

Echocardiography in helping to determine the Causes of Pericardial Effusion in the Sudanese patients

M S Alkhalifa¹, Maha Elnima², S A Ismaeel³



Abstract:

Pericardial disease is not uncommon in Sudan and the etiology may impose a diagnostic problem.

The aim of this study is to determine the etiology of isolated pericardial effusion and to assess the usefulness of the echocardiographic features of the effusion in helping to determine the etiology.

Patients and Methods:

This is an observational cross-sectional prospective study done from Jan. 2002 to Aug. 2003. Fifty one patients were collected from four centers in Khartoum State. Chest X-ray, Echocardiogram and ECG were done for all patients. Pericardiocentesis was done for 35 patients [68.6%]. Specific investigations for the etiological diagnosis were done when appropriate.

Results and Conclusion:

Male to female ratio was 1.3:1. The age ranged between 4 and 80 years with 68% of patients in the age group 11-40 years.

Forty one Patients [82%] were referred with a correct diagnosis of pericardial effusion. The etiology was evident clinically or by specific investigation in 31 patients [61%] and 20 patients [39%] needed pericardiocentesis.

The common etiologies were tuberculosis, malignancies, rheumatological, idiopathic and bacterial infection consecutively.

The result showed useful echo features to differentiate between tuberculous, occult malignancy and idiopathic etiologies. Thickened Effusion, fibrin strands and shaggy pericardium are suggestive of tuberculosis while thickened Effusion without fibrin strands or shaggy pericardium makes malignancy a competitive diagnosis and the thin appearance of the effusion with shaggy pericardium and no fibrin strands goes more with idiopathic effusion while the features of massive effusion, tamponade or the hemorrhagic appearance of the fluid although common in these three etiologies has no much differential value.

Key words: Tuberculous, malignant and idiopathic effusions, thickened appearance, fibrin strands, Shaggy pericardium

Primarily pericardial effusion is not rare and may be suspected in any patient with unexplained chest pain, dyspnoea or cough, especially in the presence of pericardial friction rub, increased cardiac dullness and/or muffled heart sounds¹⁻⁸.

1. Prof of Medicine. Omdurman Islamic University. Sudan.

2. Consultant physician Ministry of Health.

3. Prof of Medicine Khartoum University. Khartoum Sudan

The plain chest radiograph and electrocardiogram (ECG) may add to the diagnosis⁹⁻¹².

The most sensitive, rapid and widely used technique for detecting pericardial effusion is Echocardiography.

M-mode echocardiography appears to be sensitive in detecting as little as 20ml of pericardial fluid but few studies evaluated the role of the echocardiographic features of the pericardial effusion in helping in the etiological diagnosis^{1, 7, 13-15}.

The etiological diagnosis may be evident clinically or by specific investigations but in some patients pericardial fluid analysis or even a pericardial biopsy may be needed. On the other hand knowing an etiological condition of pericardial effusion in a patient may give a clue to it as the cause of the patient's cardiac symptoms and/or signs¹⁶⁻¹⁸.

The dilemma arises when the etiology is not obvious clinically or by special investigations. This is specially encountered when one want to differentiate between tuberculous, occult malignancy and idiopathic causes^{1, 4, 6, 7}.

Objective:

The objective of this study is to identify the causes of isolated pericardial effusion in the Sudanese patients and to assess the usefulness of the echocardiographic features of the effusion in helping to determine the etiology.

Patients and methods:

This is an observational, prospective, cross-sectional study, performed in El Shaab teaching hospital Khartoum Sudan. The patients were referred from four centers in Khartoum state, in the period from January 2002 to August 2003. Fifty one patients were studied.

The inclusive criteria were patients with pericardial effusion and no other primary cardiac problem. Patients with pericardial effusion due to a primary cardiac problem or as part of a generalized edema were not included. Data were collected including history, general and full cardiovascular assessments. Investigations included electrocardiogram, chest roentgenogram and echocardiography for all patients.

The Echo characteristics were defined as follows:

The size of the Effusion was categorized by measuring the fluid strip as small when it is less than 10 mm, moderate-sized when it is 10 to 15 mm and large when it is more than 15 mm.

Tamponade was defined by early diastolic right atrial and/or ventricular collapse or dipping. Thickened Effusion was diagnosed when the pericardial fluid appears as

spontaneous contrast with the normal echo density [Fig1].

