

## Cardiac tamponade a prospective study of (31) cases

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### ABSTRACT

**Objectives:** To identify the causes, and the value of the clinical data and echocardiography in the diagnosis of cardiac tamponade (CT).

**Design:** Prospective study of 31 cases with cardiac tamponade.

**Setting:** Coronary care unit, medical wards and echocardiographic department at Ibn-Sina teaching hospital, Mosul.

**Subjects:** Thirty one patients (19 males, 12 females) presented with (CT), selected according to the clinical and echocardiographic criteria.

**Results:** Chronic renal failure (CRF) was the main cause of CT constituting (35.5% of the cases) followed by tuberculosis and malignancy, each constituted 25.8% of the cases, systemic lupus erythematosus (SLE) constituted 6.5% and pyogenic infection and idiopathic each constituted 3.2%. Right atrial collapse was found in 28 cases (90%) by echocardiogram.

**Conclusion:** This study showed that CRF was the most common cause of CT and right atrial diastolic collapse was the most sensitive indicator.

**Key words:** Cardiac tamponade, echocardiogram.

### الخلاصة

هدف الدراسة: ١- معرفة توزيع الأسباب المؤدية لانحشاء التامور في مستشفى ابن سينا التعليمي الموصل .

٢- لتوضيح قيمة الفحص السريري وفحص الإيكو في تشخيص انحشاء التامور .

عينات المرضى وطريقة العمل: تمت دراسة ٣١ حالة انحشاء التامور شمل فيها المرضى الراقدين في ردهات الباطنية للمستشفى والمرضى المحالين إلى شعبة الإيكو في مستشفى ابن سينا التعليمي في الموصل خلال الفترة من كانون الثاني ٢٠٠٠ حتى أيار ٢٠٠٢ .

النتائج: درست ٣١ حالة انحشاء التامور (١٩) من الذكور و(١٢) من الإناث تتراوح أعمارهم بين ٢-٧٠ سنة (معدل ٣٣,٩ ± ١٥,١) . مثل عجز الكلى المزمن (١١) (٣٥,٥%) من الحالات ثم التدرن حيث وجد في (٨) حالات وكذلك السرطان في (٨) حالات (اثنان منها كانت سرطان القصبات ، ٢ سرطان الثدي و٤ حالات سرطان العقد اللمفاوية) .

الاستنتاجات: إن العلامات السريرية لانحشاء التامور مثل النبض المتناقض ، تسارع نبضات القلب ، ارتفاع ضغط الوريد الوداجي وانخفاض ضغط الدم هي مفاتيح مهمة للتشخيص، لكنها ليست خاصة ، إن أيكو القلب يسمح بإثبات سريع لوجود أو عدم وجود استسقاء التامور ويمكن من تقييم تأثير ذلك على ديناميكية عضلة القلب .

**C**ardiac tamponade (CT) is one of the serious eminent cardiac emergencies, and since immediate treatment may be life saving, prompt measures to establish the diagnosis are essential. CT means that there is a compression of the heart by fluid within the pericardial sac that impedes diastolic filling of the ventricles causing reduction of stroke volume and cardiac output<sup>(1,2)</sup>.

The development of increased intrapericardial pressure secondary to pericardial effusion depends on several factors<sup>(2,3)</sup>:

1. The absolute volume of the effusion.
2. The rate of fluid accumulation.
3. The physical characteristics of the pericardium itself.

CT is either acute or subacute type, acute CT is the more common, usually sudden in onset, may be associated with chest pain

and dyspnea, and is life-threatening if not promptly treated. The central venous pressure is markedly elevated, while hypotension is common due to the decline in cardiac output. The heart sounds are often muted. Treatment involves urgent removal of fluid, via percutaneous drainage or surgery<sup>(4-9)</sup>.

