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Original Research Article

An Observational Study on Prevalence, Risk Factors, Etiology and Immediate Outcomes of Respiratory Distress in Neonates

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Abstract:

Background: Neonatal respiratory distress (NRD) is a common cause of neonatal morbidity and mortality, particularly in preterm infants. Its prevalence, risk factors, etiology, and outcomes vary by gestational age, birth weight, and delivery mode, with limited region-specific data in Bihar, India.

Aim: To evaluate the prevalence, risk factors, etiology, and immediate outcomes of respiratory distress in neonates admitted to a tertiary care hospital in Bihar.

Methodology: A prospective observational study was conducted over seven months at Sri Krishna Medical College and Hospital, Muzaffarpur. Eighty-four inborn neonates presenting with respiratory distress within six hours of birth were enrolled. Maternal and neonatal data, clinical features, investigations, and immediate outcomes were recorded. Statistical analysis was performed using SPSS v25, with significance at $p<0.05$.

Results: Among 84 neonates, 59.5% were male, 52.4% were term, and 57.1% were delivered via LSCS. The most common etiologies were respiratory distress syndrome (33.3%), meconium aspiration syndrome (23.8%), and transient tachypnea of the newborn (14.3%). Mortality was 16.7%, highest in RDS (35.7%). Risk factors included LSCS delivery (57.1%), prematurity (47.6%), and low birth weight (45.2%). Antenatal steroid administration significantly improved survival in RDS cases (87.5% discharged vs 55% without steroids).

Conclusion: NRD is multifactorial with outcomes influenced by gestational age, etiology, and antenatal care. Early identification, preventive strategies, and timely management, including antenatal steroids, are essential to reduce morbidity and mortality.

Keywords: Neonatal respiratory distress, respiratory distress syndrome, meconium aspiration, prematurity, cesarean delivery, neonatal outcomes.

Introduction

Neonatal respiratory distress is one of the most frequent and severe disorders in neonatal intensive care units (NICUs) that leads to a significant number of neonatal morbidity and mortality across the globe. It typically contributes about 30-40 percent of admissions in NICU units and is especially more prevalent in the case of preterm infants [1,2]. The incidence of this condition is of particular concern in developing countries, where disparities in healthcare access, maternal health, and perinatal care affect incidence and outcomes. The prevalence of neonatal respiratory distress is widely varied in Asia, with reports of 0.9 to 60% depending on the populations of the studies, diagnostic criteria, and the healthcare infrastructure [3]. In the setting of Bihar, India, where neonatal healthcare issues remain a problem, it is necessary to comprehend the scale and the factors of respiratory distress to enhance the neonatal outcomes.

Respiratory distress is a clinical syndrome in neonates that is manifested by the inability to breathe an insufficient oxygenation. The Southeast Asia regional neonatal-perinatal database defines respiratory distress as either two or all of the following: respiratory rate exceeding 60 breaths per minute, subcostal or intercostal recessions, expiratory grunting or groaning [4]. Other clinical manifestations like flaring of nose, suprasternal retractions, and diminished air entry on chest examination further confirm

the diagnosis. In extreme cases, gasping, choking, stridor (indicative of obstruction of the upper airways), apnea, poor respiratory effort, bradycardia, poor perfusion, and cyanosis may be life-threatening and require immediate medical attention.

The etiology of neonatal respiratory distress is multifactorial and can be generally divided into pulmonary and non-pulmonary causes. Structural and functional abnormalities that cause pulmonary causes are choanal atresia, respiratory distress syndrome (RDS), meconium aspiration syndrome (MAS), pneumonia, transient tachypnea of the newborn (TTN), pneumothorax, tracheoesophageal fistula (TEF), persistent pulmonary hypertension of the newborn (PPHN), pulmonary hypo. These states directly affect the functioning of the lungs or the airways, causing a defect in gas exchange [5]. Non-pulmonary causes, on the other hand, include systemic and secondary causes, including congenital heart disease (CHD), neurological causes, which include asphyxia, cerebral edema, intracranial hemorrhage, and metabolic disturbances, such as hypothermia, hypoglycemia and metabolic acidosis. The other causes are maternal sedation, neonatal sepsis, anemia, polycythemia, hypothermia, and hyperthermia, which may negatively impact respiratory function [6].

