

Subxyphoid Pericardial Drainage for Tuberculous Pericardial Effusion in Antananarivo

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Abstract

Introduction: Tuberculosis is the leading cause of pericardial effusion in sub-Saharan African countries. The aim of this study was to describe the diagnosis and the surgical management of tuberculous pericardial effusion in low-income country. **Methods:** This was a retrospective and descriptive study performed at Vascular Surgery Unit for 10 years-period (from January 2012 to December 2021), including all cases of drainage of pericardial effusion due to tuberculosis. **Results:** Sixty-seven cases were recorded, including 38 males (56.71%) and 29 women (43.28%). The average age was 35.47 years old. Patients lived in urban areas in 67.16% of cases. Thirteen patients (13.43%) had a previous history of pulmonary tuberculosis. The most common risk factors for tuberculosis infection were malnourishment (80.59%), indoor air pollution (77.61%) and close contact with tuberculosis patient (40.29%). The commonest symptom were dyspnea, (95.52%), chest pain (89.55%), fever (67.16%), tachycardia (95.52%) and cough (80.59%). Twenty-seven patients (39.02%) presented clinical signs of cardiac tamponade. Electrocardiogram showed sinus tachycardia (97.53%) with microvoltage (39.02%). Chest-X-ray showed cardiomegaly (100%) and pleural effusion (56.71%). Echocardiography showed moderate (43.28%) and large (56.71%) pericardial effusion. All patients underwent subxyphoid pericardial drainage. *Mycobacterium tuberculosis* detection via GeneXpert test of pericardial effusion were positive in 38.80% of patients. Pericardial biopsies confirmed the diagnosis of tuberculosis in 41.79%. The mortality rate was 8.95%. **Conclusion:** Subxyphoid peri-

cardial drainage reduced the risk of cardiac tamponade in patients with massive pericardial effusion. Histopathology of pericardial biopsies made a definitive diagnosis for tuberculosis.

Keywords

Tuberculosis, Echocardiography, Pericardial Effusion, Surgery, Cardiac Tamponade

1. Introduction

Tuberculosis is the leading cause of pericardial effusion in sub-Saharan African countries. In Africa, tuberculosis represents 79% of the etiology of adult pericardial effusion, 15% of effusive constrictive and a large proportion of them (up to 20%) responsible for cardiac tamponade [1]. Tuberculosis is a major public health problem in Madagascar. Few studies have been published about surgical drainage for tuberculous pericardial effusion in Antananarivo. The definitive diagnosis of tuberculosis in pericardial effusion remains a challenge in Madagascar due to resource-limited settings. The diagnosis is not definite in most cases, based on the patient's history, clinical signs, histopathology of pericardial biopsy and GeneXpert analysis of pericardial effusion. Cardiac tamponade is the main risk of tuberculous pericardial effusion [2]. Surgical drainage is the commonest procedure to treat or to prevent the cardiac tamponade due to abundant tuberculous pericardial effusion [3]. Few studies have been published about surgical drainage of tuberculous pericardial effusion despite of the high prevalence of tuberculosis in Madagascar. The aim of this study was to describe the diagnosis and the surgical management of tuberculous pericardial effusion in low-income country.

2. Materials and Methods

This study was performed in cardiovascular surgery unit at Joseph Ravoahangy Andrianavalona (JRA) Teaching Hospital in Antananarivo Madagascar. It's one of referral hospital of cardiac surgery in Antananarivo. This hospital received all patients referred for surgical drainage due to abundant pericardial effusion from all nearby hospitals in Antananarivo. We conducted a retrospective and descriptive study for 10 years period (from 1st January 2012 to 31th December 2021), performed at Cardiovascular Surgery Unit of JRA Teaching Hospital. We included in this study all cases of surgical drainage for pericardial effusion with or without tamponade pericarditis and in context of tuberculosis infection: previous history of tuberculosis, risk factors for tuberculous infection, symptomatology and clinical signs of tuberculosis, image of pulmonary tuberculosis in chest X-ray, direct or indirect signs of tuberculosis infection in analysis of pericardial effusion, detection of *Mycobacterium Tuberculosis* infection in GeneXpert analysis of pericardial effusion and histology of pericardial biopsies. Data

were collected from patients folders stored in Cardiovascular Surgery Unit, including all documents from Emergency Unit, Anesthesiology and Resuscitation Unit, Operating room and Cardiovascular Surgery Unit. Demographic data, type of residence of patients, tuberculosis risk factors, symptomatology, signs in physical exam, paraclinical investigations, surgical procedures and outcomes were analyzed. Data were recorded with Microsoft Excel 2016, then analyzed with SPSS 21.0 software. Data are presented as absolute values and frequency, mean and standard deviation and range according to the sample distribution.

