

CASE REPORT

Case report: Respiratory distress syndrome, recurrent pneumothorax, and multisystem complications in a late preterm neonate

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Introduction: Pneumothorax in premature neonates remains a significant clinical issue, especially when linked to respiratory distress syndrome and systemic inflammation. Providing early respiratory support and customized interventions is essential to prevent life-threatening complications.

Objective: To present the complex and evolving management of a late preterm neonate with respiratory distress syndrome, bilateral recurrent pneumothorax, congenital pneumonia, and intraventricular hemorrhage.

Methods: A female newborn born at 36 weeks via cesarean due to placenta previa and uterine scarring showed worsening respiratory distress soon after birth. Her condition required various levels of respiratory support, including intratracheal surfactant, high-frequency oscillatory ventilation, and surgical pleural drainage. A suspected congenital infection caused a systemic inflammatory response, leading to extended, targeted antimicrobial treatment.

Results: Despite multiple episodes of respiratory decompensation and radiologically confirmed recurrent pneumothorax, the patient responded well to high-frequency oscillatory ventilation and surgical pleural drainage. Gradual clinical improvement allowed for stopping respiratory support by day twelve, leading to full recovery without additional complications.

Conclusion: This case highlights the critical importance of personalized, step-by-step management in preterm neonates with respiratory distress syndrome complicated by recurrent pneumothorax and infectious comorbidities, emphasizing the therapeutic benefits of early surfactant therapy, high-frequency oscillatory ventilation, surgical pleural drainage, and targeted antimicrobial treatment.

Keywords: respiratory distress syndrome, pneumothorax, high-frequency oscillatory ventilation, late preterm neonate, multisystem complications

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Introduction

Pneumothorax is a serious and potentially life-threatening condition in neonates, particularly those born prematurely with underdeveloped lungs. It is often associated with respiratory distress syndrome (RDS) caused by a deficiency of surfactant. Managing pneumothorax becomes more complicated when it occurs alongside congenital pneumonia and systemic inflammation, necessitating a comprehensive treatment approach. The presence of intraventricular hemorrhage (IVH) further complicates respiratory support due to the risks of hemodynamic instability and impaired cerebral perfusion [1-3]. Late preterm infants (born between 34 and 36 +6 weeks of gestation) have a higher risk of respiratory complications compared to term neonates, including pneumothorax, due to relative surfactant deficiency, delayed lung fluid clearance, and increased vulnerability to barotrauma [4]. The incidence of neonatal pneumothorax is 0.5–1% in the general population and is significantly higher among NICU admissions [5]. In preterm infants, the incidence ranges between 0.6% and 4%, with a similar risk profile in the late preterm subgroup [6]. Management

includes conservative observation, needle aspiration, or chest-tube drainage. In late preterm infants, careful adjustment of respiratory support is required to maintain oxygenation and ventilation while minimizing further lung injury. Lung-protective ventilation strategies, such as volume-targeted ventilation and non-invasive respiratory support including CPAP or HFOV, reduce the risk of air leaks and complications such as IVH and bronchopulmonary dysplasia [7]. This case report presents a preterm neonate with multiple comorbidities who required specialized respiratory and infectious disease treatments, including high-frequency ventilation and surgical pleural drainage.

Case Presentation

A female neonate was delivered via cesarean section at 36 weeks of gestation due to placenta previa and uterine scarring. The birth weight was 3,270 grams, with a length of 51 cm and a head circumference of 37 cm. The Apgar scores were 8 and 9 at 1 and 5 minutes, respectively. Initial resuscitation measures included thermal stabilization, tactile stimulation, and a brief administration of oxygen therapy. The neonate experienced respiratory distress, characterized by expiratory grunting and intercostal retractions, within

