NORTHWESTERN MEDICAL JOURNAL

Northwestern Med J. 2025;5(3):156-161
DOI: 10.54307/NWMJ.2025.139

RESEARCH ARTICLE

Retrospective evaluation of cases with pneumothorax in our neonatal intensive care unit

Abdulvahit Aşık[1], **Selahattin Akar**[2]

[1]Department of Pediatrics, Adıyaman University Education and Research Hospital, Adıyaman, Türkiye
[2]Department of Neonatology, Faculty of Medicine, Adıyaman University, Adıyaman, Türkiye

Cite as: Aşık A, Akar S. Retrospective evaluation of cases with pneumothorax in our neonatal intensive care unit. Northwestern Med J. 2025;5(3):156-161.

ABSTRACT

Aim: This study aimed to retrospectively evaluate the patients who were followed up in the neonatal intensive care unit of our hospital with the diagnosis of pneumothorax.

Methods: The records of patients who were followed up with the diagnosis of pneumothorax in our neonatal intensive care unit between September 1, 2016 and December 31, 2022 were retrospectively reviewed. Birth weight, sex, gestational week, mode of delivery, localization of pneumothorax, presence of underlying primary lung disease, and mortality were evaluated.

Results: The mean birth weight of 35 patients (19 girls, 16 boys) who developed pneumothorax was 2200±1050 g and the mean gestational age was 33.2±5.1 weeks. Twenty-seven of the patients were delivered by cesarean section and 8 by normal spontaneous vaginal delivery. Pneumothorax was most common on the right side (n:19) and no patient had bilateral pneumothorax. 13 patients had received surfactant treatment before pneumothorax. The primary diagnoses were respiratory distress syndrome (RDS) in 17 patients and transient tachypnea of the newborn (TTN) in 11 patients. 14 patients were resuscitated at birth. A thoracic tube was inserted in 22 patients, while 13 patients were followed up conservatively.

Conclusions: The most common predisposing causes in patients with pneumothorax are RDS and TTN. Early diagnosis and treatment of pneumothorax is life-saving. It should be kept in mind that pneumothorax may develop in patients who are followed up in the neonatal intensive care unit due to respiratory distress.

Keywords: Neonatal intensive care unit, neonate, pneumothorax

Corresponding author: Abdulvahit Aşık **E-mail:** vahit_asik@hotmail.com
Received: 13.07.2024 **Accepted:** 03.10.2024 **Published:** 30.07.2025

INTRODUCTION

Pneumothorax is defined as lung collapse secondary to the presence of air in the space between the parietal and visceral pleura (1). Depending on the extent of lung collapse, the pneumothorax may be partial or complete, unilateral or bilateral. While partial pneumothoraxes with a small amount of air are generally asymptomatic and spontaneously absorbed by the body, pneumothoraxes with a large amount of air can be fatal in the neonatal period (2,3).

The gold standard diagnostic method for pneumothorax is radiologic demonstration of air in the pleural space. The use of lung ultrasonography has become widespread in recent years. Its sensitivity and specificity are reported to be very high in experienced hands (4-7).

It is most commonly observed in the neonatal period of childhood. Its incidence is 1-2% in term newborns and 6% in preterm newborns. This rate increases up to 30% in those who need mechanical ventilation and have an underlying pulmonary problem (8,9). Pneumothorax, which is one of the major causes of respiratory distress, leads to high mortality and morbidity, especially in premature babies. Therefore, urgent diagnosis and initiation of treatment are very important in terms of mortality and morbidity (10).

In this study, we aimed to retrospectively evaluate the patients who were followed up in the neonatal intensive care unit of our hospital with a diagnosis of pneumothorax.

MATERIAL AND METHODS

The records of patients who were followed up and treated with a diagnosis of pneumothorax in our neonatal intensive care unit between September 1, 2016 and December 31, 2022 were retrospectively reviewed. The study was approved by the Non-Interventional Clinical Research Ethics Committee of Adıyaman University (approval date 15.11.2022, number 2022/8-3). The diagnosis of pneumothorax was confirmed through radiological imaging. Patients whose diagnosis was not confirmed radiologically were excluded from the study. Gestational week, gender, mode of delivery, birth weight, Apgar scores, cardiopulmonary resuscitation (CPR) after delivery, time of pneumothorax onset and symptoms, underlying primary lung disease, localization of pneumothorax, type of oxygen and respiratory support before and after the diagnosis of pneumothorax, surfactant administration and their association with mortality were evaluated. The decision to insert a chest tube was based on the patient's clinical condition. Babies with a gestational week less than thirty-seven weeks were considered preterm, while those with a gestational age of thirty-seven weeks or more were considered term.