3. Results

A total of 67 patients were recorded in this ten-years-period. Population of study was youth that most of patients arranged between 20 to 59 years old (76.11%). The average age was 35.47 years-old, ranged from 9 months to 75 years-old. There was male predominance in our study, including 38 males (56.71%) and 29 women (43.28%), giving a sex ratio of 1.31. Patients live in urban area in 67.16% of cases (**Table 1**). Nine patients (13.43%) had a previous history of pulmonary tuberculosis. The most risk factors of *Mycobacterium tuberculosis* infection were malnourishment (80.59%), indoor air pollution (77.61%) and close contact with tuberculosis patients (40.29%) (**Table 1**). Six patients (8.95%) were tested positive in HIV infection. In admission, the commonest symptoms were dyspnea (95.52%), chest pain (89.55%), cough (80.59%) and palpitations (71.64%) and fever (92.53%). Physical exams of patients found tachycardia (95.52%), jugular venous distension (56.71%) and muffled heart sounds (56.71%) (**Table 2**). Thirty-eight patients (56.71%) presented the Beck's triad clinical signs of cardiac tamponade. Electrocardiogram (ECG) showed sinus tachycardia (97.01%), low QRS voltage (40.29%) and electrical alternans (56.71%) (**Figure 1**). Chest-X-ray showed water bottle heart (100%) (**Figure 2**) and pleural effusion in 56.71% of cases. Echocardiography confirmed the diagnosis of pericardial effusion in all patients. Echocardiography showed moderate (10 - 20 mm) pericardial effusion in 28 patients (43.28%), large pericardial effusion (>10 mm) in 39 patients (58.20%), circumferential effusion in 42 patients (62.68%) (**Figure 3**) and focal effusion in 25 patients (37.31%) (**Table 3**). Echocardiography found cardiac tamponade signs in 38 patients (56.71%). All patients underwent sub-xiphoid surgical pericardial drainage using local anesthesia in 36 patients (53.73%) (**Figure 4**) and general anesthesia in 31 patients (46.26%). Pericardial effusion was hemorrhagic in 85.07% of cases. Pericardial fluid abundance was moderate in 29 patients (43.28%) and massive in 38 patients (56.71%). Biochemical analyses of pericardial effusion showed exudate for all patients. *Mycobacterium tuberculosis* detection via GeneXpert was positive in 38.80% of patients. The histopathology of pericardial biopsies showed epithelioid granuloma with giant cell in 26 patients (38.80%) (**Table 4**), epithelioid granuloma with caseating necrosis in 2 patients (2.98%) and chronic inflammation in 39 patients (56.52%) (**Figure 5**). Six patients (8.95%) were death after surgery of cardiac tamponade drainage. The average hospital length of stay was 11 days, ranged from 4 to 23 days.

Table 1. Demographic data/Type of place of residence/Tuberculosis risk factors.

Demographic data/Type of place of residence/Tuberculosis risk factors		Frequencies (n = 67)	Percentage (%)
Age (years)	0 to 19	14	20.89
	20 to 39	37	55.22
	40 to 59	14	20.89
	≥ 60	2	2.98
Gender	Male	38	56.71
	Female	29	43.28
Type of place of residence	Urban areas	45	67.16
	Rural areas	22	32.83
Previous history of tuberculosis	Yes	9	13.43
	No	58	86.56
Tuberculosis risk factors (n = 58)	Malnourishment	54	80.59
	Indoor air pollution	52	77.61
	Active smoking	13	19.40
	Alcohol abuse	21	31.34
	Close contact with TB patients	27	40.29
	HIV infection	6	8.95
	Diabete mellitus	15	22.38
	Malignancy	6	8.95

Table 2. Previous history of tuberculosis, Tuberculosis risk factors, Symptom and physical exam.

