

Incidence, Management, and Outcomes of Pneumothoraces in the NICU: An 11-Year Multicenter Cohort Study

Madison Lee¹; Asher Hancock²; Haley Thomassy³; Tadeo Aviles Zuniga⁴; Tatiana Lestido, DO⁵; Samia Aleem, MD, MHS^{5,6}

¹Louisiana State University Health Sciences Center New Orleans School of Medicine, New Orleans, LA

²Brody School of Medicine at East Carolina University, Greenville, NC

³Lewis Katz School of Medicine at Temple University, Philadelphia, PA

⁴Gianforte School of Computing, Montana State University, Bozeman, MT

⁵Department of Pediatrics, Duke University School of Medicine, Durham, NC

⁶Duke Clinical Research Institute, Duke University School of Medicine, Durham, NC

Background:

Neonatal pneumothorax is a potential life-threatening complication in neonatal intensive care units (NICUs). Although pneumothorax occurs in approximately 1-2% of neonates admitted to the NICU, premature infants weighing <1500 g have a substantially higher incidence of 5-7%. Although several risk factors have been associated with neonatal pneumothorax, the relationships between these factors and pneumothorax development across gestational age (GA) groups is not fully understood. Variability in management practices across NICUs further highlights the need for standardized approaches to prevention and management of neonatal pneumothorax to improve outcomes.

Objective:

To characterize pneumothorax incidence, factors associated with pneumothorax development, management strategies, and clinical outcomes across GA groups in a large multicenter NICU cohort.

Methods:

We conducted a cohort study of inborn infants admitted to 400 Pediatrix Medical Group NICUs between 2012 and 2023. Infants with major congenital anomalies, pleural effusions occurring near or at the time of needle aspiration or chest tube placement, and those who were transferred prior to discharge were excluded. Development of pneumothorax within the first 7 days of life was stratified by GA. Risk factors, management strategies, and clinical outcomes among affected infants were compared across gestational age groups using chi-square analyses. Multivariable logistic regression was used to identify factors independently associated with pneumothorax development.

Results:

Among 722,481 infants, 22,239 (3.08%) developed a pneumothorax. Incidence varied substantially across participating NICUs although there was a stable incidence over the study period. The highest incidence was observed among infants in the ≤ 24 -week (8.73%) and ≥ 37 -week GA groups (4.67%), while the ≥ 37 -week group demonstrated the greatest adjusted odds of pneumothorax development (OR 3.78, 95% CI 3.37-4.25). Compared to infants in room air, those requiring respiratory support had significantly greater odds of developing pneumothoraces, notably infants receiving high-frequency ventilation (OR 43.93, 95% CI 39.78-48.51) and continuous positive airway pressure (OR 12.54, 95% CI 11.78-13.34). Most infants did not receive any intervention for management of pneumothorax (68.21%). Among 4,520 infants that underwent needle aspiration, 2,421 (53.56%) required subsequent chest tube placement. Among infants with pneumothorax, those ≤ 24 weeks had the highest mortality (73.94%). Infants 25-28 weeks had the highest BPD diagnosis (36.36%), longest length of stay (75 days, [IQR,12-95]) and most total days on respiratory support (55 days, [IQR, 11-82]).

Conclusions:

In this large cohort of infants admitted to the NICU, 3% developed pneumothorax, with the highest incidence observed among infants born at ≤ 24 weeks' gestation and those born at ≥ 37 weeks' gestation. Those receiving respiratory support had the highest risk of pneumothorax, suggesting that respiratory management practices may represent a modifiable risk factor. Pneumothorax remained a significant complication throughout the study period, with stable incidence over time but substantial variation across NICUs. These findings highlight the need for standardized, evidence-based approaches to improve neonatal pneumothorax and clinical outcomes across NICUs.