

Case Report

Lung Adenocarcinoma Presenting as Early Cardiac Tamponade: A Case Report

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Keywords

Lung cancer · Adenocarcinoma · Tamponade · Diagnosis · Treatment · Oncology

Abstract

Introduction: Lung cancer remains the most common cause of cancer death in the USA and worldwide despite continued advances in lung cancer screening and treatment. Pericardial effusion (PerF) has been found in up to 50% of postmortem patients with cancer; lung and breast cancers are the most frequent malignancies. Furthermore, it is a sign of poor outcomes with fewer than 5 months of survival. Nevertheless, PerF with or without tamponade as a presentation of lung cancer is uncommon. **Case Presentation:** We present a 72-year-old male without medical history who presented with 1 month of cough with white sputum and shortness of breath, progressively worsening, associated with weight loss (20 pounds). Further studies demonstrated early cardiac tamponade secondary to malignancy. **Conclusion:** Cardiac tamponade can arise secondarily from various etiologies and have different presentations depending on the cause. In general, it is a slowly developing and clinically silent disease process. Therefore, malignant PerFs can rarely present with hemodynamic instability and be the initial manifestation of an underlying malignancy. Our case review presents a rare case of metastatic lung adenocarcinoma manifesting as early symptomatic cardiac tamponade and as an emergency. The results might be life-threatening if this presentation is not recognized and managed appropriately. Clinicians must be aware of such atypical presentations of thoracic malignancies to take action adequately.

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Introduction

Lung cancer remains the second most diagnosed cancer in females and males. However, it is still the most common cause of cancer death in the USA, accounting for 21% of deaths related to cancer. Furthermore, despite continued advances in lung cancer screening and treatment, it is the principal cause of death worldwide [1]. Close to 237,000 people were diagnosed with lung cancer in 2022 [2]. The majority of patients with lung cancer present for diagnostic evaluation because of suspicious symptoms such as cough, hemoptysis, dyspnea, and chest pain or an incidental finding on chest imaging [2]. Lung cancer arises from the epithelium cells in the respiratory system and can be divided into two broad categories – small cell lung cancer and non-small lung cancer [3].

Small cell lung cancer is a poorly prognostic malignant tumor derived from cells exhibiting neuroendocrine characteristics, accounting for approximately 15% of all lung cancer cases. NSCLC accounts for the remaining 85% of cases. Adenocarcinoma is one of the NSCLC subtypes of lung cancer, accounting for 38.5% of all lung cancer cases. Cardiac metastasis from cancer is not uncommon, but cardiac tamponade complicating malignant pericardial effusion (PerF) is a rare presentation of any kind of malignancy [4].

It is a fairly rare presentation of lung adenocarcinoma and always points toward a grim prognosis. Malignant cardiac tamponade is a serious complication of cancer overall and has been recognized in 2–15% of cases of postmortem autopsy in patients with a lung cancer history [5]. PerF or cardiac tamponade secondary to lung cancer is far less common and could be identified during life [6].

The most common primary tumor that involves pericardium is lung cancer; other types include breast, lymphoma, leukemia, and esophageal cancer. The clinical manifestation of malignant pericardium can present as pericarditis, cardiac tamponade, malignant PerF, or pericardial constriction. In patients with known lung cancer diagnosis, the manifestation of symptomatic malignant PerF has been associated with poor outcomes and an average survival of less than 4 months [4].

Malignant cardiac tamponade is an understudied oncological emergency. This case provides an unusual presentation of lung adenocarcinoma and shows the importance of intervention in a timely manner in malignancy associated with pleural effusions and malignant cardiac tamponade. Quick recognition can be crucial to saving a life, providing symptomatic relief, and helping to diagnose the etiology [7].