## PATIENTS AND METHODS

Thirty-one patients (19 males 12 females), of an age range from 2-70 year with CT, were studied including patients admitted to medical wards, coronary care unit (CCU) and patients referred to echocardiographic department at Ibn-Sina teaching hospital in Mosul over the period from January 2000 to June 2002.

All patients were prospectively assessed; the general diagnostic protocol was carried out in all the 31 patients, including: clinical history and physical examination, chest X-ray, electrocardiography (ECG), echocardiography (M-mode, two dimensional and doppler), complete blood count, erythrocyte sedimentation rate, (ESR), serum urea, and creatinine. Pericardial fluid aspirate was submitted for biochemical, bacteriological and cytological examination. Antinuclear antibodies, rheumatoid factor, peritoneal fluid examination, ultra sound of the abdomen, computerized scan, MRI, and tissue biopsy for histopathological examination were performed whenever indicated.

**STATISTICS:** Sensitivity was calculated as (positive echoes/total number of patients with CT), (positive ECG findings/total number of patients with CT) and predictive value was calculated by using Z-test with P-value of less than 0.05 was considered to be significant. Ages of the patients were expressed as mean  $\pm$  SD (year).

## RESULTS

Chronic renal failure (CRF) was the main cause of CT in 11 cases (35.5%), tuberculosis, 8 cases, and malignancy, 8 cases (2 were bronchogenic carcinomas, 2 were carcinomas of breast and 4 cases were lymphomas); (Table 1).

Elevated systemic venous pressure was present in all patients, while paradoxical pulse was present in 24(77.4%), hypotension with systolic blood pressure < 100 mmHg was present in 20 patients; (Table 2). Sinus tachycardia was present in 24(77.4%) patients, arrhythmia was present in 7 patients (4 cases had atrial fibrillation and 3 had supraventricular tachycardia).

Enlarged cardiac silhouette (cardiothoracic ratio greater than 50%) was present in all cases. low voltage (total QRS deflection < 5mm in each standard lead) was present in 11 patients, ST-segment elevation was present in one or more leads in 10 cases, electrical alternans of the QRS complex was found only in 4 cases. (Table 3).

Right atrial diastolic collapse was found in 28 patients with sensitivity of about (90%), right ventricular diastolic collapse was found in 26 patients with sensitivity of about 84%, abnormal respiratory changes in ventricular dimensions in 26 patients with sensitivity of about 84%, exaggerated changes in transtricuspid and transmitral flow in 27 patients with sensitivity of about 87%. (Table 4). Figures 1,2,3 show echo findings.

The appearance of pericardial fluid was described as bloody in 18 of 31 patients (CRF 9 cases, TB 3 cases, malignancy 5 cases, SLE one case), and straw color in the rest. Protein was more than 25 g/L, the cause of this rise in patients with CRF was super added infection.

**Table (1): Shows the underlying causes of cardiac tamponade.**

Underlying cause	No.	%
1- CRF	11	35.5
2 - TB	8	25.8
3 - Malignancy	8	25.8
4- SLE	2	6.5
5- Pyogenic infection	1	3.2
6- Idiopathic/viral	1	3.2
Total	31	100%

CRF = Chronic renal failure, TB = Tuberculosis

SLE = Systemic lupus erythematosus

**Table (2):** Illustrates the physical findings in cardiac tamponade.

Physical findings	Present		Absent		*P-value
	No.	%	No.	%	
Elevated JVP	31	100	0	0.0	-
Heart rate $\geq$ 100 beats/min	25	80.6	6	19.3	< 0.001
Respiratory rate $\geq$ 20/min	25	80.6	6	19.3	< 0.001
Paradoxical pulse	24	77.4	7	22.6	< 0.001
B P < 100 mmHg systolic	20	64.5	11	35.5	< 0.05
Pericardial friction rub	10	32.3	21	67.7	< 0.05
Hepatomegaly	17	54.8	14	45.2	N.S
Diminished heart sound	15	48.4	16	51.6	N.S
Peripheral oedema	13	41.9	18	58.1	N.S

BP = Blood pressure JVP = Jugular venous pressure  
N.S = Not significant \* = Using z-test.