Statistical analyses

Statistical analyses were performed using SPSS version 25 (IBM Corp. Released in 2017. IBM SPSS Statistics for Windows, version 25.0. Armonk, NY: IBM Corp.) package program. Descriptive statistics were used to present the frequencies and ratios of individuals in the groups with respect to various variables. Chi-square analysis or Fisher exact test was used to compare categorical variables. The significance level was set at as $p < 0.05$ for all analyses.

RESULTS

Of the 35 patients with pneumothorax, 19 (54.3%) were female and 16 (45.7%) were male. The mean birth weight of the patients was 2200±1050 g and the mean gestational age was 33.2±5.1 weeks. Eight (22.9%) patients had a normal delivery and 27 (77.1%) patients had a cesarean section. In 16 (45.7%) patients the Apgar score at 1 minute was less than 7. In 9 (25.7%) of these patients, the 5th minute Apgar score remained below 7. Thirteen (37.1%) patients received surfactant treatment before pneumothorax. In 19 (54.3%) patients the localization of the pneumothorax was on the right side and no patient developed bilateral pneumothorax. There was no difference between term and preterm infants in terms of gender, mode of delivery, Apgar score, surfactant requirement, and site of pneumothorax (Table 1). When the primary diagnoses of patients with pneumothorax were analyzed, respiratory distress syndrome (RDS) was observed with the highest rate (48.6%, n=17). 11 (31.4%) patients had transient tachypnea of the newborn (TTN). Neonatal pneumonia and congenital

diaphragmatic hernia were observed in 2 (5.7%) patients each, while spontaneous pneumothorax, meconium aspiration syndrome (MAS) and non-immune hydrops were observed in 1 (2.9%) patient each (Table 2). Early respiratory characteristics and clinical outcomes of patients with pneumothorax were analyzed. Fourteen (40%) patients were resuscitated at birth. During resuscitation, Positive pressure ventilation (PPV)+intubation was performed in 13 (37.1%) patients and PPV+chest compression in 3 (8.6%) patients. There was no significant difference between preterm and term babies in terms of resuscitation and

Table 1. Demographic characteristics of cases with pneumothorax

	Total n (%)	Preterm n (%)	Term n (%)	p
Gender				
Female	19 (54.3)	13 (59.1)	6 (46.2)	0.458
Male	16 (45.7)	9 (40.9)	7 (53.8)	
Delivery				
Vaginal	8 (22.9)	4 (18.2)	4 (30.8)	0.397
Cesarean Section	27 (77.1)	18 (81.8)	9 (69.2)	
Apgar score 1. min.				
<7	16 (45.7)	11 (50)	5 (28.5)	0.508
≥7	19 (54.3)	11 (50)	8 (61.5)	
Apgar score at 5 min.				
<7	9 (25.7)	6 (27.3)	3 (23.1)	0.783
≥7	26 (74.3)	16 (72.7)	10 (76.9)	
Surfactant requirement				
Yes	13(37.1)	10 (45.5)	3 (23.1)	0.178
No	22 (62.9)	12 (54.5)	10 (76.9)	
Location of Pneumothorax				
Right	19 (54.3)	13 (59.1)	6 (46.2)	0.458
Left	16 (45.7)	9 (40.9)	7 (53.8)	

Table 2. Primary diagnoses of cases with pneumothorax

Diagnoses	Total n (%)	Preterm n (%)	Term n (%)
Spontaneous pneumothorax	1 (2.9)	1(4.5)	0 (0)
Transient tachypnea of the newborn (TTN)	11 (31.4)	3 (13.6)	8 (61.5)
Respiratory distress syndrome (RDS)	17 (48.6)	16 (72.7)	1 (7.7)
Neonatal pneumonia	2 (5.7)	0 (0)	2 (15.4)
Meconium aspiration syndrome (MAS)	1 (2.9)	0 (0)	1(7.7)
Congenital diaphragmatic hernia	2 (5.7)	1 (4.5)	1(7.7)
Nonimmune hydrops	1 (2.9)	1 (4.5)	0 (0)
Total	35 (100)	22 (100)	13 (100)