Case Narrative

We present a 72-year-old male without medical history who presented to the emergency department with 1 month of cough associated with white sputum and shortness of breath, progressively worsening, and weight loss of 20 pounds. Social history was significant for 25-year smokers, with 25 packs per year. Vital signs at arrival were blood pressure of 126/72 mm Hg, heart rate of 110 per minute, respiratory rate of 16 per minute, and temperature of 97.7 F. Initial blood work showed mild hyperkalemia (K: 5.7 mEq/L), hyponatremia (132 mEq/L), creatinine of 1.6 mg/dL, and mild transaminitis (Tables 1, 2). The electrocardiogram on presentation showed sinus rhythm and tachycardia of 100 beats per minute with low voltage complexes (Fig. 1). The chest X-ray demonstrated a mass-like structure in the right lower lung lobe with infiltrates. Therefore, computer tomography of the chest (CT chest) demonstrated moderate to large PerF, right pleural effusion, and a posteriorly layering component with multiple lymphadenopathies (Fig. 2). Because of these findings, pneumonia was considered, and the patient was started on antibiotics, which were discontinued later.

Table 1. Pertinent laboratories upon admission

Variable	Results	Reference range
Potassium (K)	5.7 mEq/L	3.5–5.3 mEq/L
Sodium (Na)	132 mEq/L	135–145 mEq/L
Blood urea nitrogen (BUN)	40 mg/dL	8–23 mg/dL
Creatinine	1.5 mg/dL	0.6–1.2 mg/dL
AST	86 IU/L	8–33 IU/L
ALT	110 IU/L	4–36 IU/L
White blood cell (WBC) count	$9.4 \times 10^3/\mu\text{L}$	$4.2\text{--}9.1 \times 10^3/\mu\text{L}$
Absolute lymphocyte count	$1.01 \times 10^3/\mu\text{L}$	$1.32\text{--}3.57 \times 10^3/\mu\text{L}$
Red blood cell (RBC) count	$4.25 \times 10^6/\mu\text{L}$	$4.63\text{--}6.08 \times 10^6/\mu\text{L}$
Hemoglobin	13.3 g/dL	13.7–17.5 g/dL
Mean corpuscular volume (MCV)	95.8 fL	79.0–92.9 fL
COVID-19 test	Negative	Negative
Flu and RSV test	Negative	Negative

During his stay at ED, the patient developed persistent tachycardia; therefore, an electrocardiogram (Fig. 3) was performed, showing atrial fibrillation with rapid ventricular response, therefore prompted an echocardiogram showing a large PerF collapsing the right atrium, an ejection fraction of 56%, and moderate left ventricular hypertrophy; furthermore, the patient was tachycardic during the test (Fig. 4). Hence, an emergent pericardiocentesis was performed by draining 60 mL of hemorrhagic pericardial fluid, and further fluid analysis revealed malignant epithelial cells consistent with metastatic lung adenocarcinoma. A pericardial window was placed per the recommendation of cardiothoracic surgery and was discontinued 4 days after placement; drainage was 1,040 mL in the first 24 h and 1,920 in total. Furthermore, the patient had a pigtail due to a significant left pleural effusion. Histopathology (Fig. 5) showed PDL1 70%, tumor mutational burden was high 14 Muts/Mb, MS stable with IHC + CK7 and Ber EP4, negative p40, TTF1, CK20, CALR, Napsin A. Further brain magnetic resonance imaging showed 5-mm enhancing lesions in the right superior cerebellum and 6 mm at the left inferior cerebellum, consistent with metastasis. Cardiology was consulted due to the new onset of atrial fibrillation, which was considered secondary to the malignant PerF. A CT abdomen pelvis with contrast was performed and was unremarkable.

Nevertheless, he was never started on anticoagulation due to the high risk of bleeding. The patient was planning to start pembrolizumab for further treatment of metastatic adenocarcinoma of the lung. After the resolution of pericardial and pleural effusion, he was discharged to be followed up as a patient with oncology. Unfortunately, the patient died 1 month after the diagnosis due to complications of lung cancer.

Discussion

Lung cancer, a multifaceted disease with varying clinical presentations, remains a significant public health challenge and is a predominant malignancy in terms of incidence and mortality. Globally, it accounted for approximately 2.1 million new cases and 1.8 million deaths in 2018, making it the most commonly diagnosed cancer and the leading cause of cancer death [8].