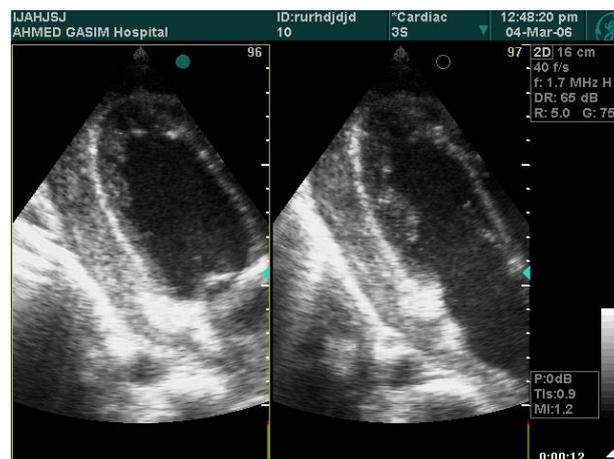


Fig1: Thickened Appearance of the Pericardial Effusion

Shaggy pericardium was considered when there is speckled appearance of the visceral pericardium.

Fibrin strands appears as freely floating strands radiating from one or both layers of the pericardium into the pericardial space [Fig2].

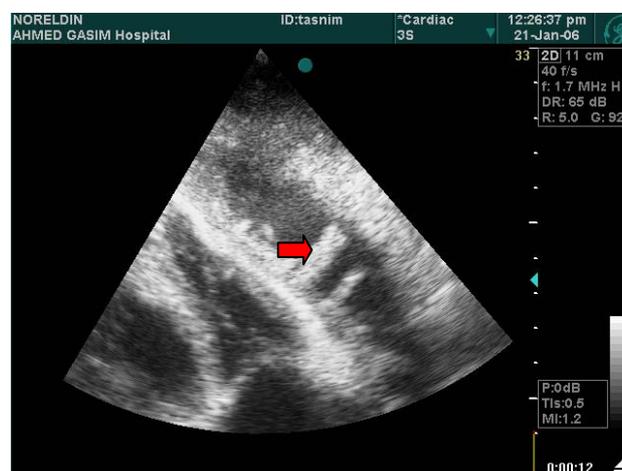


Figure 2: Fibrin Strands == Arrow head ==

Pericardiocentesis was performed safely in 35 patients, in 15 of them for both therapeutic and diagnostic purpose, in further 15 mainly for therapeutic goal, while it was done primarily for diagnostic information in five patients. All the samples were sent for

biochemical, microscopical, microbiological and cytological analysis.

Investigations to determine the etiology included ESR, blood urea and Mantoux test which were done for all patients. Sputum for AAFB, serum albumin, rheumatological studies and other special investigations were done when relevant.

Tuberculous etiology was diagnosed on the basis of most of the following features: the clinical picture, the presence of pulmonary tuberculosis, strongly positive Mantoux test, pericardial fluid analysis and strict therapeutic trial with anti tuberculous drugs with no steroids or anti failure drugs added and the demonstration of a good clinical, biochemical, radiological and Echo response. Malignant effusion was diagnosed by a positive cytology of the pericardial fluid or the presence of a primary focus and no positive clue for other etiology. The diagnosis of idiopathic etiology was based on the clinical picture, the pericardial fluid analysis including serology and exclusion of other etiologies.

The data were analyzed using statistical package of social sciences [SPSS] program. Significance testing of difference between proportions was conducted using the Chi-square test where applicable, adjusted by Pearson's or Fisher's exact test, depending on the number of observations, with a value corresponding to $p < 0.05$ for significance unless otherwise stated.

Results

In this study the number of patients was 51, 22 were females with female to male ratio of 1:1.3.

The age ranged from four to 80 years, with mean age \pm SD of 34.2 ± 17.2 years. 68% of the patients were in the age group 11-40 years.

Forty one patients [82%] were referred with a correct diagnosis of pericardial effusion on the basis of the clinical, CXR and ECG findings while the rest were detected by Echo. Shortness of breathing, cough, chest pain,

increased pericardial dullness, muffled heart sounds, enlarged cardiac shadow in CXR and low voltage ECG, were the most common presenting features.

The most frequent Echo features of the pericardial effusion were thickened appearance, massive effusion and signs of tamponade.

The common etiology was tuberculosis [table1]

Table1: Etiology of the Effusion:

Etiology	No. of patients[%]
Tuberculous	15 [29.4]
Malignant	9[17.6]
Rheumatological	7[13.7]
Idiopathic	6[11.8]
Bacterial	5[9.8]
Uraemic	4[7.9]
Others	5[9.8]
Total	51[100]

The sensitivity of the Echo characteristics in relation to the etiology showed tuberculosis to be the commonest cause of massive effusion, tamponade and thickened fluid appearance. Fibrin strands were found mainly with tuberculosis [80%]. The shaggy pericardium was associated with tuberculous, idiopathic, and bacterial etiologies [table2].