Table 3. Early respiratory characteristics and clinical outcomes in neonates with pneumothorax

		Total n (%)	Preterm n (%)	Term n (%)	p
Resuscitation at birth	yes	14 (40)	10 (45.5)	4 (30.8)	0.392
	no	21 (60)	12 (54.5)	9 (69.2)	
Resuscitation (PPV)	yes	14 (40)	10 (45.5)	4 (30.8)	0.392
	no	21 (60)	12 (54.5)	9 (69.2)	
Resuscitation (PPV+ intubation)	yes	13 (37.1)	10 (45.5)	3 (23.1)	0.336
	no	22 (62.9)	12 (54.5)	10 (76.9)	
Resuscitation (chest compression)	yes	3 (8.6)	2 (9.1)	1 (7.7)	0.886
	no	32 (91.4)	20 (90.9)	12 (92.3)	

PPV: Positive Pressure Ventilation

Table 4. Respiratory and clinical characteristics at the time of pneumothorax diagnosis

		Total	Preterm	Term	p
Respiratory support before pneumothorax	Oxygen	4 (11.4)	2 (9.1)	2 (15.4)	0.728
	NIV	12 (34.3)	7 (31.8)	5 (38.5)	
	MV	19 (54.3)	13 (59.1)	6 (46.2)	
Respiratory support after pneumothorax	Continue with oxygen	4 (11.4)	2 (9.1)	2 (15.4)	0.861
	Continue with NIV	3 (8.6)	2 (9.1)	1 (7.7)	
	Transition to MV	9 (25.7)	5 (22.7)	4 (30.8)	
	Continue with MV	19 (54.3)	13 (59.1)	6 (46.2)	

MV: Mechanical ventilation; NIV: Non-invasive ventilation

observable clinical characteristics (Table 3). When analyzing the respiratory status of the patients before and after pneumothorax, it was found that 4 (11.4%) patients received free oxygen, 12 (34.3%) patients received noninvasive ventilation (NIV) support, and 19 (54.3%) patients received invasive mechanical ventilation (IMV) support before pneumothorax. After pneumothorax, 4 (11.4 %) patients continued with free oxygen, 3 (8.6 %) patients continued with NIV, 9 (25.7 %) patients switched to IMV, and 19 (54.3 %) patients continued with IMV. There was no statistically significant difference between respiratory support received before pneumothorax and respiratory support received after pneumothorax in preterm and term infants (Table 4).

DISCUSSION

Pneumothorax is most commonly observed in the neonatal period, especially in the first 72 hours after birth (11). The reason for its frequent occurrence in the neonatal period is the high pressure in the lungs with the onset of respiration (12). While its incidence in all live births is between 0.08% and 0.14%, this rate increases to between 1% and 6% in babies followed in the intensive care unit during the neonatal period (3,13). In our study, the incidence of pneumothorax was found to be 0.12% among all live births and this rate was compatible with the literature. In a study conducted by Özbek et al. (14) with 112 patients, it was reported that pneumothorax developed in the

first 48 hours in 76% of the patients, and in a study conducted by Akdoğan et al. (15), it was reported that pneumothorax developed in the first 48 hours in 100% of the patients. In our study, 91.4% of our patients developed pneumothorax in the first 72 hours.

Pneumothorax may present with a severe picture including dyspnea, severe tachypnea, subcostal, intercostal retractions, and cyanosis, or it may present with mild symptoms including only an increase in respiratory rate (16). Pneumothorax should be considered in cases presenting with decreased oxygen saturation, sudden onset of respiratory distress, the need to increase ventilator settings, or absent breath sounds on auscultation (17). Pneumothorax may be secondary to underlying lung pathology (such as RDS, meconium aspiration syndrome, pulmonary hypoplasia), resuscitation at birth, positive pressure mechanical ventilation, or may occur spontaneously (8,9). It is known that pneumothorax is more common in premature and cesarean born babies. Its frequent occurrence in premature infants has been attributed to their need for respiratory support due to respiratory problems (18,19). Cesarean section is known to predispose to pneumothorax by causing RDS and TTN (20). The two most common risk factors for pneumothorax in our patients were TTN and RDS. RDS was the most common primary diagnosis in preterm babies, and TTN was the most common primary diagnosis in term babies. In the study by Çördük et al. (21), 63% of the patients were preterm and the most common causes of pneumothorax were reported as RDS and TTN. In our study, 63% of the patients were preterm infants and the rate was similar to the literature.

