Erciyes Med J 2021; 43(6): 579–84 • DOI: 10.14744/etd.2021.35033
ORIGINAL ARTICLE – OPEN ACCESS

Etiologic, Echocardiographic, Cytological, and Biochemical Characteristics of Patients with Significant Pericardial Effusion requiring Pericardiocentesis in a Tertiary Hospital

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ABSTRACT

Objective: The purpose of this study was to determine the etiology in 100 tertiary care patients who underwent pericardiocentesis in the last 5 years due to cardiac tamponade or large pericardial effusion (floating heart) through retrospective analysis of their echocardiographic findings, biochemical and cytological test results, and imaging methods.

Materials and Methods: The records of 100 patients who underwent pericardiocentesis in 2014–2019 due to pericardial effusion were reviewed retrospectively. Their etiology was determined by recording their echocardiograms, biochemical test results, imaging results, and those of laboratory tests performed on pericardial fluid, culture, and cytology results. All data of the patients were recorded and analyzed.

Results: Cardiac tamponade was the most common reason (77%) for pericardiocentesis performed in the patients in the study group. Of the drained effusions, 56% were macroscopically hemorrhagic. The most common etiology was associated with idiopathic causes by 32%. Malignancy was found only in 44.6% of the hemorrhagic effusions. Cytological examination revealed 83% benign findings. Only 58.6% of the patients with malignancy were found to have malignant cells in their cytological tests.

Conclusion: The most common cause was idiopathic in the patients for whom pericardiocentesis was indicated in our study group. Nearly half of the macroscopically hemorrhagic effusions had malignancy. Half of the patients who developed effusion due to malignancy were found to have malignant cells in cytological tests. This study differs from other studies conducted in Turkey because it included a higher number of patients and its results are important to guide our daily practice.

Keywords: Echocardiography, etiology, pericardiocentesis, cytology, pericardial effusion

Cite this article as:
Erkal Z, Bayar N, Köklü E, Cagirci G, Arslan Ş, Güven R. Etiologic, Echocardiographic, Cytological, and Biochemical Characteristics of Patients with Significant Pericardial Effusion requiring Pericardiocentesis in a Tertiary Hospital. Erciyes Med J 2021; 43(6): 579-84.

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Submitted
20.10.2020

Accepted
10.02.2021

Available Online
30.09.2021

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INTRODUCTION

The pericardium consists of visceral (cereous) and parietal (fibrous) layers. The space between the visceral and parietal leaflets contains 15–50 mL of physiological fluid (1, 2). The pericardium prevents the sudden enlargement of especially the right spaces of the heart, dislocation of the heart and large vessels, reduces friction between the heart and the surrounding tissues, and prevents the spread of infections and cancer from the lungs and pleura (3).

Pericardial effusion is caused by increased production of pericardial fluid and/or several diseases that impair its drainage (4). Pericardial effusions may be asymptomatic or presented with life-threatening cardiac tamponade findings (5). The treatment of pericardial effusions includes medical therapy, pericardiocentesis, or surgery depending on the clinical status of the patient, underlying pathology, and location of the effusion (6).

The purpose of this study was to determine the etiology in 100 tertiary care patients who underwent pericardiocentesis in the last 5 years due to cardiac tamponade or large pericardial effusion (floating heart) through retrospective analysis of their echocardiographic findings, biochemical and cytological test results, and imaging methods.

MATERIALS and METHODS

The study included 100 consecutive patients who were admitted to the Antalya Training and Research Hospital's Cardiology Clinic from 2014 to 2019 due to various complaints and who had cardiac tamponade findings according to the clinical examination and transthoracic echocardiography or had large pericardial effusion and were thus hospitalized with an indication for pericardiocentesis and underwent urgent pericardiocentesis. Pericardiocentesis was performed in all patients for therapeutic purposes in our study. Our study was a retrospective study. Approval for the study was obtained from the clinical research ethics board of the Antalya Training and Research Hospital (Approval date; 12/03/2020, issue number 5/13).

