

ORIGINAL ARTICLE

Clinical differences and outcomes in patients with cardiac tamponade of malignant and nonmalignant aetiology

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Summary

Introduction: Metastatic tumors are the most frequent cause of pericardial manifestations, with metastatic tumors being most frequent. Pericardial effusion in malignancy is a marker of poor short-term prognosis. This study evaluated the differences in the clinical presentation, complications, and short-term survival of patients with cardiac tamponade of malignant versus nonmalignant etiology.

Methods: We included all patients referred to the University Clinical Center of Serbia for pericardiocentesis from February 2021 to June 2022. Clinical data, physical examination, laboratory analysis, and imaging were collected. Pericardiocentesis was guided by echocardiography or fluoroscopy, depending on availability and clinician assessment. Procedural complications and survival data at 3 months were recorded.

Results: The study included 71 patients with cardiac tamponade (52.1% female, mean age 59.7±15.7 years). The major symptom on presentation was dyspnea (63.4%), followed by chest pain (15.4%). The most common comorbidity was malignancy (56.3%), predominantly lung carcinoma (29.5%), followed by breast carcinoma (11.3%) and lymphoproliferative disease (8.5%). Hemorrhagic effusions were the most frequent (62%), especially in malignancy (70%), with a higher average total drainage volume in malignant effusions (1713.5 ml vs. 1503.5 ml). Pericardiocentesis was successful in 97.1% of cases, with minor complications in 14% of patients. The rate of complications did not differ between the two groups, and at the 3-month follow-up, out of all patients with a fatal outcome, 72.7% had malignant disease.

Conclusion: Malignant disease is the predominant cause of cardiac tamponade and poor short-term mortality, and pericardiocentesis complications are rare and minor if the procedure is performed in a high-volume tertiary center.

Keywords: cardiac tamponade, malignant aetiology, nonmalignant aetiology

INTRODUCTION

Cardiac tamponade is caused by the accumulation of fluid in the pericardium, which further leads to compressive effects on the heart muscle and hemodynamic disturbances. This condition can be fatal if not recognized in time and adequate therapy is not implemented. The fluid that accumulates can be a transudate or exudate, pus, blood, blood clots, or gases (1). The stiffness of the pericardium and the rate of fluid accumulation determine how quickly the clinical picture will develop (2). An abrupt accumulation of even 200 mL can cause tamponade. In comparison, the pericardium can tolerate up to 2000 mL of fluid without hemodynamic disturbances, depending on the thickness of the myocardium, parietal pericardium, and intracardiac pressures (2,3).

Most pericardial effusions (PE) have a benign clinical course with spontaneous resolution (4). About two-thirds of effusions are idiopathic or caused by viral infection (5,6). Registries and unselected cohorts indicate that about 5% of PEs are associated with malignant disease (6,7). However, if we analyze patient registries with PE, malignant diseases are much more common in this group, occurring in 12% to 23% of cases (8,9). Furthermore, patients with malignant diseases have the incidence of pericardial manifestations of about 10% (10), with 76% having direct pericardial dissemination and 34% developing pericardial effusions without malignant cells (11).

Primary pericardial tumors (mesothelioma, sarcoma, and teratoma) are about 40 times less common than secondary (metastatic) tumors (1). The most common secondary pericardial tumors are advanced lung cancer (~30%) and breast cancer (~25%), which is explained by the anatomical proximity of these organs. Melanoma can disseminate to the pericardium in 40%–70% of cases and leukemias and lymphomas in about 15% of patients (12,13). Pericardial effusion can be induced by both chemotherapy and radiotherapy (14). Recently, immune checkpoint inhibitors have been increasingly mentioned as causes of acute pericarditis, pericardial effusions, or tamponade (15–17). We previously published data comparing the safety and efficacy of echo- and fluoroscopy-guided pericardiocentesis in cardiac tamponade (18), which showed no difference in short-term mortality, as determined by the progression of the primary, usually malignant, disease.

Since there is a paucity of studies comparing patients with cardiac tamponade of malignant or nonmalignant etiology, this study aimed to determine differences in clinical characteristics, presentation, and short-term survival of these two distinct populations.

