CASE REPORT

Successful percutaneous drainage of pneumatoceles in an extremely low-birthweight infant

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SUMMARY

Pneumatoceles are thin-walled, air-filled cystic lesions developing within the lung parenchyma. It used to be a relatively common entity in the presurfactant era when preterm babies were ventilated at an unacceptably high positive pressure for respiratory distress syndrome. Pneumatocele formation is a very rare complication of pneumonia in neonates. We here report a case of extremely low-birthweight (ELBW) neonate who developed large bilateral pneumatoceles after staphylococcal pneumonia. Hereby, we present a case of an ELBW infant with bilateral massive pneumatoceles who underwent successful percutaneous catheter drainage to decompress these pneumatoceles.

BACKGROUND

Pneumatoceles are thin-walled air-filled cystic lesions developing in the lung parenchyma.¹ In the presurfactant era due to high pressures, all kinds of air leaks including pneumatoceles were fairly common. However, in the current era with the advent of surfactant and gentle ventilation strategies, incidence of pneumatoceles has decreased significantly.² The aetiology of pneumatoceles may be infectious, traumatic, congenital or positive pressure ventilation induced. In older age groups, post-infectious pneumatocele is common in contrast with neonates where ventilator-induced pneumatocele is the most common aetiology.² There is very limited data on postinfectious pneumatoceles in neonates due to its relatively rare nature.³ In neonates with pneumatocele, other congenital or acquired cystic conditions like bronchopulmonary foregut malformations, congenital lobar emphysema and aspiration or bacterial pneumonia with cavitation must be considered as differential diagnosis. We here present a case of postinfectious pneumatocele in an extremely preterm neonate.

CASE PRESENTATION

An extremely preterm and extremely low-birthweight boy (26 weeks gestational age, birth weight 900 g) was born by preterm vaginal delivery in view of eclampsia in the mother. Baby had smooth perinatal transition with Apgar scores of 6 and 7 at 1 and 5 min, respectively. Antenatal period was uneventful and ultrasound done at 21 weeks showed normal liquor. Mother did not have any significant medical or obstetric history. She received one dose of dexamethasone 3 hours prior to the delivery. The baby had mild hyaline membrane disease for which

he required maximum continuous positive airway pressure (CPAP) up to 6 cm of water and 40% fraction of inspired oxygen (FiO₂). Respiratory distress improved with CPAP, though the CPAP of 5 cm with 21% FiO₂ continued due to extreme prematurity.

On day 5 of life, respiratory distress worsened along with recurrent apnoea and hyperglycaemia; however, the vitals were stable on CPAP support. At this worsening possibility of late onset neonatal sepsis was considered and intravenous meropenem was started as per unit policy. Lumbar puncture was not suggestive of meningitis. Chest X-ray showed bilateral patchy consolidation, but there was no cystic lesion in lung parenchyma at that time. Blood culture grew methicillin-resistant *Staphylococcus aureus* (MRSA) and antibiotics changed to vancomycin as per sensitivity. Baby remained stable for next 5 days on CPAP and room air.

On day 11, respiratory distress worsened in the form of increase in tachypnoea, retractions and frequent desaturation, however, he remained haemodynamically stable. The repeat chest X-ray showed bilateral large pneumatoceles (figure 1). In view of this worsening, CPAP was upgraded to non-invasive positive pressure ventilation (NIPPV) and injection vancomycin was continued. Bone and joint examination were normal including ultrasound cranium and urinary system and two-dimensional echocardiography. Repeat blood culture after 3 days of vancomycin again grew MRSA; however, only on day 7 of vancomycin, blood culture became

Figure 1 Chest X-ray showing bilateral large pneumatocele.

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sterile. The baby was continued on NIPPV, but there was a gradual increase in the size of pneumatocele leading to worsening of respiratory distress. In view of respiratory failure, the baby was put on high-frequency ventilation (HFV). There was a gradual increase in the size of pneumatocele on both sides leading to compression of the heart and haemodynamic compromise. Needle aspiration under ultrasound guidance was attempted to decompress it, but there was no improvement. CT-guided pigtail insertion was planned, but could not be done due to instability and very high ventilatory settings (mean airway pressure 22 cm of water) at this point.

