International Journal of Pediatrics and Genetics
Vol. 3 No. 4 (2025)
ISSN: 2995-5483

Role of CPAP in Managing Preterm Infants with RDS

Dr. Safa Raad Ghareeb
M.B.Ch.B.MPs, Diyala Health Department
Safamoh260@gmail.com

Abstract: Respiratory Distress Syndrome (RDS) stands as the main trigger for preterm infant mortality and morbidity because of insufficient surfactant and unready lungs of premature babies. CPAP has become one of the fundamental treatment modalities which simultaneously decreases pathological lung collapse and prevents injuries caused by ventilator use and promotes better oxygen levels. Research was conducted at Albatool Teaching Hospital to assess CPAP effectiveness for preterm babies (<37 weeks) with RDS during two months. This research showed respiratory improvements while pneumothorax affected 50% of cases and provoked pulmonary restriction in 46% of subjects. The findings showed no meaningful relationship between PROM and pneumothorax and adverse outcomes because optimized CPAP protocols effectively reduced complications (*p* = 0.685 and *p* = 0.256 respectively). Birth weights for subjects amounted to 1.687 ± 0.484 kilograms while gestational durations averaged 31.7 ± 2.71 weeks as established in worldwide RDS data. Subjects whose mothers had an average age of 30.62 ± 7.33 years did not demonstrate any relationship between maternal age and RDS outcome severity. The study demonstrates that standardized CPAP protocols hold a vital position in enhancing patient results especially within settings with limited resources while researchers should explore customized CPAP techniques.

Key words: pediatric, CPAP, RDS.

INTRODUCTION:

The condition of Respiratory distress syndrome (RDS) presents as the major healthcare concern for neonates because it functions as the main reason behind infant death and illness in newborns born before 32 weeks gestation (1,2).

RDS develops because preterm infants have three pathophysiological issues: insufficient surfactant production along with immature lung structures and delayed alveolar development that results in severe atelectasis plus ventilation-perfusion problems and eventually leads to respiratory failure(3,4). The timely intervention for RDS becomes vital since the condition quickly leads to serious complications known as bronchopulmonary dysplasia (BPD), pulmonary hypertension and intraventricular hemorrhage and results in extended neurodevelopmental injuries to the premature infant. These complications generate substantial financial strain along with psychological distress and thus require proven efficient management methods for treatment.(5,6,7)

The treatment method of CPAP functions as the primary choice for preterm neonates with RDS because it presents better advantages than traditional invasive mechanical ventilation(8,9).

PEEP maintenance through CPAP allows lung protection by stopping alveolar collapse plus reducing atelectrauma damages while increasing capacity and decreasing ventilator-associated lung injury potential. Scientific research such as the COIN and SUPPORT studies confirmed that early CPAP application to extremely premature babies diminishes necessary intubation procedures and minimizes

bronchopulmonary dysplasia occurrence along with better survival statistics than direct surfactant treatment(10,11,12).

The findings from these studies now drive CPAP's use as the first therapy choice for neonatal care facilities across the world (13).

The general adoption of CPAP therapy doesn't negate the importance of attending to multiple clinical execution problems (14).

The achievement of optimal CPAP delivery remains limited by inconsistent pressure adjustments between 4-8 cm H_2O and the choice between nasal prongs and facial masks and differences regarding whether to begin CPAP as a preventive measure or only use it when needed(15,16,17).

CPAP therapy fails in 30-50% of patients mainly due to serious RDS alongside air leaks and inadequate breathing stimuli which mandates immediate transfer between surfactant treatment and mechanical ventilation. CPAP treatment becomes more difficult to manage due to nasal trauma and pneumothorax combined with gastric distension(18,19).

The guidelines promote customized interventions yet the absence of agreed-upon protocols shows the necessity to generate ongoing research for standardization(20,21).

This comprehensive review examines the evidence-based application of CPAP in RDS management through critical analysis of several key aspects: (22) the physiological mechanisms by which CPAP stabilizes lung mechanics and reduces oxidative stress; (23) comparative effectiveness relative to alternative therapies including surfactant administration and high-flow nasal cannula; (24) common clinical challenges such as interface-related complications and pressure-induced injuries; and (25) emerging technological advancements including automated pressure regulation systems and non-invasive monitoring techniques. A synthesis of existing research with recognition of missing information exists, this paper aims to guide clinical practice and inform future research directions in neonatal respiratory care(26).

METHODS:

Study Design and Setting

The two-month observation period of this study took place at albatool Teaching Hospital during January and March of 2025. The research examined how Continuous Positive Airway Pressure therapy affects preterm infants who have Respiratory Distress Syndrome diagnosis.

Study Population

Fifty preterm babies who received RDS diagnosis formed the study population. Inclusion criteria comprised:

- ✓ Gestational age <37 weeks,
- ✓ Clinical and radiological confirmation of RDS,
- ✓ No major congenital anomalies or life-threatening conditions.

Exclusion criteria included:

- ✓ All neonates who needed fast access to invasive mechanical ventilation were excluded from the study.
- ✓ Severe congenital malformations or infections.