Table 2. Pertinent laboratories on the first day of admission

Variable	Results	Reference range
Potassium (K)	5.4 mEq/L	3.5–5.3 mEq/L
Sodium (Na)	137 mEq/L	135–145 mEq/L
Blood urea nitrogen (BUN)	44 mg/dL	8–23 mg/dL
Creatinine	1.4 mg/dL	0.6–1.2 mg/dL
AST	43 IU/L	8–33 IU/L
ALT	87 IU/L	4–36 IU/L
White blood cell (WBC) count	$12.0 \times 10^3/\mu\text{L}$	$4.2\text{--}9.1 \times 10^3/\mu\text{L}$
Absolute lymphocyte count	$1.01 \times 10^3/\mu\text{L}$	$1.32\text{--}3.57 \times 10^3/\mu\text{L}$
Red blood cell (RBC) count	$3.91 \times 10^6/\mu\text{L}$	$4.63\text{--}6.08 \times 10^6/\mu\text{L}$
Hemoglobin	12.0 g/dL	13.7–17.5 g/dL
Mean corpuscular volume (MCV)	96.4 fL	79.0–92.9 fL
COVID-19 test	Negative	Negative
Flu and RSV test	Negative	Negative

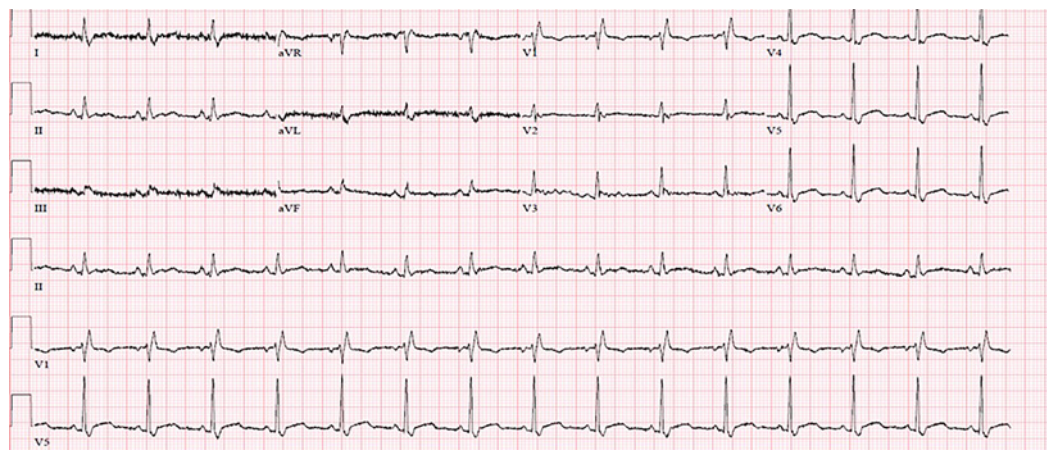


Fig. 1. First ECG demonstrating sinus rhythm and tachycardia of 100 beats per minute with low voltage complexes.