There was a progressive increase in number as well size of pneumatoceles, and endotracheal aspirate sent at the time of intubation showed growth of MRSA sensitive to vancomycin and linezolid. Since baby showed growth while on vancomycin for 9 days, antibiotics were changed to intravenous linezolid and given for 3 weeks. The baby remains stable on HFV for next 20 days. The baby had respiratory worsening on day 31 of life for which CT-guided bilateral pigtail was inserted by an intervention radiologist. Following pig tail catheter insertion, there was a significant reduction in the size of pneumatocele on both sides, more so in right side (figure 2). After this drainage procedure, ventilatory requirements decreased significantly (mean airway pressure 12 cm of water) and oxygenation improved within next 8 hours. The baby was stable on these settings for next 4 days.

On day 35 of life (day 20 of linezolid), baby had acute deterioration in the form of hypoxaemia and worsening of respiratory distress probably related to either healthcare-associated infection (HAI) or worsening of pneumatoceles or displacement of pigtail catheter. Antibiotics were upgraded to colistin considering possibility of multidrug resistant gram-negative sepsis and needle aspiration on the left side was negative.

OUTCOME AND FOLLOW-UP

The baby continued to worsen and developed catecholamine refractory shock and died on the same day. A repeat X-ray could not be done at that time due to technical issues. Autopsy was not performed. Blood culture sent at the time of acute deterioration grew multidrug resistant *Acinetobacter baumannii* sensitive to colistin only.

DISCUSSION

In neonates, pneumatocele formation is described as a very rare complication of pneumonia. Organisms implicated in pneumatocele formation are *S. aureus*, *Streptococcus pneumoniae*, *Escherichia coli*, *Klebsiella pneumoniae*, *Enterobacter cloacae* and *Pseudomonas aeruginosa*.⁴ Conservative management along with ventilation at low mean airway pressure leads to resolution of pneumatocele in most of the mild to moderate cases.² However, severe pathologies causing respiratory failure or haemodynamic compromise need urgent intervention. Various strategies have been used in past for unilateral pneumatoceles like unilateral lung intubation, selective bronchial occlusion with balloon catheter and surgical lung volume reduction; however, none of these will be helpful in bilateral pathology like our case.^{5,6}

In cases of bilateral pneumatocele causing respiratory failure like our case, the options are either image-guided percutaneous catheter drainage or lobectomy. Decompression by percutaneous CT-guided catheter placement or direct transthoracic drainage of a large pneumatocele has been used in past with variable success for large pneumatoceles causing a mass effect.^{2,7-9} For extremely small neonates like our case, percutaneous drainage is very challenging and needs a lot of expertise. Lobectomy

Figure 2 Chest X-ray showing pigtail catheter in situ on both sides along with resolution of pneumatocele on right side and decreased size on left side.

Learning points

- In the current era, pneumatocele formation is relatively less common but is an important clinical entity which merits early diagnosis and appropriate management.
- Postinfectious pneumatocele formation is relatively infrequent in neonates compared with other age groups.
- Antibiotics along with gentle ventilation strategy is the mainstay of management and will lead to resolution of most cases.
- Image-guided percutaneous catheter drainage should be considered as an alternative in the cases of severe disease with bilateral pneumatoceles where other interventions fail or cannot be used.
- Appropriate supportive care along with prevention or early treatment of sepsis will improve the outcome.

was not considered in our case due to diffuse pathology and extremely low weight. Arias-Camison *et al*⁹ described similar case like us in which they successfully did percutaneous catheter drainage of bilateral pneumatoceles in an extremely preterm baby like our case.

For infective pneumatocele antibiotics are the mainstay of treatment and most of the cases resolve spontaneously with use of appropriate antibiotics.¹⁰ Screening for disseminated staphylococcus should be done as it has important implication on the duration of the antibiotic therapy.¹¹

In case of acute worsening of these cases, displacement or obstruction of the catheter and pneumothorax must be considered and excluded. Once mechanical causes have been ruled out, then HAI becomes very likely pathology for which appropriate antibiotic coverage must be considered urgently. We were able to manage the pneumatocele and respiratory failure but lost the infant due to sepsis.

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in the writing of manuscript, literature search and finalising the manuscript. All authors approved the final manuscript.

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