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the first hour of life. The initial arterial blood gas analysis indicated mixed acidosis and hypoglycemia. Continuous positive airway pressure (CPAP) support was initiated with an FiO_2 of 35% and PEEP of 5 cm H_2O . The thoracoabdominal X-ray (Figure 1) performed on the first day of life showed fine bilateral granular opacities indicative of Grade I respiratory distress syndrome [8], along with moderate enteral air distension. After initial stabilization, the patient's respiratory function deteriorated, prompting a ra-

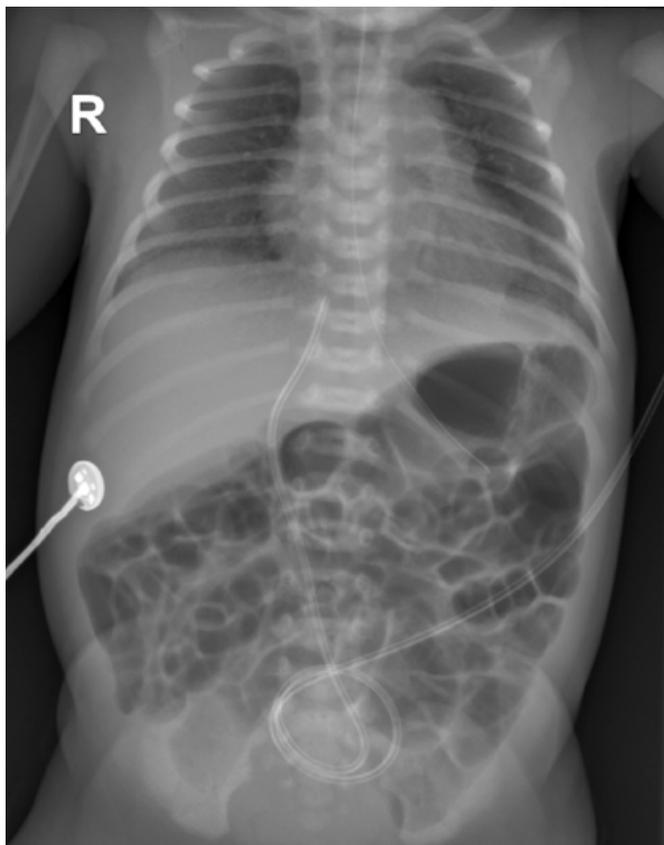


Fig. 1. Thoracoabdominal radiography on Day 1 showing bilateral granular pulmonary opacities and moderate enteral air distension.

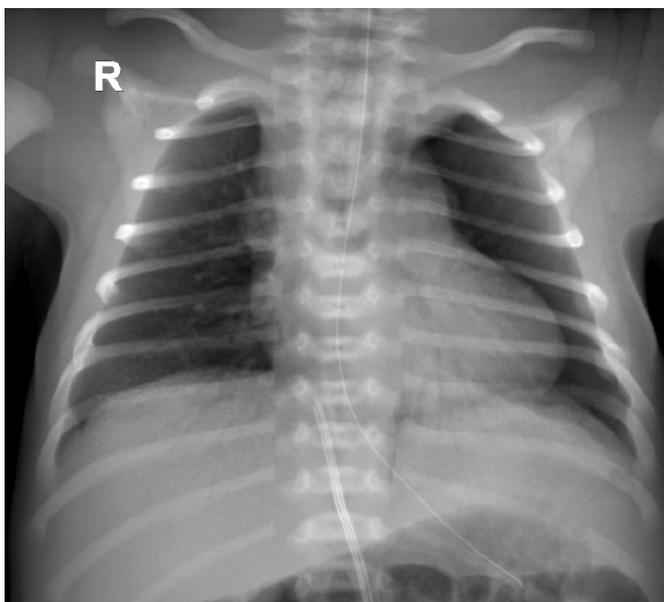


Fig. 2. Chest radiography: left apical pneumothorax and grade II RDS.

