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Original Research Article

Study on etiology, risk factors, severity and outcome of newborns presenting with respiratory distress in neonatal intensive care unit

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ABSTRACT

Background: Respiratory distress (RD) is one of the frequent complications in neonates within 24 hours of delivery. Early recognition and treatment are important to prevent morbidity and mortality. The aim of the study was to assess the etiology, risk factors and outcome of neonates with RD.
Methods: This was a prospective study conducted on 75 newborns admitted to neonatal intensive care unit (NICU) of tertiary healthcare center. The severity of the RD was assessed using Silverman-Anderson (SA) and Downes scoring clinical scoring and the final outcome of neonates were evaluated.
Results: The incidence of RD was higher in male newborns (69.3%), caesarian section delivery (68%) and the onset of RD was 24 hours in 74.7% of the neonates. SA and Downe's scoring showed moderate severity in 61.3% of the neonates. The major etiology was transient tachypnea of newborn (TTN) and RD syndrome (RDS) in 40% and 24% of the neonates respectively. The preferred treatment modality was oxygen support in 58.7% and mortality rate in this study was 4%.
Conclusions: The common etiology of RD was TTN and the important risk factors include male gender, caesarian section delivery and preterm delivery.

Keywords: RD, Neonates, Caesarean section delivery, TTN, SA score, Oxygen support

INTRODUCTION

Neonatal respiratory distress syndrome (RDS) is a RD condition in newborn which occurs immediately after delivery or within few hours after birth. Preterm infants are more vulnerable to RDS, as compared to term infants.[1] NICU hospitalization is often necessary for newborns experiencing RD.[2] Approximately 15% of full-term infants and 29% of preterm infants experience respiratory complications during NICU and the incidence is more in infants delivered before 34 weeks of gestation.[3] Previous reports showed an incidence rate of 2.42% for neonates who had developed RDS.[4] RD is neonates is mainly due to decreased production of surfactants or inactivation of surfactant as a result of immature lungs.[5]

The major risk for neonatal RD in developing countries includes premature babies, low Apgar scores at 1 and 5 minutes, meconium stained liquor, caesarean delivery, preeclampsia, gestational diabetes, premature delivery, oligohydramnios and structural anomalies in lungs.[6] The other factors includes transient tachypnoea of the newborn (TTN), neonatal sepsis, pneumonia, hyaline membrane disease and persistent pulmonary hypertension of the newborn.[7] The other causes of ND include metabolic disturbances like hyperthermia, hypothermia, low blood glucose, cardiac anomalies, metabolic anomalies and inborn errors of metabolism. [8]

Downes` score (DS) and SA score are the routinely used tools for the accurate and rampant diagnosis and also to assess the severity of RD. These tools are also helpful in the management and also in decision making including

mechanical ventilation. DS is employed in the assessment of both term and preterm babies, whilst SA score is used in the assessment of preterm babies.[9,10]

Management strategies like antenatal corticosteroids, surfactants and advanced respiratory support have improved the outcome in RD neonates but still the morbidity and mortality due to RD is still on rise.[2] Ventilators have enhanced the RD outcome in neonates. In earlier stage, the therapy was to deliver high concentration of oxygen. But the novel therapies aimed to mitigate the physiological abnormalities of immature lungs and thus prevent adverse effect of oxygen and positive pressure ventilator support.[11] The purpose of this study was to evaluate the different risk variables linked to the occurrence of severe RD in newborns, as well as to evaluate the immediate clinical consequences of RD in newborns..

METHODS

This was a prospective study of 75 newborns admitted to NICU with RD in department of pediatrics, Al Ameen medical college, Vijayapura, and Karnataka, India for a period of one year from March 2023 to March 2024.

Inclusion criteria

Neonates admitted to the NICU of department of pediatrics, Al Ameen medical college, Vijayapura, and Karnataka, within 72 hours of birth due to RD.

Exclusion criteria

Neonates in NICU after 72 hours of RD and newborn admitted to NICU delivered at other hospital were excluded from the study.

