Original Article

Outcome of Neonates with Respiratory Distress in a Tertiary Center NICU of Bangladesh: A Prospective Study

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ABSTRACT

Background

Respiratory distress in neonatal period is of diverse etiology and require timely diagnosis and treatment for a good outcome. This study was aimed to determine the outcome of neonates having respiratory distress admitted in the NICU of a tertiary care hospital.

Methods

This prospective study was conducted in the neonatal intensive care unit of Dr. M R Khan Shishu Hospital & ICH, from July 2021 to June 2022. Neonates presented with signs of respiratory distress were enrolled in the study. History, examination and investigations were performed to find out various etiologies. Neonates were managed accordingly and were followed up to hospital stay. Primary outcome was measured in terms of discharge and death, and secondary outcomes were pattern of respiratory supports required. Data was analyzed using SPSS 20.

Results

Among 1225 admitted newborns, 720 (59%) had respiratory distress. Mean gestational age was 37.54 ± 2.1 weeks and mean birth weight was 2692.96 ± 651 g. Common causes of respiratory distress were sepsis (35.4%) and perinatal asphyxia (27%) followed by transient tachypnea of newborn (11.4%). Most of the babies required only nasal oxygen support (72%) and 15% were treated with CPAP and 8% got mechanical ventilator. Mortality rate was 2.5% and congenital pneumonia was significantly associated with neonatal death (p=0.02).

Conclusion

The common causes for respiratory distress were sepsis, asphyxia, TTNB, RDS, MAS and congenital pneumonia. Congenital pneumonia was significantly associated with mortality.

Keywords

Neonate; cause; outcome; respiratory distress; Bangladesh.

INTRODUCTION

Neonatal period is one of the most delicate periods of a human life. All systems of the body undergo important physiological changes at the time of delivery.[1] There is also a risk of acquiring potential life-threatening diseases.[2]

Respiratory diseases are the leading cause of neonatal morbidity and mortality worldwide especially in developing countries.[3] It is also the most frequent indication for admission

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Bangladesh Journal of Medical Science Vol. 23 No. 03 July'24

DOI: https://doi.org/10.3329/bjms.v23i3.75114

to the neonatal intensive care units. Around 15% of term infants and 29% of late preterm infants require admission to the Neonatal Intensive Care Unit (NICU) for respiratory morbidity. The percentage is higher for infants born at or less than 34 weeks of gestation.[4] A study reported that, 33.3% of all neonatal admissions are due to respiratory morbidities.[5] Furthermore, neonates with respiratory distress have 2–4 times higher mortality than neonates without respiratory distress.[6]

Neonatal respiratory conditions may arise from various reasons such as delayed adaptation or maladaptation to extra-uterine life, Transient Tachypnea of Newborn (TTNB), Respiratory Distress Syndrome (RDS), Meconium Aspiration Syndrome (MAS), existing conditions such as surgical or congenital anomalies or from acquired conditions such as sepsis.[7] Neonatal respiratory distress is characterized by one or more of the signs including: fast breathing (respiratory rate 60 or more), chest indrawing, nasal flaring and grunting.[8]

Certain risk factors increase the risk of respiratory illnesses in newborns such as prematurity, meconium aspiration, caesarian section, maternal diabetes and maternal chorioamnionitis. Whatever may be the underlying cause, when a newborn presents with respiratory distress, quick assessment and timely initiation of treatment can save lives. Similarly, delay in treatment can lead to respiratory failure and increased mortality.[8]

Oxygen is an essential drug for managing hypoxemia. It is also important for adequate cellular functioning of the body.[9] For providing oxygen, different respiratory devices are being used in the neonatal intensive care units. Both noninvasive and invasive methods of respiratory support are the cornerstone of treatment for neonates presenting with respiratory distress. In recent years, there has been a tremendous advancement in the use of various non-invasive respiratory devices in the neonatal intensive care units of developing countries such as Continuous Positive Airway Pressure (CPAP). Conventional mechanical ventilation, High frequency oscillatory ventilation, are less commonly used. Timely use of these, can also improve the outcome of patients. But there is limited scientific work regarding this from Bangladesh. So, this study was focused to identify different causes of respiratory distress in neonates and outcome of those neonates in a tertiary level NICU having out born facility. This will surely act as a reference for similar kind of neonatal units of the country. The study also aimed to observe the use of various respiratory supports used in them. This will help to compare the findings with those of other developing countries in future.