MATERIAL AND METHODS

The study prospectively included all consecutive patients who were hospitalized or referred to the University Clinical

Center of Serbia for pericardiocentesis from February 2021 to June 2022. Upon admission, socio-epidemiological data, present and previous medical history, and data on comorbidities were gathered, together with a physical examination and vital parameters, an electrocardiographic and telerradiographic examination, and routine laboratory analyses. A focused echocardiographic examination was performed upon admission, evaluating maximal size and distribution of PE. All patients requiring pericardiocentesis were included in the final analysis. Echocardiographic criteria for tamponade were defined as the presence of deflection of the heart cavities, clinical criteria were the severity of the clinical presentation, and hemodynamic criteria were the low arterial blood pressure (below 90 mmHg). According to current recommendations, the physician's clinical assessment, and the availability of a catheterization room, pericardiocentesis was further performed under ultrasound or fluoroscopy control, and the access site was noted. A control echocardiogram was performed if there was suspicion of poor catheter position or if the general condition worsened. The pericardial aspirate was sent for additional biochemical analyses, bacteriological examination, and cytological examination with immunocytochemistry. Additional diagnostic tests, including CT, abdominal ultrasound, tumor markers, thyroid hormone levels, and immunological analyses, were performed. The length of drainage and the total volume of drainage were evaluated. In-hospital and three-month survival were investigated as well. Patients with a history of malignant disease, those with newly diagnosed malignant disease, or those with malignant cells identified in the pericardial fluid were considered to have a malignant pericardial effusion. Complete echocardiography examination was performed before discharge. Patients were clinically observed to determine early and late complications of the procedure. The study endpoints were the occurrence of any pericardiocentesis complication, including early and late (3-month) post-procedural mortality. This study has been conducted in full accordance with national and international ethical guidelines and standards relevant to this type of study.

Statistical analysis

Continuous variables were presented as mean $\pm$ standard deviation or median (interquartile range). The t-test or Mann-Whitney U-test was used to compare the statistical significance of continuous variables, means, and medians, respectively. Categorical variables are presented as percentages, and the chi-square or Fisher's exact test was used to test statistical significance for categories above or below 5, respectively. A P-value < 0.05 was set as the threshold for statistical significance. Multivariate analysis was not performed due to low event rates. All statistical analyses were performed in IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp.) software package and R 3.4.2 (R Core Team (2017)).

Table 1. Clinical presentation of patients with tamponade

	Malignant pericardial effusion (n=40)	Nonmalignant pericardial effusion (n=31)	P-value
Dyspnoea, n (%)	27 (67.5)	18 (58.1)	0.413
Orthopnoea, n (%)	3 (7.5)	5 (16.1)	0.254
Chest pain, n (%)	6 (15)	5 (16.1)	0.896
Caugh, n (%)	3 (7.5)	0 (0)	0.251
Palpitations, n (%)	0 (0)	1 (3.2)	0.436
Vertigo, n (%)	0 (0)	1 (3.2)	0.436
Asymptomatic, n (%)	1 (2.5)	1 (3.2)	1.000

RESULTS

This prospective study included 71 consecutive patients with cardiac tamponade (52.1% female), with a mean age of 59.7 ± 15.7 years. The majority presented with dyspnea (63.4%), followed by chest pain (15.4%) and orthopnea (11.3%), while less common were cough (4.2%), arrhythmias, and dizziness (1.4% each). Two patients were asymptomatic (2.8%) (Table 1). Rapid worsening of symptoms was observed in 21 cases (29.6%) (Table 1-2).

The most common comorbidity was previous malignancy (33.8%), with 18 newly diagnosed patients during hospitalization (total number of patients with malignancy 56.3%). The most prevalent malignant disease was lung carcinoma (29.5%), followed by breast carcinoma (11.3%) and lymphoproliferative disease (8.5%). Carcinoma of the uterus, stomach, thyroid gland, thymus, urinary bladder, pericardium, and right atrial angiosarcoma were registered in one case each (Figure 1).

Arterial hypertension (46.5%) and smoking (32.4%) were the most dominant cardiovascular risk factors. The

two groups differ in the prevalence of diabetes, hypertension, and previous pericardial effusion, which were all more frequent in the non-malignant group. In contrast, higher average values of natriuretic peptides were present in the malignant pericardial effusions (Table 2).