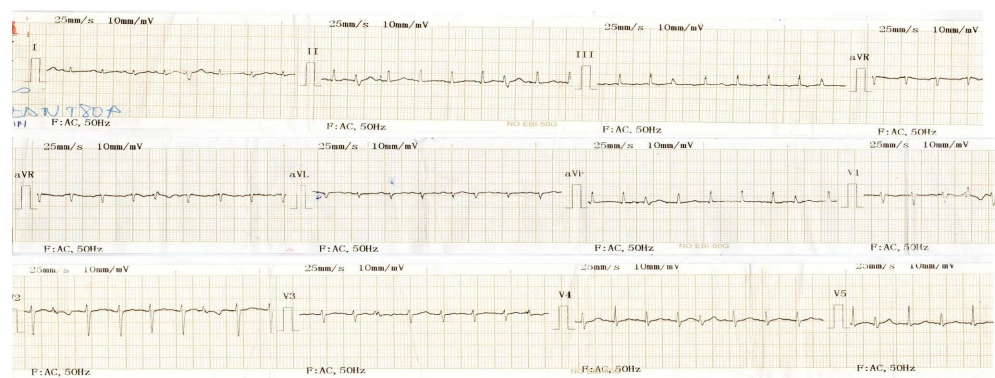
Previous history of tuberculosis/Tuberculosis risk factors/Symptom and physical exam		Frequencies (n = 67)	Percentage (%)
Symptoms	Dyspnea	64	95.52
	Cough	54	80.59
	Chest pain	60	89.55
	Palpitation	48	71.64
	Paroxysmal nocturnal dyspnea	23	34.32
	Weakness	52	77.61
	Fever	62	92.53
	Abdominal pain	25	37.31
Physical exam findings	Tachycardia	64	95.52
	Muffled heart sounds	38	56.71
	Hypotension	27	40.29
	Jugular venous distension	38	56.71
	Pulsus paradoxus	27	40.29
	Ascitis	16	23.88
	Pericardial friction rub	23	34.32
	Hepatojugular Reflex	22	32.83
Peripheral edema	32	47.76	
Beck's triad	38	56.71	

Table 3. Electrocardiogram and diagnostic imaging.

ECG/Diagnostic imaging		Frequencies (n = 67)	Percentage (%)
Electrocardiogram	Sinus tachycardia	65	97.01
	Low QRS voltage	27	40.29
	Electrical alternans	39	56.71
	PR segment depression	2	2.32
Chest X-ray	Water bottle heart	67	100
	Pleural effusion	38	56.71
	Pulmonary TB lesion	9	13.43
Echocardiography	Small effusion (<10 mm)	0	0
	Moderate effusion (10 - 20 mm)	28	43.28
	Large effusion (>10 mm)	39	58.20
	Circumferential effusion	42	62.68
	Focal effusion	25	37.31
	Cardiac tamponade signs	38	56.71

Table 4. Characteristic of pericardial effusion and results of histopathology of pericardial biopsies.

Characteristics of pericardial fluid and histopathology of pericardial biopsies		Frequencies (n = 67)	Percentage (%)
Fluid abundance	Small (<100 cc)	0	0
	Moderate (100 - 500 cc)	29	43.28
	Abundant (>500 cc)	38	56.71
Color of pericardial fluid	Hemorrhagic	57	85.07
	Nonhemorrhagic	10	14.92
Biochemical analyses	Transudate	0	0
	Exsudate	67	100
GeneXpert	Positive	26	38.80
	Negative	0	0
	Not done	41	61.19
Histopathology of pericardial biopsies	Epithelioid granuloma with giant cell	26	38.80
	Epithelioid granuloma with caseating necrosis	2	2.98
	Chronic inflammation	39	56.52

