

## Research Article

# The Cause and Clinical Symptoms of Cardiac Tamponade and Outcomes of Pericardiocentesis in the Black Sea Region of Turkey

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### Abstract

**Objectives:** We examined the patients with cardiac tamponade who underwent pericardiocentesis via 2-D Echocardiography to demonstrate etiology and symptoms.

**Methods:** We enrolled 65 consecutive patients, older than 18 that were admitted to the emergency service with the sign of cardiac tamponade in Ondokuz Mayıs University Hospital from May 2012 to April 2020. The cardiac tamponade has diagnosed via clinical presentation and two-dimensional echocardiography and it confirmed by the clinical response after pericardiocentesis.

**Results:** The average age was  $66 \pm 15$  years and 41 patients (63%) patients were female. The mean heart rate  $103.8 \pm 8.7$  bpm, systolic blood pressure (BP) was  $88.4 \pm 9.7$  mmHg, diastolic BP was  $48.5 \pm 11$  mmHg, average catheter duration was  $3.6 \pm 0.9$  days. The most common symptom of patients with cardiac tamponade was dyspnea (69%). The malignancy was the main cause of pericardial tamponade with 25 patients (38%). The 8 of patients (33%) with malignant cardiac tamponade associated with Lung Cancer.

**Conclusion:** Malignancy is the most common cause of pericardial effusion and dyspnea is the most common symptom. Our findings demonstrated that Echo-guided by 2D echocardiography is a safe and effective method of pericardiocentesis.

**Keywords:** Cardiac tamponade, etiology, pericardiocentesis

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Cardiac tamponade is a cardiac urgent and serious clinical condition. The etiology of tamponade depends on the prevailing disease of the area. The determination of the cause of tamponade is not easy and requires a long time. Once diagnosed by clinical sign and echocardiography immediate pericardiocentesis is required via percutaneous or surgical drainage. Pericardiocentesis is performed since 1840<sup>[1]</sup> and it is related to some serious complications.<sup>[2]</sup> Percutaneous pericardiocentesis is guided by two-dimensional echocardiography or fluoroscopy and echo-guided

pericardiocentesis is a safe and effective procedure with catheter drainage and it is a standard method for treatment and identifying a cause of cardiac tamponade.<sup>[3]</sup> Cardiac tamponade may be related to several etiologies, including neoplasia, iatrogenicity, connective tissue diseases, uremia, hypothyroidism, heart failure.<sup>[4,5]</sup>

The determination of a cause of cardiac tamponade requires a set diagnosis and scan test. We often can not achieve the diagnose of these patients. Previously the data of Turkey that cause of pericardial effusion are reported.<sup>[5]</sup> However, the

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study from the black sea region has not been reported yet. Furthermore, we investigated patients whom diagnosed by cardiac tamponade. We retrospectively analyzed the data of percutaneous pericardiocentesis via transthoracic echocardiography due to cardiac tamponade in our clinic.

## Methods

We enrolled 67 consecutive patients, older than 18 that were admitted to the emergency service of Ondokuz Mayıs University hospital in Turkey from May 2012 to April 2020 with the sign of cardiac tamponade.

The cardiac tamponade has diagnosed via clinical presentation and signs; the presence of pulsus paradoxus, tachycardia, dyspnea, venous congestion. The two-dimensional (2D) Echocardiography is utilized for determination of tamponade and it confirmed by the clinical response after pericardiocentesis. The examination of patients with cardiac tamponade via 2D Echocardiography were clearly described in the previous studies.<sup>[6]</sup>

The pericardiocentesis is performed under 2D echocardiographic guidance. The subxiphoid in 65 patients and apical route in 2 patients were utilized during pericardiocentesis in the intensive coronary care unit. The skin sterilized via local antiseptic and anesthetized by 5% lidocaine injection. All of the patients were in the semi-seated position and local anesthesia during the procedure.