Microvoltage was most commonly detected on electrocardiography, present in 39.4% of patients, of whom 53.5% had malignant disease. Tachycardia ($HR \geq 110/min$) was present in 15.5% of cases and electrical alternans in 16.9% (83% of malignant effusions). Typical saddle ST-segment elevation was present in only 4 cases (5.6%), and PR depression was not observed in any patient.

For the assessment of indications for pericardiocentesis, echo criteria were decisive in 34 patients (47.9%), equally present in malignant and nonmalignant effusions. On the other hand, clinical criteria were present in 23 (32.4%) and hemodynamic criteria in 6 (8.4%) patients, both predominantly with malignant effusions, while 8 (11.3%) patients had neither.

The maximum effusion size measured by echocardiography was 6 cm; 81.7% of patients (58.6 malignant

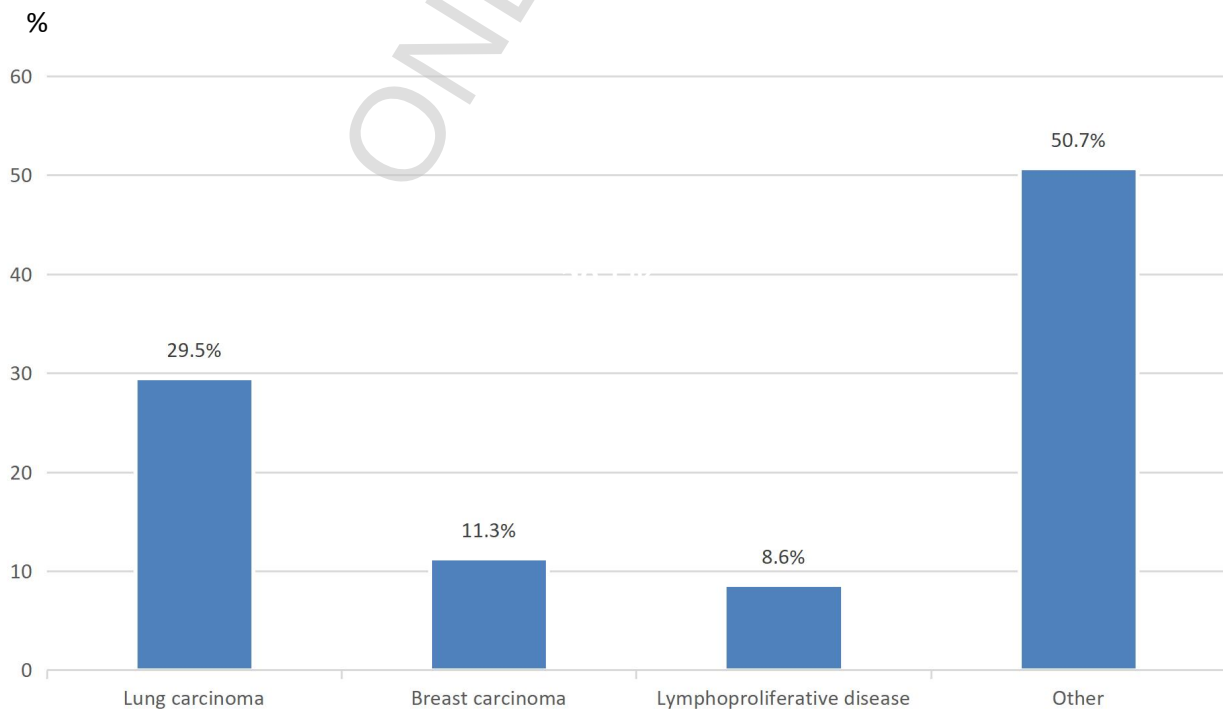
**Figure 1.** Distribution of malignant diseases in patients with tamponade