**Figure 1.** ECG with low QRS voltage in patient with massive pericardial effusion.

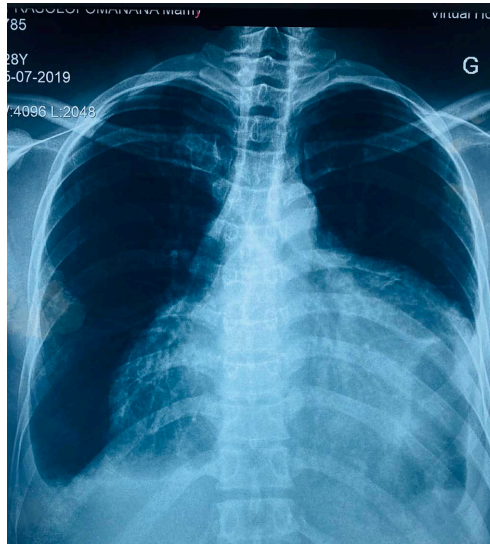


Figure 2. Water bottle heart in chest X-ray.

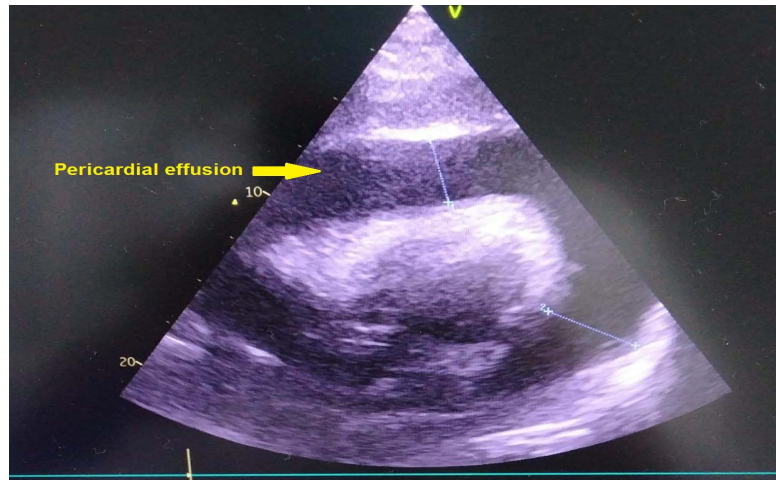


Figure 3. Transthoracic echocardiography with massive pericardial effusion.



Figure 4. Subxyphoid pericardial drainage using local anesthesia in patient with cardiac tamponade.

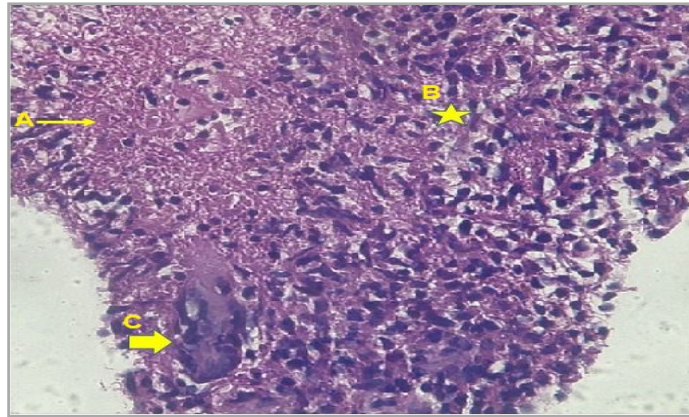


Figure 5. Histopathology of tuberculosis in pericardial biopsy (A: Caseating necrosis, B: Epithelioid granuloma, C: Giant cell).

4. Discussion

Tuberculosis is the most common cause of pericardial effusion in sub-Saharan african countries and remains a major public health problem. The mortality in patients treated for tuberculous pericarditis in sub-Saharan Africa was 26% [4]. In Africa, patients with tuberculous pericarditis presented mostly with effusive pericarditis (79%), effusive constrictive pericarditis (15%) and myopericarditis (13%); a large proportion of them (up to 20%) presented a cardiac tamponade [1]. Subxyphoid pericardial drainage is one of the surgical procedure performed in sub-Saharan african countries to evacuate a massive pericardial effusion. Prevalence of surgical drainage for tuberculous pericardial effusion depends on the prevalence of tuberculous pericarditis in each country. Many cases of tuberculous pericardial effusion were published in sub-Saharan african literature. Some authors have been published their experience in diagnosis of tuberculosis in pericardial effusion after subxyphoid surgical drainage [5] [6].