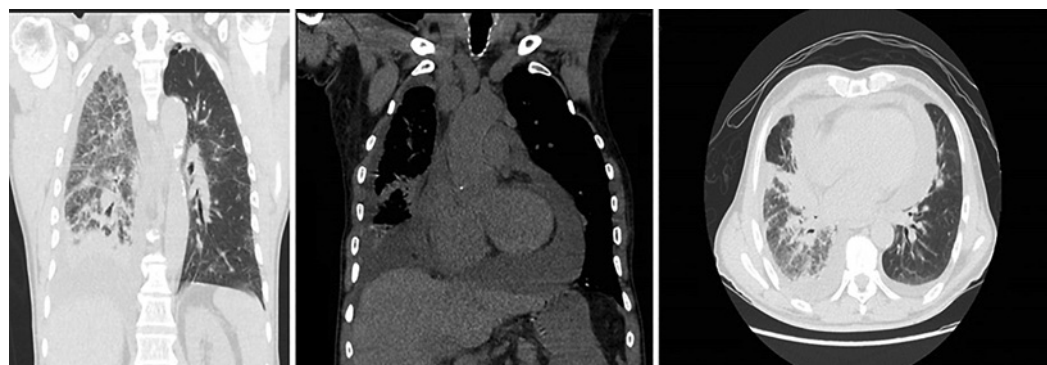


Fig. 2. Sagittal and coronal view of the CT chest without contrast demonstrated moderate to large PerF, right pleural effusion, and a posteriorly layering component with multiple lymphadenopathies.

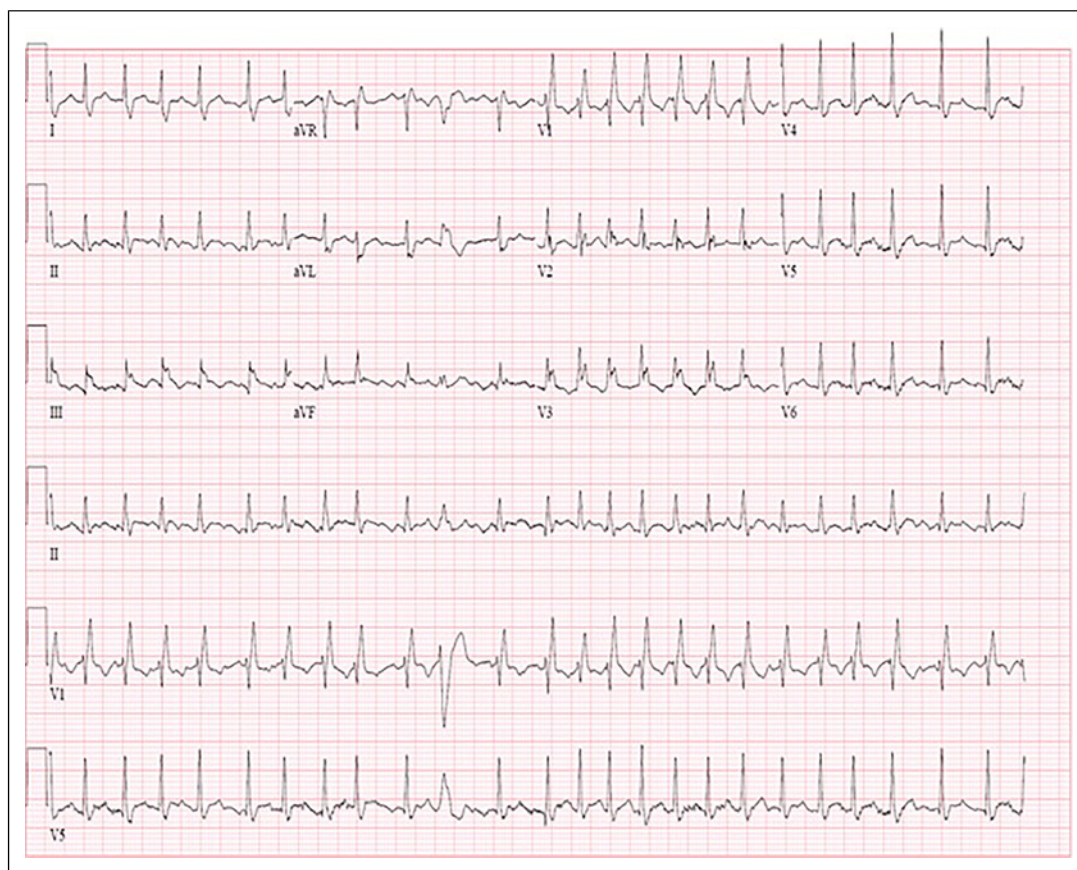


Fig. 3. Second ECG showing the new onset of atrial fibrillation (Afib) with rapid ventricular response.