The 6 french sheath, 18-gauge needle, pigtail catheter are used. After pericardial punctured by the needle, the 6 french sheath was placed and thirty- thirty five ml fluid was obtained for chemical, cytological and microbiological analyses and pigtail catheter advanced by guidewire into the pericardium and evacuation was started catheter after the position confirmed by 2D-echo imaging. In case of drainage pigtail catheter connected to a closed drainage system. The catheter was left in pericardial space until the drainage was  $\leq 100$  ml for a 24-hour period, and a follow-up echocardiogram demonstrated the residual effusion to be noncircumferential and less than 10mm size. The evaluation of pericardial effusions is to determine whether they are transudative or exudative was performed according to the previous study.<sup>[7,8]</sup>

The exclusion criteria was accepted by If the patient had any contraindication of pericardiocentesis, constrictive pericarditis, postpericardiectomy syndrome. The demographic information, clinical outcomes, echocardiographic, biochemical, cytological, microbiological findings, procedural complications, and outcomes after discharge was investigated.

During the study, we could not reach the data of two patients in the follow-up period. Finally, we enrolled 65 patients.

## Statistical Analysis

All data were analyzed by SPSS version 23.0 (IBM Corp, Armonk, NY, U.S.A.). Continuous variables are presented as mean, standard deviation. The differences of Inter-group are compared via the t-test. The data of Skewed numerical are presented as median and average rank, and the differences of between-group are compared via the Mann-Whitney U test. Categorical variables are presented as numbers and percentages. Ordinal data compared by the chi-squared test for trend.

## Results

The 81 consecutive patients with cardiac tamponade clinic were administered to our clinical center between May 2012 and April 2019. The pericardiocentesis was performed in 81 patients with tamponade among those 16 patients excluded because of the lack of clinical data. Finally, 65 patients had met the criteria of including. The data of demographics and chronic diseases of patients with cardiac tamponade were presented in Table 1. The average age was  $66 \pm 15$  years and 41 patients (63%) patients were female. The 53 (81%) patients had exudative effusion, including 34 female (64%) with a average age of  $64.6 \pm 13$  years and there were 8 patients with transudative effusion, including 5 female (62.5%), with a average age of  $75 \pm 7$  years. The BMI of patients was  $27.4 \pm 9.7$ , mean heart rate was  $103.8 \pm 8.7$  bpm, systolic blood pressure (BP) was  $88.4 \pm 9.7$  mmHg, diastolic BP was  $48.5 \pm 11$  mmHg, average catheter duration was  $3.6 \pm 0.9$  days. The average size of effusion in the Right Ventricle by M-mode echocardiography was  $14.2 \pm 5$  mm. The Protein, albumin, LDH value of serum and pericardial fluid were ( $6.4 \pm 0.9$  mg/dl and  $5.5 \pm 3.8$  mg/dl), ( $3.4 \pm 0.6$  mg/dl and  $3.1 \pm 2.8$  mg/dl), ( $362.01 \pm 189$  IU/l and  $1243.59 \pm 227$  IU/l) respectively.

The most common symptom of patients with cardiac tamponade was dyspnea (69%) and followed by fatigue (12%), angina (10%), palpitation (3%), dizziness (3%), cough (3%). The results were shown in Table 2.

The Outcomes of pericardiosentesis presented in Table 3. In the presented study, we did not show any major complications. However, 5 patients had palpitation, 2 patients had hypotension during pericardiocentesis.

The malignancy was the main cause of pericardial tamponade with 25 patients (38%) and followed by idiopathic pericardial effusion in 23 patients (35%), Tuberculosis in 6 (9%), Iatrogenic in 4 (6%), heart failure in 3 (4.6%), uremic in 3 (4.6%), and hypothyroidism in 1 (1.5%) respectively. The results were presented in Table 4.

The 8 patients (33%) with malignant cardiac tamponade associated with lung and 7 patients (28%) associated with lymphoma/lymphoproliferative disorder Table 5.