Tuberculous pericarditis affects patients of all ages. However, youth patients were more affected by tuberculous pericarditis in african studies. Our study showed a similar result of these african studies with predominance of young patients (68%). The average age of patients in our study (35 years) was similar in other african study like Kombila *et al.* (34 years) [7], Zabsonre *et al.* (35 years) [8], and Randimbirina *et al.* (33 years) [9].

The gender difference in the population of patients with tuberculosis was published in the literature [10]. More publications showed a male predominance in population of patients presented pericardial effusion due to tuberculosis like the sub-Saharan african studies of Kirioua-Kamenan *et al.* (62%) [11] and Rakotomizao *et al.* [12]. These results were similar with our result (56%). But, some authors found a female predominance in population of patients underwent pericardial effusion drainage like Kombila *et al.* [7]. In Antananarivo, men dropped out of treatment more frequently than women and age under 30 years was one among the independent factors associated with dropping out of anti-tuberculosis treatment according Rakotonirina *et al.* [13]. This situation could

be explained the youth male predominance in our population of study.

The prevalence of tuberculosis is generally higher in urban areas than in rural areas. This hypothesis has been published in previous studies. In our study, most patients underwent surgical drainage of pericardial effusion lived in urban areas (67%). Our study showed a similar result as in studies of Ravahatra *et al.* (62%) [14] and Levoyer *et al.* (66%). [15] The predominance of tuberculosis infection in urban areas could be explained by overcrowding in urban areas responsible for the contagious spread of Koch's bacillus.

In patients with previous history of pulmonary tuberculosis, the diagnosis of tuberculosis pericardial effusion is generally clear. But, clinicians must search the risk factors of tuberculosis in patients without previous history of pulmonary tuberculosis. There were nine patients (13%) with a previous history of pulmonary tuberculosis in our study. The most common risk factors of tuberculosis in our study were malnourishment (80%), indoor air pollution (77%) and close contact with tuberculosis patient (40%). Our results were similar in study of Aazri *et al.* which the commonest risk factors were poorest population (70%), indoor air pollution (20%), close contact with tuberculosis patient (31%) and tabagism (31%) [16]. HIV infection is the one of the most risk factors for tuberculosis infection in sub-Saharan african countries. We recenssed 8 cases (8.95%) of HIV infection among our 67 patients. In the study of Zabsonre *et al.* performed in Burkina Faso, the rate of HIV infection in patients with tuberculosis pericardial effusion was 57%. [8]. But, Reuter *et al.* found 36% of HIV positive among 233 patients with tuberculous pericardial effusion in South Africa [5].

The diagnosis of tuberculous pericardial effusion remains challenge for practitioners in sub-Saharan african countries. It's generally difficult to establish the definitive diagnosis of tuberculous pericardial effusion because they needed specific exams like histology exam of pericardial biopsy or geneXpert analysis of pericardial effusion. In our practice, the diagnosis of tuberculosis pericardial effusion depend on results of questions to ask for the patients, the clinical symptomatology, the results of diagnostic imaging, the analysis of pericardial effusion and the histology exam of pericardial biopsy.

The commonest symptoms of massive pericardial effusion in our patients were dyspnea (95%), chest pain (89%), cough (80%), palpitations (71%) and fever (92%). These signs were observed in other studies about surgical drainage of tuberculosis pericardial effusion like Diakité *et al.* [6] and Randimbirina *et al.* [9]. The most common signs of pericardial effusion in patients underwent subxyphoid pericardial drainage were dyspnea (61%) and chest pain (26%) in study of Diakité *et al.* [6]. The commonest symptoms of tuberculosis pericardial effusion in patients with tamponnade pericarditis were dyspnea (93%), cough (83%), abdominal pain (80%) and chest pain (54%) in study of Randimbirina *et al.* [9].