Table 2. Clinical characteristics of patients with tamponade

	Malignant pericardial effusion (n=40)	Nonmalignant pericardial effusion (n=31)	P-value
Demographic characteristics			
Gender (female), n (%)	22 (55)	15 (48.4)	0.306
Age, mean (SD)	54.8 (15.8)	65.8 (12.5)	0.516
Clinical characteristics			
Systolic blood pressure, mmHg, mean (SD)	115.3 (13.9)	125.3 (24.3)	0.376
Heart rate, /min, mean (SD)	100.7 (15.3)	89.3 (14.8)	0.524
Progressive worsening symptoms n (%)	15 (37.5)	6 (19.4)	0.096
Tamponade, n (%)	36 (90.0)	27 (87.1)	0.701
Comorbidities			
Hypertension, n (%)	14 (35.0)	19 (61.3)	0.027
Diabetes, n (%)	3 (7.5)	8 (25.8)	0.034
Dyslipidemia, n (%)	3 (7.5)	6 (19.4)	0.136
Obesity, n (%)	2 (5.0)	4 (12.9)	0.120
Smoking, n (%)	15 (37.5)	8 (9.7)	0.296
Coronary artery disease, n (%)	1 (2.5)	3 (9.7)	0.311
Atrial fibrillation, n (%)	5 (12.5)	7 (22.6)	0.342
CVI/TIA, n (%)	3 (7.5)	2 (6.5)	0.864
Chronic kidney disease, n (%)	1 (2.5)	3 (9.7)	0.311
Previous pericardial effusion, n (%)	2 (5.0)	7 (22.6)	0.035
Laboratory parameters			
Leucocytes, 10 ⁹ /L, median (IQR)	8.7 (6.1-10.7)	7.6 (5.1-11.6)	0.872
Hemoglobin, g/L, mean (SD)	116.0 (19.3)	122.0 (22.0)	0.205
CRP, mg/L, median (IQR)	40.7 (11.3-81.7)	19.2 (4.1-73.0)	0.180
Hs troponin-T, ng/L, median (IQR)	14.5 (7.0-21.0)	14.0 (9.0-44)	0.540
d-dimer, mg/L FEU, median (IQR)	3.2 (1.7-8.0)	3.8 (0.7-9.7)	0.465
BNP, pg/mL, median (IQR)	157 (57-268)	125 (36-142)	0.023
eGFR<60, mL/min/1.73 m ² , mean (SD)	56.5 (9.4)	52.4 (15.4)	0.237

BNP- brain natriuretic peptide; CVI-cerebrovascular insult; CRP-C-reactive protein; eGFR-estimated glomerular filtration rate; TIA-transient ischemic attack

effusions) had an effusion > 2 cm, while the rest had a maximum effusion of 1-2 cm. Circumferential effusion was present in the majority of patients (92.9%), of whom 56.5% had malignancies, while in other cases it was described as asymmetric/loculated. Of the echocardiographic signs of hemodynamic significance of pericardial effusion, the most frequently described were right atrium deflection (67.6%) and right ventricular deflection (64.8%), followed by heart palpitations in 30.9% and dilated inferior vena cava in 16.9%, and septal bounce (5.6%) was the least common.

The predominant approach site was subcostal (60.6% of all patients), with no differences between patients with and without malignant disease; this approach was more frequent in fluoroscopically guided procedures (93.8% of cases), $p=0.003$. On the other hand, in echocardiographically guided punctures, the apical intercostal and subxiphoid approaches were almost identically represented (~49% vs. ~51%).

Hemorrhagic effusion was most frequent (62%), numerically more often in patients with malignancy (70%),

while serous was more prevalent in nonmalignant effusions ($p = \text{NS}$). The average total drainage was higher in malignant effusions (1713.5 ml vs 1503.5 ml), and the average length of drainage was one day longer in malignant effusions; the difference was not significant (**Table 3**).

Pericardiocentesis was successful in 97.1% of cases, with failure in patients with asymmetric effusions, localized predominantly posteriorly, which are inaccessible to the usual approach. More than one attempt was needed in only 6 cases, and minor complications were recorded in 10 cases (14.1% of patients). The most common complication was pleural puncture (5.6%) in the apical intercostal approach and pneumothorax (4.2%) regardless of the approach. In one case at the apical intercostal approach, rupture and unwinding of the guidewire thread were noted, which was removed without the need for surgical intervention. Also, with the apical intercostal approach, kinking of the guidewire and emptying of the effusion into the pleural space due to simultaneous puncture of the pleura and pericardium were noted in one case. There were no complications requiring surgical intervention in

