

Post-surgical hydropneumopericardium: a case report of dramatic increase in the apparent size of pericardial effusion with positional changes

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Background

Pneumopericardium is an uncommon clinical finding. It most commonly occurs after chest trauma but can also emerge as a complication following interventional or surgical procedures and can result in life-threatening complications. A high index of clinical suspicion should be present and once the condition is recognized, it should be managed promptly. Paucity of literature on pneumopericardium makes outlining any new case of paramount importance to emphasize the aspects of diagnosis and management of this rare condition.

Case summary

A 59-year-old woman with severe mitral valve and moderate tricuspid valve regurgitation underwent mitral and tricuspid valve repair with uneventful post-operative in-hospital stay. She presented 10 days after discharge with progressive shortness of breath. Chest X-ray revealed right hydropneumothorax. Transthoracic echocardiography (TTE) performed in the emergency department showed an apparently small pericardial effusion with patient in supine position; the effusion size increased substantially when imaging in left lateral decubitus, with presence of intrapericardial air bubbles. Computed tomography scan of the chest confirmed the presence of right hydropneumothorax and hydropneumopericardium, with a communicating pleuro-pericardial tract. The patient underwent chest tube placement which successfully decompressed both pleural and pericardial space.

Discussion

Hydropneumopericardium is a rare post-operative complication. Comprehensive TTE with imaging from multiple acoustic windows is mandatory when evaluating the extent of pericardial effusion. Presence of cardiac tamponade is crucial in determining the management plan.

Keywords

Pneumopericardium • Transthoracic echocardiography • Mitral valve repair • Case report

Learning points

- Pneumopericardium is a potential complication of cardiac surgery and should be considered in the differential diagnosis of shortness of breath in the post-operative period. This complication can be lethal as it can result in cardiac tamponade.
- Changes in patient's position usually result in redistribution of the pericardial fluid which can make detection challenging; highlighting the value of a thorough echocardiographic assessment.

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Introduction

Pneumopericardium can potentially lead to cardiac tamponade in patients with trauma and in newborns.¹ Here, we present a case of hydropneumopericardium that developed after minimally-invasive mitral and tricuspid valve repair. Pneumopericardium usually does not result in haemodynamic instability; however, tension pneumopericardium can be life-threatening.²

Timeline

January 2019	First contact in our institution, the patient presented with shortness of breath. Review of previous transthoracic echocardiography revealed severe mitral regurgitation and moderate tricuspid regurgitation.
March 2019	Patient underwent mitral and tricuspid valve repair. The post-operative in-hospital stay was uneventful and the patient was discharged.
March 2019	Ten days after discharge, the patient returned to the emergency department complaining of shortness of breath. Transthoracic echocardiography revealed pneumopericardium. Computed tomography (CT) chest confirmed a large pneumopericardium and right pneumothorax with likely pleural-pericardial communication.
March 2019	The patient underwent CT-guided right chest tube placement with decompression of both pneumothorax and pneumopericardium. Tube was removed after 4 days.
April 2019	The patient was symptom-free on follow-up.

Case presentation

A 59-year-old woman with no significant past medical history presented with new-onset fatigue and dyspnoea on exertion. On exam, she looked well. The lungs were clear to auscultation. There was a grade 3/6 holosystolic murmur at the apex. Social history and past medical history were unremarkable.

Evaluation with transthoracic echocardiography (TTE) revealed severe mitral regurgitation secondary to myxomatous mitral valve disease with bileaflet prolapse. The left ventricle was mildly dilated, with borderline reduced ejection fraction at 59%. Computed tomography cardiac angiogram showed no significant coronary artery disease. Thoraco-abdominal vasculature was favourable, and the patient underwent valve repair via mini-thoracotomy.

The patient presented with progressive shortness of breath 10 days after surgery. On examination, she was in mild respiratory discomfort. Vital signs were within normal limits. Cardiac examination was unremarkable, with normal intensity heart sounds and no murmurs. A chest X-ray revealed right hydropneumothorax.

