

Case report

Pneumopericardium after pericardiocentesis

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ABSTRACT

Pericardial effusion is a common clinical finding that can arise from a wide range of etiologies, including infections, malignancies, autoimmune disorders, and iatrogenic causes. Management often requires pericardiocentesis, particularly when large effusions cause hemodynamic compromise or diagnostic clarification is necessary. While pericardiocentesis is generally a safe procedure when performed under imaging guidance, complications can still occur, particularly in elderly patients or those receiving anticoagulation therapy. One rare but important complication is pneumopericardium—the presence of air within the pericardial space—which may result in serious consequences such as cardiac tamponade or pericardial irritation if not promptly recognized and managed.

1. Introduction

Pericardial effusion is a common clinical finding that can arise from a wide range of etiologies, including infections, malignancies, autoimmune disorders, and iatrogenic causes. Management often requires pericardiocentesis, particularly when large effusions cause hemodynamic compromise or diagnostic clarification is necessary. While pericardiocentesis is generally a safe procedure when performed under imaging guidance, complications can still occur. One rare but important complication is pneumopericardium—the presence of air within the pericardial space—which may result in serious consequences such as cardiac tamponade or pericardial irritation if not promptly recognized and managed.

2. Case presentation

An 88-year-old man with permanent atrial fibrillation on Vitamin K Antagonist (VKA) and a recent upper respiratory tract infection was admitted due to worsening dyspnea.

On examination, he was normotensive (blood pressure 105/70 mmHg), tachycardic (110 bpm), and afebrile. Oxygen saturation was 93 % on room air, and respiratory rate was 15 breaths per minute. Blood tests revealed mild anemia (Hb 10.5 g/dL), a normal white blood cell count, and elevated C-reactive protein (2.3 mg/dL; normal range < 0.5 mg/dL).

Echocardiography and computed tomography (CT) scan confirmed a large pericardial effusion and a moderate left pleural effusion. Pericardiocentesis, using the subxiphoid access site (Fig. 1), was performed under fluoroscopic guidance after the International Normalized Ratio (INR) had fallen below 2, draining a total of 1400 mL of sero-hemorrhagic fluid.

While withdrawing the multiple-side-hole, pigtail-shaped catheter to a more proximal position with the intent to remove it, aspiration was inadvertently continued. Fluoroscopy revealed air entry into the pericardial space, resulting in iatrogenic pneumopericardium (Fig. 2, Video 1). Some holes of the pigtail, located distal to the radio-opaque marker, were now positioned outside the pericardium, and the negative pressure gradient created by continuous aspiration had caused air to enter the pericardial space. The initial pigtail catheter was replaced with a shorter end-hole sheath under fluoroscopic guidance, and air was almost completely drained with manual aspiration (Fig. 3). At echocardiography, residual air bubbles in the pericardial space were evident (Fig. 4), with normal left and right ventricular function.

On follow-up CT the following day, only a small layer of air was visible in the pericardial space, located in the retrosternal area (Fig. 5). The pericardial fluid analysis revealed no malignant cells, but did show pigmented macrophages and reactive mesothelial cells. The fluid had a specific gravity of 1022, a pH of 7.5, and a protein concentration of 4.9 g/dL. The patient was started on a Non-Steroidal Anti-Inflammatory Drug (NSAID) and colchicine, and his VKA was replaced with a direct

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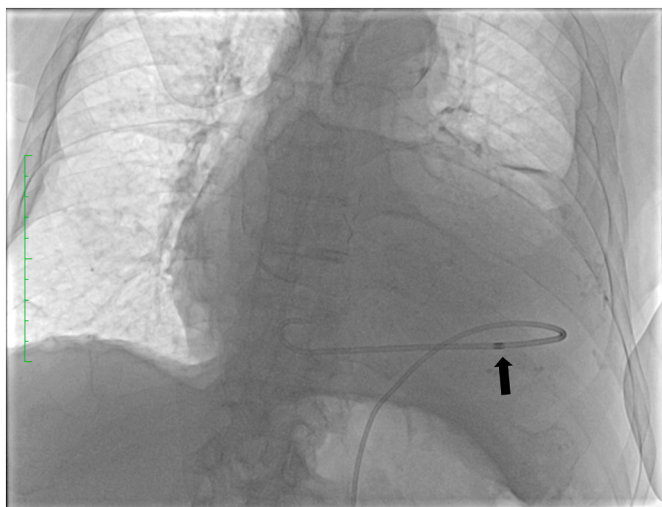


Fig. 1. Basal fluoroscopic view showing pericardial and left pleural effusion. A pigtail-shaped catheter with multiple side-holes distal to the radio-opaque marker (arrow) has been inserted into the pericardium.