Table 3. Procedural and pericardial effusion characteristics

	Malignant pericardial effusion (n=40)	Nonmalignant pericardial effusion (n=31)	P-value
Access point, n (%)			
• Apical	15 (37.5)	13 (41.9)	0.704
• Subcostal	25 (62.5)	18 (58.1)	0.705
Complications, n (%)	6 (1.5)	4 (1.3)	0.371
Pleural puncture/pneumothorax			
Pneumopericardium	3 (7.5)	3 (9.7)	1.000
Guidewire crack	2 (5)	1 (3.2)	0.414
	1 (2.5)	0 (0)	0.157
Microscopic characteristics of pericardial fluid, n (%)			
• Haemorrhagic	28 (70.0)	16 (51.6)	0.113
• Opalescent	1 (2.5)	1 (3.2)	1.000
• Sero-haemorrhagic	4 (7.3)	2 (12.5)	0.593
• Serous	8 (20.0)	10 (32.2)	0.238
Total drainage volume, mL, median (IQR)	1713.5±927.3	1503.5±935.7	0.384
The length of drainage, days, median (IQR)	5 (3 - 6)	4 (3 - 6)	0.441

any case. In three cases, fibrinolytics were administered intrapericardially due to pronounced soft tissue deposits and signs of constriction, and the procedure proceeded without complications. The rate of procedural complications did not differ between the two groups (Table 3).

At the 3-month follow-up, eleven patients died, eight of whom (72.7%) died from the progression linked to primary malignant disease.

DISCUSSION

In this study, patients with tamponade on admission presented predominantly with orthopnea or dyspnea in 74.7% of cases, which is consistent with large series in which dyspnea was the predominant symptom in 51-89% of cases (9,19). Conversely, the absence of symptoms can exist in up to 13% of cases with cardiac tamponade (19), which is more frequent than our study showed, where non-specific complaints or asymptomatic patients were present in 2.8% of cases. This is relevant since fatal outcomes can occur in up to 80% of asymptomatic large pericardial effusions (20). Although inflammation is the main pathophysiological mechanism and a predictor of nonmalignant effusions (9,21), the two groups did not differ in inflammatory parameters. Differences in the study sample may explain this discrepancy, since our study included more patients with malignant diseases. However, patients with malignant pericardial effusions had higher average natriuretic peptide (NP) levels, in contrast to other trials in which lower serum NPs were associated with malignant etiology (22). This may have occurred due to the more rapid development of tamponade in patients with malignant disease in our patient cohort. At the same time, NPs can be suppressed in the presence of slowly developing and severe pericardial effusions (23).

The study showed that patients with malignant etiology were numerically younger than those without malignant

etiology, which is consistent with other publications that describe a correlation between malignant etiology, particularly lymphoma and leukemia, and a younger population (24). Lymphoproliferative diseases were the third most common malignant disease in our study, after lung and breast carcinoma, which are described as the most prevalent secondary pericardial tumors in 30% and 25% of cases, respectively (1,12,13). Metastatic cancers were more often the cause of cardiac tamponade than primary tumors of the heart and pericardium, which is also in accordance with previous studies (24,25). Among other comorbidities, hypertension and diabetes were more prevalent in nonmalignant pericardial effusions. These more common cardiovascular risk factors implicate other pathophysiological mechanisms of pericardial effusions than in malignant disease (26).

Hemorrhagic effusion was the most common macroscopic feature, consistent with previous publications, in which this type of effusion occurs most often regardless of etiology (27). However, it is more common in malignancies (21). In terms of volume of pericardial effusion extracted, malignant pericardial effusions had larger volumes of fluid drainage, which is in accordance with other trials, showing effusions of larger quantity in patients with malignancy and tuberculosis (9, 21, 28). The average drainage duration was about 4 days, which is consistent with recommendations not to exceed a 7-day interval to avoid infectious complications (1).

This study showed a low complication rate, similar to other trials, in which complications were reported in 4-20% of cases (29-33). Patients with malignant disease were predominant among those who died during the 3-month follow-up, which is similar to data from other publications, where malignant effusions have a worse clinical course with more recurrences (29,34). In our patient cohort, lung carcinoma was the predominant malignant disease. Previous studies have shown that pericardial effusion in patients with lung cancer is associated with a significant shortening of survival in comparison with

other malignant effusions, such as those in breast cancer or hematological malignancies (21,35).

Limitations

The main limitations of this study were the relatively small number of patients and the short follow-up period. In addition, there could have been bias in the definition of malignant pericardial effusion due to the multifactorial etiology of effusion. Furthermore, the study was conducted in a tertiary institution and a center with a large volume of pericardiocentesis, where patients from other departments are also referred, especially those with malignant diseases and those with periprocedural complications. For this reason, the conclusion cannot be generalized. Due to the heterogeneous management of medical records, some parameters could not be analyzed. Also, certain procedures may not have been included in the final analysis because they are performed in another department within the University Clinical Center.