Patients whose heart rate was over 100 beats/min, systolic blood pressure was below 90 mm Hg, or had a finding of pulsus paradoxus were considered to have clinical tamponade (7). Patients whose echocardiography revealed early diastolic collapse of the right ventricle, late diastolic collapse of the right and left atria, loss of respiratory variations in the inferior vena cava, marked increase in the tricuspid E wave during deep inspiration during Doppler echocardiographic examination, and marked decrease in mitral E wave were considered to have pericardial tamponade (8, 9). Effusions that were wider than 2 cm during diastole were considered to be large effusions. Presence of large pericardial effusion (floating heart) due to typical clinical manifestation of tamponade, presence of echo findings, and high likelihood of tamponade were considered as an indication for pericardiocentesis.

Patients' records were reviewed to determine the diseases that could play a role in the etiology of these patients who underwent pericardiocentesis (e.g., myocardial infarct, collagen tissue diseases, tuberculosis, hypothyroidism, chronic renal failure, malignancy, history of cardiac surgery, recent history of upper respiratory tract infection prior to an interventional cardiac procedure). The clinical examination and echocardiography results of the patients were evaluated for the indication of pericardiocentesis. Laboratory findings, pathology results, and radiological results were obtained retrospectively from hospital records and recorded. The diagnosis was considered certain if collagen disease or thyroid dysfunction was diagnosed or if neoplastic cells were found in the effusion. In the absence of one of these findings, patients with known renal failure or neoplastic disease were considered to have those conditions as the cause of pericardial effusion.

We included 100 patients for whom pericardiocentesis was performed in line with the abovementioned diagnostic criteria, who were admitted to the coronary intensive care unit later on, and whose underlying etiology was explored. Patients who did not meet the algorithm for any reason whatsoever were excluded from the study (patients whose etiological examination or analysis was missing, who were willingly discharged after pericardiocentesis, who died after the examination).

All pericardiocentesis procedures were performed under a fluoroscope and with subxiphoid approach. Lidocain was administered to the puncture area at a rate of 1%–2%. An 18-G puncture needle was inserted through the right side of the xiphoid and diverted up to the right shoulder while negative pressure was applied with a 10-cc injector. As soon as the liquid entered the injector, the floppy guidewire was advanced and a 6F sheath was placed. Then, the pigtail catheter was advanced for drainage. The guidewire and catheter were inserted under fluoroscopy and echocardiography for the safety of the procedure.

The hemogram, sedimentation, glucose, creatine, total protein, albumin, LDH, cholesterol, TSH, and PTT values of the blood specimens collected from the patients as well as their serological test results (CRP-RF-ANA) were analyzed and recorded. The hemogram, sedimentation, glucose, creatine, total protein, albumin, LDH, cholesterol values tested in the pericardial fluid samples of the patient, culture, cytology Erlich-ziehl-Neelsen, gram staining, density, and adenosine deaminase results were recorded. Two blood culture vials (one aerobic and one anaerobic) were obtained after the initial evaluation. The macroscopic features (hemorrhagic or serous) and amount of effusion drained were determined from the patient records. Modified Light's criteria were used for the differentiation between pericardial fluid and exudates–transudates. The fluid was considered to be exudate if any of the following parameters was present: fluid total protein >3 gr, fluid/serum protein ratio >0.5, fluid LDH >200 IU/dL, fluid/serum LDH ratio >0.6, and fluid cholesterol concentration >45 mgr/dL (9).

The purpose of the cytological examinations was to identify the presence of malignant cells. The results were recorded as presence of benign, malignant, or atypical cells. No malignant cells were found in benign cytology, while cells with atypical cytology were rarely found in the presence of atypical cells.

Moreover, the pathological findings (such as malignancy, tuberculosis) detected by the imaging methods used (CT-USG) were reviewed and recorded.