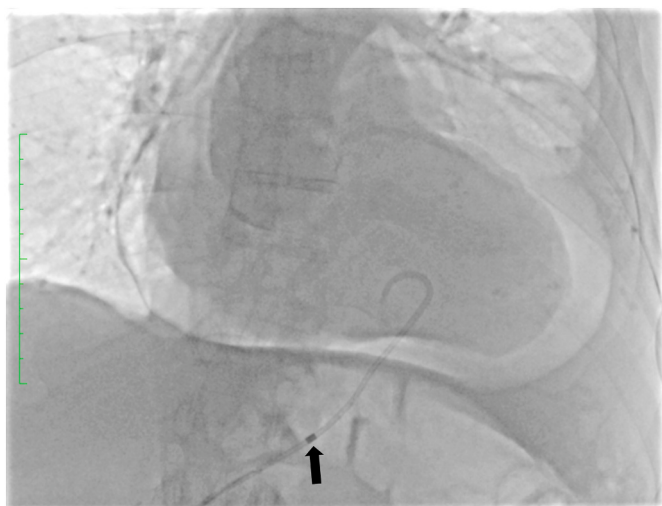


Fig. 2. Fluoroscopic view demonstrating air in the pericardial space—namely, an iatrogenic pneumopericardium—following pericardial fluid drainage. The pigtail catheter has been withdrawn to a more proximal position, with some holes distal to the radio-opaque marker (arrow) now located outside the pericardium.

oral anticoagulant (DOAC). He had an uneventful recovery.

3. Discussion

This case illustrates several important aspects of pericardial disease management, particularly in elderly patients with comorbidities such as atrial fibrillation requiring anticoagulation. Pericardial effusions in this population may result from multiple overlapping factors, including infection, anticoagulation-related bleeding, or underlying inflammatory processes. In this patient, recent respiratory tract infection and anticoagulation likely contributed to the development of a large, sero-hemorrhagic pericardial effusion.

Pericardiocentesis remains the cornerstone of both diagnosis and therapy for large effusions, but it carries a risk of complications [1]. Iatrogenic pneumopericardium [2,3], while rare, can occur if air enters the pericardial space during or after [4] the procedure.

In our case, withdrawal of a multiple-side-hole pigtail catheter



Fig. 3. Final fluoroscopic view after pericardial air drainage. An end-hole sheath is positioned inside the pericardium, allowing complete air aspiration.

during continuous aspiration led to the exposure of side holes outside the pericardial cavity. The negative pressure generated during continuous aspiration created a conduit for atmospheric air to be sucked into the pericardial space, resulting in pneumopericardium. This phenomenon may occur with side-hole catheters that are not optimally positioned.

Other mechanisms of pneumopericardium formation may involve anatomical variations, such as pleural adhesions or localized pneumothorax, which can create an unintended communication between the pleural and pericardial spaces [3]. In such cases, air may enter the pericardial sac during or after the procedure, especially if an apical approach is used [2].

Pneumopericardium is often asymptomatic but can lead to serious outcomes including hemodynamic instability and tamponade physiology. The clinical presentation can range from chest discomfort and dyspnea to signs of cardiac tamponade such as hypotension and elevated jugular venous pressure. Diagnosis is typically made via imaging, with fluoroscopy, echocardiography, and chest X-ray demonstrating air within the pericardial sac.

Management of pneumopericardium depends on the severity of symptoms and hemodynamic status. In asymptomatic or minimally symptomatic cases, conservative management with observation may suffice [2,3,5]. However, in symptomatic cases or when large volumes of air are present, drainage is necessary, and repeated pericardiocentesis remains the treatment of choice [4]. In this patient, pneumopericardium was promptly recognized and, by replacing the side-hole pigtail catheter with a shorter end-hole sheath, complete evacuation of air was achieved. This immediate intervention led to rapid clinical improvement and prevented any potential complications. Before discharge, anti-inflammatory therapy was initiated to address possible pericardial irritation and prevent recurrent effusion.