CONCLUSIONS

The increase in the number of patients with malignant diseases will lead to a higher need for pericardiocentesis in

the future. Patients with malignant etiology represent the predominant group of those presenting with cardiac tamponade and seem to have poor short-term survival. However, patients with malignant disease do not have more complications of the pericardiocentesis, which are rare and minor if the procedure is performed in a high-volume tertiary center. Nuanced differences in characteristics, presentation, and survival could be obtained in a larger population and a longer follow-up period.

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Ethical approval: The study was approved by the Ethics Committee of the Clinical Center of Serbia under decision No. 635/423 dated June 25, 2026.

Informed consent: Patient consent was waived since this was an observational trial and all patients were treated according to the standard of care.

REFERENCES

- Maisch B, Seferović PM, Ristić AD, Erbel R, Rienmüller R, Adler Y et al. Task Force on the Diagnosis and Management of Pericardial Diseases of the European Society of Cardiology. Guidelines on the diagnosis and management of pericardial diseases executive summary; The Task force on the diagnosis and management of pericardial diseases of the European society of cardiology. *Eur Heart J* 2004; 25:587-610. doi: 10.1016/j.ehj.2004.02.002.
- Halpern DG, Argulian E, Briassoulis A, Chaudhry F, Aziz EF, Herzog E. A novel pericardial effusion scoring index to guide decision for drainage. *Crit Pathw Cardiol* 2012; 11:85-8. doi: 10.1097/HPC.0b013e318254a5ca.
- Spodick D. Acute Cardiac Tamponade. *N Engl J Med* 2003; 349:684-90. doi: 10.1056/NEJMra022643.
- Adler Y, Charron P, Imazio M, Badano L, Barón-Esquívias G, Bogaert J, et al. ESC guidelines for the diagnosis and management of pericardial diseases: the task force for the diagnosis and management of pericardial diseases of the European Society of Cardiology (ESC) endorsed by: the European Association for Cardio-Thoracic Surgery (EACTS). *Eur Heart J* 2015; 36:2921-64. doi: 10.1093/eurheartj/ehv318.
- Little WC, Freeman GL. Pericardial disease. *Circulation* 2006; 113:1622-32. doi: doi.org/10.1161/CIRCULATIONAHA.105.561514
- Imazio M, Cecchi E, Demicheli B, Ierna S, Demarie D, Ghisio A, et al. Indicators of poor prognosis of acute pericarditis. *Circulation* 2007; 115:2739-44. doi: 10.1161/CIRCULATIONAHA.106.662114.
- Zayas R, Anguita M, Torres F, Gimenez D, Bergillos F, Ruiz M, et al. Incidence of specific etiology and role of methods for specific etiologic diagnosis of primary acute pericarditis. *Am J Cardiol* 1995; 75:78-82. doi: 10.1016/s0002-9149(99)80558-x.
- Imazio M, Spodick DH, Brucato A, Trincherio R, Adler Y. Controversial issues in the management of pericardial diseases. *Circulation* 2010; 121:916-28. doi: 10.1161/CIRCULATIONAHA.108.844753.
- Sagrasta-Sauleda J, Merce J, Permanyer-Miralda G, Soler-Soler J. Clinical clues to the causes of large pericardial effusions. *Am J Med* 2000; 109:95-101. doi: 10.1016/s0002-9343(00)00459-9.
- Maisch B, Ristic A, Pankuweit S. Evaluation and management of pericardial effusion in patients with neoplastic disease. *Prog Cardiovasc Dis* 2010; 53(2):157. doi: 10.1016/j.pcad.2010.06.003.
- Klatt EC, Heitz DR. Cardiac metastases. *Cancer* 1990; 65(6):1456. doi: 10.1002/1097-0142(19900315)65:6<1456::aid-cnrcr2820650634>3.0.co;2-5.
- Lam KY, Dickens P, Chan AC. Tumors of the heart. A 20-year experience with a review of 12,485 consecutive autopsies. *Arch Pathol Lab Med* 1993; 117(10):1027.
- Abraham KP, Reddy V, Gattuso P. Neoplasms metastatic to the heart: review of 3314 consecutive autopsies. *Am J Cardiovasc Pathol* 1990; 3(3):195.
- Chang HM, Okwuosa TM, Scarabelli T, Moudgil R, Yeh ETH. Cardiovascular Complications of Cancer Therapy: Best Practices in Diagnosis, Prevention, and Management: Part 2. *J Am Coll Cardiol* 2017; 70(20):2552. doi: 10.1016/j.jacc.2017.09.1096.
- Escudier M, Cautela J, Malissen N, Ancedy Y, Orabona M, Pinto J et al. Clinical Features, Management, and Outcomes of Immune Checkpoint Inhibitor-Related Cardiotoxicity. *Circulation* 2017; 136(21):2085. doi: 10.1161/CIRCULATIONAHA.117.030571.
- Heinzerling L, Ott PA, Hodi FS, Husain AN, Tajmir-Riahi A, Tawbi H et al. Cardiotoxicity associated with CTLA4 and PD1 blocking immunotherapy. *J Immunother Cancer* 2016; 4:50. doi: 10.1186/s40425-016-0152-y. eCollection 2016.
- Gornik H, Gerhard-Herman M, Beckman J. Abnormal cytology predicts poor prognosis in cancer patients with pericardial effusion. *J Clin Oncol* 2005; 23(22):5211-6. doi: 10.1200/JCO.2005.00.745.
- Simeunović DS, Milinković I, Polovina M, Trifunović Zamaklar D, Veljić I, Zaharijev S, Babić M, Nikolić D, Perić V, Gatačić N, Ristić AD, Seferović PM. Safety and Efficacy of Echo- vs. Fluoros-