diographic evaluation (Figure 2) that revealed a left apical pneumothorax and grade II respiratory distress syndrome [9]. CPAP therapy was effectively discontinued, and lateral positioning combined with oxygen therapy was implemented. The follow-up X-ray confirmed the successful resorption of the pneumothorax. On day 2, the neonate had a right-sided pneumothorax measuring about 7 mm, requiring needle aspiration and subsequent surgical chest tube placement due to recurrence (Figure 3) [10]. She was placed on high-frequency oscillatory ventilation (HFOV) and received intratracheal surfactant (Curosurf 120 mg/kg). Analgesia and sedation were achieved using paracetamol and intranasal midazolam [11]. A temporary improvement was observed (Figure 4). However, on the fifth day of life, a thoracoabdominal X-ray revealed a medium-volume pneumothorax on the right side. This pneumothorax was

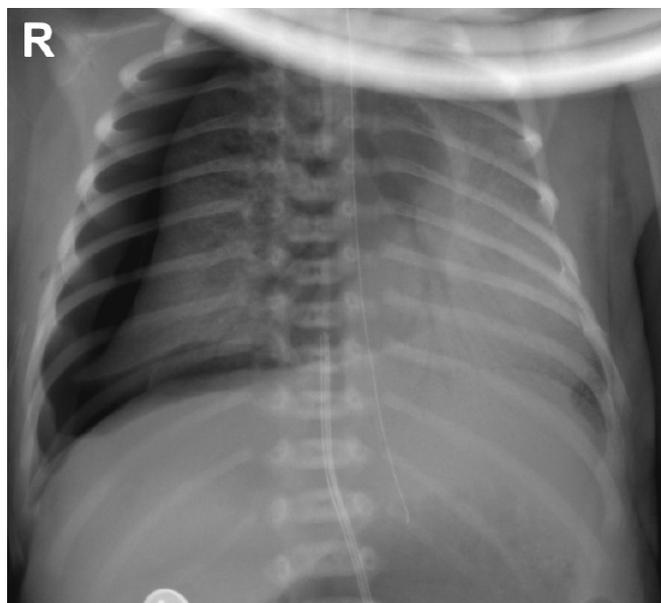


Fig. 3. Chest Radiography – right-sided pneumothorax.

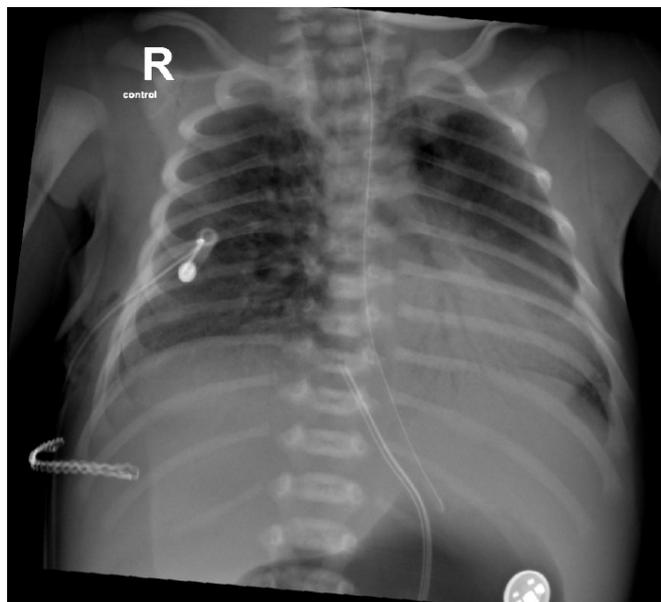


Fig. 4. Radiography – Day 5: Subtotal resolution of air collections after surgical drain, under HFOV.

circumferentially distributed in the lateral thoracic region, with an estimated thickness of up to 5 mm (refer to Figure 5) [12].