**Table (3):** Shows the Chest X-ray and ECG findings in cardiac tamponade.

The findings	Present		Absent		Sensitivity %	P-value
	No.	%	No.	%		
Chest X-ray						
- Enlarged cardiac silhouette	31	100	0	0.0	-	-
ECG						
- Sinus tachycardia	24	77.4	7	22.6	77.4	<0.001
- Low voltage	11	35.5	20	64.5	35.4	<0.05
- ST elevation	10	32.3	21	67.7	32.2	<0.05
- Electrical alternans	4	12.9	27	81.1	12.9	<0.001

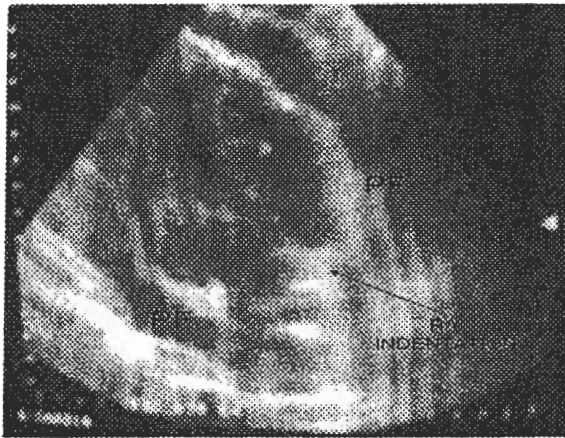
ECG = Electrocardiography

**Table (4):** Demonstrates the echocardiographic criteria in cardiac tamponade.

Findings	Present		Absent		Sensitivity %	P-value
	No.	%	No.	%		
- Pericardial effusion	31	100	0	0	100	-
- R.A. diastolic collapse	28	90.3	3	9.1	90	<0.001
R.V. diastolic collapse	26	83.9	5	16.1	84	<0.001
- Abnormal respiratory changes in ventricular dimension	26	83.9	5	16.1	84	<0.001
Exaggerated changes in transmitral and transtricuspid flow	25	80.6	6	19.4	80	<0.001

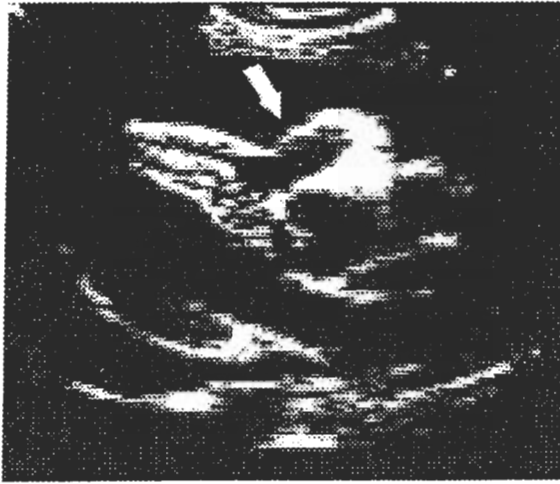
R.A = right atrium

R.V = right ventricle

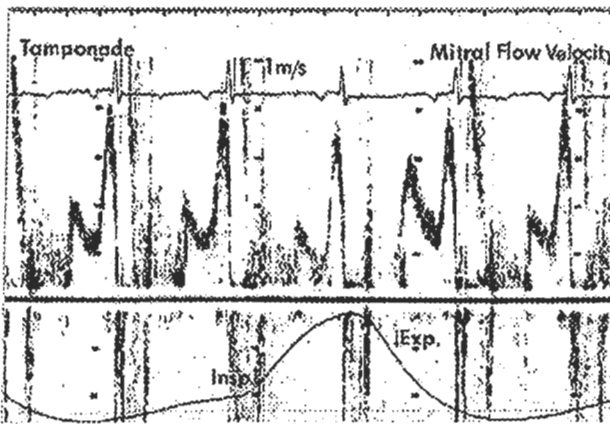


PF pericardial effusion RA right atrium

**Figure (1):** Apical four-chambers image demonstrating the presence of right atrial diastolic collapse.



**Figure (2):** Parasternal long axis image from a patient with cardiac tamponade demonstrating the presence of right ventricular diastolic collapse.



