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Clinical Characteristics and Outcomes of Preterm Infants with Respiratory Distress Syndrome: A Cross-Sectional Study in Tertiary Care Units

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Abstract: Background: Neonatal respiratory distress syndrome (RDS), also known as hyaline membrane disease, is an acute lung disorder of newborns caused by pulmonary surfactant deficiency and immature lung development. It predominantly affects premature infants, with clinical signs of respiratory distress typically appearing within minutes to hours after birth. RDS remains a critical problem in neonatology, despite advances in perinatal care.

Methods: A descriptive cross-sectional study was conducted in the neonatal intensive care unit of a tertiary care hospital in Baghdad, Iraq, at Al-Kadhimiya Teaching Hospital during period from 4 June 2023 to 6 June 2024. 56 preterm infants were included in the study. The study aimed to assess the clinical profile and outcomes of preterm infants diagnosed with respiratory distress syndrome (RDS) during this time. A total of

Results: More than half of the mothers (57.1%) were between 20 and 34 years of age, which is considered the optimal reproductive age group. Most pre-term infants (75.0%) received surfactant therapy, which is a key treatment for RDS. CPAP was the most used mode of respiratory support, applied in 50% of cases. The overall survival rate among preterm infants with RDS was 71.4%, while the mortality rate was 28.6%. The average NICU stay was approximately 12.3 days.

Conclusion: critical role of early gestational age, low birth weight, antenatal steroid administration, and neonatal complications in determining outcomes in preterm infants with RDS. Efforts to improve antenatal care, especially the use of corticosteroids, and to strengthen infection control practices in NICUs may significantly enhance survival outcomes.

Key words: Preterm, Respiratory Distress Syndrome, Outcomes.

1. Introduction

Neonatal respiratory distress syndrome (RDS), also known as hyaline membrane disease, is an acute lung disorder of newborns caused by pulmonary surfactant deficiency and immature lung development (1). It predominantly affects premature infants, with clinical signs of respiratory distress typically appearing within minutes to hours after birth (2). RDS remains a critical problem in neonatology; despite advances in perinatal care, it continues to be a leading cause of morbidity and mortality among preterm neonates (3). Globally, complications of prematurity – among which RDS is a major contributor – are now the leading cause of neonatal deaths, particularly in low- and middle-income countries (4). This highlights the importance of RDS as a focus for improving neonatal outcomes worldwide (5).

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The incidence of RDS is inversely proportional to gestational age: the more premature the infant, the greater the likelihood of developing RDS. Nearly all extremely preterm infants born before 28 weeks' gestation develop some degree of RDS, whereas the syndrome is uncommon near term (6). One Neonatal Research Network study reported RDS in 98% of infants born at 24 weeks, compared to about 5% at 34 weeks and under 1% at 37 weeks (7). In high-resource settings, RDS is estimated to affect approximately 1% of all newborns (roughly 24,000 cases annually in the United States) (7). In low-resource regions, the true burden may be under-recognized due to limited reporting, but these areas bear a disproportionately high share of preterm births and related neonatal mortality (8).

Multiple maternal and neonatal risk factors influence the occurrence and severity of RDS. Unsurprisingly, the degree of prematurity and low birth weight are the strongest predictors. Male infants are at higher risk than females, attributable in part to slower lung maturation in males (9). Delivery without labor (such as elective cesarean section) is associated with increased RDS incidence, since the infant misses the hormonal and physiological benefits of labor that promote lung maturity. Maternal diabetes mellitus is another well-established risk factor; fetal hyperinsulinemia in diabetic pregnancies can delay surfactant production, predisposing the newborn to RDS. Perinatal asphyxia and hypoxia can also contribute by causing lung injury or surfactant inactivation (10).

If not recognized and managed promptly, RDS can progress to life-threatening respiratory failure. The collapse of underdeveloped alveoli leads to severe hypoxemia and acidosis, and infants with severe RDS are at risk of multi-organ dysfunction. Moreover, RDS is a significant precursor of chronic lung disease; survivors, especially those at the lowest gestational ages, are at increased risk of long-term respiratory complications (11).

Despite these advances, significant challenges remain in translating evidence-based RDS care into practice across all settings. In many low- and middle-income countries (LMICs), resource constraints impede the uniform implementation of standard interventions (11). Costly therapies like surfactant may be limited in availability, and not all hospitals have the equipment or trained personnel to provide optimal respiratory support (12).

