






Iatrogenic pneumopericardium following therapeutic pericardiocentesis for pericardial effusion in the emergency department - a case report

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ABSTRACT

Background: This case report highlights a rare iatrogenic complication of pericardiocentesis and discusses its clinical management. In most cases, pneumopericardium is usually self-limiting and does not require any specific treatment. Therefore, a timely diagnosis and urgent treatment are required. Currently, there are only a few reports regarding pneumopericardium following therapeutic pericardiocentesis.

Case Presentation: We present a case of an 81-year-old woman who developed pneumopericardium following pericardiocentesis for pericardial effusion, a rare association reported in the literature.

Conclusion: Pneumopericardium may develop iatrogenically after pericardiocentesis. Attention should be paid to the puncture site and angle during pericardial puncture, especially in weak patients.

Keywords: Pericardial effusion, pericardiocentesis, pneumopericardium, emergency medicine, bedside ultrasonography.

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Background

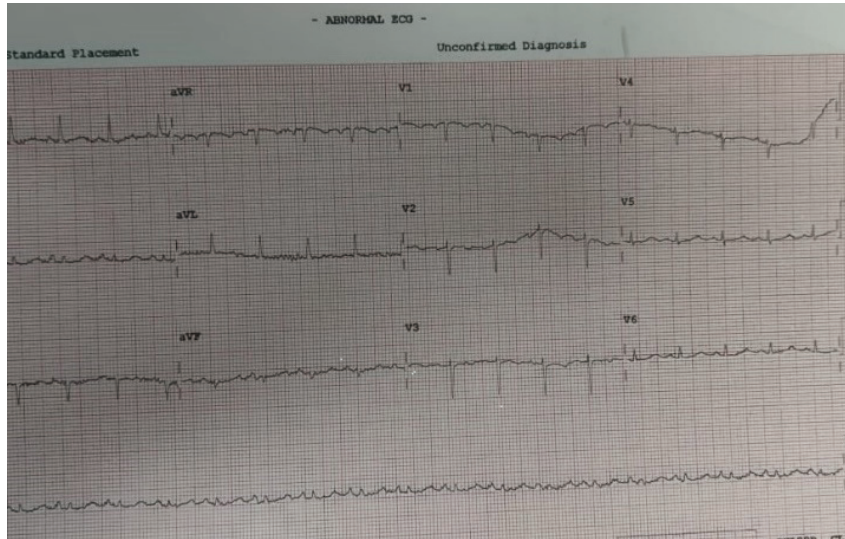
This case report highlights a rare iatrogenic complication of pericardiocentesis and discusses its clinical management. Although pneumopericardium is often self-limiting, its potential progression to life-threatening conditions like tamponade necessitates careful monitoring and timely intervention. However, if tension pneumopericardium occurs in some patients with hemodynamic instability, life-threatening pericardial tamponade may occur. Therefore, you will need to make a timely diagnosis and urgent treatment. So far, there are only limited reports about pneumopericardium after therapeutic pericardiocentesis. We present the case of an 81-year-old woman who developed pneumopericardium following pericardiocentesis for pericardial effusion, a rare association reported in the literature. This clinical case analysis aims to summarize the etiology, clinical features, diagnosis, treatment methods, and complications of pneumopericardium to improve understanding of this rare condition.

Case

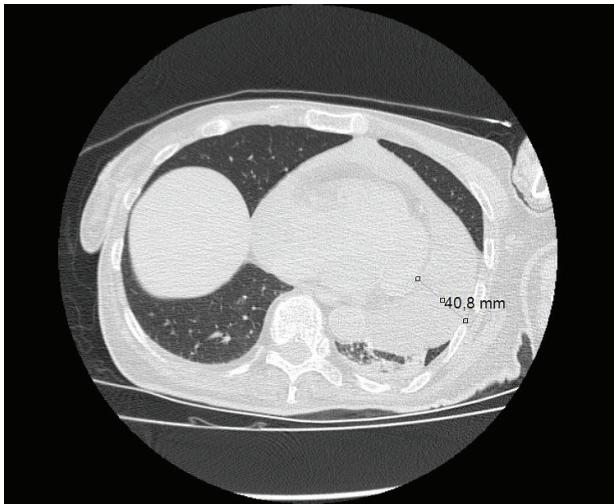
An 81-year-old woman presented with increasing dyspnea during the day. She was cachectic, immobile, and being fed through a PEG tube due to ischemic cerebrovascular disease (CVD). The patient's general condition