**Figure (3):** Doppler study of mitral flow velocity shows marked decrease in mitral flow velocity during inspiration.

## DISCUSSION

The results of our findings differ from other studies in that the malignancy was the commonest cause (32%) followed by idiopathic pericarditis (14%), and uremia (9%), while TB constituted only (5%)<sup>(10,11)</sup>. This discrepancy reflects the population served by Ibn-Sina teaching hospital in Mosul in which the dialysis program is very active.

Physical findings in CT not specific, but give clues such as dyspnea, tachycardia, hypotension, elevated JVP and pulsus paradoxus. However, reliance solely on clinical signs of cardiac tamponade may also be a problem in several settings as systemic blood pressure may be normal, decreased or even elevated<sup>(1)</sup>.

Pulsus paradoxus is a valuable sign but it is not specific for patients with cardiac tamponade as it may occur in patients with

acute or chronic obstructive airway diseases, shock, pulmonary embolism, constrictive pericarditis, right ventricular infarction, restrictive cardiomyopathy and extreme obesity or tense ascites<sup>(12)</sup>. Also pulsus paradoxus may be absent during CT under some conditions like, atrial septal defect, aortic regurgitation, severe aortic stenosis, or uremia with left ventricular dysfunction<sup>(13)</sup>. All patients included in this study have enlarged cardiac silhouette; this might be explained by the chronicity of the underlying causes. A 12-lead ECG was done for all patients and we depend on several ECG signs of CT (Table 3). Low voltage and S-T segment elevation was present in 11 and 10 patients with sensitivity of 35.4%, 32.2% respectively which mean that only one third of all patients with CT will have these signs in their ECGs. Electric

alternans even has less sensitivity (12.9%). In addition it has been reported in a number of different clinical settings beside CT, including supraventricular tachycardia, ventricular tachycardia, electrolyte abnormalities, drugs, hypothermia, prolonged QT syndromes, and bradycardia<sup>(14)</sup>. So these ECG signs are not reliable diagnostic indicators of cardiac tamponade which are similar to other studies<sup>(11,14)</sup>.

Echocardiography is well established as a sensitive and accurate procedure for detection of pericardial effusion<sup>(15)</sup>. The potential for using echocardiography to gauge the haemodynamic significance of pericardial effusion after pericardiocentesis has aroused considerable interest<sup>(16)</sup>. There are various echocardiographic observations associated with CT. Our study showed that these echocardiographic findings are very sensitive with high predictive value (P-value < 0.001); the right atrial diastolic collapse appears to be the most sensitive indicator of CT with sensitivity of about 90%. This result is in accord with others<sup>(16,17)</sup>. The specificity of echo-findings has not been determined in this study.

The sensitivity and specificity of these findings are blunted under circumstances in which the haemodynamic status and properties of the ventricular or atrial walls are altered by other processes, like shock state, hypertension or hypertrophy<sup>(16)</sup>. In addition, right ventricular diastolic collapse may occur by increased intrapericardial pressure from large intrapleural effusion in the presence of trivial pericardial effusion<sup>(15,18)</sup>.

## CONCLUSIONS

CT is a life threatening condition. Accurate diagnosis and prompt intervention are necessary to prevent adverse outcome. Clinical features of CT such as pulsus paradoxus, tachycardia, elevated JVP and hypotension are important clues to the diagnosis but are nonspecific. Echocardiography allows rapid confirmation of presence or absence of an effusion, and enables assessment of its hemodynamic impact.

We recommend echocardiography once CT has been suspected.

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