Statistical Analysis

The data were analyzed using SPSS 24.0 (IBM Corp., Armonk, NY, USA). Parametric test results were expressed as mean±standard deviation, and nonparametric test results were expressed as medians. The χ^2 and Fisher's exact tests were used to compare categorical variables. The Shapiro–Wilk test was used to assess the distribution of continuous variables. The Student's t-test was used for variables with normal distribution and the values were presented as mean±standard deviation. Continuous variables without normal distribution were analyzed using the Mann–Whitney U test. A two-tailed $p<0.05$ was considered statistically significant.

RESULTS

The records of 100 patients (45 females, 55 males) undergoing pericardiocentesis were reviewed retrospectively in this study. The mean age in the patient group with serous effusion was 70.4±15.5 years while it was 60.8±15.1 years in the group with hemorrhagic effusion (p=0.03). In the patient group with serous effusion, 13 patients had concomitant hypertension (HT), 9 had diabetes mellitus (DM), 7 had coronary artery disease (CAD), 3 had cerebrovascular disease (CVD), and 2 had thyroid disease. In the group with hemorrhagic effusion, 12 patients had HT, 4 had DM, and 4 had CAD. The history of the patients is presented in Table 1. The most common complaint was shortness of breath.

Regarding the macroscopic features of the drained effusions, the pericardial effusions were serous in 44 patients and hemorrhagic in 56. The drained effusions were classified according to their macroscopic images because we consider certain preliminary diagnosis such as malignancy and tuberculosis, etc., when we encounter hemorrhagic effusions in our daily practice. We preferred this way considering that we would gain some time by performing etiological evaluation in the light of this classification. The etiology of the hemorrhagic pericardial effusions shows that 44.6% of the patients had malignancy, 26.8% were due to idiopathic causes, and 14.3% had chronic renal failure (CRF). All patients with renal insufficiency were on hemodialysis. As for the etiology of the serous pericardial effusions, 38.6% were due to idiopathic causes, 18.2% had CRF, and 11.4% had iatrogenic causes. The etiology, regardless of macroscopy, revealed that 32% were associated with idiopathic causes, 29% to malignancy, and 16% to CRF (Table 2 and Fig. 1).

Table 1. Clinical characteristics of the study population

Variable	Serous (n=44)	Hemorrhagic (n=56)	p
Age, years	70.4±15.5	60.8±15.1	0.003
Female, n (%)	18 (40.9)	27 (48.2)	0.466
HT, n (%)	13 (29.5)	12 (21.4)	0.352
DM, n (%)	9 (20.5)	4 (7.1)	**0.049**
CAD, n (%)	7 (15.9)	4 (7.1)	0.164
SVD, n (%)	3 (6.8)	0 (0.0)	**0.047**
CRF, n (%)	8 (18.2)	5 (8.9)	0.172
Symptom, n (%)			0.626
Angina	7 (15.9)	7 (12.5)	
Short of breathness	37 (84.1)	49 (87.5)	
Malignancy n (%)	4 (9.1)	19 (33.9)	0.003
Thyroid n (%)	2 (4.5)	0 (0.0)	0.107
Otoimmun, n (%)	8 (20.0)	5 (9.8)	0.168
Blood culture (+), n (%)	4 (9.8)	3 (5.9)	0.486
Cytology n (%)			**0.013**
Benign	43 (97.7)	40 (71.4)	
Malignite	1 (2.3)	16 (28.5)	
Indication n (%)			0.954
Floating heart	10 (22.7)	13 (23.2)	
Tamponade	34 (77.3)	43 (76.8)	
Transude, exudate, n (%)			0.534
Transuda	9 (20.9)	9 (16.1)	
Exudate	35 (81.8)	47 (83.9)	
Time interval, n (%)			**0.005**
Acute	13 (29.5)	32 (57.1)	
Subacute	19 (43.2)	20 (35.7)	
Chronic	12 (27.3)	4 (7.1)	
CAmark (+)	11 (27.5)	16 (31.4)	0.688
Total cholesterol, mg/dL	186.8±40.5	217.7±42.8	<0.001
LDL, mg/dL	116.2±34.3	144.1±37.9	<0.001
HDL, mg/dL	43.7±9.1	41.6±12.6	0.056
Triglyceride, mg/dL	120.0 (93.5–179.0)	160.0 (112.0–210.0)	0.008
CRP, mg/dL	4.58±4.02	4.86±2.8	0.675
Glucose, mg/dL	82.7±11.4	96.1±14.6	0.026