Method of collection of data

Information was gathered for every newborn that was part of the trial and had RD. Documentation was made regarding general information, socioeconomic level, historical background, and clinical examination findings of both the mother and the newborn. Infants experiencing difficulty breathing were sent to the NICU for additional treatment and care. The time at which the distress began was recorded, and the intensity of the distress was measured and evaluated using Downe's clinical rating system. Serial radiographs were performed at one hour and six hours of age on all neonates and were evaluated by the radiologist for any abnormal findings. Appropriate examinations were conducted and neonates were handled according to the procedure based on a clinical diagnosis of RD. The study recorded the length of time O_2 therapy was administered, as well as the specific interventions used such as surgical procedures, ventilator support, surfactant therapy, or other treatments. The primary focus was to evaluate the clinical result in relation to the final diagnosis, including mortality rates.

Statistical analysis

Descriptive analysis was used. The data were shown as frequency and percentage. Chi square test was used to study the association between the variables. A $p<0.05$ was found to be significant. SPSS version 24 was used for the analysis.

RESULTS

The demographic and clinical characteristic of the neonates were shown in Table 1. The incidence of RD was higher in male babies (69.3%) and babies delivered through caesarean section (68%). Majority of the babies were born to full term mothers (56%) and the major symptoms was tachypnoea (94.6%). The onset of RD was 24 hours in 74.7% of the neonates.

Table 1: Demographics and clinical characteristic of neonates.

Variables	N (%)
Gender	
Male	52 (69.3)
Female	23 (30.7)
Gestational age	
Full term	42 (56)
Pre-term	33 (44)
Mode of delivery	
Lower segment caesarean section	51 (68)
Vaginal delivery	24 (32)
Symptoms	
Tachypnoea (>60/min)	71 (94.6)
Nasal flaring	65 (86.6)
Subcostal and intercostals retractions	62 (82.6)
Grunting	60 (80)
Cyanosis	68 (90.6)
Onset of RD	
24 hours	56 (74.7)
48 hours	14 (18.7)
72 hours	5 (6.6)

The severity of RD based on SA and Downe's scoring was shown in Table 2. In this the RD severity was moderate in majority of the neonates encompassing 61.3%, mild in 32% and severe in 6.7% respectively.

Table 2: Severity of RD based on SA and Downe's scoring.

RD severity	SA score	Downes score	N (%)
Mild	<3	<3	24 (32)
Moderate	3-7	3-6	46 (61.3)
Severe	>7	>6	5 (6.7)

The etiological cause of RD was shown in Table 3. In our study the major cause of RD in neonates is due to TTN in 40% followed by RDS (24%) and neonatal sepsis

(13.3%). The meconium aspiration syndrome (MAS) was found in 9.3% of neonates.

Table 3: Etiological causes of RD in neonates.

Etiological causes	N (%)
TTN	30 (40)
RDS	18 (24)
Neonatal sepsis	10 (13.3)
MAS	7 (9.3)
Birth asphyxia	4 (5.3)
Acyanotic congenital heart disease	2 (2.7)
Congenital diaphragmatic hernia	2 (2.7)
Congenital pneumonia	1 (1.3)
Pneumothorax	1 (1.3)

Risk factors for neonatal RD (Table 4). Most common risk factor for RD gestational diabetes mellitus (GDM) in 33.3% of neonates followed by preeclampsia 25.3% and premature rupture of membranes (PROM) 20%.

Treatment pattern of RD neonates was shown in Table 5. Majority of neonates were oxygen support 44 (58.7%), mechanical ventilation 22 (29.3%) and continuous positive air pressure (CPAP) in 9 (12%) respectively.

Table 4: Risk factors for neonatal RD in the present study.

Risk factors	N (%)
GDM	25 (33.3)
Preeclampsia	19 (25.3)
PROM	15 (20)
Meconium-stained liquor	8 (10.7)
Antepartum hemorrhage	3 (4)
Maternal pyrexia	3 (4)
Obstructed labor	2 (2.7)

Table 5: Treatment modality among the RD neonates.

Treatment modality	N (%)
Oxygen support	44 (58.7)
Mechanical ventilation	22 (29.3)
CPAP	9 (12)

The final outcome in the present study was shown in Table 6. The mortality rate among the RD neonates was found to be 4%. The mortality was observed only in neonatal sepsis (2 neonates, 2.7%) and RDS (1 neonate, 1.3%) respectively.

Table 6: Etiological causes.