HFOV was resumed, followed by a second drainage procedure. After stabilization, the patient transitioned to synchronized intermittent mandatory ventilation (SIMV) and then to non-invasive positive pressure ventilation (NIPPV). The chest tube was removed on day 11, and oxygen supplementation was stopped by day 8. Radiological monitoring indicated complete resolution of the pneumothorax (see Figure 6). The neonate also experienced poor enteral tolerance with blood-stained secretions, managed by repeating vitamin K and continuing parenteral nutrition until day 12. Initial inflammatory markers, including C-reactive protein and neutrophil count were elevated [13]. Antibiotic therapy was initiated with ampicillin, gen-

tamicin, and ceftazidime, then adjusted based on culture results and antibiogram sensitivity profiles. Cranial ultrasound performed on day 5 of life revealed bilateral grade I–II intraventricular hemorrhage (IVH). The cerebral hemispheres appeared symmetrical, with normal inter-hemispheric and periventricular subependymal structures. The cavum septum pellucidum measured 11 mm in diameter. Bilateral thalamus-caudate grooves showed small, homogeneous hypoechoic nodules (1.5×0.56 cm on the right and 1.55×0.56 cm on the left), consistent with minor cystic changes. On day 14 of life, the findings remained unchanged, showing a stationary aspect with no progression of hemorrhage [14]. The infant showed progressive weight gain and was hemodynamically stable at discharge on day 15 of life.

Discussion

Late preterm infants have a distinct pathophysiological profile compared to term neonates. Despite being near-term, they often exhibit incomplete alveolar development, lower surfactant pool size, and delayed fluid clearance from the lungs [15]. These factors increase their susceptibility to respiratory morbidity, including RDS, transient tachypnea of the newborn, and air-leak syndromes such as pneumothorax. They are also at higher risk for complications from mechanical ventilation, including volutrauma, barotrauma, and oxygen toxicity [16]. Infection risk is elevated due to relatively immature immune function, contributing to more severe presentations when sepsis or pneumonia coexist [16]. This case highlights the complexity of managing recurrent pneumothorax in a preterm neonate with additional risk factors such as congenital pneumonia, intraventricular hemorrhage, and systemic inflammation. Early detection and escalation of respiratory support were crucial in preventing fatal complications. High-frequency oscillatory ventilation (HFOV) proved effective in managing air leaks and improving oxygenation while reducing lung trauma [3]. HFOV, when applied with lung-protective strategies, may reduce the risk of further air leaks [9]. Recent randomized trials and meta-analyses further confirmed the safety and efficacy of HFOV in extremely and late preterm infants, showing improved oxygenation, lower incidence of chronic lung disease, and reduced ventilator-induced lung injury when compared with conventional ventilation [17,18,19]. Early or rescue application of HFOV has been shown to enhance alveolar recruitment and improve gas exchange while minimizing volutrauma and barotrauma. The latest international consensus statements recommend individualized adjustment of mean airway pressure and oscillation amplitude to achieve optimal lung recruitment and to prevent chronic lung disease without increasing mortality or severe intraventricular hemorrhage. For instance, Werther et al. demonstrated that regular lung recruitment maneuvers during HFOV significantly improved oxygenation stability and reduced ventilator days in extremely preterm infants. The favorable response observed in the



Fig. 5. Chest Radiography: recurrent right-sided pneumothorax with partial lung collapse

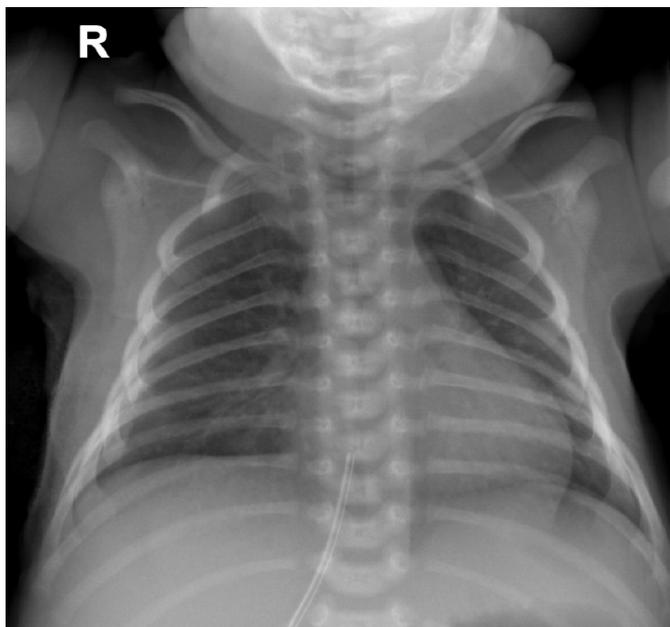


Fig. 6. Radiography – Day 6: Complete re-expansion of both lungs.

