

Iatrogenic Pneumopericardium after tube thoracostomy: Case Report

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Case report

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Abstract

Background: Pneumopericardium, the presence of air within the pericardial space, is a rare occurrence which usually follows positive pressure ventilation in infants, or blunt and penetrating thoracoabdominal injuries in adults. The occurrence of iatrogenic pneumopericardium following tube thoracostomy is an extremely rare occurrence.

Case presentation: We present a rare case of iatrogenic pneumopericardium in a 1 year and 7 months old female child for whom a left side tube thoracostomy was done using nasogastric tube for an indication of left empyema thoracis. Later, she developed progressive worsening of shortness of breath and imaging revealed iatrogenic pneumopericardium. She was managed conservatively and discharged home in good condition.

Discussion: Pneumopericardium can have a range of presentations from being asymptomatic to presenting with features of cardiac tamponade. Treatment can range from conservative observation to pericardiocentesis and insertion of a small chest tube into the pericardium. In the absence of echocardiographic evidence of tamponade, the severe malnutrition our patient had and the already infected pleural cavity which could have increased her postoperative complication we deferred surgical intervention.

Conclusion: Iatrogenic pneumopericardium is a rare event but it might lead to death if not diagnosed and treated promptly. Although reporting of complications is not popular, this represents an opportunity to advance the safety during chest drain insertion. The tendency to develop tension pneumopericardium urging surgical intervention is high in pediatric patients but our patient has improved well with conservative management.

Introduction

Pneumopericardium, a rare occurrence defined by the presence of air within the pericardial space, is a rare consequence of blunt, penetrating and iatrogenic injury (1–4). It can also occur following pericarditis by gas forming organisms, through continuous positive pressure ventilation in infants, and through a connection with air containing adjacent organs such as the esophagus and the stomach (5). It can be classified into simple and tension pneumopericardium. The former group can also transform into the latter group in 37% of cases (6).

Three main mechanisms can result in a pneumopericardium. The first is a macro perforation of the pericardium with communication to either the respiratory or gastrointestinal tracts (3, 6, 7). The second mechanism involves a pleuro-pericardial connection in the presence of a pneumothorax (4, 8) and the third is pulmonary volutrauma with tracking of alveolar air into the pericardium (3, 6).

Usually simple pneumopericardium is asymptomatic while tension pneumopericardium may present with circulatory collapse due to cardiac tamponade and classically include attenuation of heart sounds

,elevated central venous pressure, hypotension, tachycardia and pulsus paradoxus as occurs in pericardial effusions (3, 6, 9–12). Percussion may reveal “shifting precordial tympany” in which the precordial hyperresonance shifts as the patient changes position (10). These clinical signs may be difficult to elicit in emergency situations (4, 10).

Chest radiography typically shows a small heart, partially or completely surrounded by air, which is contained within a sharply defined halo of pericardium (the halo sign) (3, 13, 14). Chest CT scan (15) and transthoracic or transesophageal echocardiography, are also helpful in visualizing signs of pericardial tamponade or the presence of pericardial air (13, 16–19).

The immediate treatment of tension pneumopericardium is decompression of the pericardial air by insertion of a large-bore needle or intravenous catheter (20).

Case Presentation

One year and seven months old female child presented with a complaint of intermittent dry cough of 3 weeks duration associated with high grade intermittent fever and loss of appetite. She has no contact history with known pulmonary tuberculosis patient. For her above complaints she was taken to nearby health center where she was given antibiotics (amoxicillin syrup) for 7 days but showed no improvement. Subsequently she was referred to our hospital but her parents preferred to take her home. Two weeks later she presented to our tertiary care center, St. Paul's Hospital Millennium Medical College (SPHMMC), with worsening of cough and shortness of breath. On presentation her vital signs were deranged and oxygen saturation was 70% with atmospheric air. She was in respiratory distress with grunting, intercostal and subcostal retraction. She also had absent air entry on her left posterior lower two-third of the lung field. Her anthropometric assessment revealed she had severe acute malnutrition (SAM).

Her basic laboratory examinations revealed leukocytosis of 26,500 with left shift & was negative for PIHCT (Provider initiated HIV counselling & testing). Sputum gene x-pert for tuberculosis was negative & Chest x-ray showed a left side chest homogenous opacity.

With these findings her left chest was tapped revealing frank pus for which chest tube was inserted at the left triangle of safety with impression of post pneumonic empyema thoracis using feeding (nasogastric) tube due to lack of thoracic tube. Upon chest drain insertion about 100 ml frank pus was drained and her respiratory distress improved. Pleural fluid analysis revealed cell count of 16,000 with neutrophil of 77.7%. Post procedure she was continued with intravenous antibiotics (ceftriaxone & metronidazole), intranasal oxygen and admitted to pediatric intensive care unit (PICU). On the 2nd day after chest tube insertion she developed worsening of shortness of breath with clinical examination revealing increased respiratory rate, significant tachycardia (120-140beats/minutes) and distant heart sounds for which a control chest X-ray was taken (Fig. 1) which showed pneumopericardium with classical “halo sign”, left sided pneumothorax and a misplaced chest tube. Her Electrocardiogram showed normal sinus rhythm and echocardiographic evaluation revealed pneumopericardium with reserved cardiac functions.