Pericardiocentesis was done safely for 35patients [68.6%]. Macroscopically the fluid was haemorrhagic in 14 patients (40%), serous in 17 patients (48.6%), and purulent in four patients (11.4%). Cytology for malignant cells was positive in six patients [75%], out of the eight patients with malignant etiology who had pericardiocentesis.

The Echo characteristics of the pericardial effusion were helpful to differentiate between the tuberculous, malignant and idiopathic etiologies [table3] and [Fig 3].

Table 2: Etiology versus echo characteristics of the effusion

Etiology	Thickened Fluid		Fibrin Strands		Shaggy Pericardium		Massive Effusion		Signs of Tamponade	
	NO	%	NO	%	NO	%	NO	%	NO	%
Tuberculous	14	50	8	80	5	50	10	39	7	41
Bacterial	5	17.8	1	10	2	20	2	7.8	0	0
Malignant	5	17.8	0	0	0	0	5	19.5	4	23.6
Idiopathic	0	0	0	0	3	30	3	11.7	2	11.8
Rheumatological	1	3.6	0	0	0	0	4	15.6	1	5.9
Uraemic	1	3.6	0	0	0	0	0	0	2	11.8
Others	2	7.2	1	10	0	0	2	7.8	1	5.9
Total	28	100	10	100	10	100	26	100	17	100

Table 3: Relationship between the Etiology and the Echo features and the macroscopic appearance of the effusion:

Echo feature	Tuberculous (N=15)			Malignant (N=9)			Idiopathic (N=6)		
	No.	%	P	No.	%	P	No.	%	P
Fibrin strands	8	53.3%	<0.001	0	0%	0.03	0	0%	0.09
Shaggy pericardium	5	33.3%	0.11	0	0%	0.03	3	50%	0.04
Thick fluid	14	93.3%	<0.001	5	55.5%	0.4	0	0%	<0.001
Signs of tamponade	7	46.7%	0.19	4	44.4%	0.44	2	33.3%	1.00
Massive effusion	10	66.6%	0.36	5	55.5%	0.6	3	50%	0.4
Bloody effusion	4	27%	0.29	6	66.6%	0.04	2	33%	0.4

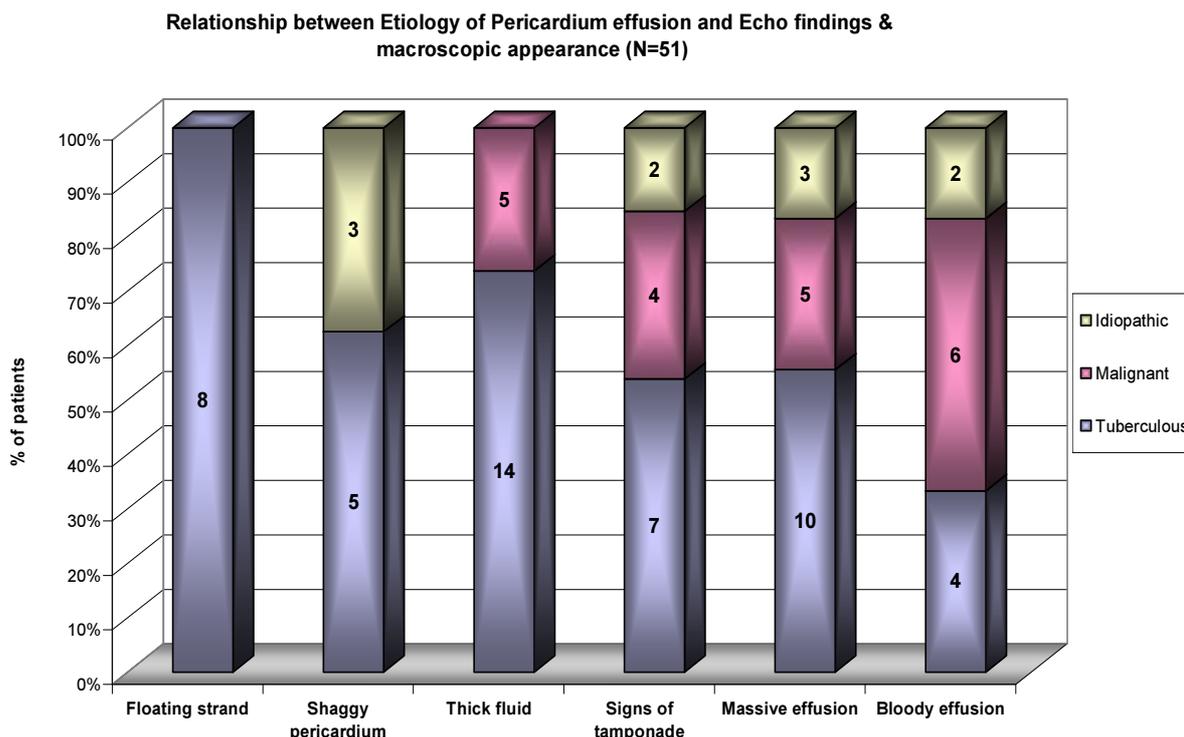


Fig 3: Etiology and echo findings of effusion.