MATERIAL AND METHODS

This prospective study was done at the Neonatal Intensive Care Unit (NICU) of Dr. M R Khan Shishu (Children) Hospital from July 2021 to June 2022. This is one of the busiest pediatric hospitals in Dhaka city. The NICU is 30 bedded with annual admission being 1700-1800. After ethical approval (Ref no: ICH-SSF/ERC/2012-2014/21-22), all preterm and full-term neonates of either sex, who were admitted with respiratory distress, were included in the study. Neonates with respiratory distress, who were syndromic, had multiple congenital malformations, congenital heart diseases were excluded from the study. Respiratory distress was defined when neonate had one or more signs of increased of work of breathing such as tachypnea (respiratory rate 60/minute or more), nasal flaring, chest retractions or grunting.[10-11]

Maternal history such as diabetes, pre-eclampsia, infection was looked for as per predesigned proforma. Neonatal variables such as mode of delivery (vaginal or caesarian), gestational age, birth weight and gender were documented. Causes of respiratory distress were diagnosed based on history, clinical examination, radiological and laboratory findings. TTN was diagnosed in term or late preterm neonates who had respiratory difficulty soon after birth and had chest X-ray features of hyperinflation or prominent perihilar marking. Any preterm neonate who presented with respiratory distress within first six hours of life and had characteristic chest Xray finding: presence of air bronchogram, reticulo-granular pattern or ground glass opacity were labelled as RDS. A term or post term neonate who was meconium stained or had history of meconium aspiration with coarse, fluffy densities or patchy infiltrates in chest Xray was diagnosed as Meconium aspiration syndrome. Congenital pneumonia was identified when respiratory distress was evident soon after birth with patchy opacity in chest X-ray and significant risk factor was found. Neonates having history of delayed cry requiring resuscitation were labelled as perinatal asphyxia. Neonates having respiratory distress along with lethargy or poor feeding at any age during neonatal period with associated risk factors for sepsis and/or X-ray finding of patchy opacities were marked as sepsis.

Babies were managed according to the unit protocol. Data regarding mode of respiratory support and duration of oxygen therapy were documented. Primary outcome was measured in terms of discharge or death and secondary outcome was observed about the pattern of respiratory support used. All data were collected in a pre-structured questionnaire.

Data analysis: Data were analyzed using the Statistical Package for Social Sciences (SPSS) version 20. Quantitative data were expressed as the mean ± standard deviation and categorical data were presented as frequency. Fisher Exact test and Chi-square test were performed to compare the categorical variables where indicated. P value < 0.05 was considered as significant.

RESULTS

During the study period, a total of 1225 neonates were admitted in the NICU and out of them 720 (59%) had respiratory distress who required oxygen support as shown in figure-1.

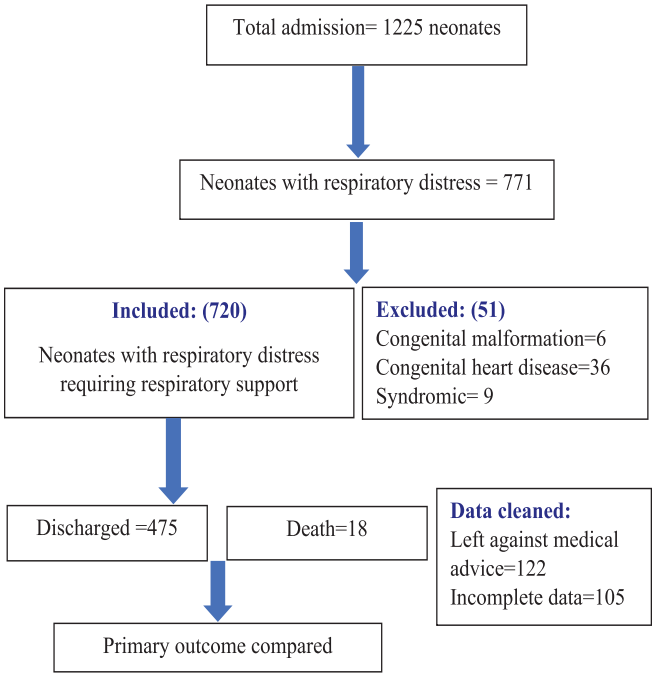

Figure-1: Study flow chart

Mean gestational age was 37.54 ± 2.1 weeks and mean birth weight was 2692.96 ± 651 g. Most of them were delivered by Lower segment caesarian section (LSCS) as shown in table 1.

