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Causes, Risk Factors, and Clinical Outcomes of Respiratory Distress in Neonates Admitted to a Tertiary Hospital

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Abstract

Background: Respiratory distress is one of the leading causes of neonatal morbidity and mortality, especially in NICU settings. The condition arises from a variety of etiologies and is influenced by multiple maternal and neonatal risk factors. Early identification of causes and predictors of poor outcome is essential for effective neonatal care.

Aim: To determine the risk factors, causes, and hospital outcomes of respiratory distress among neonates admitted in a tertiary care neonatal intensive care unit.

Material and Methods: This prospective observational study included 98 neonates admitted with respiratory distress in the NICU. Data on maternal antenatal history, perinatal events, neonatal clinical features, and outcomes were collected. Statistical analysis was conducted to assess associations between risk factors and outcomes. Multivariate logistic regression was used to identify independent predictors of poor prognosis.

Results: Perinatal asphyxia was the most common cause (59.2%), followed by RDS (26.5%) and pneumonia (25.5%). Irregular antenatal care, delayed crying at birth, and immediate onset of

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respiratory distress were significantly associated with adverse outcomes (p<0.05). Severe respiratory distress emerged as an independent predictor of poor prognosis (adjusted OR: 35.09, p = 0.006). Most neonates had good outcomes with timely NICU intervention.

Conclusion: Perinatal asphyxia remains the predominant cause of neonatal respiratory distress. Irregular antenatal visits, immediate onset of distress, and delayed crying at birth are significant risk factors. Strengthening antenatal care and ensuring timely resuscitation and NICU support can improve neonatal outcomes significantly.

Keywords: Respiratory Distress, Neonates, Perinatal Asphyxia, Risk Factors, Neonatal Outcome

Introduction

Respiratory distress is one of the most common and life-threatening conditions encountered in the neonatal period, contributing significantly to neonatal morbidity and mortality worldwide. It is characterized by signs such as tachypnea, nasal flaring, intercostal or subcostal retractions, and grunting, indicating compromised pulmonary function requiring immediate medical attention [1]. Globally, it is estimated that up to 7% of all newborns may experience respiratory distress, and the incidence rises considerably in neonatal intensive care unit (NICU) settings, especially among preterm and low birth weight infants [2].

The causes of neonatal respiratory distress are multifactorial and vary according to gestational age, perinatal risk factors, and early neonatal care practices. In preterm neonates, respiratory distress syndrome (RDS), resulting from surfactant deficiency, is the predominant etiology [3]. In contrast, in term and late preterm neonates, conditions such as transient tachypnea of the newborn (TTN), meconium aspiration syndrome (MAS), pneumonia, and persistent pulmonary hypertension are more frequently implicated [4,5].

Identifying risk factors for respiratory distress is crucial for early diagnosis and management. Antenatal factors such as maternal diabetes, chorioamnionitis, premature rupture of membranes, and lack of antenatal steroid coverage play a significant role [6]. Perinatal risk factors include mode of delivery (particularly elective cesarean section), birth asphyxia, and inadequate neonatal resuscitation, all of which may predispose the neonate to respiratory compromise [7].

Timely recognition of the underlying cause is vital for optimal management and prognosis. With advances in neonatal care, including antenatal corticosteroid administration, surfactant therapy, and the availability of mechanical ventilation and continuous positive airway pressure (CPAP), the survival of neonates with respiratory distress has significantly improved, especially in tertiary care settings [8]. However, the outcome is still influenced by the severity of illness, gestational age, birth weight, and presence of comorbidities such as sepsis or congenital anomalies [9].

In resource-limited settings, delayed diagnosis and inadequate management often worsen outcomes, highlighting the need for local epidemiological data to inform and guide NICU protocols. Moreover, understanding the risk factors and causes in a specific healthcare setting can help in developing targeted preventive and therapeutic strategies to reduce neonatal mortality and long-term complications [10].

This study is therefore undertaken to determine the **risk factors**, **etiologies**, and **hospital outcomes** of respiratory distress among neonates admitted in the NICU of a tertiary care hospital, aiming to improve the early identification and management of this critical neonatal emergency.

Material and Methods

A prospective observational study was conducted in the Neonatal Intensive Care Unit (NICU) of a tertiary care hospital over a period of one year. A total of **98 neonates** who developed respiratory

distress and required NICU admission were enrolled after obtaining informed consent from the parents or legal guardians.

