

A rare complication of pericardiocentesis: Pneumopericardium

Oktay Şenöz 

Department of Cardiovascular Surgery, İzmir Bakırçay University Faculty of Medicine, İzmir, Türkiye

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ABSTRACT

Pneumopericardium is a rare complication of pericardiocentesis and defined as the presence of air in the pericardial space. Pneumopericardium usually occurs after trauma. However, pneumopericardium due to iatrogenic procedures, such as pericardiocentesis, is extremely rare. It can be caused by either direct pleuropericardial connection development or reverse air leakage in the drainage system. Herein, we report the case of a 39-year-old female with cardiac tamponade who developed pneumopericardium after pericardiocentesis.

Keywords: Chylous effusion, pericardial effusion, pneumopericardium, tamponade.

Pneumopericardium is a rare condition in which there is air in the pericardial space. It usually occurs after trauma. However, iatrogenic pneumopericardium during pericardiocentesis is less common.^[1-4] Imaging methods are the cornerstone in the diagnosis of pneumopericardium. Posteroanterior chest radiography reveals the typical finding of air-fluid level in the pericardial space. Echocardiography can demonstrate mobile air bubbles around the pericardium. Chest tomography is the gold standard for definitive diagnosis.

Iatrogenic pneumopericardium usually has a good prognosis and does not require specific treatment. Echocardiographic and hemodynamic follow-up is generally sufficient, and it spontaneously wears off over time. However, it rarely progresses to pericardial tamponade. Early diagnosis and therapy, such as percutaneous pericardiocentesis or surgical intervention, may be required in such cases.^[5,6] In this paper, we report a case with pneumopericardium, a rare complication of pericardiocentesis.

CASE REPORT

A 39-year-old female patient with no previous chronic disease was admitted to the outpatient clinic with complaints of increased shortness of breath, palpitations, and a recently developed weakness. On physical examination, the patient looked pale and tired. The patient's blood pressure was 105/60 mmHg and pulse rate was 110 bpm. On auscultation,

there were muffled heart sounds and a Grade 2/6 pansystolic murmur at the apex with radiation to the axilla. There was no peripheral edema, and other physical findings were unremarkable. Chest X-ray demonstrated an enlarged cardiothoracic ratio with open bilateral costophrenic sinuses and clear lung parenchyma. Normal sinus rhythm was detected on electrocardiography, and there were no signs of hypovoltage. Echocardiography revealed a massive pericardial effusion compromising the diastolic relaxation of the right ventricle. Left ventricular systolic functions were normal with mild mitral insufficiency. The patient was hospitalized in the coronary care unit with the diagnosis of massive pericardial effusion. Pericardiocentesis was performed through the subxiphoid approach with the Seldinger technique under echocardiography guidance. A 6 Fr introducer was inserted into the pericardial space, then a pigtail catheter was advanced over a 0.035 guidewire through the pericardial space. Initially, 700 mL of chylous fluid was drained. Afterward, a total of 1600 mL fluid was drained in five days. The sheath was kept in position until the amount

Corresponding author: Oktay Şenöz, MD. İzmir Bakırçay Üniversitesi Tıp Fakültesi Kalp ve Damar Cerrahisi Anabilim Dalı, 35665 Menemen, İzmir, Türkiye.

Tel: +90 506 - 882 81 29 e-mail: oktayssss@hotmail.com

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of drained fluid was less than 100 mL per day. Laboratory findings of the pericardial fluid were as follows: protein, 5.5 g/dL; albumin, 3.3 g/dL; lactate dehydrogenase, 145 U/L; triglyceride, 872 mg/dL. The serum-fluid albumin gradient was 0.9 g/dL, suggesting an exudative form. In the blood analysis, the leukocyte count was 12,500/mm³, and the eosinophile ratio was 51%. Sedimentation and C-reactive protein were within normal limits. Other laboratory parameters were in normal range. All tumor markers were negative. Additionally, all autoimmune markers were negative except ANA positivity. Polymerase chain reaction was negative for *Mycobacterium tuberculosis* deoxyribonucleic acid. The adenosine deaminase level in the pericardial fluid was normal. Microbial growth did not occur in the pericardial fluid culture. On the fifth day, the catheter was removed due to reduced fluid drainage and regression of pericardial fluid on echocardiography. The next day, a crackling sound was detected on the patient's chest when moving and leaning forward. Chest X-ray revealed radiolucent space around the heart with a radiopaque demarcation line, suggesting air and fluid surrounding the pericardial space (Figure 1). Echocardiography demonstrated a microbubble appearance (small and bright air vesicles) around the pericardial space and mild pericardial effusion (Figure 2). The diagnosis of pneumopericardium was confirmed by thorax chest tomography (Figure 3). Given the fact that the

