sciendo Acta Marisiensis - Seria Medica / Ahead of Print DOI: 10.2478/amma-2025-0048

CASE REPORT

Challenges in the management of a preterm neonate with respiratory distress and pneumothorax: A case report

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Introduction: Pneumothorax is a potentially life-threatening complication in preterm neonates, frequently associated with respiratory distress syndrome (RDS). Prompt diagnosis and individualized respiratory support are essential to avoid invasive interventions.

Objective: To describe the successful conservative management of a preterm neonate with respiratory distress syndrome complicated by pneumothorax and congenital infection, emphasizing the role of early respiratory support and infection control.

Methods: A male infant was born prematurely with clinical signs of systemic inflammation and respiratory distress. Initial management in the delivery room included thermal stabilization, tactile stimulation, and continuous positive airway support. Blood gas analysis revealed mild mixed acidosis. Chest radiography confirmed pneumothorax and respiratory distress syndrome. The patient was managed conservatively with intratracheal surfactant (100 mg per kilogram per dose), right lateral positioning and high-frequency oscillatory ventilation, without pleural drainage.

Results: The patient responded favorably to supportive management. Respiratory status improved progressively. Oxygen requirements decreased rapidly, and the pneumothorax resolved without invasive intervention. Extubation was achieved on the second day of life, and oxygen therapy was stopped by day six. The patient remained hemodynamically stable, tolerated enteral feeding, and showed appropriate weight gain. On day seven, he was transferred to the neonatal prematurity unit for continued monitoring of growth and jaundice.

Conclusions: This case supports the safety and effectiveness of conservative management in selected preterm neonates with pneumothorax. Early surfactant administration combined with high-frequency oscillatory ventilation (HFOV) can facilitate recovery while avoiding the risks associated with pleural drainage [2]. Tailored respiratory strategies and early control of systemic infection are essential for optimizing outcomes in vulnerable neonates.

Keywords: pregnancy, pneumothorax, newborn, respiratory distress

Received 30 July 2025 / Accepted 15 September 2025

Introduction

Pneumothorax is the presence of air in the pleural space that can lead to lung collapse, respiratory failure, and hemodynamic instability [1]. In premature neonates, it frequently arises as a complication of respiratory distress syndrome (RDS), often exacerbated by mechanical ventilation [2, 3]. RDS results from surfactant deficiency, leading to reduced lung compliance and increased respiratory effort [4]. Although the introduction of postnatal surfactant has significantly decreased the incidence of pneumothorax, it remains a relevant complication in the neonatal period [5]. Prompt recognition and intervention are crucial to avoid severe outcomes, including intraventricular hemorrhage and death [6]. Management strategies range from conservative observation with supplemental oxygen in clinically stable infants, to needle aspiration or chest tube drainage in cases of tension pneumothorax or persistent air leak [7]. Despite advances in neonatal intensive care, pneumothorax continues to be associated with significant morbidity and mortality. This report highlights a case of neonatal pneumothorax in a premature infant, successfully managed without invasive drainage, underscoring the importance of individualized therapeutic decisions.

Case Presentation

A male preterm infant was born to a primiparous mother at 33 weeks of gestation by emergency lower segment caesarean section performed due to a scarred uterus and placenta praevia, with extraction from breech presentation. The mother had premature rupture of membranes (PROM) for approximately 50 hours. A full course of antenatal corticosteroids (dexamethasone) was administered, consisting of 6 mg intramuscular injections given every 12 hours for a total of four doses (24 mg in 24 hours) to promote fetal lung maturation. In addition, due to PROM, the mother received prophylactic antibiotic therapy with Ampicillin 2 g intravenously every 6 hours for a total of eight doses over 48 hours. The newborn had Apgar scores of 9 at 1 and 5 minutes, and a birth weight of 2.49 kg. He was admitted to the neonatal intensive care unit for monitoring and supportive care.

Shortly after birth, the infant developed tachypnea, with a respiratory rate of 70 breaths per minute. The initial arte-

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rial blood gas analysis revealed severe mixed acidosis, with a pH of 7.179, partial pressure of carbon dioxide (pCO_2) 57.3 mmHg, bicarbonate (HCO_3^-) 20.9 mmol/L, and base excess (BE) –8.4 mmol/L. These findings were associated with hypoxemia, defined by a partial pressure of oxygen (pO_2) of 37.3 mmHg and oxygen saturation (sO_2) of 75.7%. Lactate was moderately elevated at 2.36 mmol/L, indicating impaired tissue oxygenation.

Continuous positive airway pressure (CPAP) was initiated with a positive end-expiratory pressure (PEEP) of 5 cm H_2O. A repeat blood gas analysis performed 30 minutes later showed partial improvement: pH 7.215, pCO_2 48.9 mmHg, HCO_3^- 20.4 mmol/L, BE –8.7 mmol/L, with persistent but slightly improved hypoxemia (pO_2 50.9 mmHg, sO_2 80.4%) and reduced hypercapnia. Surfactant therapy was initially withheld, as oxygenation remained satisfactory on an inspired oxygen fraction (FiO_2) of 25%.

