Original Article

Morbidity and Mortality Profile of Preterm Neonate Admitted in Neonatal Intensive Care Unit of Combined Military Hospital, Rangpur, Bangladesh

Sarker MM[1], Sharmin MI[2]

1. **Lt Col Dr. Mst. Mukta Sarker**
    MBBS, FCPS
    Classified Specialist
    Department of Paediatrics
    Combined Military Hospital, Rangpur
2. **Lt Col Dr. Mahmuda Iffat Sharmin**
    MBBS, FCPS
    Classified Specialist Obstetrics and Gynaecology
    Department of Obstetrics and Gynaecology
    Combined Military Hospital, Rangpur.

Correspondence to:
Lt Col Dr. Mst. Mukta Sarker
MBBS, FCPS
Classified Specialist
Department of Paediatrics
Combined Military Hospital, Rangpur.
E-mail: muktasarker@hotmail.com
Mobile: 01716-319313

Abstract:
Introduction: Premature birth contributes significantly to neonatal mortality rate and Morbidness rates worldwide. Despite declines in under-five mortality, neonatal mortality rate remains high, with a substantial portion occurring within the first week of life. This study investigates the morbidness and mortality profile of preterm neonates admitted to the Neonatal Intensive Care Unit (NICU) of Combined Military Hospital, Rangpur, Bangladesh. **Methods:** The study was conducted at the Neonatal Intensive Care Unit (NICU) of Combined Military Hospital, Rangpur, Bangladesh, from November 2020 to November 2023, with a total of 192 preterm neonates. It employed a cross-sectional design, with retrospective data collection. Statistical analysis was conducted using the Statistical Package for Social Sciences (SPSS) version 26, encompassing descriptive statistics and chi-square tests (p<0.05) to assess associations between categories of prematurity and clinical outcomes. The study included both inborn and outborn preterm neonates, focusing on baseline neonatal characteristics and maternal risk factors. **Results:** Respiratory distress syndrome (RDS) was the most prevalent morbidness, affecting 40.10% of cases, with a mortality rate of 2.60%. Neonatal jaundice was highly prevalent (95.83%) but had no associated mortality. Meconium aspiration syndrome (MAS) and congenital pneumonia affected 5.72% and 7.81% of preterm neonates, respectively, with low mortality rates. Extremely preterm infants (<28 completed weeks) had the highest mortality rate, declining with increasing gestational age. **Conclusion**: This study highlights the multifactorial nature of preterm birth, with maternal infections and inadequate antenatal care playing significant roles. Respiratory distress syndrome (RDS) emerged as the most prevalent morbidity, highlighting the critical need for advanced respiratory support in preterm neonates. Additionally, the significant association between the prematurity category and clinical outcomes emphasizes the importance of gestational age-specific care interventions.

Keywords: Preterm neonates, Morbidity, Mortality, Neonatal Intensive care unit (NICU), Low birth weight (LBW)

Introduction:

Premature birth significantly contributes to both the mortality rate and morbidness rates among newborns.[1] Over the last forty years, neonatal mortality rates have not changed, despite a decline in under-five and infant mortality rates in developing countries. Neonatal deaths account for about 3.9 million of the 10.8 million deaths in children under five each year; between 50% and 70% of these deaths occur in the first week of life.[2,3] In Bangladesh, approximately 20% of babies are born prematurely, and 30% are born

with low birth weight (LBW).[3] From 93.7 deaths per 1,000 live births in 1968 to 18.4 deaths per 1,000 live births in 2017, Bangladesh's newborn mortality rate has gradually decreased.[4] In general, neonatal morbidness and mortality stem from inadequate maternal health and nutrition status, along with insufficient care during delivery or immediately after birth. Prematurity, low birth weight (LBW), infections, jaundice, and asphyxia are among the primary issues impacting newborns in developing countries, all of which are largely preventable.[5] Direct causes of mortality rate include sepsis (32%), asphyxia (26%), tetanus (15%), and respiratory distress (6%), with 14% of cases remaining unidentified.[6] Another study identified the most common reasons for admission to the Neonatal Intensive Care Unit (NICU) as prematurity, infection, and perinatal asphyxia.[4] One important factor contributing to the death rate of preterm infants is apneic episodes. According to reports, 13.43% of preterm newborns with very low birth weights have respiratory distress syndrome (RDS). To be more precise, it affects about 5% of babies born at 36 weeks of gestation and rises to 25% of babies born at 28 weeks. Interestingly, the incidence of RDS appears to increase with a lower gestational age, suggesting a higher risk of preterm.[7] Prematurity tends to exacerbate the severity while diminishing the distinctiveness of clinical manifestations in many neonatal conditions. Immature organ function, complications arising from therapy, and the specific disorders triggering premature labor all contribute to the morbidness and mortality associated with premature and low birth weight (LBW) infants. In very low birth weight (VLBW) infants, infections stand out as the primary cause of mortality. The premature neonate's underdeveloped host defense mechanisms and the use of invasive life support systems render them particularly vulnerable to severe infections. Preterm LBW babies are significant contributors to the morbidity and mortality observed among neonates admitted to the intensive care unit (ICU).[8] Chronic maternal conditions such as urinary tract infections (UTIs), hypertension, and diabetes mellitus are linked to premature birth.[9] The consequences of morbidness among preterm infants and their admissions to the Neonatal Intensive Care Unit (NICU) can have long-term impacts on outcomes, potentially affecting neurodevelopmental outcomes. A proactive approach to both antenatal and postnatal care yields promising outcomes in the management of preterm neonates. Enhanced medical care, improved resuscitation practices, the implementation of surfactant therapy, and the use of gentle ventilation techniques have all played significant roles in improving survival rates.[10]