With diagnosis of iatrogenic simple pneumopericardium with pneumothorax the surgical team decided to manipulate the chest drain & observe her closely with conservative management. She was put on facemask oxygen, intravenous (IV) antibiotics, nutritional, treatment and analgesics. The pneumopericardium decreased in the subsequent days and the chest drain output was also negligible with no bubbling (Figs. 2 and 3). The left side chest tube was removed on the 10th day after insertion.

Subsequently, the patient showed a remarkable improvement and was discharged from the wards in a stable condition.

Discussion

Pneumopericardium was first described by Bricheteau in 1844 (6, 7, 21). It was initially assumed that air in the pericardium was a finding causing no harm. Later it was found that the rate of instillation of air into the pericardium was a major factor in the formation of cardiac tamponade as up to 500 cc of air could be accommodated into the sac without causing marked cardiac tamponade if injected slowly. This goes in line with the known knowledge that the pericardium can accommodate up to 1,000 ml of blood without causing tamponade (6). This could explain why our patient developed severe respiratory distress and tachycardia 2 days after the insertion of the chest tube opposed to immediately developing tamponade due to the ability of the sac to accommodate large amounts of air if injected at a slow pace. Pneumopericardium can be a potentially fatal as up to 37% of simple pneumopericardium events can progress to form a tension pneumopericardium (6, 7, 20). Cummings et.al. who reviewed 221 cases of pneumopericardium noted a mortality rate of 57% (6, 7). Iatrogenic pleuro-pericardial connection in the presence of a pneumothorax looks a mechanism for the development of pneumopericardium in our patient.

Management of pneumopericardium depends on the presence of tamponade effect and age of the patient. In adults with no signs of tamponade a conservative approach may be taken with no intervention. However, the conservative approach is not advised in infants as they might have a mortality rate of up to 40% due to the development of a tension pneumopericardium (6). In our patient considering absence of echocardiographic evidence of tamponade, the severe malnutrition she had and the already infected pleural cavity could have increased her postoperative complication we deferred surgical intervention and continued conservative management.

In cases where there is an evidence of a cardiac tamponade, immediate pericardiocentesis through a large bore intravenous catheter can be undertaken as a primary treatment which is expected to be followed by a small chest tube (24French) insertion through a subxiphoid approach (6, 7). Ismael et. al. reported a case of pneumopericardium in a preterm neonate following chest tube insertion for pneumothorax. With failed conservative management they did median sternotomy & repair of breached pericardium (22).

Upon subsequent follow-up, our patient has both clinical and radiological improvement and her family is also happy with her treatment.

Conclusion

Iatrogenic pneumopericardium is very rare event and proper positioning of drain during placement is crucial preventive measure. Diagnosis mainly relies on clinical examination and imaging. Although its challenging to get pediatric thoracic tube in resource limited facility like ours extra caution should be made when deciding to use tubes like feeding tube as replacement. The tendency to develop tension pneumopericardium urging surgical intervention is high in pediatric patients but our patient has improved well with conservative management. While the reporting of complications is not popular, this represents an opportunity to advance the safety during chest drain insertion.

Abbreviations

CT - computerized tomography

PICU- Pediatric Intensive care unit

IV- intravenous

PIHCT- Provider initiated HIV counseling & testing

SAM – Severe acute malnutrition

SPHMMC – St. Paul's Hospital Millennium Medical College

Declarations

Ethical clearance: Clearance was obtained from the Institutional Research and Ethics Review Committee (IRB) of SPHMMC for the publication of the case report

Availability of data and materials

All data related to the outcome are included in the manuscript.

Conflict of interest

All authors declare that they have no competing interest.

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Consent: Written informed consent was obtained from the patient's family for publication of this case report and accompanying images.

Author's contribution

EM: Diagnosed the pneumopericardium & involved in patient management, conceived and conducted the study, did literature search & Critical revision of the manuscript AA: Over all supervision of the manuscript and Critical revision of the manuscript, TT: Over all supervision of the manuscript and Critical revision of the manuscript. MB: Over all supervision of the manuscript and Critical revision of the manuscript.

All authors have read and approved the manuscript.

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Figures



Figure 1

Chest X-ray showing radiolucency within the cardiac shadow (Pneumopericardium), Left sided pneumothorax and a misplaced chest tube



Figure 2

Chest X-ray taken 2 days later showing relatively decreased air within the pericardium



Figure 3

Final CXR up on discharge of the patient showing resolved pneumopericardium

Supplementary Files

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