present case following HFOV re-initiation reflects these benefits in clinical practice, demonstrating rapid pulmonary stabilization and sustained recovery [20]. Timely surfactant administration enhanced lung compliance and supported recovery [21]. The decision to perform surgical drainage was based on persistent and recurrent pneumothorax despite conservative measures [10]. Literature supports pleural drainage in unstable neonates or those not responding to non-invasive support [22]. Antibiotic therapy was adjusted according to inflammatory markers and culture results, following neonatal sepsis protocols [23]. The presence of grade I/II intraventricular hemorrhage (IVH) required careful adjustment of ventilation parameters to avoid fluctuations in intracranial pressure [14]. Supportive strategies were used to minimize neurological complications, including hemodynamic stabilization, gentle ventilation techniques, and serial cranial imaging to monitor intraventricular hemorrhage [20]. Recent evidence supports a multidisciplinary and individualized approach in managing neonatal pneumothorax, particularly in preterm infants with multiple comorbidities, combining optimized respiratory strategies, targeted infection control, and close neurological monitoring to improve short- and long-term outcomes [22]. Compared with previously reported cases of recurrent pneumothorax in late preterm neonates, the present case illustrates a more complex clinical course due to the coexistence of congenital pneumonia and grade II intraventricular hemorrhage. While most published reports describe unilateral or spontaneously resolving pneumothoraxes, our patient experienced bilateral recurrence requiring both high-frequency oscillatory ventilation and surgical drainage. Similar to the findings of Hsu et al. and Kim et al., timely escalation of respiratory support and individualized adjustment of ventilation parameters were decisive for full pulmonary recovery. The favorable outcome despite multiple complications supports recent literature emphasizing early multidisciplinary management and the benefits of HFOV in preventing chronic lung injury in vulnerable preterm infants [24, 25, 26, 27, 28]. Gradual improvement in clinical condition and weight gain reflected the success of tailored multidisciplinary management. At one-month follow-up, the infant showed mild motor developmental delay consistent with prematurity and prior grade II intraventricular hemorrhage. Cranial ultrasound described bilateral pseudocysts and features consistent with cerebral immaturity and prior grade II IVH, without evidence of new hemorrhagic events. Neurological evolution remained slowly favorable under close clinical and cranial ultrasound monitoring. Long-term follow-up in this case revealed normal respiratory function and appropriate neurodevelopmental progression, consistent with published evidence indicating that late preterm infants recovering from mild IVH and air-leak syndromes generally have a favorable prognosis when early neuroprotective and lung-protective strategies are applied [29,30].

Conclusion

In late preterm neonates presenting with recurrent pneumothorax and systemic complications, particularly those with underlying respiratory distress syndrome (RDS) requiring surfactant therapy, early aggressive intervention with high-frequency oscillatory ventilation and surgical drainage, combined with targeted infection control and neuroprotective strategies, can substantially improve clinical outcomes. This case emphasizes the importance of a flexible, personalized approach to managing complex respiratory and infectious conditions in the vulnerable late preterm population. Long-term follow-up demonstrated complete respiratory recovery and gradual neurological improvement, supporting a favorable overall prognosis when early multidisciplinary and neuroprotective care is provided.

Authors' contributions

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

IB - Investigation, Methodology, Project administration

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

Conflict of interest

None to declare.

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Ethical statement

Informed consent was obtained from the legal guardian and this case report received approval from the institutional ethics committee.

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