Methods

This descriptive cross-sectional study was conducted in the neonatal intensive care unit (NICU) of a tertiary care hospital in Baghdad, Iraq, at Al-Kadhimiya Teaching Hospital over a one-year period from 4 June 2023 to 6 June 2024. The NICU functions as a referral center for high-risk deliveries and critically ill neonates and is equipped with essential facilities for advanced neonatal care, including mechanical ventilation, continuous positive airway pressure (CPAP), and surfactant therapy. The study aimed to assess the clinical profile and outcomes of preterm infants diagnosed with respiratory distress syndrome (RDS) during this time.

A total of 56 preterm infants were included in the study. Eligibility criteria included all neonates born before 37 completed weeks of gestation who were admitted to the NICU and diagnosed clinically and radiographically with RDS. The diagnosis was based on the presence of signs of respiratory distress within the first six hours of life—such as tachypnea, nasal flaring, grunting, chest retractions, and cyanosis—along with chest X-ray findings indicative of RDS, including a reticulogranular pattern and air bronchograms. Neonates with other identifiable causes of respiratory distress, such as transient tachypnea of the newborn, meconium aspiration syndrome, congenital diaphragmatic hernia, or structural heart or lung malformations, were excluded from the study.

Data were collected prospectively using a structured data sheet developed by the research team. Information gathered included maternal variables (age, mode of delivery, antenatal steroid use, presence of gestational diabetes, hypertension, premature rupture of membranes) and neonatal characteristics (gestational age, sex, birth weight, Apgar scores, need for resuscitation, and timing of symptom onset). Clinical course details were also recorded, including the need for surfactant administration, type and duration of respiratory support, complications such as sepsis or pneumothorax, and final outcomes including discharge or death.

All participants were monitored from admission to discharge or death. Data was extracted from medical records and patient charts and then entered into a Microsoft Excel spreadsheet. Statistical analysis was conducted using the Statistical Package for the Social Sciences (SPSS) version 26. Descriptive statistics were used to summarize the variables. Frequencies and percentages were used for categorical data, while continuous variables were expressed as means with standard deviations. Relationships between selected variables and clinical outcomes were assessed using the chi-square test, and a p-value of less than 0.05 was considered statistically significant.

Ethical approval for the study was obtained from the Scientific and Ethical Committee of AL- Karkh health director, Baghdad. Parental consent was obtained prior to inclusion, and confidentiality of patient information was strictly maintained throughout the study process.

3. Results

Table 1: Maternal Characteristics of the Study Population (n = 56)

Variable	Frequency (n)	Percentage (%)
Maternal Age (years)		
• < 20	10	17.9
• 20–34	32	57.1
• ≥ 35	14	25.0
Mode of Delivery		
• Vaginal	18	32.1
• Cesarean Section	38	67.9
Antenatal Steroid Use		
• Yes	22	39.3
• No	34	60.7
Gestational Diabetes		
• Yes	8	14.3
• No	48	85.7
Hypertension		
• Yes	12	21.4
• No	44	78.6
Premature Rupture of Membranes		
• Yes	16	28.6
• No	40	71.4

More than half of the mothers (57.1%) were between 20 and 34 years of age, which is considered the optimal reproductive age group. The majority of deliveries (67.9%) were conducted via cesarean section, indicating a high rate of operative delivery among preterm births with RDS. Antenatal steroid administration was reported in only 39.3% of cases, reflecting suboptimal usage of a known protective intervention. The incidence of gestational diabetes and hypertension among the mothers was 14.3% and 21.4%, respectively. Premature rupture of membranes occurred in nearly one-third of the pregnancies, highlighting a significant obstetric risk factor in this population.

Table 2: Neonatal Characteristics of Preterm Infants with RDS (n = 56)

Variable	Mean ± SD / n (%)
Gestational Age (weeks)	31.8 ± 2.4
Birth Weight (grams)	1,550 ± 420
Sex	
• Male	34 (60.7%)
• Female	22 (39.3%)
Apgar Score at 5 Minutes	6.4 ± 1.2

Need for Resuscitation	**20 (35.7%)**
Time of Symptom Onset	
• Within 1 Hour	**38 (67.9%)**
• 1–6 Hours	**18 (32.1%)**

The mean gestational age of the preterm infants was 31.8 weeks, and the average birth weight was 1,550 grams, consistent with moderate to late prematurity. Male neonates constituted the majority (60.7%), suggesting a possible male predisposition to RDS. The mean Apgar score at 5 minutes was 6.4, indicating moderate birth depression. Over one-third of neonates (35.7%) required resuscitation at birth, and the majority (67.9%) exhibited signs of respiratory distress within the first hour of life, underscoring the rapid onset and severity of RDS in this population.