Lung cancers can be categorized into four primary histological subtypes: adenocarcinoma, squamous cell carcinoma, large-cell carcinoma, and small cell carcinoma. Adenocarcinoma represents approximately 50% of all lung cancers, marking it as the predominant type. Furthermore, it is the leading lung cancer type among nonsmokers, light smokers, and women [9].

The incidence of lung cancer varies by region, with high rates observed in countries with high tobacco consumption or exposure to carcinogens like radon. Notably, in some developed countries, incidence rates have plateaued or even declined, likely due to effective public health campaigns against smoking and better occupational health practices [10].

Disparities in lung cancer presentation are evident across sex and racial lines. Historically, males exhibited a higher incidence of lung cancer than females. However, recent trends show a narrowing of this gap, possibly due to changing smoking behaviors among women in the latter half of the 20th century [11]. Regarding racial disparities, black men in the USA have consistently had higher lung cancer incidence rates compared to white men, even though the gap has narrowed over time. Differences in socioeconomic status, access to healthcare, and exposure to risk factors contribute to these disparities [12].

The diagnosis of lung cancer is mostly made following evaluation for respiratory signs and symptoms or incidental finding of a nodule or mass during routine imaging. The most common presentations of lung cancer are cough (50–75%), hemoptysis (25–50%), dyspnea (25%), and chest pain (20%). Other symptoms include hemoptysis, hoarseness, superior vena cava, and Pancoast syndrome. It can metastasize to other organs in the body, including the liver, adrenal glands, bones, brain, and pericardium [13].