Continuous variables are expressed as mean [SD] or median [interquartile range]. CAmark: Cancer markers; CAD: Coronary artery disease; CVD: Cerebrovascular disease; CRF: Chronic renal failure; CRP: C-reactive protein; DM: Diabetes mellitus; HDL: High density lipoprotein; HT: Hypertension; LDL: Low density lipoprotein

Cytological examination of the pericardial effusions showed that 83% of 100 patients had benign cytology, whereas 17% had malignant cytology (p<0.001) (Table 3). It was also shown that 71.4% of the hemorrhagic effusions had benign cytology (p=0.013), while 28.5% had malignant cytology. The rate of malignancy was only 2.3% in the cytology of the serous effusions (Table 1).

Table 2. Etiology distribution of serous and hemorrhagic effusions

Variable	Serous (n=44)	Hemorrhagic (n=56)	p
Rheumatologic	4 (9.1)	1 (1.8)	
Hypothyroidism	2 (4.5)	0 (0.0)	
CRF	8 (18.2)	8 (14.3)	
Malignancy	4 (9.1)	25 (44.6)	0.001
Idiopathic	17 (38.6)	15 (26.8)	
Infections	4 (9.1)	0 (0.0)	
Iatrogenic	5 (11.4)	7 (12.5)	

CRF: Chronic renal failure

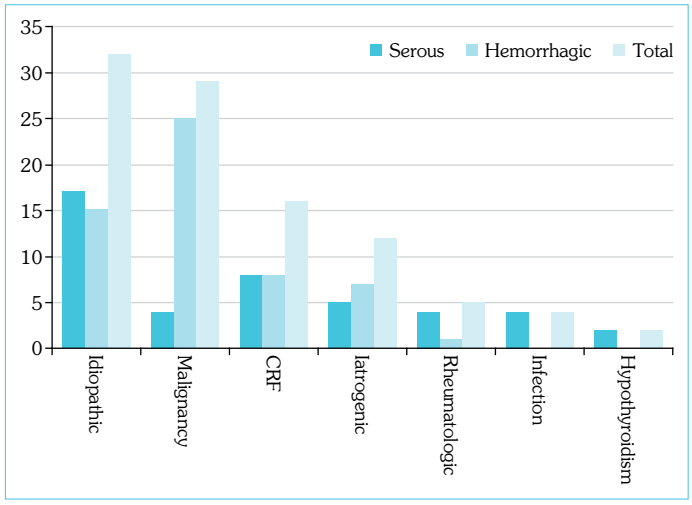

Figure 1. Etiology distribution of serous and hemorrhagic effusions

An analysis of the cytology of the pericardial effusions found to have a known or newly detected malignancy showed that only 58.6% had malignant cytology while 41.4% had benign cytology.

The biochemical examination results of the pericardial effusions revealed that hemorrhagic effusions had markedly elevated LDH and cholesterol levels (LDH, 1060±828,1 mg; cholesterol, 126.4±31.6; p=0.009, p=0.014). Of the pericardial effusions, 82% were exudates and 18% were transudates (Table 4).

An analysis of the indications for pericardiocentesis demonstrated that drainage was performed due to cardiac tamponade findings in 77 patients and floating heart findings in 23 patients. Malignancy was found in 33.8% of the patients who had presented with clinical manifestations of tamponade. Moreover, 33.8% of the patients had idiopathic causes. The most common cause in the patients who underwent pericardiocentesis due to floating heart findings was iatrogenic (39.1%; p<0.001) (Table 5).

When the pericardial effusions were classified as acute and chronic depending on the speed of accumulation, it was understood that malignancy was the cause of the effusions accumulating in a short time (44.4%) while rheumatic causes led to chronic accumulation of effusions (31.3%; p<0.001) (Table 6).