Discussion:

The age, sex and clinical picture in our study are agreeing with many large international studies with a slight male preponderance and a wide age range. The slight difference in the mean age and in the frequency of the clinical symptoms and signs between these studies may be a reflection of the difference in the etiology in the different areas¹⁹⁻²⁹.

In our study, the commonest cause was tuberculosis (29.4%). This goes with the studies of Vithalani, in India, and Asir group, in Saudi Arabia, who found tuberculosis as the commonest cause of effusion accounting for 48% and 17% of the cases respectively. This high frequency of tuberculosis in these studies probably reflects the high incidence of tuberculosis in these areas^{22, 23}. In the west and in Hong Kong, malignancy was the commonest cause, affecting 40% to 80% of the patients, while in our study malignancy was second to tuberculosis while in Spain and Turkey Idiopathic effusion was found to be the cause in 73% of patients, which is different from our results^{25, 28}.

We found tuberculosis as the commonest cause of massive effusion and tamponade this was followed by malignancy. Asir study found tamponade secondary to tuberculous in 40%. Guberman et al in USA, found that malignancy was the commonest cause of tamponade (32 %). From these studies it seems that there is no specific correlation between the etiology and massive effusion or tamponade^{23,24}. Haemorrhagic effusion was strongly associated with malignant, but to a lesser extent with tuberculous, uraemic, and idiopathic effusions [table 3]. In the literature bloody effusion was very common among cases of malignant, tuberculous and uraemic etiologies^{23, 24}.

Interestingly in this study three out of four patients who had malignant pericardial effusion as the first manifestation of metastatic adenocarcinoma of the lung had tamponade. This goes with some reports in literature^{30, 31}.

In our study there was a strong positive correlation between the thickened appearance of the fluid and tuberculous

etiology [P 0.001] but it was also seen in 55% of the malignant cases which makes this feature not highly specific for tuberculosis. This Echo feature was not mentioned in the literature. A strong negative correlation [p<0.001] between the thickened appearance of the fluid and idiopathic etiology was also noted. The feature of fibrin strands was strongly correlated with tuberculosis [P <0.001] and specific for it, as it was negative for both malignant and idiopathic etiologies [P <0.001] but it has low sensitivity as it was detected in only 53% of the tuberculous patients. The shaggy pericardium correlated with the idiopathic [P <0.04] and tuberculous [P 0.1] etiologies and was negative for malignancy but again it is rather insensitive sign [detected in 50% of the idiopathic and 33% of the tuberculous cases]. These signs seem to be inflammatory and the fibrin strands related to the bacterial infections [acute and chronic] while the shaggy pericardium incorporates the viral infections as well. In George study they found fibrin strands, exudative coating and deposits i.e. shaggy appearance were more common in tuberculous than idiopathic pericardial effusion³².

The signs of tamponade and massive effusion were common for these three etiologies and showed no significant correlation to any of them. The haemorrhagic appearance of the pericardial fluid correlated with malignancy [P <0.04] and again although the P value was not significant for both tuberculous and the idiopathic etiologies this feature was seen in 27% of the tuberculous and 33% of the idiopathic cases which makes it of no great value as a differential sign.

Fluid analysis in this study gave a high yield of positive results in malignant etiology.

So in essence, for the Echo features, tuberculous effusion was associated with the thickened appearance and the inflammatory signs of fibrin strands and shaggy pericardium while the thickened appearance without the inflammatory signs makes malignancy a competitive diagnosis.

The lack of the thickened appearance and/or the fibrin strands with the presence of the shaggy appearance goes more with the idiopathic effusion. These results go with Sagrista and Sauleda study who concluded that massive effusion and/or tamponade without inflammatory signs is associated with malignant effusion²⁵.

Conclusion:

The clinical diagnosis of pericardial effusion is not difficult, if considered and echocardiography can readily reveal the undiagnosed patients and add useful information regarding the etiology and the presence of tamponade.

The common etiology was tuberculosis, followed by malignancy, rheumatological, idiopathic, bacterial and uraemic respectively

Although the sample size was relatively small there were significant echo correlates for the etiology i.e. the thickened appearance, the fibrin strands and the shaggy pericardium which were helpful in differentiating tuberculous from malignant and idiopathic etiologies. The signs of tamponade, massive effusion and haemorrhagic appearance although common for these three etiologies, were not helpful as differential signs. Further studies were needed to support the significance of the thickened effusion, the fibrin strands and the shaggy pericardium as predictors to the etiology.

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