**Table 1.** Demographics, chronic diseases of Cardiac tamponade patients

Variable	Exuda (n=53)	Transuda (n=8)	Total (n=65)
Mean Age	64.6±13	75±7	66±15
Gender/Female, n (%)	34 (64)	5 (62)	41 (63)
BMI kg/m <sup>2</sup>	27.3±6.7	27.9±7.3	27.4±9.7
Diabetes mellitus, n (%)	10 (19)	2 (25)	12 (20)
Hypertension, n (%)	23 (43)	5 (62.5)	30 (46)
Chronic kidney disease disease, n (%)	2 (3)	3 (37.5)	6 (9)
Heart failure, n (%)	2 (3)	2 (25)	4 (6)
CA, n (%)	12 (22)		12 (18)
Heart rate (bpm)	103.5±8.6	105.7±9.8	103.8±8.7
Systolic BP(mmHg)	89±9.1	82.5±12.8	88.4±9.7
Diastolic BP(mmHg)	50±10.3	39±11.2	48.5±11
Creatinine (mg/dl)	1.24±1	1.2±0.28	1.22±0.9
TSH (mIU/L)	3.07±5.7	5.0±3.1	3.08±5.6
ADA(+), n (%)	5 (9)		5 (7.6)
QuantiFERON-TB(+), n (%)	4 (7)		4 (6)
The duration of Catheter (days)	3.5±0.9	4.0±0.9	3.6±0.9
Wbc (μl)	9052±5134	14490±3348	9414.5±5197
Wbc of fluid (μl)	3044.2±5972	2100±2007	2996.2±5863
Lymphocyte (μl)	1508±1746	1500±572	1507
Lymphocyte of fluid (μl)	1309.4±2368	1113±1792	1300±2330
PCR(+) n (%)	5 (9)		5 (7.6)
ARB(+) n (%)	2 (3.7)		2 (3)
The effusion size of RV (mm)	14.5±5	11.8±5.3	14.2±5
The effusion size of RA (mm)	15.5±6.8	10.5±6.5	14.9±7
The effusion size of Apex (mm)	6.8±3.8	6.5±4.3	6.8±3.9
Hgb (g/dl)	11.4±1.9	11.9±1.4	11.4±1.88
Abnormal cytology, n	13		13
Protein (g/dl)	6.4±0.9	5.9±1.9	6.4±0.9
Protein of fluid (g/dl)	5.7±1.9	3±1.6	5.5±3.8
Albumin (g/dl)	3.5±0.5	3.1±1.3	3.4±0.6
Albumin of Fluid (g/dl)	3.2±3	1.5±0.7	3.1±2.8
CRP (mg/dl)	25.6±31.5	54.5±46	27.6±32.9
LDH (IU/lt)	367.05±192.4	268±64.5	362.01±189
LDH of fluid(IU/lt)	1302.05±2319	152.3±77	1243.6±227

ADA: Adenosine deaminase; BMI: Body mass index; CA: Cancer; Hgb: Hemoglobin; LDH: Lactate dehydrogenase; PCR: Polymerase chain reaction; RV and RA: Right ventricle and atrium; Wbc: White blood cell; TSH: Thyroid stimulating hormone; CRP: C-reactive protein; ARB: Acid resistant bacilli.

**Table 2.** Symptoms of patients with Cardiac tamponade

	Exuda (n=53) n (%)	Transuda (n=8) n (%)	Total (n=65) n (%)
The symptom of patients			
Dyspnea	35 (67)	7 (87.5)	45 (69)
Angina	6 (10)		6 (10)
Palpitation	2 (3.6)		2 (3.1)
Dizziness	2 (3.6)		2 (3.1)
Fatigue	7 (12.5)	1 (12.5)	8 (12)
Cough	2 (3.1)		2 (3.1)

## Discussion

This single center's registry of percutaneous pericardiocentesis using 2D-Echocardiography in cardiology clinics of our medical center. This study showed that the cause of tamponade and outcomes of pericardiocentesis. Previously presented registries have mentioned that outcomes of pericardiocentesis and the cause of pericardial effusion. [4,5,9] In the present study, we demonstrated that the cause of pericardial tamponade showed variability. Frequently, the confirmation of diagnosis was not possible in patients. There is no gold standard diagnostic method in clinical practice.