Patients receiving mechanical ventilation and positive pressure ventilation are more likely to develop pneumothorax. High pressure causes pneumothorax by causing barotrauma (22). In a study conducted by Malek et al. (9) on 400 neonatal patients receiving mechanical ventilation, it was reported that 26% of the patients developed pneumothorax. In our study, 54.2% of the patients were receiving IMV support, 34.3% were receiving NIV support, and 11.4% were receiving free oxygen before the development of pneumothorax. Our findings support the literature and reveal that mechanical ventilation is an important risk factor for pneumothorax.

Pneumothorax is frequently unilateral and is most commonly seen on the right side (22). Navaei et al. (23) found that pneumothorax was located on the right side in 57%, on the left side in 40%, and bilateral in 3%. In our study, 54.3% of the pneumothorax was right localized, 45.7% was left localized, and no patient developed bilateral pneumothorax. Our results are similar to the study of Navaei et al.

Although rare, pneumothorax is a condition with high mortality if diagnosis and treatment are delayed (24). Pneumothorax increases the length of hospital stay, the need for mechanical ventilation, and mortality (22). Currently, mortality rates of 20-60% are reported. The earlier the onset of pneumothorax, the higher the mortality rate. In particular, pneumothorax that develops within the first 24 hours of life has a mortality rate of up to 60% (11,16). Patients with accompanying lung parenchymal disease are known to have a worse prognosis. The mortality rate increases with decreasing gestational age and birth weight. Mortality is especially high in preterm infants with gestational age less than 29 weeks (10,11). In our study, 12 patients were lost (mortality rate 34%). Seventy-five percent of the lost patients were preterm, and our mortality rates were compatible with the literature.

In conclusion, pneumothorax most commonly develops in the neonatal period and usually occurs within the first 72 hours of life. The most common cause is TTN in term babies and RDS in preterm babies. Pneumothorax, defined as air entering between the parietal and visceral pleura, which is one of the air leak syndromes, should be considered in the event of sudden deterioration in general condition, increased retractions, cyanosis and bradycardia in infants monitored in the neonatal intensive care unit for respiratory distress. It should be noted that morbidity and mortality are reduced with prompt and effective treatment.

Ethical approval

This study has been approved by the Adıyaman University Non-Interventional Clinical Research Ethics Committee (approval date 15/11/2022, number 2022/8-3). Written informed consent was obtained from the participants.

Author contribution

Concept: AA, SA; Design: AA, SA; Data Collection or Processing: AA, SA; Analysis or Interpretation: AA, SA; Literature Search: AA, SA; Writing: AA, SA. All authors reviewed the results and approved the final version of the article.

Source of funding

The authors declare the study received no funding.

Conflict of interest

The authors declare that there is no conflict of interest.