was assessed as moderate to sound, but communication could not be established due to previous CVD, and information was obtained from relatives. Her medical history shows that pericardiocentesis was done for pericardial effusion, with tests focused on ruling out non-cardiac causes. On physical examination, her blood pressure was 81/64 mmHg, pulse was 116 beats/min, respiratory rate was 16 breaths/min, and saturation was 100%. The heart sounds were rhythmic and deep during auscultation, with no additional sounds detected. Pulmonary and abdominal examinations were regular; venous fullness in the neck and pretibial edema were absent. Electrocardiography (ECG) showed sinus rhythm and left axis deviation. There were no significant ST-T changes and low voltage (Figure 1). Chest computed tomography (CT) demonstrated a pericardial effusion up to 4 cm in size (Figure 2). Bedside ultrasonography (USG) showed an LVEF of 50% and a massive pericardial effusion surrounding the heart with a maximum width of 35 mm in the posterolateral left ventricle and 20 mm in the apex of the right ventricle. Right atrial collapse and floating heart image were observed.

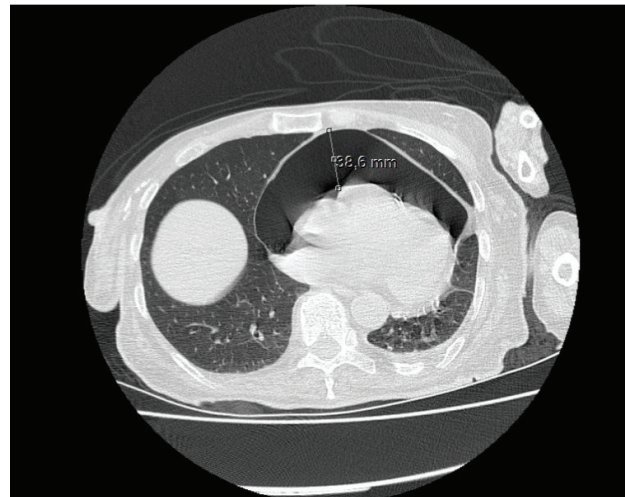
The hematocrit value was 26.6%, leukocytes 9900/mm³, and platelets 603000/mm³. Troponin-I value was 45 (control value was 46 in the second hour), liver function tests and renal function tests were standard, and CRP



75
76 **Figure 1.** ECG showing sinus rhythm and left axis deviation.



80
81 **Figure 2.** Chest CT demonstrated a pericardial effusion.



77
78 **Figure 3.** A chest CT scan showed a significant pericardial effusion measuring up to 4 cm in width.
79

82 level was 78 mg/dl (normal <5 mg/dl). Pericardiocentesis
83 was performed through a subxiphoid approach under
84 echocardiographic guidance. A 7 Fr introducer and a
85 pigtail catheter were inserted into the pericardial cavity,
86 and approximately 250 ml of serous-appearing fluid
87 was drained. We encountered difficulties positioning the
88 patient due to muscle contractures from previous CVD,
89 and it was also a complex procedure because of the heart's
90 position in the cachectic patient. As a result, we conducted
91 follow-up thoracic imaging due to concerns about potential
92 complications. Control thorax CT appeared compatible
93 with pneumopericardium, reaching 38 mm in the
94 widest part with no pericardial effusion (Figure 3). Since
95 there was no evidence of tamponade on control echocardiography
96 (ECHO) and hemodynamics were stable, it was
97 decided to follow the patient with medical treatment. The
98 patient was discharged after 7 days of follow-up in the
99 cardiology department.

Discussion

100
101 Pneumopericardium is a rare clinical condition caused
102 by many different things. The most common etiologies
103 include trauma, fistula formation between the pericardium
104 and adjacent hollow organs, and iatrogenic causes.
105 It may develop due to high-pressure mechanical ventilation,
106 mediastinal tumors, tuberculosis, gastropericardial
107 fistulas, and iatrogenically after endomyocardial biopsy
108 and pacemaker application [1-3]. On the other hand,
109 pneumopericardium is a rare complication of pericardiocentesis
110 and mainly develops as a result of a direct pleuropericardial
111 connection. The current gold standard for pericardial fluid
112 aspiration is ultrasound-guided pericardiocentesis, and the
113 apical and subxiphoid approaches are the two most commonly
114 used methods for pericardiocentesis. The literature describes
115 that the apical approach is the preferred location in 69%–79%
116 of the cases, compared with the subxiphoid approach
117 preferentially selected. In