Table 3. Cytological results of malignant and non-malignant effusions

Variable	Malignant etiology (n=29)	Non-malignant etiology (n=71)	p
Cytology			<0.001
Benign	12 (41.4)	71 (100.0)	
Malignant	17 (58.6)	0 (0.0)	
CAmark			0.400
Ca Mark (-)	18 (64.3)	46 (73.0)	
Ca Mark (+)	10 (35.7)	17 (27.0)	

CAmark: Cancer markers

Table 4. Biochemical values of serous and hemorrhagic effusions

Variable	Serous (n=44)	Hemorrhagic (n=56)	p
Amount of effusion	1200.00±336.6	1000±552.2	0.051
Hb, median (quartiles)	12.4 (10.6–13.3)	12.2 (10.9–13.3)	0.261
Htc	36.9 (33.1–40.7)	37.8 (34.1–39.6)	0.245
Neutrophile	73.07± 8.1	75.06±7.0	0.171
Lymphocyte	16.47±7.9	14.30±7.9	0.257
N/L	5.95±4.5	6.86±3.9	0.273
Sed	28.00±12.7	55.00±52.5	0.111
CRP	57.80±57.7	77.86±42.9	0.601
BUN	36.50±28.3	15.40±5.0	0.483
TSH	1.78±0.6	1.35±0.9	0.067
PTT	31.40±6.0	30.44±3.2	0.343
Glucose	108.50±29.6	132.20±47.7	0.522
Ser. Pot	6.77±0.68	6.54±0.5	0.658
Ser. Alb	3.45±0.6	3.66±0.5	0.666
Ser LDH	303.75±50.9	309.00±95.7	0.976
Ser koll, median (quartiles)	151.0 (85.0–157.0)	154.0 (124.0–185.0)	0.978
Eff. Prot	5.71±0.8	5.33±0.4	0.179
Eff alb, median (quartiles)	3.5 (2.8–4.0)	3.7 (3.2–4.1)	0.985
Eff. LDH	206.50±44.9	1060±828.1	**0.009**
Eff. Chol.	81.50±13.2	126.40±31.6	**0.014**
Eff. Glucose	84.50±43.4	69.20±35.2	0.786
Prt. ratio	0.80±0.1	0.76±0.0	0.127
LDH ratio	0.67±0.2	4.25±3.8	**0.041**

BUN: Blood urea nitrogen; CRP: C-reactive protein; TSH: Thyroid stimulating hormone; PTT: Partial prothrombin time; LDH: Lactate dehydrogenase

None of the patients was on an anti-inflammatory treatment prior to pericardiocentesis. Recurrent pericardiocentesis was not needed for any of the patients. Pericardial fluid accumulation within 3 months after surgical drainage or pericardiocentesis is defined as recurrent pericardial effusion (10).

Table 5. Etiology classification distribution according to the indication for pericardiocentesis

Variable	Floating heart (n=23)	Tamponade (n=77)	p
Rheumatologic	0 (0.0)	5 (6.5)	
Hypotyroidism	1 (4.3)	1 (1.3)	
CRF	2 (8.7)	14 (18.2)	
Malignancy	3 (13.0)	26 (33.8)	<0.001
Idiopathic	6 (26.1)	26 (33.8)	
Infections	2 (8.7)	2 (2.6)	
Iatrogenic	9 (39.1)	3 (3.9)	

CRF: Chronic renal failure

Table 6. Etiology classification of pericardial fluid distribution assembly according to speed

Variable	Acute (n=45)	Subacute (n=39)	Chronic (n=16)	p
Rheumatologic	0 (0.0)	0 (0.0)	5 (31.3)	
Hypotyhroidism	1 (2.2)	0 (0.0)	1 (6.3)	
CRF	2 (4.4)	11 (28.2)	3 (18.8)	
Malignancy	20 (44.4)	6 (15.4)	3 (18.8)	<0.001
Idiopathic	9 (20.0)	19 (48.7)	4 (25.0)	
Infections	2 (4.4)	2 (5.1)	0 (0.0)	
Iatrogenic	11 (24.4)	1 (2.6)	0 (0.0)	

CRF: Chronic renal failure

DISCUSSION

The incidence of pericardial effusions has been increasing in recent years due to reasons such as long survival of patients with malignancy, dialysis treatment for CRF, frequent use of anticoagulants, and use of radiation for tumor treatment (11).