- copy-Guided Pericardiocentesis in Cardiac Tamponade. *Medicina (Kaunas)*. 2025 Feb 4;61(2):265. doi:10.3390/medicina61020265.
19. Reuter H, Burgess LJ, Doubell AF. Epidemiology of pericardial effusions at a large academic hospital in South Africa. *Epidemiol Infect* 2005; 133(3):393–9. doi: 10.1017/s0950268804003577.
 20. Refaat MM, Katz WE. Neoplastic Pericardial Effusion 2011; 34(10):593–598. doi: 10.1002/clc.20936. Epub 2011 Sep 16.
 21. Sagristà-Sauleda J, Merce AS, Soler-Soler J. Diagnosis and management of pericardial effusion. *World Journal of Cardiology* 2011; 3(5):135. doi: 10.4330/wjc. v3.i5.135.
 22. Carasso S, Grosman-Rimon L, Nassar A, Kusniec F, Ghanim D, Elbaz-Greener G, et al. Serum BNP levels are associated with malignant pericardial effusion. *Int J Cardiol Heart Vasc* 2019; 23:100359. doi: 10.1016/j.ijcha.2019.100359.
 23. Lauri G, Rossi C, Rubino M, Cosentino N, Milazzo V, Marana I, et al. B-type natriuretic peptide levels in patients with pericardial effusion undergoing pericardiocentesis. *Int J Cardiol* 2016; 212:318–23. doi: 10.1016/j.ijcard.2016.03.075.
 24. Perek B, Tomaszewska I, Stefaniak S, Katynska I, Jemielity M. Cardiac tamponade - unusual clinical manifestation of undiagnosed malignant neoplasm. *Neoplasma* 2016; 63(4):601–606. doi: 10.4149/neo_2016_414.
 25. De Ceuninck M, Demedts I, Trenson S. Malignant cardiac tamponade. *Acta Cardiol* 2013; 68(5):505–507. doi: 10.1080/ac.68.5.2994474.
 26. Shanker DA, Gaur A, Warriner D. Pericardial Effusion: Overview of Aetiology, Pathophysiology, Diagnosis, and Management. *Cureus* 2025 Sep 12;17(9):e92177. doi: 10.7759/cureus.92177.
 27. Colombo A, Olson HG, Egan J, Gardin JM. Etiology and prognostic implications of a large pericardial effusion in men. *Clin Cardiol* 1988;11(6):389–394. doi: 10.1002/clc.4960110606.
 28. Inglis R, King AJ, Gleave M, Bradlow W, Adlam D. Pericardiocentesis in contemporary practice. *J Invasive Cardiol* 2011; 23(6):234–9.
 29. Sanchez-Enrique C, Nunez-Gil JJ, Viana-Tejedor A, De Agustin A, Vivas D, Palacios-Rubio J et al. Cause and long-term outcome of cardiac tamponade. *Am J Cardiol* 2016;117(4):664–9. doi: 10.1016/j.amjcard.2015.11.023.
 30. Ainsworth CD, Salehian O. Echo-guided pericardiocentesis: Let the bubbles show the way. *Circulation* 2011;123:e210–1. doi: 10.1161/CIRCULATIONAHA.110.005512.
 31. Kil UH, Jung HO, Koh YS, Park HJ, Park CS, Kim PJ, et al. Prognosis of large, symptomatic pericardial effusion treated by echo-guided percutaneous pericardiocentesis. *Clin Cardiol* 2008;31:531–7. doi: 10.1002/clc.20305.
 32. Tsang TS, Enriquez-Sarano M, Freeman WK, Barnes ME, Sinak LJ, Gersh BJ, et al. Consecutive 1127 therapeutic echocardiographically guided pericardiocenteses: Clinical profile, practice patterns, and outcomes spanning 21 years. *Mayo Clin Proc* 2002;77:429–36. doi: 10.4065/77.5.429.
 33. Duvernoy O, Borowiec J, Helmius G, Erikson U. Complications of percutaneous pericardiocentesis under fluoroscopic guidance. *Acta Radiol.* 1992;33:309–13.
 34. Shih CT, Lee WC, Fang HY, Wu PJ, Fang YN, Chong SZ. Outcomes of Patients with and without Malignancy Undergoing Percutaneous Pericardiocentesis for Pericardial Effusion. *J Cardiovasc Dev Dis* 2021;8(11):150. doi: 10.3390/jcdd8110150.
 35. Burazor I, Imazio M, Markel G, Adler Y. Malignant pericardial effusion. *Cardiology*. 2013; 124(4):224–232. doi: 10.1159/000348559.

