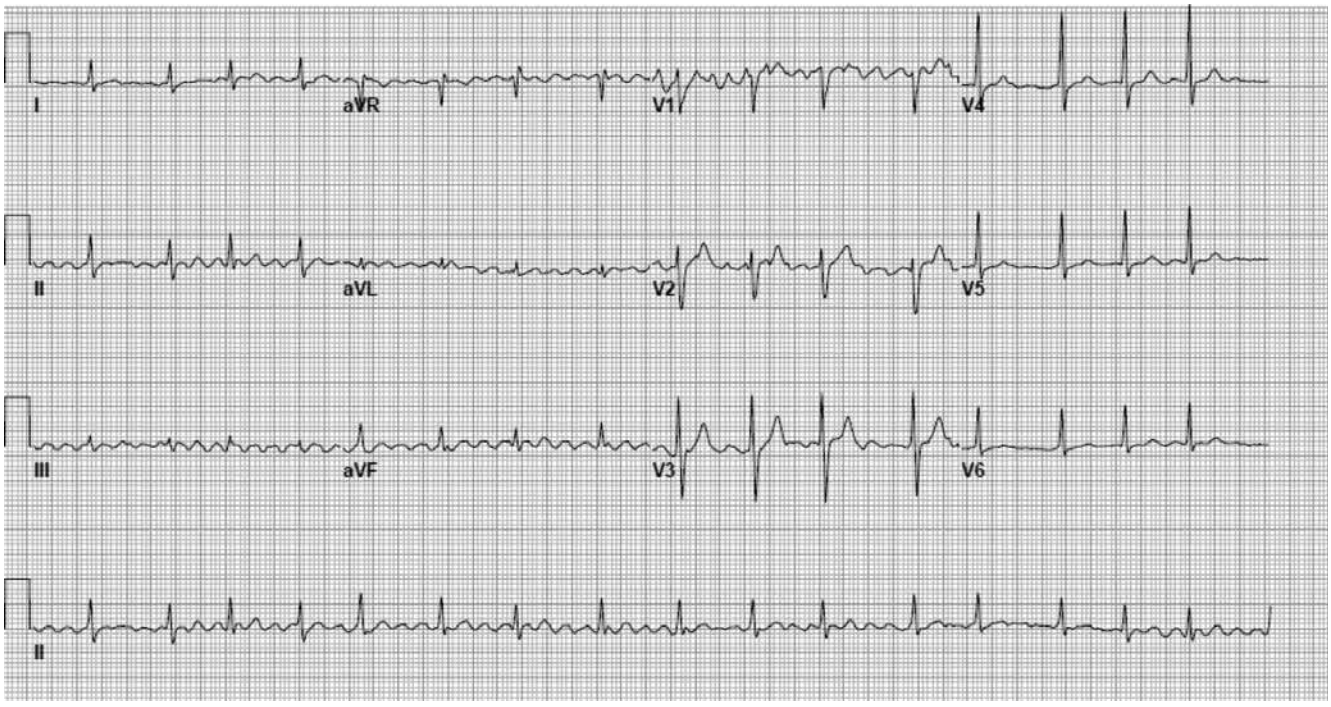

Figure 1. One of the patients with atrial fibrillation and a low QRS voltage.

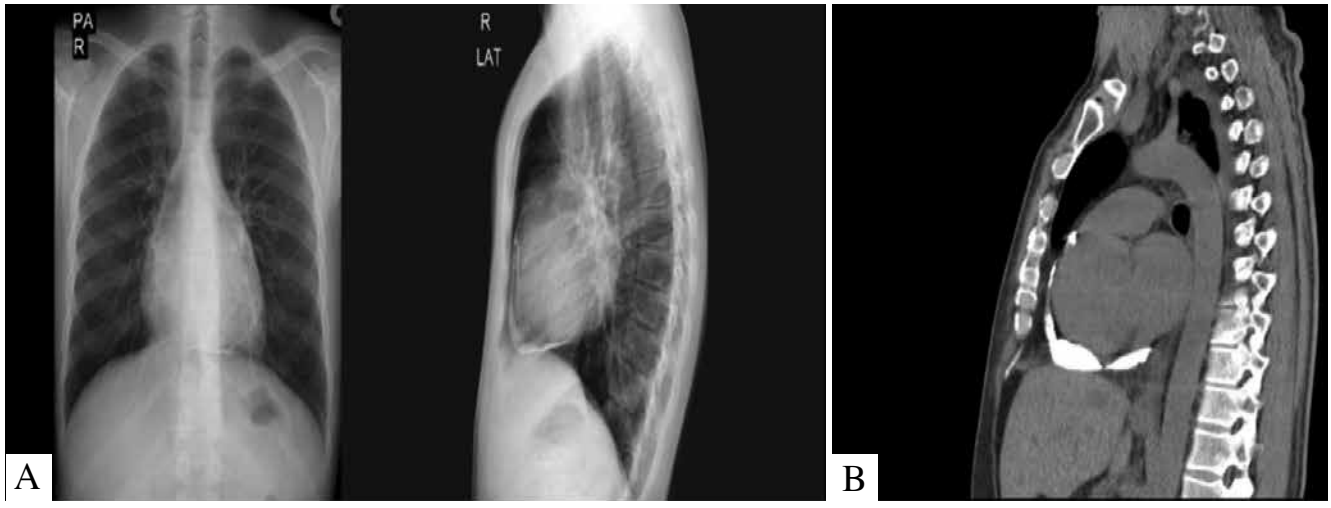

Figure 2. (A,B). Chest X-Ray **(A)** and computed tomography **(B)** Images showing calcific pericardium.