There are a number of maternal and neonatal risk factors that predispose newborns to respiratory distress. Prematurity is still among the most important risk factors because of the immaturity of the lungs and the lack of sufficient production of surfactants. Low birth weight, below 2.5 kg, also makes them more vulnerable [7]. The increased risk has also been linked to maternal conditions like diabetes and abnormalities of the amniotic fluid volume, which include polyhydramnios and oligohydramnios. Cesarean section without prior labor, precipitated labor and intrauterine asphyxia are obstetric factors that lead to the occurrence of respiratory distress. Moreover, neonatal determinants, including second-twin birth, cold stress exposure, and gender (male) have been found to be significant determinants [8].

Neonatal respiratory distress has diverse outcomes based on the underlying cause, severity and the promptness of intervention. In-hospital mortality rates related to neonatal respiratory distress vary globally, ranging between 0.21 and 57.3, whereas in Asia the rates are 1.03-49.3, with a different prevalence in different regions and healthcare settings. Early diagnosis and proper treatment is thus very important in minimizing morbidity and mortality [9].

In spite of the progress in neonatal care, respiratory distress remains a major issue, especially in resource-constrained environments like Bihar, India. Regional specific data are required to have a better insight into the epidemiology, risk factors, and outcomes of this condition. This information is crucial in planning specific interventions, enhancing the services provided by neonatal care, and decreasing the rate of mortality among neonatal patients.

Thus, the current research will assess the incidence of respiratory distress in neonates, the risk factors, the underlying etiologies, and the immediate clinical outcomes in the study group. It is hoped that the results of this study will lead to better clinical practice and health outcomes of infants in Bihar, India.

Methodology

Study Design: This study was conducted as a prospective observational study aimed at assessing the prevalence, risk factors, etiology, and immediate outcomes of respiratory distress in neonates. The observational nature of the study allowed systematic data collection without any intervention, ensuring that the natural course and clinical profile of the condition were accurately documented.

Study Area: The study was carried out in the Department of Pediatrics at Sri Krishna Medical College and Hospital (SKMCH), Muzaffarpur, Bihar, India.

Study Duration: The study was conducted over a period of six months from March 2025 to August 2025.

Sample Size: A total of 84 neonates were included in the study. The sample size was determined based on the number of cases presenting during the study period and feasibility considerations within the available time frame.

Study Population: The study population comprised neonates born at Sri Krishna Medical College and Hospital who were admitted to the neonatal unit with clinical features suggestive of respiratory distress. These neonates were observed from the time of admission until their immediate outcome during the hospital stay.

Data Collection: Data were collected using a predesigned and pretested clinical proforma to ensure uniformity and completeness. Detailed maternal history including age, parity, antenatal complications, and mode of delivery was recorded. Neonatal parameters such as gestational age, birth weight, sex, and Apgar scores were documented. Clinical features of respiratory distress including tachypnea, nasal flaring, chest retractions, grunting, and cyanosis were noted. Relevant investigations such as chest radiographs and laboratory tests were performed when indicated to determine the underlying etiology. The causes of respiratory distress were classified into respiratory and non-respiratory categories, and immediate outcomes such as recovery, need for respiratory support, complications, or death were recorded.

Inclusion Criteria

- All inborn neonates delivered at SKMCH

- Neonates admitted with respiratory distress within 6 hours of birth
- Parental/guardian consent obtained

Exclusion Criteria

- Neonates whose parents/guardians did not give consent
- Outborn neonates
- Neonates referred to other hospitals before complete evaluation
- Neonates with onset of respiratory distress after 6 hours of birth

Procedure: All neonates meeting the inclusion criteria were enrolled consecutively until the desired sample size was reached. A thorough clinical evaluation was performed at admission, followed by appropriate investigations based on clinical judgment. The severity of respiratory distress was assessed clinically, and management was provided as per standard neonatal care guidelines. The neonates were closely monitored throughout their hospital stay, and relevant clinical findings along with outcomes were recorded systematically.