Pericardiocentesis was performed due to cardiac tamponade in 77% of the patients, and large pericardial effusion in 23% in our study group. In a study including 291 patients, pericardiocentesis was performed due to tamponade in 64% of the patients and large effusion in 28% (12). In another study including 149 patients, tamponade was the reason for pericardiocentesis in 70% of the patients (13). The findings of our study are also consistent with the literature. This highlights the need to pay attention to the clinical and echocardiographic tamponade findings.

The etiology of the pericardial effusions in our study showed that the most common causes were idiopathic. The patients in whom we could not detect any etiology after reviewing all tests were considered to be idiopathic. Idiopathic pericarditis is the most common cause of inflammation-related pericardial effusions in the United States and Western Europe. It usually occurs after viral infections. Although histological, cytological, and immunohistological examination of the pericardium is required for the definitive diagnosis of viral pericarditis, this approach is generally not performed and is

not recommended in routine viral serological research (14). Routine serological tests were not conducted in our study either for viruses or atypical pneumonia. The second most common cause is malignancy. In one of the largest series, Sagrista et al. (15) reported in their study including 322 patients that 20% of the pericardial effusions were idiopathic, 16% were iatrogenic, and 13% were neoplastic. Başar et al. (16) included 104 patients in a study where they found that idiopathic causes were the most common on es. Another study conducted in Turkey including 123 patients with pericardial effusion found that 31.1% of the etiology was associated with idiopathic causes (17). In another study conducted by Strobbe et al. (18) and including 269 patients undergoing pericardiocentesis in the past decade, the etiology was found to be idiopathic in 26% of the cases, and associated with malignancy in 25% . These findings are similar to those of the present study.

Reported that the most common causes of pericardial effusion were tuberculosis, malignancy, and uremia in a study including 246 patients, which was different from our findings. In 2014, Aytürk et al. (19) studied 43 patients with severe pericardial effusion and found that 26% had malignancy, 23% had idiopathic causes, and 16% had uremia.

Tuberculosis is a common cause of pericardial effusion, especially in developing countries. In patients with suspected tuberculosis pericarditis, it is necessary to investigate in terms of extracardiac tuberculosis. Pericardiocentesis fluid, biopsy material culture, or PCR investigation should be done (14). In Turkey, there is a small number of reported cardiac tamponade cases associated with tuberculosis and hypothyroidism (20, 21). Tests specific to tuberculosis were also performed for all patients in our study, but no evidence of the disease was found in any of the patients. Such differences between various series as regards to the etiology of pericardial effusion are due to the location of the centers, their target patient groups, and geographical features (22). In less developed countries, such as South Africa, infectious causes such as tuberculosis are more prevalent. In developed countries, however, cancer and cardiac surgery complications are more common causes of effusion (22). Cancer and iatrogenic causes were found to be the most common causes of pericardial effusions in Singapore patients (13). In developing countries such as Turkey, idiopathic causes and malignancy are more common causes. Studies were performed in the past in Turkey with a small number of patients to identify the etiology of pericardial effusion in patients indicated for pericardiocentesis. Moreover, trials were performed with a larger number of patients using noninvasive tests to determine the etiology of mild-moderate effusion in patients who did not undergo pericardiocentesis. Our study differs from the others as an interventional treatment procedure was performed for all patients and it included a large number of number of patients.

From the macroscopic perspective, 56 patients had hemorrhagic pericardial effusion and 44 had serous pericardial effusion in our study. This rate was consistent with the literature findings. The etiology varied between hemorrhagic and serous effusions. Contrary to what we think in our daily practice, malignancy was found only in 44.6% of the hemorrhagic effusion patients. In certain studies, hemorrhagic pericardial effusions were associated with neoplasm, but hemorrhagic effusion can also be observed in idiopathic pericarditis (12). In a study including 25 male patients with large pericardial effusions, idiopathic causes accounted for 32% of the etiologies, whereas hemorrhagic effusions were found in 25% (23).

