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Mid-Term Outcome of Pericardiectomy for Chronic Constrictive Pericarditis

Résultats à mi-parcours de la péricardectomie pour péricardite chronique constrictive

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ABSTRACT

Background. Constrictive pericarditis is the result of a spectrum of primary cardiac and non-cardiac conditions, resulting in impaired diastolic function. The purpose of this study was to evaluate the mid-term outcomes following treatment of constrictive pericarditis by pericardiectomy. **Patients and methods.** Between January 2010 and December 2019, patients who underwent pericardiectomy for constrictive pericarditis were retrospectively examined. All patients underwent pericardiectomy by median sternotomy, phrenic-to-phenic. Demographic, pre-, intra- and postoperative data and mid-term outcomes were analyzed. **Results.** A total of 25 patients with chronic constrictive pericarditis. The mean age was 39 ± 12.4 years, with 80 % of patients were males. Dyspnea was the most complaint symptoms. Seventy-eight percent of patients were in stage III-IV of NYHA, and most patients were idiopathic in 44.4 %. In hospital mortality was 4%, in malignancies aetiologies. Mean duration of the pericardiectomy was 125 ± 25.5 min. The mean preoperative central venous pressures was 18 ± 3.5 vs 9.5 ± 1.2 mm Hg postoperatively ($p < 0.05$). Postoperative complications noted were pleural effusion, long-term intubation, pulmonary infection, low cardiac output syndrome, bleeding. Late mortality rate was 8%, in the sub group of patients with malignancies. Mean follow-up time was 48 ± 24.5 months. The actuarial survival rates were 94 %, 88 % and 86 % at 1, 2 and 5 years, respectively. **Conclusion.** When performing early before onset of congestive symptoms, pericardiectomy might achieve to good results. Malignancies aetiologies usually had poor prognosis.

RÉSUMÉ

Introduction. La péricardite chronique constrictive peut être secondaire à une pathologie cardiaque ou extracardiaque, entrainant une dysfonction diastolique. L'objectif de ce travail était d'évaluer les résultats à mi-parcours d'une péricardectomie. **Patients et méthodes.** Entre janvier 2010 et décembre 2019, tout patient opéré pour péricardite chronique constrictive a été inclus. Elle se déroule par sternotomie médiane, et la résection s'est faite de manière phréno-phrénique. Les variables démographiques, préopératoires, postopératoires ont été analysées. **Résultats.** Vingt-cinq patients ont été opérés. L'âge moyen était de 39 ± 12.4 ans, avec 80 % de patient de sexe masculin. La dyspnée était la plainte principale. Soixante-dix-huit pourcents de patients étaient en stade III-IV de NYHA. L'étiologie idiopathique représentait 44,4 %. Mortalité hospitalière était de 4 %, chez les patients ayant un cancer. La durée moyenne de péricardectomie était de 125 ± 25.5 min. La pression veineuse centrale préopératoire était de 18 ± 3.5 vs 9.5 ± 1.2 mm Hg ($p < 0.05$). Les complications postopératoires ont été : pleurésie, infection pulmonaire, bas débit cardiaque, intubation prolongée, saignement. Mortalité à moyen terme était de 8 %, chez les patients ayant un cancer. La durée moyenne de suivi 48 ± 24.5 mois. Le taux de survie était de 98%, 88%, et 86%, respectivement à un an, deux, et cinq ans. **Conclusion.** La péricardectomie donne d'excellents résultats quand elle est réalisée avant la survenue des signes de congestion. L'étiologie cancéreuse présente un pronostic péjoratif.

INTRODUCTION

Chronic constrictive pericarditis (CCP) is an infammatory disease of the pericardial leaflets that results in pericardial thickening and fibrosis. These irreversible changes of the pericardium ultimately lead to impairment of right heart filling [1-3]. While, in Africa [4] and India [5], tuberculosis is the prevalent etiology, the underlying cause of CCP is unknown in most patients in Europe and North America [6].