In conclusion, while pericardiocentesis is a generally safe and effective procedure, rare complications like pneumopericardium must be anticipated. This case highlights the importance of meticulous catheter management during pericardiocentesis and awareness of pneumopericardium as a potentially serious but treatable complication.

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.crmic.2025.100077>.

CRediT authorship contribution statement

Giuseppe Andò: Writing – review & editing, Supervision, Conceptualization. **Alessio Villari:** Writing – original draft, Software, Data

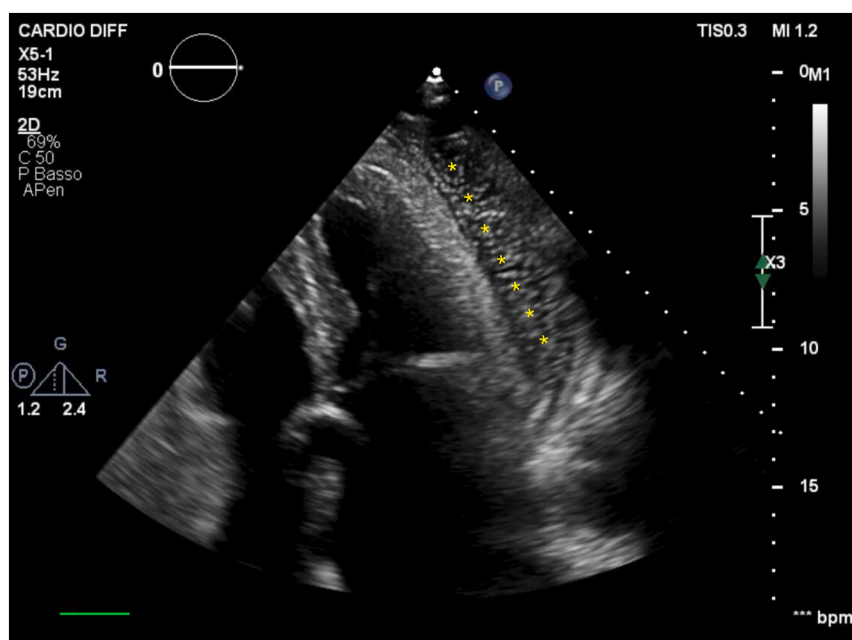


Fig. 4. Off-axis four-chamber echocardiographic view showing air bubbles (asterisks) within the fluid in the pericardial space, evident laterally to the left ventricle.

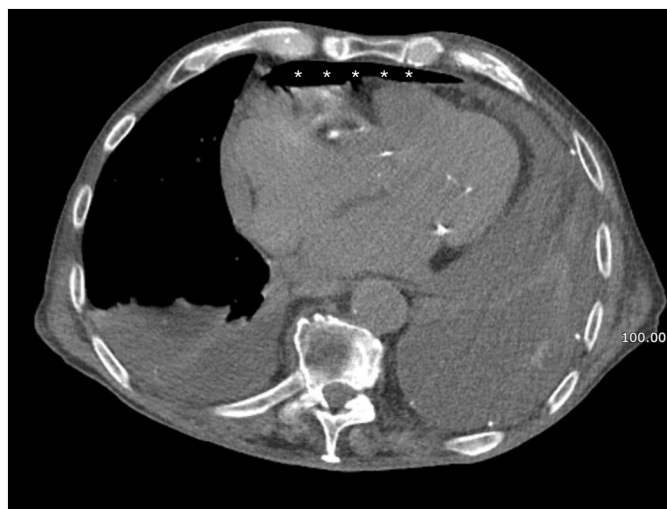


Fig. 5. Computed tomography of the chest revealing a small layer of air (asterisks) inside the pericardial space, located in the retrosternal area.

curation. **Giulia Cavolina:** Writing – original draft, Software, Formal analysis, Data curation. **Olimpia Trio:** Writing – review & editing,

Validation, Supervision, Methodology, Conceptualization.

Declaration of competing interest

The authors declare that there is no conflict of interest pertinent to this manuscript.

Data availability

No data was used for the research described in the article.

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