Statistical Analysis: The collected data were coded and entered into Microsoft Excel for organization and preliminary analysis. Statistical analysis was performed using SPSS software version 25. Descriptive statistics such as mean, standard deviation, frequencies, and percentages were used to summarize the data. Associations between categorical variables were analyzed using the Chi-square test or Fisher's exact test as appropriate. A p-value of less than 0.05 was considered statistically significant. The results were presented in the form of tables, bar diagrams, and pie charts for better interpretation."

Result

Table 1 presents the baseline characteristics of the study subjects (n=84). Of the neonates, 50 (59.5%) were male and 34 (40.5%) were female. Regarding gestational age, 22 (26.2%) were <34 weeks, 18 (21.4%) were 34–36+6 weeks, and 44 (52.4%) were ≥37 weeks. In terms of mode of delivery, 48 (57.1%) were delivered by LSCS, while 36 (42.9%) were delivered vaginally (NVD). This indicates a slight male predominance, a majority of term infants, and a higher proportion of cesarean deliveries in the study population.

Table 1: Baseline characteristics of study subjects (n=84)

Variable	Category	Number (n)	Percentage (%)
Gender	Male	50	59.5
	Female	34	40.5
Gestational age	<34 weeks	22	26.2
	34–36+6 weeks	18	21.4
	≥37 weeks	44	52.4
Mode of delivery	LSCS	48	57.1
	NVD	36	42.9
Total		**84**	**100**

Table 2 shows the distribution of etiological factors of respiratory distress according to gestational age among the study subjects (n=84). RDS was the most common cause (28 cases, 33.3%), predominantly seen in preterm neonates <34 weeks (16 cases), with fewer cases in later gestations. In contrast, MAS (20 cases, 23.8%) and birth asphyxia (10 cases, 11.9%) were more common in term babies (≥37 weeks), accounting for 15 and 8 cases respectively. TTN (12 cases, 14.3%) was fairly distributed but slightly higher in late preterm (5 cases) and term (5 cases) neonates. Pneumonia (5 cases) was mainly observed in term infants (4 cases), while PPHN, CHD, and other causes were exclusively or predominantly seen in term neonates. Overall, preterm births contributed largely to RDS, whereas term gestation was associated with MAS, birth asphyxia, and other causes of respiratory distress.

Table 2: Etiology of respiratory distress with gestational age distribution (n=84)

Cause of respiratory distress	<34 weeks	34–36+6 weeks	≥37 weeks	Total (n)	Percentage (%)
RDS	16	8	4	28	33.3
MAS	1	4	15	20	23.8
TTN	2	5	5	12	14.3
Birth asphyxia	1	1	8	10	11.9
Pneumonia	1	0	4	5	6
PPHN	0	0	3	3	3.6
CHD	1	0	2	3	3.6
Others	0	0	3	3	3.6
Total	**22**	**18**	**44**	**84**	**100**

Table 3 shows the distribution of etiology of respiratory distress according to mode of delivery among the study subjects (n=84). Among LSCS deliveries (n=48), the most common cause was RDS with 15 cases, followed by MAS (14 cases) and TTN (9 cases). In NVD cases (n=36), RDS was also the most common with 13 cases, followed by MAS (6 cases) and birth asphyxia (5 cases). TTN was more frequently observed in LSCS (9 cases) compared to NVD (3 cases). Pneumonia, PPHN, CHD, and other causes were relatively less common in both modes of delivery. Overall, LSCS deliveries accounted for a higher proportion of respiratory distress cases, particularly RDS, MAS, and TTN.

Table 3: Etiology according to mode of delivery (n=84)			
Cause of respiratory distress	**LSCS (n=48)**	**NVD (n=36)**	**Total**
RDS	15	13	28
MAS	14	6	20
TTN	9	3	12
Birth asphyxia	5	5	10
Pneumonia	2	3	5
PPHN	1	2	3
CHD	1	2	3
Others	1	2	3
Total	**48**	**36**	**84**

Table 4 shows the outcome according to different causes of respiratory distress among the study subjects (n=84). Respiratory Distress Syndrome (RDS) had the highest number of cases (28), with 18 discharged and 10 expired, contributing the maximum to overall mortality. Meconium Aspiration Syndrome (MAS) accounted for 20 cases, with 18 discharged and 2 expired. Transient Tachypnea of Newborn (TTN) had 12 cases, all of whom were discharged with no mortality. Birth asphyxia showed 10 cases with 8 discharges and 2 deaths, while pneumonia had 5 cases with 4 discharged and 1 expired. Persistent Pulmonary Hypertension of the Newborn (PPHN) and others showed no mortality, with all cases discharged (3 and 5 respectively). Congenital Heart Disease (CHD) had 3 cases, with 2 discharged and 1 expired. Overall, mortality was highest in RDS, while TTN, PPHN, and other causes had favorable outcomes with no deaths.