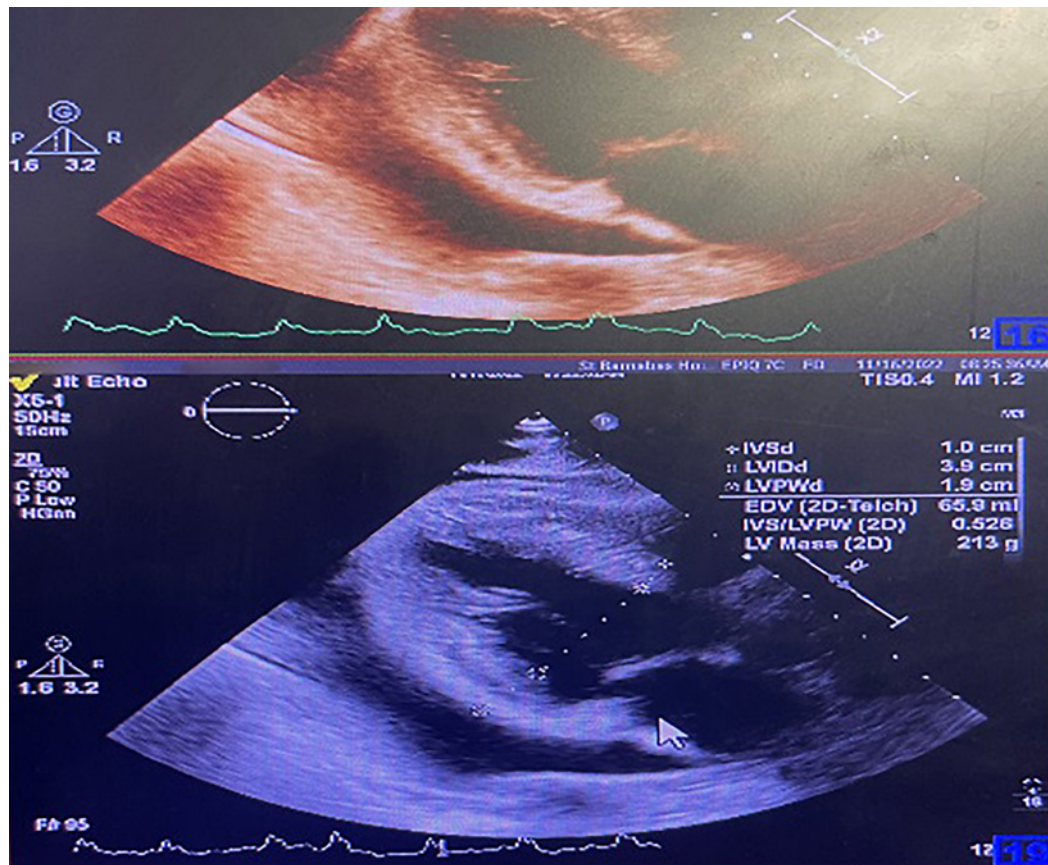


Fig. 4. Echocardiogram showing a large PerF collapsing the right atrium, an ejection fraction of 56%, and moderate left ventricular hypertrophy.

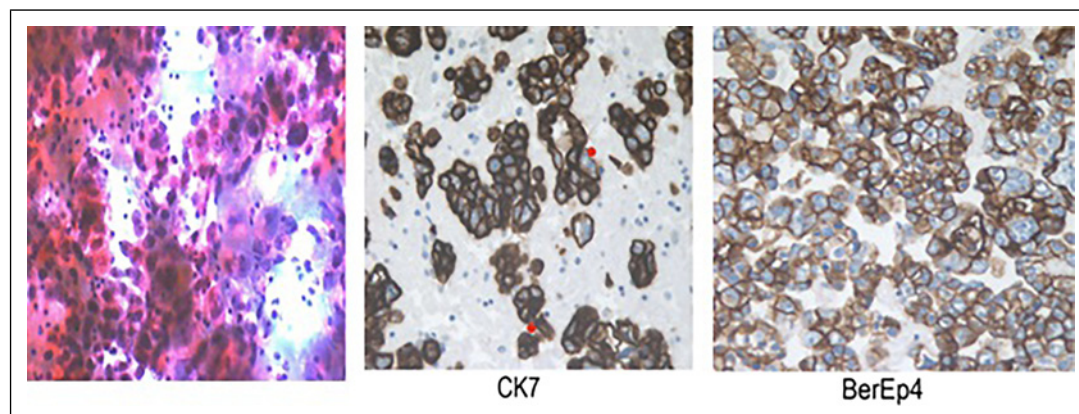


Fig. 5. Histopathology showed PDL1 70%, tumor mutational burden was high 14 Muts/Mb, MS stable with IHC + CK7 and Ber EP4, negative p40, TTF1, CK20, CALR, Napsin A.

In advanced malignant disease, cardiac and pericardial involvement is frequently observed. PerF is a common postmortem finding in such patients. A review of the literature demonstrates that lung cancer is the most prevalent cause of this complication, accounting for 37% of cases [14], followed by breast cancer [15].

PerF could develop during the course of malignancies, or it could be the initial early presentation, leading to the diagnosis of underlying neoplasm. With a history of cough and weight loss and early onset of cardiac tamponade as an initial presentation of lung adenocarcinoma, our patient's case was quite unique.

The development of pericardial tamponade depends both on fluid and rate of accumulation. The pericardial space contains a thin layer of less than 50 mL of an ultrafiltrate of plasma called pericardial fluid [16]. Furthermore, it can be present acutely, subacutely, or occultly. Malignancy-related PerF resulting in tamponade is subacute and is most commonly from cardiac metastases (e.g., lung cancer, breast cancer, lymphoma) rather than primary cardiac tumors. Our patient presented with dyspnea, which is the most common symptom of cardiac tamponade and sometimes can be a presenting sign of the neoplasm. The classic Beck triad of cardiac tamponade consists of hypotension, dilated neck veins, and muffled heart sounds. Nevertheless, one positive finding of the Beck triad is that it has 50% sensitivity to diagnose pericardial tamponade (28.0–72.0%) [17]. Fluid accumulation in the pericardial cavity leads to intracardiac pressure change and impairs ventricular filling, resulting in ventricular diastolic collapse and decreased cardiac output. Cardiac tamponade is a cardiac emergency requiring prompt diagnosis and intervention in order to stabilize the patient. Properly understanding the spectrum of clinical and hemodynamic changes in patients with pericardial tamponade is essential for hospitalists to perform pericardiocentesis promptly [18].