118 such cases, the procedure success rate for pericardiocentesis was 97%–99%. Patients are typically positioned in
 119 a supine or semi-reclining posture [4]. Complications are
 120 more common during the subxiphoid approach when ade-
 121 quate care is not taken, especially in weak patients. The
 122 sudden movement of the patient during a puncture may
 123 change the puncture angle and cause complications in
 124 an uncontrolled puncture. Furthermore, if a connection
 125 between the pleura and pericardium occurs during the
 126 puncture of a small amount of localized fluid, it may result
 127 in pneumopericardium after pericardiocentesis [5,6]. Xu
 128 et al. [7] reported a case in which the catheter was not
 129 placed in the expected location during the procedure, and
 130 the right ventricle was damaged by inappropriate punc-
 131 ture, leading to hemopericardium. Similar to our case,
 132 Schulte-Hermes et al. reported intestinal perforation after
 133 pericardiocentesis in an 81-year-old cachectic patient pre-
 134 senting with heart failure [8].
 135

136 In most cases, iatrogenic pneumopericardium absorbs
 137 spontaneously and does not require special treatment.
 138 However, if tension pneumopericardium occurs in some
 139 patients with hemodynamic instability, life-threatening
 140 pericardial tamponade may occur. Therefore, timely
 141 diagnosis and urgent treatment are required [5,6].
 142 Hemodynamic instability varies depending on the amount
 143 of accumulated air and the accumulation rate. While up
 144 to 60 ml of air with rapid accumulation causes hemod-
 145 ynamic instability, even up to 500 ml of air with slow
 146 accumulation does not cause significant hemodynamic
 147 instability. Patients are given bed rest and close hemod-
 148 ynamic monitoring with chest radiography and ECHO.
 149 Spontaneous resolution is observed in patients who do
 150 not develop tension pneumopericardium [9]. Patients
 151 are given bed rest and close hemodynamic monitoring
 152 with chest radiography and ECHO. Spontaneous resolu-
 153 tion is observed in patients who do not develop tension
 154 pneumopericardium [9]. Zhang et al. [4] proposed peri-
 155 cardiocentesis via an apical approach under USG guid-
 156 ance in a sitting position to reduce unwanted damage to
 157 the heart and nearby organs. No significant complications
 158 were observed in their study with this method, and they
 159 suggest that 8% of minor complications occurred, which
 160 is a feasible technique. Mohammed et al. [10] proposed
 161 performing pericardiocentesis using an in-plane technique
 162 with a high-frequency probe through the right parasternal
 163 route, employing a lateral-medial approach to minimize
 164 complications.

165 Conclusion

166 This case emphasizes the need for meticulous technique
 167 during pericardiocentesis and vigilant post-procedure
 168 monitoring to promptly identify and manage rare compli-
 169 cations like pneumopericardium. Attention should be paid
 170 to the puncture site and angle during pericardial punc-
 171 ture, especially in weak patients. Spontaneous recovery is

usually possible, but due to the invasiveness of the proce-
 172 dure, it has risks; hence, it is important to conduct com-
 173 plete and comprehensive assessments and preparations
 174 before the procedure.
 175

What's new

Pneumopericardium should be considered in patients with
 176 hypotension, bradycardia, and decreased heart sounds fol-
 177 lowing interventional procedures. Rapid diagnosis and a
 178 multidisciplinary approach are crucial for managing these
 179 cases.
 180
 181

List of Abbreviations

CRP	C-reactive protein	182
CT	Computed Tomography	183
CVD	Cerebrovascular disease	184
ECG	Electrocardiography	185
ECHO	Echocardiography	186
LVEF	Left ventricular ejection fraction	187
USG	Ultrasonography	188

Conflict of interests

The authors declare that there is no conflict of interest regard-
 190 ing the publication of this article.
 191
 192

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 193
 194

Consent for publication

Due permission was obtained from the patient to publish the
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 196
 197

Ethical approval

Our institution does not require ethical approval to publish an
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 199
 200

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252 **Summary of case**

253	1	Patient (gender, age)	81 years, female
254	2	Final diagnosis	Iatrogenic Pneumopericardium
255	3	Symptoms	Dyspnea
256	4	Medications	Pericardiocentesis
257	5	Clinical procedure	Hemodynamic monitoring
258	6	Specialty	Emergency Medicine