Table-1: Baseline characteristics of the study participants

Neonatal baseline variables	Number (n=720)	Frequency (%)
Mean Gestational age (weeks)	37.54 ± 2.1	
Gestational age category		
Pre-term (born before 37 completed weeks)	182	25.3
Term (born at 37-42 completed weeks)	536	74.4
Post-term (born after 42 completed weeks)	2	0.3
Mean birth weight (g), mean±SD	2692.96 ± 651	
Sex		
Male	403	56
Female	317	44
Mode of delivery		
Normal Vaginal Delivery (NVD)	273	37.9
Lower Segment Caesarian Section (LSCS)	441	61.3
History of delayed cry	349	48.5
Mean duration of oxygen therapy (days)	3.28 ± 2.63	
Mean hospital stay (days)	7.87 ± 5.19	

*Data were expressed in frequency for categorical data, mean ±SD for quantitative data

Table-2: Causes of respiratory distress among the studied population

Cause of Respiratory distress	Number (n=720)	Frequency (%)
Respiratory Distress Syndrome (RDS)	72	10
Transient Tachypnea of Newborn (TTNB)	82	11.4
Congenital pneumonia	55	7.6
Meconium Aspiration Syndrome (MAS)	61	8.5
Perinatal asphyxia (PNA)	195	**27**
Neonatal sepsis	255	**35.4**

*Data were expressed in frequency

Table 2 showed that neonatal sepsis was the predominant

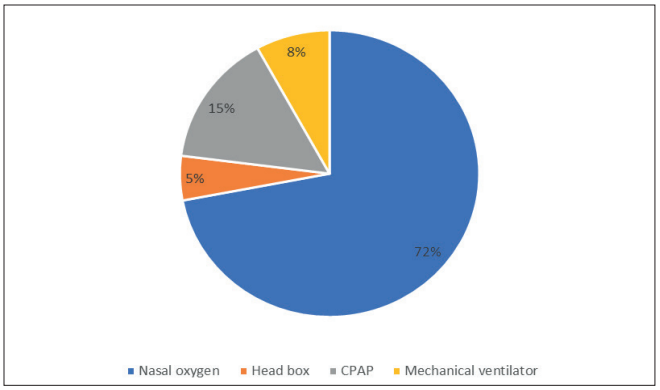

Figure- 2: Types of respiratory support required among study population (n=720)

cause of respiratory distress among the studied population followed by perinatal asphyxia, TTNB and RDS. Among them 72% required nasal oxygen and 15% required CPAP. Eight percent patients were put into mechanical ventilator (Figure 2).

In Table 3, it was observed that neonates having respiratory distress due to sepsis were mostly discharged followed by those having asphyxia and RDS. But death was significant among babies diagnosed with congenital pneumonia having p value of <0.05.

Table-3: Outcome of studied neonates having respiratory distress

Causes of respiratory distress	Total discharged (n1=475) %	Total death (n2=18) %	P value
Respiratory Distress Syndrome (RDS)	43 (9%)	3 (17%)	0.23
Transient Tachypnea of Newborn (TTNB)	33 (7%)	0	0.62
Congenital pneumonia	28 (6%)	**4 (22%)**	**0.02**
Meconium Aspiration Syndrome (MAS)	31 (7%)	1 (6%)	1.00
Perinatal asphyxia (PNA)	126 (27%)	4 (22%)	0.79
Neonatal sepsis	188 (40%)	6 (33%)	0.59

*Statistical test: Chi square test where indicated

DISCUSSION

Respiratory distress is a common presentation of many underlying serious conditions of newborn. Its prevalence may vary according to geographical and ethnic factors, availability of neonatal intensive care unit and health care facilities.[12] In this study, the proportion of neonates admitted with respiratory distress was found 59% which is consistent with studies conducted in Saudi Arabia (54.7%).[13] However, this finding is slightly higher than the result of other neighboring countries like Ethiopia (42.9%), Nepal (34%), India (33.4%) and Pakistan (25%).[14-17] Our center is a referral hospital and the NICU is large (30 bedded), well equipped with respiratory support machines for which the case burden is high. It might contribute to the high prevalence.