Several mechanisms contribute to exercise intolerance in CCP, including diastolic dysfunction, myocardial atrophy and pulmonary hypertension [7]. The aetiology might be idiopathic, prior cardiac surgery, postradiotherapy, postinfective, connective tissue disease-related, neoplastic, uremic, sarcoidosis, and miscellaneous [8]. After occurrence of constriction; the symptoms related to fluid.

The study conducted by Ling et al. revealed that the majority of patients presented with congestive heart failure. With decreasing frequencies the patients had presented with chest pain, abdominal symptoms, cardiac tamponade, atrial arrhythmia and frank liver disease [9].

Definitive treatment for chronic constrictive pericarditis is pericardiectomy.

Surgical treatment for pericarditis was first suggested by Delorme in 1898 [10]. He initially proposed lysis of the intrapericardial adhesions, and then eventually advocated resection of a portion of the pericardium. In 1913, the first pericardiectomy via a left anterolateral thoracotomy was performed in Germany by Rehn and Sauerbruch with improvement in symptoms [11]. The first successful "decortication of the heart" in the USA was performed in 1928 at Massachusetts General Hospital by Dr. Churchill on an 18-year-old girl [12]. Surgical therapy of CCP is indicated for all patients with worsening dyspnea and asthenia, specifc symptoms of right ventricular diastolic dysfunction, such as swelling of the jugular veins, edema of legs and feet, hepatomegaly, and ascites, as well as palpitations, oliguria, and low cardiac output [2]. Complete pericardiectomy through full sternotomy is the treatment of choice to remove constriction in these patients.

The aim of this study was to evaluate our pratice about surgical management of CCP.

PATIENTS AND METHODS

We retrospectively analyzed clinical reports of all patients had a pericardiectomy between January 2010 and December 2019, in International University Hospital of Cheikh Zaid at Rabat (Morocco). Demographic and operative data were evaluated. The outcomes of the patients were noted.

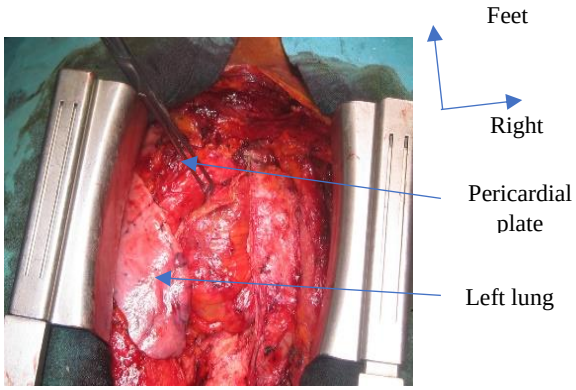

Figure 2a : Peroperative view of pericardiectomy

Immobile heavily calcified plaques were split up with a rongeur, which simplified their removal. After the right ventricle was cleared, the left ventricle followed down to the lateral wall adjacent to the phrenic nerve. The left pleura cavity was opened to identify and preserve the phrenic nerve, i.e., the pericardial resection ended approximately 1 to 2 cm above.

The apex and anterior diaphragmatic site followed. Finally, preparation of the fragile right atrium follow in a respective manner. Similarly, the right pleura cavity was opened and the phrenic nerve was protected. Chest closure was obtained in a routine manner after placement of chest tubes. In-hospital mortality was defined as death in-hospital or within 30 days after surgery.

Indications for pericardiectomy were preoperative clear diagnosis of constrictive pericarditis, patients with poor condition who did not improve after medical treatment, and patients who had pericardial fenestration before the condition improved. For all patients, diagnosis has been confirmed by chest computed tomography (figure 1a, 1b).

Figure 1a : Preoperative CT scan axial view showing pericardial plate

Figure 1b : Preoperative CT scan, Sagittal view

All surgical procedures were performed via median sternotomy, and without cardiopulmonary bypass (CPB). Pericardiectomy was always accomplished with the heart beating. The pericardium was entered at a place without excessive calcification.

Where it could be opened with a knife or electrocautery, preferably on the lower right ventricular. Careful step-by-step preparation with electrocautery and blunt dissection was performed to peel off the thickened pericardium from the epicardial surface (figure 2).