The cytological examination of our study group revealed benign findings by 83% and malignant findings by 17%. Similarly, in another study conducted in Turkey, the cytological examination of 213 patients undergoing pericardiocentesis revealed that 78.9% of the findings were benign while 15.1% were malignant (24). In a study examining 128 pericardial fluid materials, 74.2% were found to be benign, 24.2% to be malignant, and 1.6% to have atypical cells; interestingly, 23.1% of the patients in the same study were found to have malignancy, although their cytology was benign (25). In our study, 29 patients had an already known or new diagnosed malignancy. The cytological examination of these patients revealed malignancy in 58.6% and benign results in 41.4%.

The main purpose of cytological examination of pericardial effusions is to detect malignant cells. The sensitivity of the tests ranges from 66% to 100% (25, 26). Malignant cytology is considered to show tumors involving the pericardium, which is vital for prognosis, staging, and treatment decision (27). Autopsy studies performed on cancer patients demonstrated that pericardial involvement ranged from 4% to 15%–30% (27). If no malignant cells are encountered, then other hypotheses should be considered. It may occur due to obstruction of the mediastinal lymphatic system with tumor infiltration or fibrosis associated with radiotherapy and chemotherapy (10). In conclusion, malignancies may lead to both benign and malignant cytology results. Our study is consistent with the literature in terms of cytopathologic examination results and demonstrates the data of our country.

The clear cause of effusion may not be often determined as soon as it is found in many patients examined for pericardial effusion (28). There are certain clinical markers and simple diagnostic methods (e.g., inflammation markers, tamponade findings on echo) that may play an important role in predicting the etiology before a detailed investigation is started (28). In our study, the likelihood of malignancy due to idiopathic causes was significantly high in patients presenting with the clinical picture of tamponade, whereas iatrogenic causes were more commonly observed in patients who had floating heart findings on echocardiography.

Pericardial effusion is classified as acute (<1.5 months), subacute (1.5–3 months), and chronic according to the duration of its symptoms (29). The likelihood of malignancy in the etiology was observed to be higher in patients who had an acute clinical presentation, while rheumatic causes were more likely in patients with chronic complaints. These findings can be used and guide us during patient evaluation.

The mean age was lower in the patients who were found to have malignancy in the etiology in our study group compared to those who had an idiopathic etiology. In a study conducted on 25 patients, the mean age was 60±11 years in patients with malignancy, whereas it was 48±12 years in idiopathic patients, which was different from our finding. Our finding demonstrated that pericardial effusion associated with malignancy could be observed in relatively younger patients; we need to be more careful in managing these patients as we know that evaluation is important for treatment decision and prognosis.

Important limitations of this study included its retrospective nature, and analysis of patient history, laboratory tests, imaging methods, and follow-up data based on the hospital record system and files.

CONCLUSION

The frequency of pericardiocentesis has been increasing due to reasons such as increased prevalence of chronic and malignant diseases, increased survival thanks to the efficacy of treatment methods, and higher mean age. In Turkey, the results of this study including a high number of patients admitted to a tertiary care facility that performs only pericardiocentesis are consistent with the literature and may provide guidance to us with its different results.

Ethics Committee Approval: The Antalya Training and Research Hospital Clinical Research Ethics Committee granted approval for this study (date: 12.03.2020, number: 5/13).

Informed Consent: Written informed consent was obtained from patients who participated in this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept – ZE; Design – ZE, NB, EK; Supervision – SA, GC; Resource – EKG, GC; Materials – ZE, SA; Data Collection and/or Processing – ZE, RG, EK; Analysis and/or Interpretation – ZE, NB; Literature Search – NB, EK; Writing – ZE; Critical Reviews – SA, NB, GC.

Conflict of Interest: The authors have no conflict of interest to declare.

Financial Disclosure: The authors declared that this study has received no financial support.

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