Inclusion Criteria

- Neonates admitted to the NICU with clinical signs of respiratory distress (tachypnea, nasal flaring, intercostal or subcostal retractions, and/or grunting)
- Neonates within the first 28 days of life
- Both term and preterm infants

Exclusion Criteria

- Neonates with major congenital anomalies incompatible with life
- Babies referred from other hospitals after more than 48 hours of birth
- Neonates with incomplete clinical data or parental refusal to participate

Data Collection

Detailed demographic and clinical data were collected using a pre-designed structured proforma. The information included:

- **Maternal history:** age, antenatal complications, mode of delivery, use of antenatal corticosteroids, and presence of risk factors like chorioamnionitis or prolonged rupture of membranes
- **Neonatal details:** gestational age, birth weight, Apgar scores, need for resuscitation, and clinical presentation
- **Diagnosis and cause** of respiratory distress: based on clinical features, chest X-ray, arterial blood gases, and relevant laboratory tests

- **Hospital outcome:** including duration of NICU stay, need for respiratory support (oxygen, CPAP, mechanical ventilation), complications, and survival

Statistical Analysis

Data were compiled using Microsoft Excel and analyzed using SPSS software (version XX). Categorical variables were expressed as frequencies and percentages, while continuous variables were presented as mean ± standard deviation. Chi-square test was used to assess associations between categorical variables, and independent *t*-test or ANOVA was used for comparing continuous variables. A p-value <0.05 was considered statistically significant.

Ethical Consideration

The study protocol was approved by the Institutional Ethics Committee. Written informed consent was obtained from the parents or legal guardians of all participating neonates. Strict confidentiality and data privacy were maintained throughout the study.

Results

Table 1 presents the distribution of causes of respiratory distress among the 98 neonates included in the study. The most common cause was perinatal asphyxia (PNA), observed in 59.2% of the cases, followed by respiratory distress syndrome (RDS) in 26.5%, and pneumonia in 25.5%. Other notable causes included transient tachypnoea of the newborn (19.4%), sepsis (15.3%), congenital heart disease (10.2%), and meconium aspiration syndrome (9.2%). Less frequently observed causes were COVID-19-related pneumonitis and congenital diaphragmatic hernia, each constituting 1.0% of cases.

Table 2 explores the association between the causes of respiratory distress and hospital outcomes. Among neonates with PNA, 84.5% had a good outcome, while 15.5% experienced poor outcomes.

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RDS and TTN were associated with better outcomes, with 92.3% and 94.7% respectively showing recovery. In contrast, sepsis showed a higher proportion of poor outcomes (26.7%). Notably, all neonates with CHD, MAS, COVID-19, and CDH had favorable outcomes. However, the association between etiology and outcome was not statistically significant (p>0.05 for all).

Table 3 examines various maternal and neonatal risk factors in relation to clinical outcomes. Neonates born to mothers with irregular antenatal visits had a significantly higher rate of poor outcomes (39.1%, p = 0.001) compared to those with regular care. Other significant associations included delayed crying at birth, where poor outcomes were more frequent (22.2%, p = 0.033), and need for resuscitation, where all resuscitated neonates had good outcomes (p = 0.001). Additionally, onset of respiratory distress immediately after birth was associated with poorer prognosis compared to distress developing later (p = 0.005). Factors like PROM, meconium-stained liquor, antenatal steroid use, and gender did not show statistically significant impact on outcome.

Table 4 summarizes the results of the multivariate logistic regression analysis for predicting poor outcomes. Among all significant factors, severe respiratory distress emerged as an independent predictor with an adjusted odds ratio (OR) of 35.09 (p = 0.006). While irregular antenatal visits and onset of respiratory distress showed borderline associations, delayed crying and the need for resuscitation were not statistically significant predictors in the multivariate model.

Table 1: Causes of Respiratory Distress in Studied Neonates (N = 98)

Causes of Respiratory Distress	N	Percentage (%)
Perinatal Asphyxia (PNA)	**58**	**59.2%**
Respiratory Distress Syndrome (RDS)	**26**	**26.5%**

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Pneumonia	**25**	**25.5%**
Sepsis	**15**	**15.3%**
Transient Tachypnoea of the Newborn (TTN)	**19**	**19.4%**
Congenital Heart Disease (CHD)	**10**	**10.2%**
Meconium Aspiration Syndrome (MAS)	**9**	**9.2%**
COVID-19 Related Pneumonitis	**1**	**1.0%**
Congenital Diaphragmatic Hernia (CDH)	**1**	**1.0%**

Table 2: Association of Causes and Outcome of Neonates with Respiratory Distress (N = 98)