patient had stable hemodynamics, she was followed by echocardiography. The patient was consulted by a rheumatologist. Autoimmune diseases were ruled out since the ANA positivity was not confirmed by the immunoblot assay. During hospitalization, the pericardial fluid was recollected with a diastolic notch in the right atrium on echocardiography. Since the etiology of the patient could not be elucidated and the fluid was quickly recollected, the pericardial window was opened, and recurrent chylous fluid was

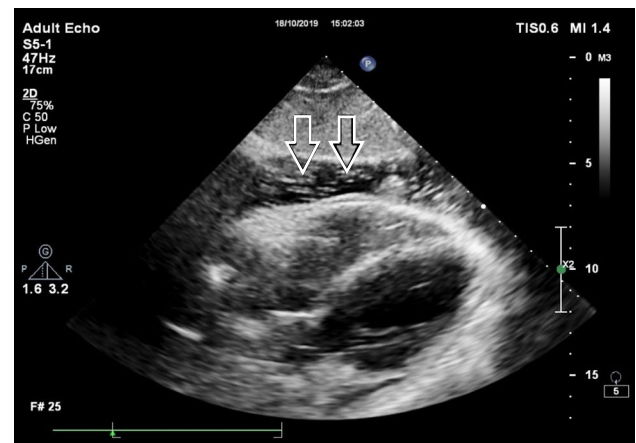


Figure 2. Two-dimensional echocardiography revealing several tiny sparkling echogenic spots swirling in the pericardial sac evoking micro air bubbles (arrows).

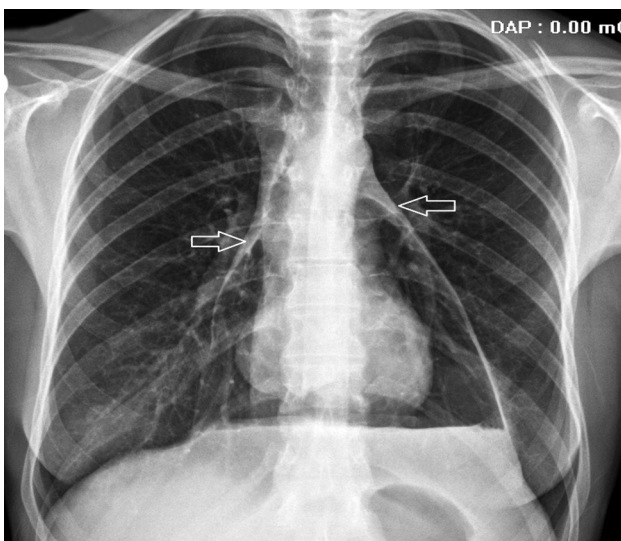


Figure 1. Chest radiograph demonstrating a radiolucent space along with a radiopaque border around the cardiac silhouette (arrows) representing pericardial air.

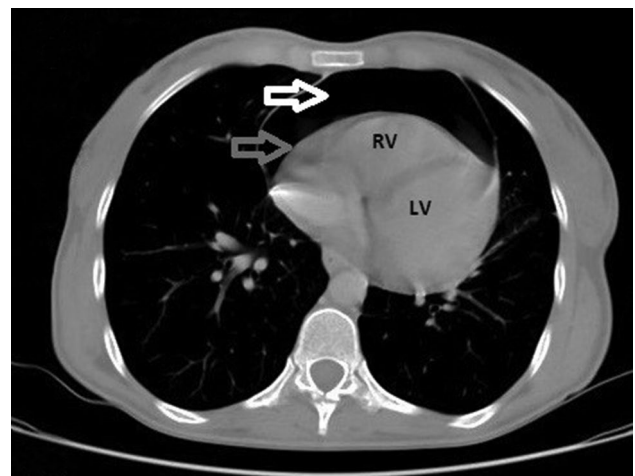


Figure 3. Chest computed tomography section displaying a marked pneumopericardium with an anterior extent (white arrow) associated with a small amount of pericardial fluid (grey arrow).