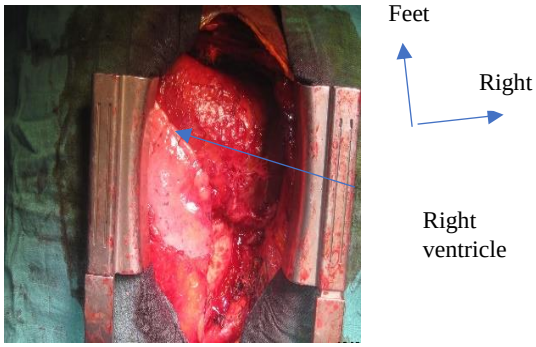

Figure 2b : Final aspect of total pericardiectomy.

Operational definitions

Perioperative mortality was defined as death during the initial hospitalization or within 30 days following surgery. Phrenic-to phrenic pericardiectomy was defined as wide excision of the pericardium anteriorly extending to both phrenic nerves and including the diaphragmatic pericardium. Incomplete pericardiectomy was defined as any pericardial excision that did not meet criteria for phrenic-to-phrenic pericardiectomy.

Continuous variables were expressed as the mean with standard deviation and categorical variables as percentages. The chi-squared test and the Student's t-test were performed as appropriate. A p value < 0.05 was considered statistically significant.

RESULTS

Twenty-five patients had operation for CCP. Mean age was 39 ±12.4 years (range, 28-56 years). Twenty patients were males. Dyspnea was the most common complaint of the patients. The majority of the cases had NHYA functional class III and IV. Peripheral edema was also most commonly noted during physical examination. Table 1 summarizes patients preoperative characteristics.

The most common etiologic factor for our patients were idiopathic, and tuberculosis. Figure 3, illustrates repartition of patients according to aetiologies

Table 1: Preoperative patient's characteristics data.

	Results
Mean age (years)	39 ± 12.4
Male/female ratio	18/7
Symptoms	
Dyspnea	25 (100%)
Chest pain	8 (32%)
Lower limb edema	4 (16%)
Abdominal distension	5 (20%)
Palpitation	6 (24%)
Constitutional*	13(52%)
Signs	
Peripheral edema	11 (44%)
Jugular venous distension	8 (32%)
Hepatomegaly	7 (28%)
Ascite	5 (20%)
Pulsus paradoxus	3 (12%)
Pericardial knock	2 (8%)

**Fever, fatigue, weight loss*

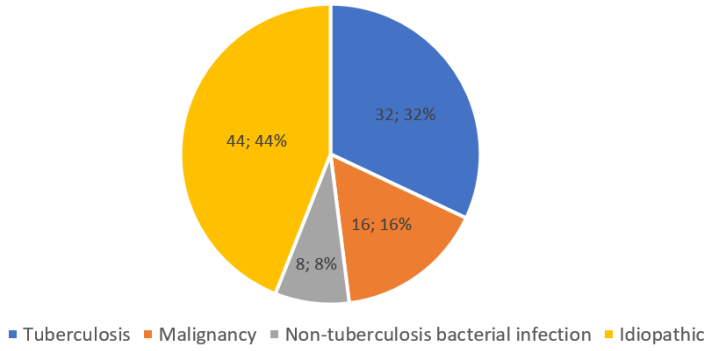

Figure 3: Patients aetiologies

In hospital mortality rate was 4% (1 of 25 patients), in malignancy patient. The cause of death was congestive heart failure. The late mortality rate was 8% (2 of 25 patients), in the sub group of patients with malignancies.

Comparison of pre and post operative NYHA functional class of all patients is given in figure 4.