RAZLIKE U KLINIČKOJ PREZENTACIJI I ISHODIMA BOLESNIKA SA TAMPONADOM SRCA MALIGNE I NEMALIGNE ETIOLOGIJE

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Sažetak

Uvod: Metastatski tumori su najčešći uzrok perikardijalnih manifestacija, a perikardijalni izliv kod malignih bolesti je marker loše kratkoročne prognoze. Ova studija je istraživala razlike u kliničkoj prezentaciji, komplikacijama i kratkoročnom preživljavanju bolesnika sa tamponadom srca maligne u odnosu na nemalignu etiologiju.

Metode: Uključeni su svi bolesnici upućeni u Univerzitetski klinički centar Srbije radi perikardiocenteze, od februara 2021. do juna 2022. godine. Od bolesnika su uzeti anamnestički podaci, urađen fizikalni pregled, laboratorijske analize i dodatne pretrage. Perikardiocenteza je urađena pod ehokardiografskom ili fluoroskopskom kontrolom, u skladu sa dostupnošću i prema proceni lekara. Praćene su proceduralne komplikacije i preživljavanje nakon tri meseca.

Rezultati: Studija je obuhvatila 71 bolesnika sa tamponadom srca (52,1% žena, prosečna starost 59,7±15,7

godina). Glavni simptom prilikom prvog pregleda je bila dispneja (63,4%), zatim bol u grudima (15,4%). Najčešći komorbiditet bio je malignitet (56,3%), pretežno karcinom pluća (29,5%), zatim karcinom dojke (11,3%) i limfoproliferativna bolest (8,5%). Hemoragični izlivi su bili najčešći (62%), posebno kod maligniteta (70%), sa većom prosečnom ukupnom drenažom kod malignih izliva (1713,5 ml naspram 1503,5 ml). Perikardiocenteza je bila uspešna u 97,1% slučajeva, uz manje komplikacije kod 14% bolesnika. Stopa komplikacija se nije razlikovala između dve grupe, a nakon tri meseca, od svih bolesnika koji su preminuli, 72,7% je imalo malignu bolest.

Zaključak: Maligna bolest je dominantan uzrok tamponade srca i kratkoročnog mortaliteta kod ovih bolesnika, a komplikacije perikardiocenteze su retke i minorne ako se ona obavlja u tercijarnoj ustanovi sa velikim brojem procedura.

Ključne reči: tamponada srca, maligna etiologija, nemaligna etiologija

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