RV: Right ventricle; LV: Left ventricle.

surgically drained. During the follow-up, there was no pericardial effusion on echocardiography. The patient was discharged uneventfully.

DISCUSSION

Pneumopericardium is the accumulation of air in the pericardial space. It is mostly caused by blunt or penetrating traumas. Rarely, it can occur due to the fistulization of nearby organs, tuberculosis and fungal infections, pacemaker implantation, and pericardiocentesis.^[2,4] During pericardiocentesis, pneumopericardium can be caused by direct pleuropericardial connection or reverse air leakage from the catheter.^[3] Therefore, the use of under-water drainage systems may be considered to prevent the back-flow of air during fluid drainage. Given the short distance between the pericardium and the skin, cachectic patients may also develop pneumopericardium after the removal of the catheter due to the development of negative pressure during inspiration.^[3,5,6] In the present case, there are two possible reasons for pneumopericardium: our patient was thin, and the hub of the pigtail catheter remained open, which might have caused the air leakage into the pericardium.

Pneumopericardium can be asymptomatic or may manifest nonspecific symptoms, such as palpitations, shortness of breath, and chest and shoulder pain. The typical auscultatory finding is the Hamman sign, which is a crackling sound that can be heard with every cardiac beat. Another physical finding is the mill-wheel murmur, or bruit de moulin, which is a succession splash and traducing shaking movement of the heart within the pericardial cavity.^[1,6] In cases where pneumopericardium is suspected, imaging should be performed by echocardiography and radiological examinations. Echocardiography can demonstrate two pathognomonic signs: the “air gap sign,” a cyclic disappearance of the cardiac shape during systole, coinciding with a cycling appearance of air within the pericardium during this phase as the volume of cardiac cavities decreases,^[7] and the “swirling bubbles sign,” representing the presence of an air-fluid interface with continuous churning movements in the pericardial cavity due to heart activity, which is revealed on echocardiography by several tiny bright echogenic spots in the pericardial sac evoking micro air bubbles.^[5,6,8] The pneumopericardium can

easily be diagnosed by chest radiographs, which reveal a radiolucent rim separating the pericardium from the heart, called the “continuous diaphragm sign.”^[5,6,8] Chest computed tomography can easily confirm the diagnosis and is the mainstay of diagnosis of pneumopericardium in obscure cases. The tomography clearly demonstrates the air-fluid level in the pericardial space, as well as informing about the cause and associated pathologies.^[9]

The clinical course in pneumopericardium is highly variable and depends on the etiology, the amount, and the rate of air accumulation. Just as in fluid buildup, a small amount of fast-collected (60 mL) air can cause hemodynamic deterioration, while more slowly collected (500 mL) air can be better tolerated.^[1] Iatrogenic pneumopericardium is usually benign. Spontaneous resolution can occur within a few days of follow-up. Bed rest should be exercised in these patients, and hemodynamic parameters should be closely monitored. The patient should be screened until resolution is observed on chest X-ray and echocardiography.^[3,5] The most feared and fatal complication is the development of tension pneumopericardium. Drainage should be performed without delay when there is hemodynamic deterioration or an increase in the amount of air or fluid on imaging methods. Drainage can be percutaneously or surgically performed depending on the urgency of the case and the etiology. Surgical treatment is considered if there is direct fistulization with an organ other than the lung or if the fluid is likely to recollect.^[3,6]

In this case report, since secondary causes of chylopericardium were ruled out, the patient was considered to have primary idiopathic chylopericardium. Treatment of this disease consists of a diet poor in fatty acids, opening a pericardial window, and, if necessary, thoracic duct ligation.^[10]

In conclusion, iatrogenic pneumopericardium, a rare complication of pericardiocentesis, usually has a good prognosis and does not require specific treatment. However, it rarely progresses to pericardial tamponade, which may require percutaneous or surgical intervention.

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