Table 3: Clinical Interventions and Complications Among Preterm Infants with RDS

Clinical Parameter	Frequency (n)	Percentage (%)
Surfactant Therapy	**42**	**75.0**
Respiratory Support Type		
• CPAP	**28**	**50.0**
• Mechanical Ventilation	**20**	**35.7**
• Nasal Oxygen	**8**	**14.3**
Complications		
• Sepsis	**18**	**32.1**
• Pneumothorax	**6**	**10.7**

Most pre-term infants (75.0%) received surfactant therapy, which is a key treatment for RDS. CPAP was the most used mode of respiratory support, applied in 50% of cases, while 35.7% required mechanical ventilation, indicating severe respiratory compromise in a significant proportion. Complications such as sepsis (32.1%) and pneumothorax (10.7%) were notable and reflect the high vulnerability of preterm infants to infections and respiratory complications during intensive care.

Table 4: Outcomes of Preterm Infants with RDS (n = 56)

Outcome	Frequency (n)	Percentage (%)
Discharged Alive	**40**	**71.4**
Death	**16**	**28.6**
Average Length of NICU Stay (days)	**12.3 ± 4.7**	

The overall survival rate among preterm infants with RDS was 71.4%, while the mortality rate was 28.6%. The average NICU stay was approximately 12.3 days, reflecting the prolonged course of illness and recovery in this group.

Table 5: Relationship Between Selected Variables and Mortality Outcome

Variable	Survived (n = 40)	Died (n = 16)	p-value
Gestational Age (weeks)	**32.5 ± 2.0**	**30.2 ± 2.5**	**0.01**
Birth Weight (grams)	**1,650 ± 380**	**1,320 ± 400**	**0.02**
Antenatal Steroid Use	**20 (50%)**	**2 (12.5%)**	**0.003**
Mechanical Ventilation Required	**10 (25%)**	**10 (62.5%)**	**0.01**
Presence of Sepsis	**8 (20%)**	**10 (62.5%)**	**0.001**

Statistically significant differences were observed between survivors and non-survivors in terms of gestational age, birth weight, and exposure to antenatal steroids. Infants who died were significantly more premature and had lower birth weights. The need for mechanical ventilation and the presence of sepsis were also significantly associated with mortality.

4. Discussion

Most mothers were aged between 20 and 34 years, and the cesarean section was the predominant mode of delivery. While this aligns with global trends of increasing operative deliveries in high-risk pregnancies, it also reflects the urgent need for neonatal resuscitation and specialized care in such cases according to similar study in Nigeria (13). The use of antenatal corticosteroids, a well-established intervention to reduce the incidence and severity of RDS, was reported in only 39.3% of cases. This low rate of steroid administration may have contributed to the observed morbidity and mortality rates, and it highlights the need to enhance adherence to antenatal care protocols in preterm labor settings. This compatible with Iniyaval (Thevathasan) study (14).

Among the neonates, the mean gestational age was 31.8 weeks and the average birth weight was 1,550 grams, consistent with moderate to late preterm birth. Male infants represented a greater proportion of cases, which supports previous research indicating a higher susceptibility to RDS in males due to delayed pulmonary surfactant production. The early onset of respiratory distress, with nearly 68% of infants symptomatic within the first hour of life, reflects the acute and severe nature of RDS in this population This percentage was almost identical to YS Reshmi ;et al- 2017, who conducted a study for the same purpose. (15). A considerable proportion of infants required resuscitation at birth, further emphasizing the need for immediate and effective neonatal support in delivery rooms.

Therapeutically, the high rate of surfactant therapy (75.0%) and use of CPAP and mechanical ventilation indicates adequate access to and utilization of life-saving respiratory interventions. However, the relatively high incidence of complications, particularly sepsis (32.1%) and pneumothorax (10.7%), raises concern regarding the challenges in infection control and the potential adverse effects of aggressive respiratory support. These complications may have contributed to the observed mortality rate of 28.6%, which is higher than some international benchmarks but comparable to other resource-limited settings These findings are consistent with previous study which done by (Prodhan, P ;et al) about Acute Respiratory Failure (16).

The analysis of risk factors associated with mortality revealed statistically significant associations with lower gestational age, lower birth weight, absence of antenatal steroid use, need for mechanical ventilation, and presence of sepsis. These findings are consistent with previous studies and confirm the multifactorial nature of neonatal outcomes in RDS. Antenatal steroid use showed a strong protective effect, supporting global recommendations for its routine use in impending preterm deliveries (17).

5. Conclusion

This study highlights the critical role of early gestational age, low birth weight, antenatal steroid administration, and neonatal complications in determining outcomes in preterm infants with RDS. Efforts to improve antenatal care, especially the use of corticosteroids, and to strengthen infection control practices in NICUs may significantly enhance survival outcomes. Future research with larger multicenter cohorts and inclusion of long-term follow-up data is recommended to develop comprehensive strategies for improving the prognosis of preterm neonates with RDS.

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