(mitral valve replacement) + TVP (tricuspid valvuloplasty), 1 patient underwent MVP (mitral valvuloplasty) + TVP, and 1 patient underwent the right ventricular apical aneurysm repair. Concomitant surgeries are summarized in Table 3. A cardiopulmonary bypass (CPB) was utilized in 12 patients (44.4%) during surgery. A 49-month Kaplan-Meier survival rate of 59% was obtained from our data (Figure 3).

The mean intensive care unit (ICU) stay length was 3.81 days (range, 1-35 days). The mean hospital stay length was 9.44 days (range, 1-35 days). During the ICU admission, 10 patients

Table 3. Concomitant surgeries

Concomitant surgery types	No. of procedures (n)
CABG	1
CABG + AVR	1
AVR + MVR + TVP	1
MVP + TVP	1
RV apical aneurysm repair	1

AVR: Aortic valve replacement, CABG: Coronary artery bypass grafting, RV: Right ventricle, MVR: Mitral valve replacement, MVP: Mitral valvuloplasty, TVP: Tricuspid valvuloplasty.

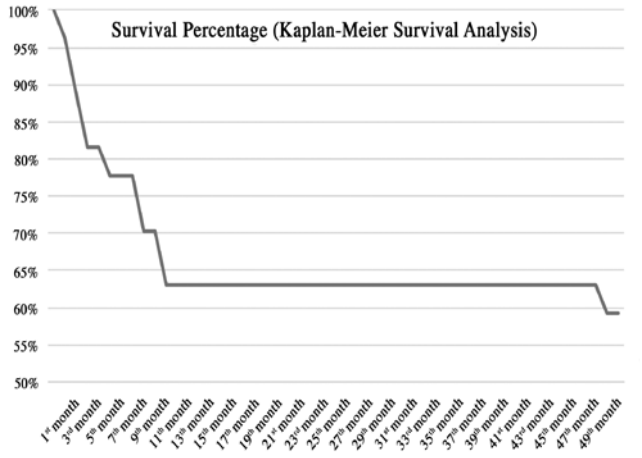

Figure 3. Kaplan-Meier survival analysis.

required inotropic support. Unfortunately, mortality was observed in 4 patients during the postoperative period (14.8%).

DISCUSSION

Surgical treatment of CP remains the subject of debate. The choice of median sternotomy or lateral thoracotomy during surgery has still not been fully elucidated. The arguments to perform a total or partial pericardiectomy are still current.

The course of the disease is usually slow, and the symptoms are nonspecific; consequently, in many cases, the symptoms may be present for 12 months or longer before a diagnosis is made[8]. The diagnosis of constrictive pericarditis is mostly a challenging process, but it seems advisable that patients with heart failure but preserved left ventricular function be considered for this diagnosis[9].

In our study, patients were mostly admitted with the symptoms of dyspnea and peripheral edema. During a physical examination, peripheral edema and jugular venous distension were the leading signs.

In the literature, idiopathic factors are the most common cause of constrictive pericarditis[10]. However, it should not be forgotten that in developing countries, tuberculosis is still a leading cause for pericardial diseases[11]. The number of idiopathic CP cases is increasing. In our study, the most common etiological factor was idiopathic. Tuberculosis was the second leading reason. Radiotherapy due to malignancies, rheumatoid arthritis, and uremia were the other causes.

A type of surgical technique to be performed in CP has been debated over the past years. In a comprehensive study by Chowdhury et al., it was observed that total pericardiectomy gave better results in terms of survival, surgical results, and recurrence than partial pericardiectomy[12]. In our clinic, 2 of 4 patients who passed away were treated with total pericardiectomy, while 2 patients were treated with partial pericardiectomy. More efficient results can be obtained by increasing the number of cases. In our series, all patients were operated via median sternotomy, which facilitated total pericardiectomy. Median sternotomy is also helpful during concomitant cardiac surgery in patients with CP. Median sternotomy also facilitates to enter CPB when required.

The use of routine CPB during pericardiectomy has been recommended in some studies[13]. The use of CPB allows an easier dissection with the emptying ventricles during surgery. However, the systemic effects of CPB should not be ignored. In our study, 44.4% of the patients needed CPB utilization. The reason for this is that some of these patients were candidates for other cardiac procedures. Only two cases with isolated CP required CPB as they had a severely calcified pericardium strictly attached to the epicardium.

Surgery is the absolute treatment in patients with CP. In some studies, early mortality reached up to 15%, and late mortality reached up to 70%[14]. Early mortality rate in our patients was approximately 14.8%. Mortality rates decrease as the surgical experience increases, as the anesthetic techniques progress, and as the quality in postoperative intensive care increase. Depboylu et al. discussed in their study with a 7-year Kaplan-Meier survival rate of 27%-88%, depending on the etiological factor[15]. Our Kaplan-Meier survival rate was 59% during the 49 months of follow-up, similar to other studies on the subject.

There are several limitations to our study. The sample size was small, and it was a retrospective study. A prospective study with a larger sample size will give better results for mortality and long-term survival. Larger, multi-center studies are required.

CONCLUSION

Examining the short-term and mid-term results of our patients diagnosed with CP revealed that a total excision of pericardium is the treatment modality that should be preferred despite of high mortality rates, as reported in the literature.

CONFLICT of INTEREST

The authors reported no conflict of interest related to this article.

AUTHORSHIP CONTRIBUTIONS

Concept/Design: Tİ, BT, MK
Analysis/Interpretation: Tİ
Data Acquisition: BT
Writting: MK, BT
Critical Revision: VK, MK
Final Approval: All of authors.

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