Oxygen saturation was 93% on room air. Electrocardiogram (ECG) showed normal sinus rhythm, but no significant abnormalities. Transthoracic echocardiography was performed in the emergency department. The unique finding in this patient was the dramatic change in the size of pericardial effusion with changes in position. Indeed, on initial imaging from subcostal window, pericardial effusion appeared to be small, and without evidence of right ventricular diastolic collapse (*Figure 1A*, yellow arrows; [Supplementary material online, Video S1](#)). As soon as the patient was placed in the left lateral decubitus position, imaging from the left parasternal and apical windows showed a substantially larger fluid collection around the pericardium (*Figure 1B*, yellow arrows; [Supplementary material online, Video S2](#)), as well as presence of air bubbles in the pericardial fluid (red arrow). There was no significant mitral inflow variation and inferior vena cava was of normal size with normal inspiratory collapse (>50%).

Computed tomography of the chest confirmed the presence of a large hydropneumopericardium and of a right hydropneumothorax. There was an apparent communicating tract between the pleural and pericardial spaces (*Figure 1C*, red arrow). Computed tomography pulmonary angiogram was negative for pulmonary embolism. After discussion between the primary team, interventional pericardial team, and interventional radiology, we felt the highest therapeutic yield at the lowest risk to the patient was percutaneous placement of a pigtail catheter in the right chest, which would address both the pleural and pericardial spaces via the communicating tract.

Low-intermittent chest tube suction was maintained with symptomatic improvement. Repeat imaging demonstrated significant decompression of both hydropneumothorax and pneumopericardium (*Figure 1D*). The chest tube was removed 4 days later, and a follow-up TTE demonstrated complete resolution ([Supplementary material online, Video S3](#)). The patient had a further uneventful recovery.

Discussion

Pneumopericardium, defined as a collection of air or gas in the pericardium, most often occurs secondary to mechanical ventilation. Other aetiologies include invasive procedures, chest trauma,³ infection with fistulous tract formation to the pericardial sac.⁴ Historically, therapeutic pneumopericardium was used to treat tuberculous pericarditis with effusion, as the air would hold the two layers of the pericardial sac apart, thereby preventing formation of adhesions.⁵

Significant haemodynamic changes do not usually occur until the intrapericardial pressure is significantly elevated.⁶ Small non-tension pneumopericardium can be haemodynamically silent, and the patients completely asymptomatic. However, it is more common to describe precordial chest pain and/or mild to moderate dyspnoea. The development of cardiac tamponade manifests as increasing shortness of breath, increased central venous pressure, and haemodynamic compromise. Peripheral pulses may be diminished and pulsus paradoxus can be detected.

Bricheteau⁷ was the first one to describe the auscultatory findings of pneumopericardium in 1844 and termed it *bruit de moulin*, which he compared to 'the noise made by the floats of a mill wheel as they strike the water'. Precordial shifting tympany may also be present. On percussion with the patient in reclining position, tympany is

