

PNEUMOPERICARDIUM: A POSSIBLE RARE CAUSE OF NEONATAL DEATH

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Summary. The aim of this paper is to point to the dangers of pneumopericardium (PPC), which is defined as a collection of air or gas in the pericardial cavity. PPC belongs to the most dangerous kinds of extra-alveolar air and only physicians' awareness of that condition and immediate air evacuation (pericardiocentesis) prevents the deleterious results. Neonatal pneumopericardium is a rare clinical condition. We report a case of neonatal pneumopericardium with the fatal outcome, occurring in the presence of significant lung pathology (in utero meconial aspiration, pulmonary hypertension) and a history of neonatal resuscitation. The pathophysiological mechanism is the obstruction of large and small airways with the aspirated material and consecutive air trapping distal to obstruction, over distension and rupture of alveolar walls, allowing gas to escape and dissect along perivascular and peribronchial sheaths towards pericardial sac within which this air accumulates. Mechanically ventilated patients are particularly at risk for tension pneumopericardium (TPPC) secondary to barotrauma. Acute cardiac shock, pulsus paradoxus and decreased systolic blood pressure (the heart is ineffectual pump), muffled heart sounds and a metallic sound of high frequency refer to the presence of a pneumopericardium. Tension pneumopericardium is a life threatening condition, so early recognition and intervention (pericardiocentesis) is very important.

Key words: Pneumopericardium, neonatal, meconial aspiration, death

Introduction

Pneumopericardium is defined as a collection of air or gas in the pericardial cavity and was first described by Bricheteau in 1844. Many cases have since been reported, mostly due to blunt or penetrating chest injuries in adults and due to respiratory distress syndrome combined with mechanical ventilation in infants (1, 2).

Neonatal pneumopericardium is a rare clinical condition that usually occurs in association with other air leak syndromes (pneumomediastinum, pneumothorax, pneumoperitoneum, subcutaneous and interstitial emphysema) especially when there is severe lung pathology, post vigorous resuscitation, or in the presence of assisted ventilation (3, 4, 5). We report a case of neonatal pneumopericardium occurring in the presence of significant lung pathology (in utero meconial aspiration, pulmonary hypertension) and a history of neonatal resuscitation.

The autopsy was performed at the Court's request, in order to determine the cause of death of the newborn but also the presence of a doctor's criminal responsibility elements. Also, the autopsy was requested by the doctor, since the death of the newborn occurred soon after the delivery and the cause of death remained unclarified.

Patients and Methods

In order to present the case, we use the available medical files collected during hospital treatment of a female newborn, as well as complete autopsy findings

taken during the examination. The autopsy of the body was done 12 hours after the death. Routine histology of the sample was carried out after fixation in 10% buffered formalin. After that, the tissues were embedded in paraffin, and the paraffin samples were stained with haematoxylin-eosin (HE).

Results

According to the medical data, the woman delivering a child, multipara (who, by the anamnesis, has one healthy child and one spontaneous abortion), was admitted to hospital 7 to 10 days prior to the expected delivery term. Not long after her being admitted, the profusion bleeding occurred from the birth canals due to premature detachment of the placenta. Tocographic finding showed a slow and arrhythmic heart rate of the offspring. The delivery was conducted by caesarean section. On its birth the child was 3150 g heavy, 53 cm long, with the signs of pale asphyxia (*asphyxia pallida*), and according to APGAR score it was marked by 1. The aspiration, intubations, assisted mechanical ventilation, medicament therapy and exterior cardiac massage were immediately performed. Although all the measures of the intensive CPR (cardio pulmonary resuscitation) were conducted, the lethal outcome occurred 35 minutes after the birth.

By the autopsy it was found that the newborn was mature female in X lunar month of the maternal life. The skin was explicitly pale, and the umbilical cord

tied. The pericardial sac was filled with air, tense and it resembled fish swim bladder. The findings on the other organs were regular. Pathohistological finding on the lungs shows signs of meconial aspiration and ruptured alveolar walls (Figure 1) and persistent lung hypertension (Figure 2). Apart from stress-involution of thymus and hydropic-vacuolar degeneration of the liver tissue, other pathological conditions in the internal organs have not been found. Injuries to the body have not been found either, except for injections needle wounds. On the basis on the clinical and post-mortem findings, the death in this case was attributed to cardiac tamponade present in the air of pericardial sac.

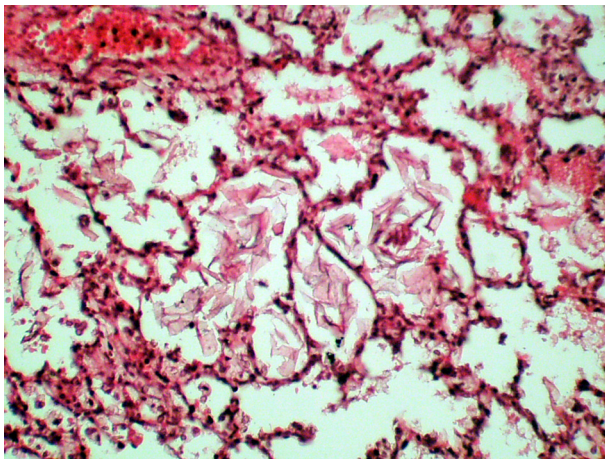


Fig. 1. Histopathology in fatal neonatal pneumopericardium: presence of aspirated contents (meconium, vernix caseosa, cellular debris) into small airways and alveoli; ruptured alveolar walls (HE staining, original magnification 100x).