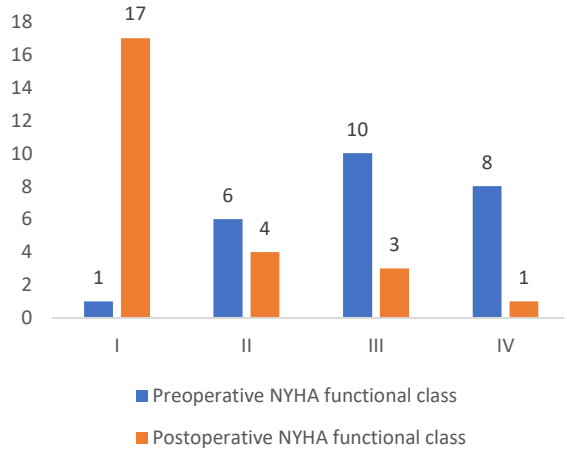

Figure 4: Functional status class of patients pre and postoperatively

Mean duration of the pericardiectomy operation was 125 ± 25.5 min (range, 80- 156 min). The mean preoperative central venous pressures of the cases decreased significantly from 18 ± 3.5 to 9.5 ± 1.2 mm Hg postoperatively ($p < 0.05$). Data regarding operation, post operative care and treatment are given in table 2.

Table 2 : Operative and postoperative data

Mean operation time (min)	125 ± 25.5
CVP change	
Preoperative CVP (mm Hg)	18 ± 3.5
Postoperative CVP (mm Hg)	9 ± 1.2
Inotropic support (no.of patients, %)	5 (20%)
Low dose	4 (16%)
Medium-high dose	1 (4%)
Blood product requirement	
N0.of patients, %	19 (76%)
Mean amount used (units)	1.5 ± 0.5
Mean duration of mechanical ventilation (hours)	18.5 ± 4.5
Mean lenght of ICU stay (days)	2.5 ± 1.2
Mean lenght of hospital stay (days)	8.5 ± 4.6
In hospital mortality (no.of patients, %)	1 (4%)

CVP : Central venous pressure, ICU : Intensive care unit

The postoperative complications noted were pleural effusion long-term intubation, pulmonary infection, low cardiac output syndrome, bleeding (require surgical revision), acute renal failure, and wound infection. The frequencies are given in table 3.

Table 3 : Complications

	N0. of patients (%)
Low cardiac output syndrome	3 (12%)
Pulmonary infection	1 (4%)
Pleural effusion	2 (8%)
Long-term intubation (over 48 hours)	2 (8%)
Wound infection	1 (4%)
Bleeding (requiring surgical revision)	1 (4%)

The mean follow-up time was 48 ± 24.5 months. The actuarial survival rates were 94 %, 88 % and 86% at 1, 2 and 5 years, respectively.

DISCUSSION

Constrictive pericarditis is an uncommon but potentially life-threatening disease. Because of the inflammatory disorder and fibrosis, pericardium becomes inelastic and then inhibits the cardiac filling. This process leads to the diastolic heart failure in the end with unfavorable clinical outcome [2]. Early surgical intervention was reported to play a positive role in reducing mortality rate, but the diagnosis seems to be challenging in the early stage [13].

The preoperative functional class of our patients was in majority belonged to NYHA Class III and IV. In our experience, the predominant symptoms of constrictive pericarditis are lower limb edema, shortness of breath, and exertional dyspnea ; abdominal symptoms, palpitation, and cough are also common. The most frequent signs are raised jugular vein distension, increased cardiac dullness, and distant heart sounds. Other findings include hepatomegaly, tachycardia, pleural effusion, and ascites. Increased heart rate and elevated venous pressure are compensatory mechanisms that offset the increase in intrapericardial pressure. In this study, our patients had tuberculosis and idiopathic causes as principal etiological factor. Echocardiography is essential for the diagnosis of the pericardial syndrome.

Compared with echocardiography, cardiac computed tomography and magnetic resonance imaging offer the advantage of better imaging of the pericardium, with more accurate measurements of pericardial thickening [14].

Cardiac computed tomography and magnetic resonance imaging can delineate abnormal pericardial thickness found in constrictive pericarditis [15].