REFERENCES

1. Zarogoulidis P, Kioumis I, Pitsiou G, et al. Pneumothorax: from definition to diagnosis and treatment. J. Thorac. Dis. 2014;6:S372-S376
2. Park SW, Yun BH, Kim KA, Ko Sy, Lee YK, Shin SM. A clinical study about symptomatic spontaneous pneumothorax. Korean J Perinatol. 2006; 17: 304-9.
3. Vibede L, Vibede E, Bendtsen M, Pedersen L, Ebbesen F. Neonatal pneumothorax: a descriptive regional Danish study. Neonatology. 2017; 111(4): 303-8. **[Crossref]**
4. Cattarossi L, Copetti R, Brusa G, Pintaldi S. Lung ultrasound diagnostic accuracy in neonatal pneumothorax. Can Respir J. 2016; 2016: 6515069. **[Crossref]**
5. Liu J, Chi JH, Ren XL, et al. Lung ultrasonography to diagnose pneumothorax of the newborn. Am J Emerg Med. 2017; 35(9): 1298-302. **[Crossref]**
6. Jhaveri V, Vali P, Giusto E, Singh Y, Lakshminrusimha S. Pneumothorax in a term newborn. J Perinatol. 2024; 44(4): 465-71. **[Crossref]**
7. Sabour S. Ultrasound of pneumothorax in neonates: diagnostic value of the anterior transverse plane and of mirrored ribs; methodological issues. Pediatr Pulmonol. 2022; 57(9): 2257-8. **[Crossref]**
8. Litmanovitz I, Carlo WA. Expectant management of pneumothorax in ventilated neonates. Pediatrics. 2008; 122(5): e975-9. **[Crossref]**
9. Malek A, Afzali N, Meshkat M, Yazdi NH. Pneumothorax after mechanical ventilation in newborns. Iran J Pediatr. 2011; 21: 45-50.
10. Bhatia R, Davis PG, Doyle LW, Wong C, Morley CJ. Identification of pneumothorax in very preterm infants. J Pediatr. 2011; 159(1): 115-20. **[Crossref]**
11. Apiliogullari B, Sunam GS, Ceran S, Koc H. Evaluation of neonatal pneumothorax. J Int Med Res. 2011; 39(6): 2436-40. **[Crossref]**
12. Al Tawil K, Abu-Ekteish FM, Tamimi O, Al Hathal MM, Al Hathlol K, Abu Laimun B. Symptomatic spontaneous pneumothorax in term newborn infants. Pediatr Pulmonol. 2004; 37(5): 443-6. **[Crossref]**
13. Trevisanuto D, Doglioni N, Ferrarese P, Vedovato S, Cosmi E, Zanardo V. Neonatal pneumothorax: comparison between neonatal transfers and inborn infants. J Perinat Med. 2005; 33(5): 449-54. **[Crossref]**
14. Özbek AS, Kavuncuoğlu S, Ugan Atik S, Aldemir EY, Payaslı M, Sander S. Investigation of cases followed up with the diagnosis of pneumothorax in the neonatal intensive care unit between 2004-2008. Journal of Gynaecology Obstetrics Pediatrics and Pediatric Surgery. 2011: 3(2): 79-85.
15. Akdoğan Z, Ovalı F, Samancı N, Dağoğlu T, Boneval C, Aksöyek S. Frequency of pneumothorax in newborns with respiratory distress. Türkiye Klinikleri Pediatri Dergisi. 1996; 5: 68-71.
16. Ali R, Ahmed S, Qadir M, Maheshwari P, Khan R. Pneumothoraces in a neonatal tertiary care unit: case series. Oman Med J. 2013; 28(1): 67-9. **[Crossref]**
17. Alice Z, Gündogdu G, Kara C, Ilikkan B, Celayir S. Which patients are at risk? Evaluation of the morbidity and mortality in newborn pneumothorax. Indian Pediatr. 2003; 40: 325-8.
18. Aly H, Massaro A, Acun C, Ozen M. Pneumothorax in the newborn: clinical presentation, risk factors and outcomes. J Matern Fetal Neonatal Med. 2014; 27(4): 402-6. **[Crossref]**
19. Kolås T, Saugstad OD, Daltveit AK, Nilsen ST, Øian P. Planned cesarean versus planned vaginal delivery at term: comparison of newborn infant outcomes. Am J Obstet Gynecol. 2006; 195(6): 1538-43. **[Crossref]**
20. Jovandaric MZ, Milenkovic SJ, Dotlic J, et al. Neonatal pneumothorax outcome in preterm and term newborns. Medicina (Kaunas). 2022; 58(7): 965. **[Crossref]**
21. Çördük N, Ürey T, Küçüktaşçı K, et al. Evaluation of newborn with pneumothorax. Pamukkale Medical Journal. 2014; 7(1): 47-51.
22. Türkmen M, Tanmış AÇ, Etensel B, Özkısacık S, Akdilli A, Gürsoy H. Evaluation of cases with pneumothorax followed in the neonatal unit. Journal of Adnan Menderes University Faculty of Medicine. 2010: 11(1): 31-4.
23. Navaei F, Aliabadi B, Moghtaderi M, Kelishadi R. Predisposing factors, incidence and mortality of pneumothorax in a neonatal intensive care unit in Isfahan, Iran. Chinese Journal of Contemporary Pediatrics. 2010; 12(6): 417-20.
24. Thomas NH, Anthony C, Alfred LG, Alicia AM. Principles of respiratory monitoring and therapy. In: Taeusch W, Ballard R, Gleason C, editors. Avery's Diseases of the Newborn. 8th ed. Philadelphia: Elsevier Saunders; 2005: 662-3.