In this study, most of the babies were term (74.4%). As there was no delivery facility in the hospital, this may result in referral of mostly term out born babies from the communities. Majority of the respiratory conditions are predominant in male population, that also reflected in our study.[18-19]In many respiratory conditions, male gender has found to be a risk factor such as RDS, TTNB etc. In a review conducted by Townsel CD *et al.*, they have noted that, male fetuses tend to weigh more at any given gestational age and thus tend to have more alveoli and alveolar surface area than gestational age-matched females. Surfactant production, however, has been shown to appear earlier in female lung development than in males. This earlier presence of surfactant seems to prevent the early closure of female alveoli and small airways, which may contribute to the higher airflow and decreased resistance found in the female respiratory system.[20]

Apart from RDS, other respiratory diseases are also more common in boys than in girls. Several studies identified male sex as a significant risk factor for TTN development. Female infants were shown to achieve higher peripheral oxygen saturation earlier than males, further confirming a "male disadvantage".[21]

The current study has found that babies having respiratory distress were mostly born by lower uterine cesarean section than by normal vaginal delivery and this finding is consistent with others.[11,13]Caesarian section (CS) has been well described as being a risk factor for TTN because of the absence of a surge in catecholamines normally released in a vaginal delivery, which may play a role in the adequate and timely clearance of lung fluid.

similar to the trigger effect of labor.[22] A meta-analysis also suggested that CS, elective CS, and emergency CS were associated with an increased risk of neonatal respiratory distress syndrome.[23]

In the current study, sepsis (35.4%) and asphyxia (27%) were the commonest causes of respiratory distress in neonates followed by TTNB and others. This result is comparable with other studies such as in Karachi, Pakistan, the common etiologies of respiratory distress were found perinatal asphyxia, sepsis, TTNB, pneumonia, MAS and RDS 22(10.75%), 37(18.05%), 29(14.1%), 36(17.6%), 34(16.7%) and 47(23.0%) of the neonates respectively.[5]As our center does not have delivery facilities, so preterm babies were admitted less and that's why, prevalence of RDS was low in this study.

Congenital pneumonia played a small but significant portion among the causes. Parkash A, *et al.* has also demonstrated pneumonia as a major contributor but they have not isolated congenital pneumonia from other pneumonias.[5] Reasons behind large number of cases with sepsis, asphyxia, MAS and congenital pneumonia might be due to the unhygienic delivery settings, inadequate number of skilled birth attendant, lack of transportation facility and insufficient hygienic precautions.

This study revealed that, majority of the distressed neonates were managed with nasal oxygen. Only 15% required CPAP and 8 % were treated in mechanical ventilator. This result is almost similar with study conducted by Raha BK, *et al.*[12]

Overall mortality was found 2.5% and when causes of respiratory distress were compared to see the outcome of neonates, it was observed that, congenital pneumonia was significantly associated with adverse neonatal outcome (p value <0.05).

Limitation of this study is that, not all causes of respiratory distress have been included here such as cardiac and surgical cases, so their outcome could not be assessed. Moreover, outcome was analyzed only in term of discharge and death. The association of outcome were not addressed in terms of gestational age, birth weight, maternal risk factors and mode of respiratory support.

CONCLUSION

The common causes for respiratory distress were sepsis, asphyxia, TTNB, RDS, MAS and congenital pneumonia. A considerable number of babies required CPAP and mechanical ventilator support. Mortality was significantly associated with congenital pneumonia.

Recommendation:

Timely identification of risk groups such as sepsis for prompt management is required during clinical evaluation. Birth attendants also need to be trained in a large scale to manage the asphyxiated babies. In addition, availability of adequate number of CPAP and mechanical ventilators is also a major concern for managing these babies in every NICU of Bangladesh. So, necessary steps need to address in this regard.

ACKNOWLEDGEMENT

We acknowledge all of our staff and colleagues who supported us during the study.

AUTHOR'S CONTRIBUTION

Sharmin Afroze contributed in study design, data compilation, manuscript writing and editing. Tareq Rahman did the data analysis and literature searching. Trisha Mallik and Sharmin Afroz Rima collected all data. Aakash Pandita and Mohammod Shahidullah reviewed the manuscript. All authors read and approved the final manuscript.

Funding source: None

Conflict of interest: Authors have declared that no competing interests exist.

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