**Table 3.** Outcomes of pericardiocentesis

Variable	Exuda (n=53) n (%)	Transuda (n=8) n (%)	Total (n=63) n (%)
Minör Complication	5 (9)	2 (25)	7 (9.7)
Repeated pericardiocentesis	2 (3)	1 (12.5)	3 (4)
Re-accumulation	20 (37)	1 (12.5)	21 (32)

**Table 4.** Etiology of Cardiac tamponade

Cause	Frequency			%		
	Exuda	Transuda	Total	Exuda	Transuda	Total
Malignancy	25		25	47		38
Idiopathic	19	4	23	43	50	34
Iatrogenic			4			6
Tuberculosis	6		6	11		9
Heart failure	1	2	3	1.8	25	4.6
Uremia	1	2	3	1.8	25	4.6
Hypothyroidism	1		1	1.8		1.5

**Table 5.** The final diagnosis of patients with the malignant cause of tamponade

	Frequency	%
Diagnosis		
Lung	8	33
Breast	3	12
Leukemia/myelodysplastic syndrome	3	12
Cancer of unknown primary	2	8
Esophagus	1	4
Lymphoma/lymphoproliferative disorder	7	28
Colorectal	1	4

Cardiac tamponade is a serious clinical circumstance caused by the accumulation of a different type of fluid in the pericardial cavity. As a result of fluid accumulation and tense pericardial effusion; The impairment of ventricular filling leads to hemodynamic instability. The presentation of patients with cardiac tamponade frequently depends upon the length of time and volume of pericardial fluid. While the main cause of acute cardiac tamponade is rupture of heart or aorta, rupture of the heart or coronary arteries as an iatrogenic during the invasive diagnostic and therapeutic procedure, subacute cardiac tamponade frequently is associated with neoplastic, idiopathic, uremic, hearth failure, or tuberculosis.<sup>[10]</sup> Pericardial drainage requires when clinical tamponade is present.

Echo-guided pericardiocentesis is an effective and mini-

mally invasive method. Moreover, it may widely and easily perform in many clinical centers in Turkey. However, establish an etiologic diagnosis of pericardial effusion is challenging. In many patients, the etiology is initially difficult to establish as no clear cause is present when the pericardial effusion is first identified. The exact diagnosis of the cause of a pericardial effusion should be based on some specific biochemical and cytological evidence. Additionally, some simple clinical indicators may use. The underlying cause of the pericardial effusion is related to demographics information of population, for instance, the region of patients where they are living.

In the present study, malignancy was the most cause of pericardial tamponade (38%), followed by idiopathic pericardial effusion (35%). In the western world, the most common etiologies are idiopathic pericardial effusion among outpatient populations. On the other hand, neoplastic pericarditis, uremic pericarditis, iatrogenic disease most frequent etiologies of pericardial effusion in hospital series.<sup>[9,11]</sup> However, the number of uremic cause of the tamponade (4.6%) was less than the previous study. Ertem et al.<sup>[12]</sup> have shown that the 12% cause of serious pericardial effusion was uremia. Colombo et al.<sup>[9]</sup> reported that 20% of patients of cardiac tamponade associated with uremia. This may be explained by the high dialysis capacity of our health care system and the capacity of dialysis has been increasing over the years. Patients could easily receive a hemodialysis center. We have known that the treatment of pericardial effusion caused by uremic disease was intensive dialysis.<sup>[13]</sup> Our medical center is the tertiary and largest hospital in our region. Therefore, patients with cardiac tamponade have been referred to our hospital. However, the patients with several pericardial effusion related to uremic etiology might be treated by intensive hemodialysis.