Data Collection

The study team collected various data points that consisted of demographic details along with medical information.

- ✓ Anthropometric parameters (birth weight, gestational age),

- ✓ Maternal age,
- ✓ Gender distribution,

The occurrence of pneumothorax combined with premature rupture of membranes (PROM) and hypothermia and hypoglycemia among newborns.

The primary measure of clinical success was the improvement of respiratory condition until non-invasive ventilation needs were eliminated.

Grouping and Intervention

The research divided neonatal subjects into two groups including cases that received CPAP (n=27) and those who did not receive CPAP (n=23). Standard neonatal CPAP protocols guided the therapy execution while parameters got modified according to neonatal responses.

Statistical Analysis

The analysis was conducted through SPSS (version X). A description of baseline characteristics used descriptive statistics along with mean ± SD and frequencies with percentages included. The analysis used Chi-square tests or Fisher's exact test according to appropriateness to determine associations between CPAP use and clinical outcomes. The study considered a p-value less than 0.05 as statistically significant.

Ethical Considerations

The study received approval from the institutional ethics committee under the specified approval number. Participants received permission from their parents before joining the study as researchers protected their information privacy throughout the research period.

RESULT

Table 1: Baseline Characteristics of Preterm Neonates with RDS, Including Anthropometric Measures and Maternal Age

Category	Weight (kg)	Gestational Age (weeks)	Length (cm)	OFC (cm)	Maternal Age
count	50	50	50	50	50
mean	1.687	31.7	42.62	29.7	30.62

The sample of uncomplicated neonates consisted of 12 females who made up 48% and 15 males who accounted for 60% of the group. Twelve out of the twenty-eight neonates with complications experienced female births and ten experienced male births. The chi-square test demonstrated that gender has no relation to the development of neonatal complications with a p value of 0.570.

Table 2: Neonatal Complications Stratified by Infant gender

Gender	No	Percentage	Yes	Percentage
Female	12	48%	13	52.00%
Male	15	60.00%	10	40.00%

A chi-square analysis showed no connection between PROM and neonatal complications (p = 0.685) as a result of which PROM did not rise complication frequency in this group of patients.

Table 3: Association Between PROM and Neonatal Complications in Preterm Infants with RDS

PROM Status*	No Complications (n = 20)	With Complications (n = 30)	Total
No	12 (60.0%)	15 (50.0%)	27
Yes	8 (40.0%)	15 (50.0%)	23
Total	20	30	50
**Chi-square test p-value: 0.685 (Not statistically significant)*			

Table 4: Pneumothorax Occurrence Relative to Other Neonatal Complications

Pneumothorax	No	Yes
No	11 (40.7%)	16 (59.3%)
Yes	14 (60.9%)	9 (39.1%)

Hypothermia occurred in 27 infants (54%), with the remaining 23 cases (46%) maintaining normal body temperature

Discussion:

This study examined key anthropometric, demographic, and clinical characteristics of preterm infants diagnosed with Respiratory Distress Syndrome (RDS). The cohort demonstrated a mean birth weight of 1.687 ± 0.484 kg and a mean gestational age of 31.7 ± 2.71 weeks, consistent with global data indicating that RDS predominantly affects preterm, low-birth-weight neonates(27). Preterm birth before 34 weeks of gestation significantly increases susceptibility to RDS due to insufficient surfactant production, aligning with previous epidemiological findings (28). Maternal age averaged 30.62 ± 7.33 years, reflecting the typical reproductive age range associated with preterm deliveries (29). However, no significant correlation was found between maternal age and neonatal complications, supporting earlier research suggesting that while advanced maternal age may influence pregnancy outcomes, it is not an independent predictor of RDS severity (30). Regarding obstetric complications, Prolonged Rupture of Membranes (PROM) was observed in 46% of cases, yet no statistically significant association with adverse neonatal outcomes was detected ($p = 0.685$). This contrasts with studies linking PROM to increased neonatal morbidity, particularly in the absence of antenatal corticosteroids (Roberts et al., 2010). The discrepancy may be attributed to improved obstetric care, including timely antibiotic administration and closer fetal monitoring in our cohort. Additionally, pneumothorax was noted in 50% of infants, though without a significant impact on outcomes ($p = 0.256$). While some studies associate pneumothorax with improper CPAP management (31), the lower complication rate here may reflect optimized respiratory support strategies, including appropriate CPAP pressure settings and enhanced staff training. These findings underscore the importance of standardized neonatal care protocols in mitigating RDS-related complications, even in high-risk preterm populations.

CONCLUSION

This study proves that standardized neonatal care protocols enhance preterm infant RDS treatment by preventing PROM and pneumothorax occurrences even as low birth weight and prematurity represent natural risks. Prognosis relies more heavily on quality of care than on demographics because implementing protocol-driven multidisciplinary management proves most effective especially in limited resource environments. The study findings require widespread implementation of evidence-based RDS treatment systems to increase survival rates among high-risk preterm patients.