Table 4: Outcome according to different causes of respiratory distress (n=84)			
Causes of respiratory distress	**Discharged**	**Expired**	**Total**
RDS	18	10	28
MAS	18	2	20
TTN	12	0	12
Birth asphyxia	8	2	10
Pneumonia	4	1	5
PPHN	3	0	3
CHD	2	1	3
Others	5	0	5
Total	**70**	**14**	**84**

Table 5 shows the overall outcome of respiratory distress among the study subjects (n=84). A majority of the cases, 70 (83.3%), were discharged, while 14 cases (16.7%) resulted in mortality. This indicates that most subjects had a favorable outcome, with a relatively smaller proportion experiencing death.

Table 5: Overall outcome of respiratory distress in study subjects (n=84)		
Outcome	**Number (n)**	**Percentage (%)**
Discharged	70	83.3
Expired	14	16.7
Total	**84**	**100**

Table 6 presents the distribution of risk factors among the study subjects (n=84). The most common risk factor was LSCS delivery, observed in 48 cases (57.1%), followed by prematurity in 40 cases (47.6%) and low birth weight (<2.5 kg) in 38 cases (45.2%). PROM/PPROM was noted in 12 cases (14.3%), while maternal diabetes was the least common risk factor, seen in 10 cases (11.9%). This indicates that mode of delivery, prematurity, and low

birth weight were the predominant risk factors in the study population.

Table 6: Distribution of risk factors among study subjects (n=84)		
Risk factor	**Number (n)**	**Percentage (%)**
Prematurity	40	47.6
Low birth weight (<2.5 kg)	38	45.2
LSCS delivery	48	57.1
PROM/PPROM	12	14.3
Maternal diabetes	10	11.9

Table 7 shows the association of antenatal steroid administration with outcomes in neonates with RDS (n=28). Among the 8 cases who received steroids, 7 (87.5%) were discharged and only 1 (12.5%) expired. In contrast, among the 20 cases who did not receive steroids, 11 (55.0%) were discharged while a much higher proportion, 9 (45.0%), expired. This indicates that receipt of antenatal steroids is associated with a better survival outcome and lower mortality in RDS cases.

Table 7: Association of antenatal steroids with outcome in RDS (n=28)		
Outcome	**Steroids received (n=8)**	**Not received (n=20)**
Discharged	7 (87.5%)	11 (55.0%)
Expired	1 (12.5%)	9 (45.0%)

Discussion

In the current research of 84 neonates with respiratory distress, males were the majority, with 59.5 percent of the sample, and females were 40.5 percent. This male preponderance is consistent with the previous reports, including Behera et al. (2020) [10] who reported 62.4% male neonates, and Lamichhane et al. (2019) [11] where 60.36% of the affected neonates were male, which suggests a similar pattern across the populations. In terms of gestational age, 52.4% of the neonates in our study were term, 26.2% were preterm (<34 weeks) and 21.4% late preterm (3436+6 weeks). The prevalence of respiratory distress was significantly greater in preterm neonates, especially those below 34 weeks, which is consistent with the findings of several studies that found prematurity to be a major risk factor. Conversely, Behera et al. (2020) [10] and Raha et al. (2020) [12] studies showed more enrollment of term neonates, leading to a comparatively higher rate of term neonates presenting with respiratory distress, which is a difference in study populations and referral patterns."