Causes of RD	Total	Good outcome	% Good	Poor outcome	% Poor	P value
PNA	**58**	**49**	**84.5%**	**9**	**15.5%**	**0.960 (ns)**
RDS	**26**	**24**	**92.3%**	**2**	**7.7%**	**0.383 (ns)**
Pneumonia	**25**	**21**	**84.0%**	**4**	**16.0%**	**0.955 (ns)**
Sepsis	**15**	**11**	**73.3%**	**4**	**26.7%**	**0.315 (ns)**
TTN	**19**	**18**	**94.7%**	**1**	**5.3%**	**0.297 (ns)**
CHD	**10**	**10**	**100.0%**	**0**	**0.0%**	**0.203 (ns)**
MAS	**9**	**9**	**100.0%**	**0**	**0.0%**	**0.267 (ns)**
COVID-19	**1**	**1**	**100.0%**	**0**	**0.0%**	**0.667 (ns)**
CDH	**1**	**1**	**100.0%**	**0**	**0.0%**	**0.667 (ns)**

Table 3: Risk Factors and Outcome of Neonates with Respiratory Distress (N = 98)

Parameters	Total	Good	% Good	Poor	% Poor	P value

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Irregular antenatal visit	**23**	**14**	**60.9%**	**9**	**39.1%**	**0.001**
Regular antenatal visit	**75**	**69**	**92.0%**	**6**	**8.0%**	**0.001**
Antepartum hemorrhage (Yes)	**20**	**16**	**80.0%**	**4**	**20.0%**	**0.703**
PROM (Yes)	**14**	**14**	**100.0%**	**0**	**0.0%**	**0.127**
Antenatal steroids (No)	**85**	**71**	**83.5%**	**14**	**16.5%**	**0.613**
Meconium-stained liquor (Yes)	**9**	**9**	**100.0%**	**0**	**0.0%**	**0.127**
Delayed crying (No)	**54**	**42**	**77.8%**	**12**	**22.2%**	**0.033**
Resuscitation needed	**44**	**44**	**100.0%**	**0**	**0.0%**	**0.001**
RD immediate after birth	**34**	**23**	**67.6%**	**11**	**32.4%**	**0.005**

Table 4: Multivariate Logistic Regression for Poor Outcome

Prognostic Factor	Adjusted OR	P value	95% CI (Lower)	Upper
Irregular antenatal visit	**0.069**	**0.069**	**0.85**	**70.09**
Delayed crying	**3.18**	**0.339**	**0.29**	**34.16**
Need of resuscitation	**0.00**	**0.998**	**–**	**–**
Onset of RD	**0.044**	**0.055**	**0.002**	**1.06**
Severe RD	**35.09**	**0.006**	**2.82**	**97.70**

Discussion

This study aimed to evaluate the risk factors, causes, and outcomes of respiratory distress among neonates admitted to a tertiary care NICU. The findings highlight that perinatal asphyxia (PNA)

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was the most prevalent cause, followed by RDS, pneumonia, and TTN, aligning with previous literature from similar resource-limited settings [11].

RDS remains a predominant cause of respiratory distress in preterm neonates due to immature lungs and surfactant deficiency [12]. However, our data indicated that neonates with RDS had a relatively favorable outcome, likely due to timely intervention with supportive ventilation and oxygen therapy. On the other hand, sepsis, although less frequent, showed a higher proportion of poor outcomes, emphasizing its lethal potential when complicating neonatal respiratory distress [13].

The significant association between irregular antenatal care and adverse neonatal outcomes in our study reaffirms the importance of routine maternal monitoring to detect complications such as preeclampsia, infections, or premature labor. Lack of prenatal steroids, inadequate management of antepartum hemorrhage, and unprepared deliveries may contribute to poor neonatal respiratory adaptation at birth [14].

Immediate onset of respiratory distress and delayed crying were also significantly associated with poor outcomes, likely reflective of underlying asphyxia or perinatal compromise. Notably, the need for resuscitation was associated with better outcomes in our cohort, possibly due to the availability of skilled birth attendants and NICU interventions. This contradicts traditional understanding but aligns with emerging evidence showing that prompt neonatal resuscitation significantly improves survival, even in severely compromised neonates [15].

Multivariate analysis revealed that severe respiratory distress was the most critical predictor of poor outcome, while delayed crying and irregular antenatal visits, though impactful, were not

independently significant. This highlights the necessity for early detection, prompt intervention, and NICU preparedness in high-risk deliveries.

Conclusion

Respiratory distress in neonates continues to be a major cause of NICU admissions and mortality, with perinatal asphyxia being the most common etiology in this study. Risk factors such as irregular antenatal visits, delayed crying at birth, and immediate onset of distress significantly affected outcomes. While supportive NICU care led to favorable outcomes in many cases, severe respiratory distress remained the strongest predictor of poor prognosis. Strengthening antenatal care, improving delivery practices, and ensuring timely neonatal resuscitation can significantly reduce the burden and improve survival outcomes in affected neonates.

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