Physical examination is important to make the diagnosis of pericardial effusion. Massive pericardial effusion could responsible of tamponnade [17]. So, clinician must find quickly all signs of tamponnade in patients admitted for pericar-

dial effusion. In our study, the commonest signs of pericardial effusion were tachycardia (95%), jugular venous distension (56%) and muffled heart sounds (56%). Beck's triad is a collection of three clinical signs associated with pericardial tamponade which is due to an excessive accumulation of fluid in pericardial sac. The Beck's triade associate low blood pressure, muffled heart sounds and raised jugular venous pressure. In our study, thirty-eight patients (56%) presented the Beck's triad clinical signs of cardiac tamponade. There was 20% of pericardial tamponade among 10 patients presented pericardial effusion due tuberculosis in study of Yaméogo *et al.* performed in Burkina Faso [18].

Electrocardiogram is one of non-invasive test, used to detect the signs of massive pericardial effusion or tamponade pericarditis. In massive pericardial effusion with cardiac tamponade, ECG found classical triad of sinus tachycardia, low QRS voltages and electrical alternans [17]. In our study, ECG showed sinus tachycardia (97%), low QRS voltage (39%) and electrical alternans (56%). Kombila *et al.* found 62% of low QRS voltages in patients with tuberculous pericardial effusion in Libreville [7].

Transthoracic echocardiography is the best diagnostic imaging, useful in diagnosis and management of tuberculous pericardial effusion. Echocardiography can provide an estimate of the size of effusions. Generally, the size of the effusion on echocardiography indicates the volume of pericardial fluid as follows: small (<10 mm), which corresponds to 50 - 100 mL pericardial fluid; moderate (10 - 20 mm), corresponding to 100 - 500 mL pericardial fluid and large (>20 mm), corresponding to >500 mL pericardial fluid [19]. In our study, echocardiography showed moderate pericardial effusion in 28 patients (43%), massive pericardial effusion in 39 patients (58%). The study of Diakité *et al.* showed 18% of moderate abundance and 81% of high abundance among 49 cases of tuberculous pericarditis [6].

The definitive diagnosis of tuberculous pericardial effusion requires sometimes different tests. Cytology and biochemical tests of pericardial fluid are usually not enough to establish the diagnosis of tuberculous pericardial effusion. Histopathology of pericardial biopsies from pericardial window are important to make definitive diagnosis of tuberculosis in pericardial effusion [20]. Histological features of granulomatous inflammation and caseous necrosis are highly suggestive of tuberculosis. But, the diagnosis was difficult in histopathological analysis with chronic inflammation. In our study, most patients (56%) showed a histological analysis with chronic inflammation. Pericardial biopsy confirmed the diagnosis of tuberculosis in 41% of cases. Histopathology with chronic inflammation made sometimes a difficult decision to treat our patients with tuberculosis drugs. Now, GeneXpert is a rapid, sensitive and specific diagnostic tool to detect *Mycobacterium tuberculosis* in pericardial effusion. The pooled sensitivity, specificity of Xpert MTB/RIF for tuberculous pericarditis were 65% and 99% [21]. In our study, all patients couldn't practice a geneXpert analysis for reason of lack of financial resources. But, GeneXpert analysis were positive in all patients who underwent it.

Mortality rate of tuberculous pericardial effusion was higher in sub-Saharan african countries than western countries. The rarity of cardiac surgeon and the delay of diagnosis contribute to high mortality rate in these countries. The overall mortality rate in patients treated for tuberculous pericarditis was 26% in sub-Saharan african countries [4]. The mortality rate of patients underwent surgical drainage for tuberculous pericardial effusion in our study was 9%. The study of Diakité *et al.* showed a lower mortality rate (4%) than in our study [6].

5. Limitations

The retrospective nature and the small size of the population studied constitute the main limitations of our study. The paucity of original studies carried out on drainage surgery for tuberculous pericarditis in the African literature limits discussion of this subject.

6. Conclusion

Subxyphoid pericardial drainage treat massive pericardial effusion and prevent the risk of cardiac tamponade. The definitive diagnosis of tuberculous pericardial effusion remain a challenge in our practice. Histopathology of pericardial biopsy and geneXpert test of pericardial fluid were the best test to confirm tuberculous pericarditis.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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