Given the antenatal context of prolonged rupture of membranes, the neonate also received prophylactic antibiotic therapy with Ampicillin at a dose of 50 mg/kg intravenously every 12 h for 48 h. Laboratory tests showed leukocytosis (17.39 $\times 10^9$/L) with marked neutrophilia (13.69 $\times 10^9$/L, 78.7%) and relative lymphopenia (13.9%). The inflammatory biomarker C-reactive protein (CRP) was elevated at 14.0 mg/L, supporting the presence of an inflammatory response. Based on these findings, Ampicillin was extended to a 7-day course, in line with treatment for a probable infection.

At 27 hours of life, signs of clinical deterioration appeared, including intercostal and subcostal retractions, sternal indrawing, diminished breath sounds, and rising oxygen requirement. At 32 hours, the infant had a sudden desaturation to 70% and FiO_2 need >40%.

The chest X-ray (Figure 1) confirmed the diagnosis: right apical pneumothorax and signs of RDS. Radiographic findings included air bronchograms, granular micronodular opacities, decreased overall opacity of both lung fields, mediastinal shift with the heart pushed to the right, a fine pleural line, and absence of peripheral vascular markings on the right hemithorax suggestive of apical right pneumothorax.

Treatment included intratracheal surfactant (100 mg/kg), right lateral positioning, and HFOV with FiO_2 21% for 20 hours. Clinical, capillary blood gas analysis (pH of 7.352, pCO_2 of 39.7 mmHg, pO_2 39.7 mmHg, sO_2 89.9%, HCO_3^- 25.8 mmol/L, BE –1.4 mmol/L, lactate 1.98 mmol/L) and radiological (Figure 2) improvement was achieved without pleural drainage.

The infant improved clinically and radiologically without requiring pleural drainage. Extubation was successfully performed on day 2, and the neonate was weaned off supplemental oxygen by day 6. On day 7, the patient was transferred to the prematurity care unit for ongoing monitoring of weight gain and jaundice and was discharged home on day 14 of life. At the neurological evaluation

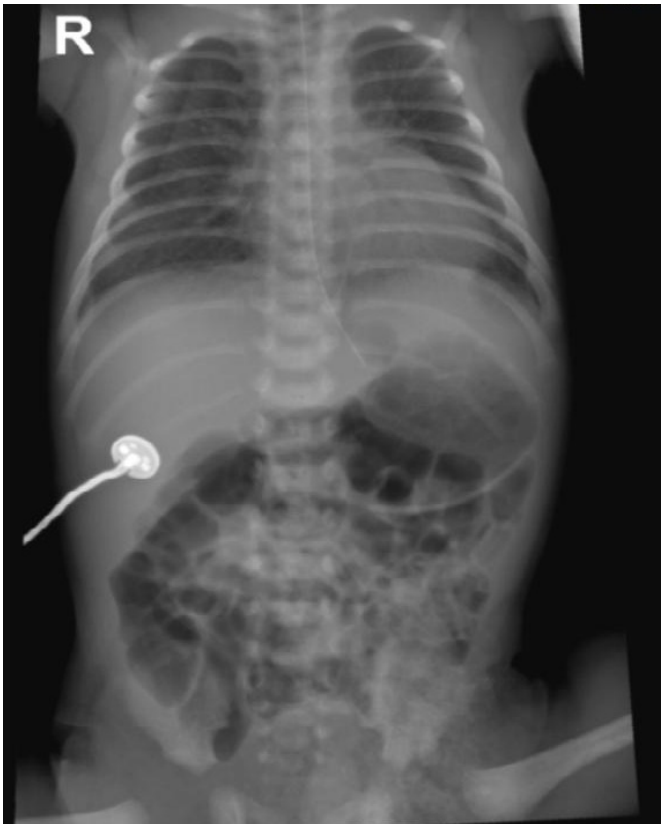

Fig. 1. Chest X-ray at 32 hours of life showing a right apical pneumothorax with granular opacities, mediastinal shift, and absence of vascularization in the right upper lung field.