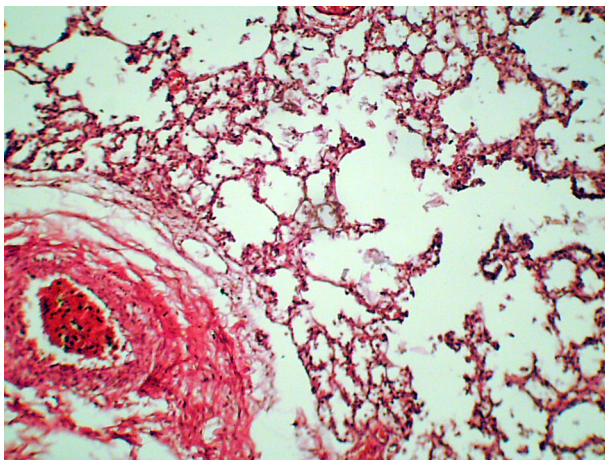


Fig. 2. Histopathology in fatal neonatal pneumopericardium: thick muscle layer of small lung arterioles-pulmonary hypertension (HE staining, original magnification 100x).

Discussion

Meconium in the amniotic fluid occurs in approximately 12% of term-birth neonates. As a consequence, meconium aspiration is considered to be a relatively common event. Other substances such as blood or amniotic fluid can also be aspirated. The aspiration syndrome of meconium is fatal in 40% of the cases. Pulmonary hypertension usually develops when meconium aspiration occurs in conjunction with varying degrees of in-utero asphyxia. Damaged lungs are incapable of discarding inhaled meconium due to the damaged cilia of epithelial cells of respiratory airways so that *circulus vitiosus* occurs within which vasoconstriction aggravates the hypoxia and vasospasm (6).

The pathophysiological mechanism is the obstruction of large and small airways with the aspirated material (meconium, blood, amniotic fluid contents) and consecutive air trapping distal to obstruction. Following, an increase in intra-alveolar pressure with alveolar over distension results in rupture of marginal alveolar walls, allowing gas escape into the perivascular space (6, 7). The escaping air travels through pulmonary interstitium dissecting the peribronchial and perivascular sheaths, with resulting presence of air into the pleural space (pneumotorax) or in the hilum, where air dissects between the fascial sheath and moves into the mediastinum (pneumomediastinum) and/or pericardium (pneumopericardium). Pericardial connective tissue is discontinuous at the reflection of parietal onto visceral pericardium near the ostia of the pulmonary veins so that there is a site of potential weakness where a microscopic dissection of air into the pericardial sac is possible (4, 8, 9, 10).

A complication of ventilatory management of neonatal respiratory distress also may result in cardiac tamponade. Mechanically ventilated patients are particularly at risk for pneumopericardium secondary to barotrauma (alveoli rupture when interstitial pressures exceed airway parenchyma pressures, and air dissects along perivascular and peribronchial sheaths towards pericardial sac) (11, 12).

Early recognition and intervention for tension pneumopericardium are very important. Clinical findings include acute haemodynamic deterioration with acute cardiac shock, dyspnoea, cyanosis, bradycardia or tachycardia, pulsus paradoxus and decreased systolic blood pressure (the heart is ineffectual pump); muffled heart sounds and a metallic sound of high frequency refer to the presence of a pneumopericardium (12, 13).

Roentgen graphically, posteroanterior and lateral roentgenograms demonstrate that, with pneumopericardium, air is confined to the space immediately around the heart. Treatment includes preventing further air entry into the pericardium and decompressing pericardial space by using pericardiocentesis or tube drainage for all neonates because of the high risk of re-accumulation of air (3, 9, 14).

Conclusion

This paper shows that the pneumopericardium belongs to the most dangerous kinds of extra-alveolar air

and only physicians' awareness of that condition and immediate air evacuation (pericardiocentesis) prevents the deleterious results.

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PNEUMOPERIKARD: MOGUĆI REDAK UZROK SMRTI NOVORODJENČETA

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Kratak sadržaj: Cilj ovog rada je da ukaže na opasnost od pneumoperikarda (PPK), koji se definiše kao kolekcija vazduha ili gasa u srčanoj kesi. PPK predstavlja najopasniji vid ekstra-alveolarnog prodora vazduha i samo oprez i svest lekara o ovom stanju, kao i urgentna evakuacija vazduha (perikardiocenteza) prevenira štetan ishod. Pneumoperikard kod novorođenčadi predstavlja relativno retko kliničko stanje. U ovom radu opisali smo slučaj pneumoperikarda novorođenčeta sa fatalnim ishodom, koji je nastao na terenu izražene plućne patologije (mekonijalna aspiracija in utero, plućna hipertenzija) i izvršene kardio-pulmonalne reanimacije novorođenčeta. Patofiziološki mehanizam nastanka PPK ogleda se u opstrukciji velikih i malih disajnih puteva aspiriranim materijalom sa konsekutivnim zarobljavanjem vazduha distalno od opstrukcije, prekomernom distenzijom i rupturom alveolarnih zidova, izlaskom vazduha i raslojavanjem perivaskularnih i peribronhijalnih omotača sve do srčane kese i akumulacijom vazduha u njoj. Mehanički ventiliranim pacijentima preči povećani rizik od nastanka tenzionog pneumoperikarda (TPPK), a kao posledica barotraume. Akutni kardiogeni šok, paradokсни puls i smanjen sistolni krvni pritisak (srce je neefikasna pumpa), potmulni srčani tonovi i metalni zvuk visoke frekvencije odgovaraju pneumoperikardu. Tenzioni pneumoperikard predstavlja po život opasno stanje, pa su rano prepoznavanje i intervencija (perikardiocenteza) od presudnog značaja u terapijskom smislu.

Ključne reči: *Pneumoperikard, novorođenče, aspiracija mekonijuma, smrt.*