Etiological causes	N (%)	Discharge N (%)	Mortality N (%)
TTN	30 (40)	30 (40)	
RDS	18 (24)	17 (22.7)	1 (1.3)
Neonatal sepsis	10 (13.3)	8 (10.7)	2 (2.7)
MAS	7 (9.3)	7 (9.3)	0
Birth asphyxia	4 (5.3)	4 (5.3)	0
Acyanotic congenital heart disease	2 (2.7)	2 (2.7)	0
Congenital diaphragmatic hernia	2 (2.7)	2 (2.7)	0
Congenital pneumonia	1 (1.3)	1 (1.3)	0
Pneumothorax	1 (1.3)	1 (1.3)	0

DISCUSSION

RD in newborn causes increased workload in breathing and it is characterized by tachypnoea, grunting, retractions of chest with decreased air entry and cyanosis. RD is a common event during neonatal period and incidence rate are as follows in term (5%), late preterm (15%) and 30% in neonates born at gestation <34 weeks.[12]

In the present study the incidence of RD was higher in males encompassing 69.3%. A previous cohort study encompassing 500,000 preterm newborn infants showed increased incidence of RD in males as compared to females with an odds ratio of 1.22 to 1.38 and it was significant.[13] The reason for higher incidence in males is due to the fact, male sex hormone (androgen) regulates the signalling mechanism of epidermal growth factor and transforming growth factor-beta, and thus hampers the fetal lung development and maturation. In addition, it inhibits the release of fibroblast-pneumocyte factor leading to delay in the formation of type II alveolar cells, and thus reduces the formation of pulmonary surfactant. Meanwhile, female hormone estrogen enhance the secretion of pulmonary surfactants and enhances the population of type II alveolar cells by promoting the lamellar bodies production.[14]

In our study, the incidence of RDS was higher in neonates delivered through caesarean section with rate of 68%. In a study done by Ahmed et al among the RD neonates 87.16% were delivered through caesarean section which was higher when to the current study.[15] Caesarean section is one of the important risk factors for the development of RD, since during vaginal delivery fetus utilizes one-third of the fetal lung fluid. But in the

case of caesarean delivery the fetal lung fluid is not properly absorbed leading to RD. Further, during labor period it activates the production of surfactant and in caesarean delivery this process is not achieved.[16]

The onset of RD in the present study is within 24 hours after delivery in most of the cases, 74.7%. Similar to our report, in a study done by Barkiya et al the onset of RD was 24 hours in 80% of the babies.[17]

The severity of RDS was evaluated using the Silverman and Downes rating scores. In the present study based on these scores, majority of the neonates, 61.3% were in the moderate severity. Similarly in Loor et al study Silverman score showed moderate severity in 39.1% of the neonates, whilst Downes score showed mild RD severity in 50% of the neonates.[18]

In the present the major etiological cause of RD is TTN in 40% of the neonates. TTN is the most frequent cause of RD in neonates irrespective of the gestational age and it occurs when there is delay in pulmonary fluid resorption after birth.[19] TTN is also referred as wet syndrome and elective caesarean section is also associated with the increased incidence of TTN.[20] In a study done by Barkiya et al the next major etiology in the present study was RDS in 24% the neonates.[17] Likewise, in Mishra et al study the second most common cause of RD in RDS in 27 % of the neonates.[21]

Regarding treatment modality majority of the neonates (58.7%) managed with oxygen support. Oxygen blending refers to the process of combining oxygen with another gas or mixture in order to achieve a desired oxygen concentration. Supplemental oxygen is an essential therapy method for RDS, whether administered via nasal cannula, continuous positive airway pressure (CPAP), or mechanical ventilation. Adjusting the proportion of inspired oxygen through titration to attain pulse oximetry saturation levels (90-95%) offers the best balance between the therapeutic advantages of oxygen and the potential harm of oxygen toxicity.[22]

In our study the mortality rate is 4% which includes 3 neonates and among these 2 cases are due to neonatal sepsis and 1 case for RDS. Similarly in a study done by Ali the incidence of mortality in RD neonates was due infections and RDS encompassing 7% and 5.74% respectively.[23]

CONCLUSION

Transient tachypnoea of new-born is the most common etiology for RD and neonatal sepsis accounts for mortality in the present study. The neonates well responded to oxygen therapy and early intervention is important to prevent mortality.

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