Mode of delivery analysis showed that 57.1% of the neonates were delivered through LSCS and 42.9% through vaginal delivery. This can be compared to Lamichhane et al. (2019) [11], who found LSCS deliveries in 51.35% of cases, and Sahoo et al. (2015) [13], where 56% of the neonates with respiratory distress were delivered by cesarean section. Studies consistently suggest that LSCS is associated with a higher incidence of neonatal respiratory distress, possibly due to the absence of hormonal and physiological adaptations associated with labor, which facilitate lung fluid clearance (Rijal & Shrestha, 2018) [14].

The most frequent etiology in our cohort was respiratory distress syndrome (RDS), which was identified in 33.3% of cases, and was mostly common in preterm infants below 34 weeks. This is in line with the results of Baseer et al. (2020) [2], who found 49.6% of respiratory distress cases caused by RDS, and Tochie et al. (2016) [3], who found 35.83% in 58 studies in Asia. A slightly lower proportion was reported by Behera et al. (2020) [10] (32.4%), and Raha et al. (2020) [12] (29.1%), which is a reflection of regional differences in the prevalence of prematurity and NICU referral trends. The second most common cause was meconium aspiration syndrome (MAS) at 23.8% with term infants being the most affected as in other studies, including Baseer et al. (2020) [2] and Lamichhane et al. (2019) [11], which reported MAS in 26.5% and 25% of cases, respectively. The proportion of transient tachypnea of the newborn (TTN) was 14.3, which is similar to 13% reported by Lamichhane et al. (2019) [11]. Birth asphyxia was 11.9% which is a bit lower than Behera et al. (2020) [10] who found 14.5% but still indicates its continuing importance as a neonatal morbidity cause. Rare causes like pneumonia (6%), persistent pulmonary hypertension of the newborn (PPHN, 3.6%), and congenital heart disease (3.6%) were in line with those found in Tochie et al. (2016) [3] and Parkash et al. (2015) [15].

Regarding the results, 83.3% of the neonates were discharged successfully, and 16.7% died. The highest mortality was observed in RDS (10/28 cases), and TTN and PPHN had an excellent prognosis with no mortality cases. The mortality of MAS and birth asphyxia were moderate, which is consistent with other studies; Tochie et al. (2016) [3] reported the overall mortality of 20.29% in Asian cohorts, whereas Rijal and Shrestha (2018) [14] reported

12.8% mortality, which is also variable, probably because of gestational age distribution and The effectiveness of antenatal steroids in enhancing the outcomes of RDS was also clear, as 87.5% of steroid-treated newborns were discharged compared to 55% in the non-steroid group, which is consistent with the literature on the topic worldwide showing the effectiveness of steroids in promoting lung maturation and reducing mortality (Yarci & Canpolat, 2022) [16].

The assessment of risk factors showed prematurity in 47.6% of neonates and low birth weight in 45.2% which is consistent with prior research indicating that these factors are significant contributors of respiratory morbidity (Aynalem et al., 2020). There was also LSCS delivery (57.1%), PROM/PPROM (14.3%), and maternal diabetes (11.9%). The findings are consistent with the reports by Rijal and Shrestha (2018) [14] and Lamichhane et al. (2019) [11], which support the multifactorial etiology of neonatal respiratory distress and the significance of the antenatal and perinatal management strategies.

In general, our research supports the known epidemiological patterns of neonatal respiratory distress but also indicates the persistence of the effects of prematurity, cesarean delivery, and antenatal interventions. The comparison with regional and international data shows some similarities and differences, which underline the necessity of context-specific management protocols and preventive measures.

Conclusion

The present prospective observational study emphasizes the fact that respiratory distress in neonates is a multifactorial phenomenon that has strong correlations with prematurity, low birth weight, and operative delivery. The results show that the etiology is dependent on the gestational age, with respiratory distress syndrome being more prevalent in preterm babies, and meconium aspiration syndrome and birth asphyxia being more prevalent in term babies. The manner of delivery also affects the allocation of causes, with some conditions being more prevalent after cesarean operations. Although the overall result was generally positive with the majority of the neonates being discharged, a significant percentage of the neonates died, especially those with severe etiologies like respiratory distress syndrome and related complications. Moreover, the existence of antenatal risk factors and the positive effect of antenatal steroid use on the outcome of affected neonates highlight the significance of early diagnosis, preventive measures, and timely treatment to minimize morbidity and mortality.

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