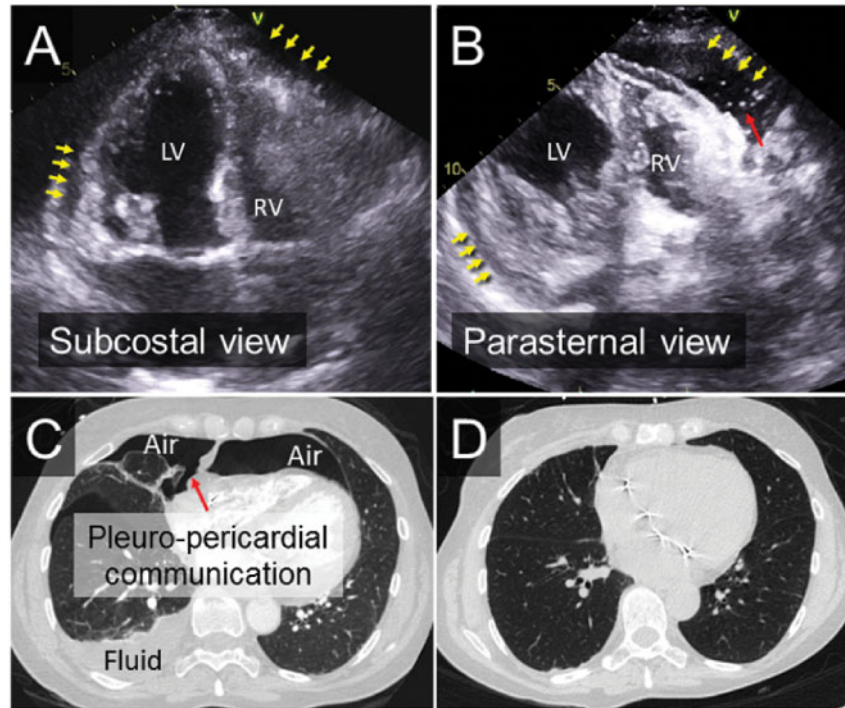


Figure 1 (A) Subcostal view with the patient supine showing small pericardial effusion (yellow arrows). (B) Parasternal view with the patient lying left lateral decubitus showing a significantly larger pericardial effusion (yellow arrows). Additionally, air bubbles are visible suggesting hydropneumopericardium (red arrow). (C) Axial image from computed tomography of the chest showing right hydropneumothorax and pneumopericardium at the time of presentation. (D) Axial image from computed tomography of the chest demonstrating resolution the hydropneumothorax and pneumopericardium after approximately 4 days of suction with the chest tube. LV, left ventricle; RV, right ventricle.

present over the entire precordial area. With shift to the upright position, there is tympany only over the upper portion of the chest, with dullness over the lower portion.⁸

Electrocardiogram may be normal or show changes of pericarditis. If tamponade ensues, low voltage is usually observed in all leads.

Other causes of shortness of breath (e.g. pulmonary embolism, myocardial infarction) should be excluded. These conditions were less likely in this patient given normal pulmonary angiography, ECG, and cardiac enzymes.

Transthoracic echocardiography can reveal evidence of air in the pericardial sac as seen in our patient; it can also confirm or exclude the presence of tamponade. We recommend starting imaging from the subcostal window whenever pericardial effusion is suspected; in our experience, this approach allows rapid diagnosis and triage. Indeed, the subcostal window has a high information yield, as it allows identification of location and extent of pericardial fluid, assessment of haemodynamic consequences with good visualization of right ventricular and right atrial walls (looking for diastolic chamber collapse), as well as the impact on venous return based on inferior vena cava assessment. Changes in the patient's position usually result in a small redistribution of the pericardial fluid. We suspect that concomitant presence of pericardial air masking the effusion around the right ventricle in supine position, together with free communication between

pleural and pericardial spaces were responsible for the dramatic changes observed in our patient. This 'out of thin air' increase in pericardial effusion highlights the importance of comprehensive echocardiographic evaluation. This is especially important in the context of the rapidly increasing use of handheld ultrasound devices for triage in the emergency department.

Treatment of pneumopericardium depends on whether or not there is associated cardiac tamponade. Tension pneumopericardium requires emergency treatment through percutaneous pericardiocentesis (preferred) or surgical approach; the latter is usually carried out via thoracotomy or subxiphoid incisions or through thoracoscopic access.²

In our patient, there was no evidence of tamponade. Additionally, the communicating tract between pleural and pericardial spaces made it more reasonable to address the situation with percutaneous placement of a pigtail catheter in the right chest.

Conclusion

Pneumopericardium is a rare yet potentially lethal complication of cardiac surgery. A thorough echocardiographic assessment in various positions is of paramount importance to confirm the diagnosis.

Lead author biography



Dr. Sorin Pislaru completed medical school at the Carol Davila University of Medicine and Pharmacy in Bucharest, Romania, and received his PhD. from the Catholic University of Leuven in Belgium. He then continued his training at Mayo Clinic Rochester, where he completed his residency and cardiology fellowship, as part of

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Supplementary material

[Supplementary material](#) is available at *European Heart Journal - Case Reports* online.

Slide sets: A fully edited slide set detailing this case and suitable for local presentation is available online as [Supplementary data](#).

Consent: The author/s confirm that written consent for submission and publication of this case report including image(s) and associated text has been obtained from the patient in line with COPE guidance.

Conflict of interest: none declared.

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