Constrictive pericarditis must be diagnosed early because cardiac tamponade can occur in the acute phase and constrictive pericardial may subsequently develop. Decreased cardiac output resulting from a chronic constrictive process may require surgical intervention. Currently, pericardiectomy is the only accepted curative treatment for improving cardiac hemodynamics in constrictive pericarditis [16]. The key question of how to perform the surgical procedure safely with a low incidence of postoperative complications is still a matter of debate.

In our study the mean central venous pressure decreased from 18 ± 3.5 to 9.5 ± 1.2 mm Hg. In a study included patients that had pericardiectomy due to constriction the central venous pressure significantly decreased from 15.3 ± 3.7 mmHg to 8.8 ± 3.1 [17]. Postoperative mortality occurred in one patient as in-hospital mortality due to congestive heart failure. Late mortality was 8 %. Bertog et al. reported a perioperative mortality of 6 % in their study. In his study idiopathic constrictive pericarditis had the best prognosis [18]. Lin et al. reported an in-hospital mortality of 3.9 %. In his study, low cardiac output syndrome due to right heart failure and acute renal failure were the causes of mortalities [19].

We have shown that mid-term outcome is strongly influenced by aetiology, namely that malignancies patients have a reduced life expectancy after pericardiectomy. A major finding of our series was that the aetiology of constrictive pericarditis influences not only short-term but also mid-term outcome following pericardiectomy. Idiopathic and inflammatory pathogenesis was associated with the best in-hospital and mid-term survival rates, while malignancies constrictive pericarditis showed very poor prognosis. High mortality rates in cases with malignancies and patients that had radiotherapy are expected. In a small series of patients a mean survival of 14.82 ± 4.4 months was reported in pericardiectomy patients that had constrictive pericarditis secondary to neoplastic disease [20].

The survival of pericardiectomy is also related to completeness of the resection at first, otherwise a second operation with a high mortality risk may be obligatory [21]. For all twenty-five patients, pericardiectomy was from phrenic-to -phrenic.

Study limitations: There are several limitations in this study. First, this a small number single-center retrospective research that inevitably has the selection bias. Secondly, no invasive hemodynamic measurements were routinely implemented; thus, known invasive prognostic parameters, such as right ventricular end-diastolic pressure and right atrial pressure, were not directly measured. Thirdly, our results may be mainly applied to patients with CCP caused by idiopathic and tuberculous pericarditis, and may not be extrapolated to patients with CCP due to other causes, such as postirradiation, postsurgical, and collagen vascular disease. The prognosis of patients with postsurgical CCP may be associated with the severity of underlying valvular or ischemic heart diseases. Finally, survival outcomes only include the mortality within 30 days after surgery, in-hospital deaths, and mid-term. Long-term outcome is required to be analyzed in the future.

CONCLUSION

Pericardiectomy is associated with less morbidity and mortality when realized rapidly diagnosis and treatment of constrictive pericarditis are crucial to reduce mortality. We suggest that pericardial stripping should be performed early and as radically as possible in an effort to prevent chronic illness. Our results demonstrate that overall

survival after pericardiectomy for CCP differs significantly among the major etiologic subgroups and is best for patients with idiopathic and tuberculosis constriction, and poor for malignancies constriction.

Conflict of interest

Authors declare that there is no conflict of interest.

Author's contribution

Samuel Moumpala, Belvie Tseyi Ossere: Wrote, introduction, patients and methods, and abstract
Reddy Atipo-galloye: Wrote results and references
Rochde Sayah: Wrote discussion.