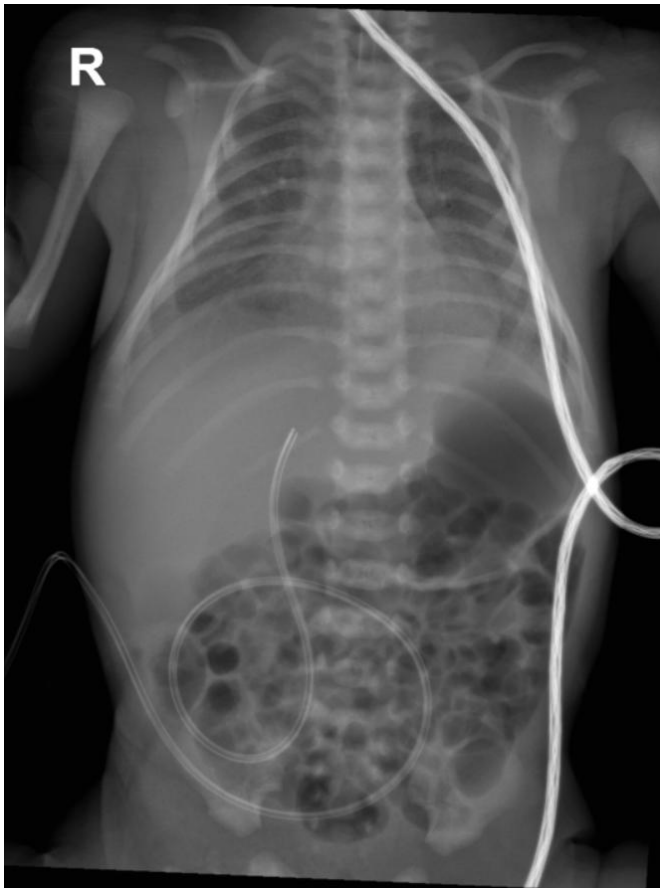

Fig. 2. Chest X-ray after surfactant administration and initiation of HFOV showing re-expansion of the right lung.

conducted at 2 months of age, the infant demonstrated signs of motor developmental delay. Imaging revealed bilateral grade I/II intraventricular hemorrhage with post-hemorrhagic subependymal pseudocysts, along with signs of cerebral immaturity and fronto-parietal atrophy, which remain under observation.

Discussion

Neonatal pneumothorax demands individualized management based on the infant's clinical condition [7]. While chest drainage is indicated in unstable or severely compromised neonates, selected cases benefit from conservative approaches. Evidence supports early surfactant therapy and high-frequency ventilation as methods to enhance alveolar recruitment and minimize ventilator-induced lung injury [2, 4, 8]. In our case, the infant remained hemodynamically stable and responded favorably to careful respiratory support, which allowed us to successfully apply a conservative strategy in line with current recommendations.

In our case, the combination of antenatal care, cautious respiratory support, and prompt surfactant delivery enabled recovery without invasive measures [9]. Notably, systemic inflammation from prolonged PROM may have contributed to reduced lung compliance [5, 10], which emphasizes the importance of considering perinatal risk factors when evaluating management options.

Pleural drainage, though sometimes lifesaving, carries potential complications including infection, bleeding, lung laceration, injury to adjacent organs and prolonged air leak [11]. In neonates, it can also lead to pain, need for sedation, and difficulty with handling and positioning. By avoiding invasive drainage in this case, we minimized these iatrogenic risks, illustrating how conservative management can be both safe and beneficial in selected patients. Avoiding this intervention, when clinically appropriate, can reduce iatrogenic risks and shorten NICU stay [12].

This case supports a growing body of evidence favoring tailored non-invasive management in stable preterm infants with pneumothorax [1, 7]. Our experience reinforces the principle that continuous monitoring and timely intervention are critical to ensuring favorable outcomes, even in high-risk preterm infants.

Several studies support the selective and conservative approach to pneumothorax management. Litmanovitz and Carlo (2008) demonstrated that expectant management of pneumothorax in ventilated neonates did not increase morbidity or mortality when compared to immediate drainage [1]. Similarly, a retrospective study by Tan et al. (2020) identified clinical stability and FiO_2 requirement below 40% as predictors of successful conservative management [13]. Our case aligns with these findings, further reinforcing the importance of individualized care based on clinical presentation rather than radiological extent alone.

Comparatively, Sweet et al. (2022) highlighted in the European Consensus Guidelines the importance of early surfactant therapy and ventilatory support tailored to lung physiology in reducing the incidence and severity of air leaks [2]. Our case illustrates this principle, with prompt administration of surfactant and high-frequency oscillatory ventilation resulting in rapid resolution without pleural intervention. These findings emphasize the growing confidence in less invasive strategies when patients meet stability criteria, potentially reducing complications and healthcare costs [2, 8].

The originality of this case lies in the successful conservative management of pneumothorax in a preterm infant with prolonged PROM and evidence of systemic inflammation, avoiding invasive pleural drainage despite radiological severity.

Conclusions

Conservative management of neonatal pneumothorax using surfactant and high-frequency ventilation can be effective in stable premature infants. Optimizing outcomes in fragile neonates relies on personalized ventilation approaches and early infection control. Avoiding invasive procedures may improve prognosis and reduce complications when careful monitoring is assured [1, 2, 4, 13].

Authors' contributions

MMC - Conceptualization, Data curation, Formal Analysis, Funding acquisition, Investigation, Methodology, Project administration, Writing – original draft

MCC - Supervision, Validation, Visualization, Writing – review & editing

Conflict of interest

None to declare.

Funding

No external funding was received.

Ethical Statement

Patient consent was obtained for publication of this case report.

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