Malignant PerF is usually diagnosed by cytologic examination of pericardial fluid. PerF caused by neoplasms has the worst prognosis and highest mortality rate compared to other causes. The average survival when lung cancer manifests as cardiac tamponade is 1.5 months. The lymphatic drainage of the heart provides some anatomical explanations for the prevalence of carcinoma of the lung as the cause of cardiac tamponade and the discrepancy in finding tumor cells in the pericardial fluid but not in the pericardium [4].

As our patient was found to be symptomatic on initial presentation due to the onset of cardiac tamponade, he had undergone pericardiocentesis, which was a diagnostic procedure as well as the treatment procedure. The evaluation of fluid cytology revealed malignant epithelial cells consistent with metastatic lung adenocarcinoma. The presence of malignant cells in the pericardial fluid analysis is usually consistent with an advanced stage of the neoplasm and usually has a negative impact on staging. In our case, the patient had advanced disease with brain mets, which is consistent with the current literature. Treatment of PerF or pericarditis secondary to malignancy, in general, is not straightforward. In cases where a patient presents with early cardiac tamponade or cardiac tamponade, emergency surgical drainage is the most proper approach [19, 20].

In most cases, the frequency of reaccumulation of the PerF is greater than 90%, even with aggressive treatment [19, 20]. Therefore, a pericardial window following drainage may be needed for durable palliation in suitably fit patients [21, 22]. Other studies have shown that the recurrence rate decreases with intrapericardial platinum bleomycin as sclerosants and nonoperative therapies. Nevertheless, the treatment is based on the burden and advance of the disease. With the new target treatments, there has been a noticeable improvement and an increase in monthly survival, but the prognosis continues to be poor [23, 24]. Colchicine and nonsteroidal anti-inflammatory treatments have no significant benefits [9, 24, 25].

This case is a good reminder that although PerF is not a commonly reported lung cancer presentation, the reverse is not valid. It has been reported that malignancy, most importantly primary lung cancer, is the cause of symptomatic PerF in up to a fifth of cases when basic workup is non-revealing.

In our case, the initial basic evaluation did not reveal a potential cause for the large PerF; further, the workup with the chest CT scan revealed an underlying lung mass. The CARE Checklist has been completed by the authors for this case report, attached as supplementary material (for all online suppl. material, see <https://doi.org/10.1159/000540183>).

Conclusion

Cardiac tamponade can arise secondarily from various etiologies and have different presentations depending on the cause. In general, it is a slowly developing and clinically silent disease process. Therefore, malignant PerFs can rarely present with hemodynamic instability and be the initial manifestation of an underlying malignancy. Our case review presents a rare case of metastatic lung adenocarcinoma manifesting as early symptomatic cardiac tamponade and as an emergency. The results might be life-threatening if this presentation is not recognized and managed appropriately. Clinicians must be aware of such atypical presentations of thoracic malignancies to take action adequately.

Statement of Ethics

The study was approved by the Ethical Committee of St. Barnabas Hospital, City University of New York, New York, NY, USA. However as it was a case report, no IRB approval was obtained. Nevertheless, written consent was taken and is available for your review upon request. This retrospective review of patient data did not require ethical approval in accordance with local/national guidelines. Informed written consent was obtained from the patient for the publication of this case report and the accompanying images.

Conflict of Interest Statement

None of the authors have a financial and nonfinancial competing interest.

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Author Contributions

Volha Chapoiolkina and Homa Saadati wrote the initial draft and revised the manuscript. Nehemias Antonio Guevara-Rodriguez contributed to the interpretation of the data and was involved in the management of the patient. Garry Francis-Morel supervised all phases of writing. All authors have read and approved of the manuscript for submission.

Data Availability Statement

The data that support the findings of this study are not publicly available due to privacy reasons but are available from the corresponding author upon reasonable request.

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