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REFERENCES

1. Madeira M, Teixeira R, Costa M, Gonçalves L, Klein AL (2016) Two-dimensional speckle tracking cardiac mechanics and constrictive pericarditis : systematic review. Echocardiography 33 :1589–1599.
2.Welch TD (2018) Constrictive pericarditis : diagnosis, management and clinical outcomes. Heart 104 :725–31.
3.Garcia MJ (2016) Constrictive pericarditis versus restrictive cardiomyopathy ? J Am Coll Cardiol 67 :2061–207.
4.Yangni-Angate KH, Tanauh Y, Meneas C, Diby F, Adoubi A, Diomande M (2016) Surgical experience on chronic constrictive pericarditis in African setting : review of 35 years' experience in Cote d'Ivoire. Cardiovasc Diagn Ther 6 : S13–S19.
5.Kumawat M, Lahiri TK, Agarwal D (2018) Constrictive pericarditis : retrospective study of 109 patients. Asian Cardiovasc Thorac Ann 26 :347–352.
6.Szabó G, Schmack B, Bulut C, Soós P, Weymann A, Stadtfeld S, Karck M (2013) Constrictive pericarditis : risks, aetiologies and outcomes after total pericardiectomy : 24 years of experience. Eur J Cardiothorac Surg 44 :1023–1028.
7. George TJ, Arnaoutakis GJ, Beaty CA, Kilic A, Baumgartner WA, Conte JV. Contemporary aetiologies, risk factors and outcomes after pericardiectomy. Ann Thorac Surg 2012 ;94 :445-51.
8.Mutyaba AK, Balkaran S, Cloete R, et al. Constrictive pericarditis requiring pericardiectomy at Groote Schuur Hospital, Cape Town, South Africa : causes and perioperative outcomes in the HIV era (1990–2012). J Thorac Cardiovasc Surg. 2014 ;148(6) :3058–3065.
9.Ling LH, Oh JK, Schaff HV, Danielson GK, Mahoney DW, Seward JB, et al. "Constrictive pericarditis in the modern era: evolving clinical spectrum and impact on outcome after pericardiectomy". Circulation. 1999 ;100(no. 13) : 1380-6.
10.Delorme E. Sur un traitement chirurgical : De la symphyse cardopéricardique. Gaz Des Hôp. 1898 ;71 :1150-1.
11.Rehn L. Ueber pericardiale Verwachsungen. Med Klin. 1920 ;16 : 991.
12.Churchill ED. Decortication of the heart (Delorme) for adhesive pericarditis. Arch Surg. 1929 ;19 :1457.
13.Pichel IA, Concepcion Fernandez Cimadevilla O, de la Hera JM, et al. Constrictive pericarditis : early diagnosis for a better prognosis [J]. J Thorac Cardiovasc Surg. 2014 ;148(4) :1766.
14.Syed FF, Mayosi BM. A modern approach to tuberculous pericarditis. Prog Cardiovasc Dis 2007 ;50 :218-36.
15.Cinar B, Enç Y, Göksel O, et al. Chronic constrictive tuberculous pericarditis : Risk factors and outcome of pericardiectomy. Int J Tuberc Lung Dis 2006 ;10 :701-6.
16.Augustin P, Desmard M, Mordant P, et al. Clinical review : intrapericardial fibrinolysis in management of purulent pericarditis. Crit Care 2011 ;15 :220.
17.Ariyoshi T, Hashizume K, Taniguchi S, Miura T, Tanigawa K, Matsukuma S, et al. Surgical experience with chronic constrictive pericarditis. Gen Thorac Cardiovasc Surg. 2012 ;60 :796–802.
18.Bertog SC, Thambidorai SK, Parakh K, Schoenhagen P, Ozduran V, Houghtaling PL, et al. Constrictive pericarditis : etiology and cause-specific survival after pericardiectomy. J Am Coll Cardiol. 2004 ;43(8) :1445-52.
19.Lin Y, Zhou M, Xiao J, Wang B, Wang Z. Treating constrictive pericarditis in a Chinese single-center study : A five-year experience. Ann Thorac Surg. 2012 ;94 :1235-40.
20.Buyukbayrak F, Aksoy E, Dedemoglu M, Kirali K, Alp HM. Pericardiectomy for treatment of neoplastic constrictive pericarditis. Asian Cardiovasc Thorac Ann. 2014 ;22(3) :296-300.
21.Avgerinos D, Rabitnokov Y, Worku B, Neragi-Miandoab S, Girardi LN. Fifteen-year experience and outcomes of pericardiectomy for constrictive pericarditis. J Card Surg. 2014 ;29(4) :434-8.