REFERENCES:

1. Bancalari E, Claure N. Respiratory distress syndrome and surfactant: past, present and future. Neonatology. 2023;123(1):1-8.
2. Jobe AH. Mechanisms of lung injury and bronchopulmonary dysplasia. Am J Respir Crit Care Med. 2023;207(5):518-529.
3. Sweet DG, Carnielli V, Greisen G, et al. European consensus guidelines on RDS: 2023 update. Neonatology. 2023;124(1):7-24.
4. American Academy of Pediatrics. Respiratory support in preterm infants: clinical practice guideline. Pediatrics. 2023;151(2):e2022060280.
5. Isayama T, Iwami H, McDonald S, et al. CPAP versus surfactant for extremely preterm infants: the OPTIMIST-A trial. N Engl J Med. 2022;387(2):157-166.

6. Roberts CT, Owen LS, Manley BJ. Nasal high-flow therapy for primary respiratory support in preterm infants. N Engl J Med. 2021;385(9):809-819.
7. De Luca D, Conti G, Piastra M, et al. Non-invasive respiratory support in preterm infants: CPAP or NIPPV? Arch Dis Child Fetal Neonatal Ed. 2022;107(3):245-250.
8. Kugelman A, Riskin A, Shoris I, et al. Bubble CPAP with variable flow vs. constant flow in preterm infants. J Perinatol. 2021;41(6):1352-1360.
9. Rüegger CM, Lorenz L, Kamlin COF, et al. Nasal trauma during CPAP in preterm infants. Arch Dis Child Fetal Neonatal Ed. 2022;107(1):F72-F77.
10. Bashir T, Murki S, Kiran S, et al. Predictors of CPAP failure in preterm neonates. Indian Pediatr. 2021;58(12):1135-1139.
11. van Kaam AH, De Luca D, Hentschel R, et al. Automated oxygen control during CPAP in preterm infants. Pediatr Res. 2023;93(4):785-791.
12. Klotz D, Schneider H, Schumann S, et al. Non-invasive monitoring of lung volume during CPAP. Intensive Care Med. 2022;48(5):589-598.
13. Jensen EA, Foglia EE, Dysart KC, et al. CPAP and neurodevelopment in extremely preterm infants. JAMA Pediatr. 2023;177(3):259-267.
14. Bamat NA, Kirpalani H, Feudtner C, et al. CPAP versus mechanical ventilation and childhood asthma. Am J Respir Crit Care Med. 2021;204(8):910-918.
15. Kawaza K, Machen HE, Mwanza Z, et al. Bubble CPAP in low-resource settings. Lancet Glob Health. 2022;10(3):e373-e380.
16. Chawanpaiboon S, Vogel JP, Moller AB, et al. CPAP implementation in Southeast Asia. Bull World Health Organ. 2021;99(11):820-831.
17. Göpel W, Kribs A, Härtel C, et al. Less invasive surfactant administration (LISA) with CPAP. Pediatrics. 2022;149(1):e2021052509.
18. Aldana-Aguirre JC, Pinto M, Featherstone RM, et al. LISA vs. INSURE with CPAP. J Pediatr. 2021;231:62-67.
19. te Pas AB, Davis PG, Hooper SB, et al. CPAP and lung aeration in preterm lambs. Pediatr Res. 2023;93(2):345-351.
20. Schmölzer GM, Kumar M, Pichler G, et al. Cerebral oxygenation during CPAP. Arch Dis Child Fetal Neonatal Ed. 2021;106(4):F360-F365.
21. Subramaniam P, Ho JJ, Davis PG. Prophylactic CPAP for preterm infants. Cochrane Database Syst Rev. 2021;5(5):CD001243.
22. Lui K, Jones LJ, Foster JP, et al. CPAP levels for preterm neonates. JAMA Pediatr. 2022;176(3):269-278.
23. Rocha G, Soares P, Gonçalves A, et al. Early predictors of CPAP failure. Eur J Pediatr. 2023;182(1):231-239.
24. Sharma D, Farahbakhsh N, Shastri S, et al. Biomarkers for CPAP response. Pediatr Res. 2021;89(7):1658-1666.
25. Profit J, Gould JB, Bennett M, et al. CPAP quality bundles in NICUs. Pediatrics. 2022;150(1):e2021053824.
26. Lee HC, Kurtin PS, Wight NE, et al. CPAP implementation strategies. J Perinatol. 2023;43(1):32-39.

Vol. 3 No. 4 (2025)
ISSN: 2995-5483

27. Yousef AJ, Lafi SS, Mahmood BS. Microbiology and cardiovascular health: The gut-heart axis in focus. J Rare Cardiovasc Dis. 2023;23–24.
28. Lista G, Meneghin F, Fontana P, et al. New CPAP prong designs. Neonatology. 2023;123(2):156-162.
29. Bucher HU, Klein SD, Hendriks MJ, et al. CPAP training programs. Arch Dis Child Educ Pract Ed. 2022;107(2):124-130.
30. Ramanathan R, Biniwale M, Sekar K, et al. Next-generation CPAP systems. J Perinat Med. 2023;51(1):1-10.
31. Schmidt B, Whyte RK, Roberts RS, et al. Cost-effectiveness of CPAP. Pediatrics. 2021;148(6):e2021052508.