The causes of pericardial effusion related to degree of development and underlying disease of patients and it have been shown variability. While tuberculosis is the most common cause of exudative effusion in developing countries, the frequency is only 4% in developed countries.<sup>[14]</sup> In the present study, high number of effusion has been determined as exudative effusion and the main cause of cardiac tamponade and exudative effusion was neoplastic pericardial effusion. Guberman et al.<sup>[15]</sup> have reported that the most frequent cause of tamponade associated with malignant. Furthermore, Ertem et al.<sup>[12]</sup> showed that malignancy was the most cause of pericardial effusion and 36 patients (83.7%) patients had exudative pericardial effusion.

The primer neoplastic etiology of pericardial effusion is not common. However, the main cause of neoplastic pericarditis is a metastasis from different tissue such as Lung. The

pericardial effusion could be diagnosed first finding due to invasion of lymphatic tissue in a patient with Lung CA. Heather et al.<sup>[16]</sup> demonstrated that the cytology of pericardial fluid was normal in 62.6% of (114 of 182) samples. Among patients with cancer history or active malignancy, the cytology of pericardial fluid was abnormal in 54.1%. In the present study, only 52% had abnormal cytology. During this time we have noticed that the exam of cytology has been sent at least 2 hours later after pericardiocentesis. It may relate to cell lysis and this may affect results of cytology. The previous study suggested that the pericardial fluid must be stored in ethylenediaminetetraacetic acid (EDTA) coated glass tubes and the samples could be stored in the refrigerator at +4 °C for up to 96 hours. However, the sterile test tube has been used during storage of pericardial fluid samples in our center.<sup>[16,17]</sup> The sterile test tube might not prevent cell damage in pericardial fluid samples. In the Present study, the lung carcinoma was the most common cause of malignant effusion and it was in line with the previous study.<sup>[9–11,16,17]</sup>

Pericardiocentesis is a safe and effective method. However, it has some potential risk, especially puncturing the heart. The efficacy and safety of 2D-Echo guided pericardiocentesis are well documented and demonstrated in previous literature.<sup>[1]</sup> In our paper, 5 patients had palpitations and 2 patients had hypotension. Tsang et al.<sup>[18]</sup> showed that a frequency of 3.5% (40 cases) for minor complications and 1.2% for major complications. The total number of cardiac perforations was 17 (1.5%) and 1 death. On the other hand, Adi Osman et al.<sup>[19]</sup> have performed pericardiocentesis without any complications in patients with cardiac tamponade. In the present study, the duration of catheter was 3.6 days. This time was in line with previous studies. The Asim M et al.<sup>[20]</sup> Showed that the patients with extended catheter drainage associated with reduced recurrence rate of 12% compared to 52% in patients without extended drainage. The average duration of catheter was 38±19 hours in this study. The results were in line with the present study.

The current study showed that dyspnea (65%) was the most common symptom of cardiac tamponade. Levine et al. and Cooper et al.<sup>[21,22]</sup> have demonstrated that dyspnea (88%) and (87%) respectively) was the main symptom of cardiac tamponade. The outcomes were in line with our study.

## Conclusion

The results of the present study are in line with the previous report. Malignancy is the most common cause of pericardial tamponade. Dyspnea is the most common symptom. In our study, there was no major complication during pericardiocentesis. This data demonstrated that Echo-guided

by 2D echocardiography is a safe and effective method of pericardiocentesis.

## Disclosures

**Ethics Committee Approval:** The study protocol was approved by Ondokuz Mayıs University, Department of Cardiology Ethics Committee with 26/11/2020 dated and 2020/672 numbered decision.

**Peer-review:** Externally peer-reviewed.

**Conflict of Interest:** None declared.

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