Methods:

The present study aimed to investigate the morbidness and mortality profile of preterm neonates admitted to the Neonatal Intensive Care Unit (NICU) of Combined Military Hospital, Rangpur, Bangladesh, spanning from November 2020 to November 2023. A cross-sectional design was employed, with data collected retrospectively. Both inborn and outborn preterm neonates were included in the study population. However, neonates with a gestational age exceeding 37 weeks or falling below 24 weeks, those with a birth weight less than 300 grams, and those with lethal congenital anomalies were excluded from the analysis. Additionally, preterm neonates with incomplete medical records or those who left against medical advice or were referred to other hospitals were excluded. Data collection involved a comprehensive analysis of baseline neonatal characteristics, including gestational age and birth weight, as well as maternal risk factors. The association between categories of prematurity and clinical outcomes was examined, with a focus on morbidity and mortality. The statistical analysis encompassed descriptive statistics to summarize baseline characteristics and clinical outcomes, along with a chi-square test to assess associations, setting a significance set at $p < 0.05$. Statistical analyses will be executed by using the Statistical Package for Social Sciences (SPSS) version 26.The fatality rate was calculated using the following formula:

Fatality Rate= (Number of deaths÷Number of cases) ×100%

Results:

Table-I: Description of preterm (n=192)

Characteristics	Frequency (N)	Percentage (%)
SEX		
Male	104	54.16
Female	88	45.83
Place of birth		
Inborn	188	97.91
Out born	04	2.08
Birth weight		
<1 kg	17	8.85
1-<1.5 kg	52	27.08
1.5- <2.5 kg	123	64.06
Gestational age		
< 28 wks	18	9.37
28-<32 completed wks	51	26.56
32-37 completed wks	123	64.06

In this study, a majority (104,54.16%) of the preterm neonates were male and inborn (188,97.91%). Most of the neonates' (123,64.06%) weight at birth was 1.5-<2.5kg, followed by (52,27.08%) 1-<1.5kg, and (17,8.85%) <1kg. Regarding gestational age, a majority (123,64.06%) of the neonates were of 32-37 completed weeks, followed by, (51,26.56%) 28- <32 completed weeks. [Table-I]

Table-II: Maternal Risk Factors for Preterm Births (n=192)

Maternal Risk Factors	Frequency (N)	Percentage (%)
PROM	43	22.39
GDM	17	8.85
Maternal Hypertensive disorders	15	7.81
Fetal distress	22	11.45
Inadequate ANC	32	16.66
Previous preterm delivery	05	2.60
Teenage mother	11	5.72
UTI	23	11.79
APH	16	08.33
Twin pregnancy	08	4.16

It was observed that most (43,22.39%) of the mothers had PROM. Other risk factors were inadequate antenatal care (32,16.66%), UTI (23,11.79%), fetal distress (22,11.45%), GDM (17,8.85%), APH (16,8.33%), maternal hypertensive disorders (15,7.81%). [Table-II]

Table-III: Morbidity and Mortality Patterns in Preterm Neonates (n=192)

Morbidity	Frequency (N)	Percentage (%)	Mortality (N)	Fatality Rate (%)
Respiratory distress syndrome	77	40.10	5	2.60
Neonatal Jaundice	184	95.83	0	00
Transient tachypnea of the newborn	24	12.5	0	00
Meconium aspiration syndrome	11	5.72	02	1.04
Congenital pneumonia	15	7.81	01	0.52
Perinatal asphyxia	08	4.16	01	0.52
Apnea	07	3.64	01	0.52
Sepsis	23	11.97	01	0.52
Congenital heart disease	09	4.68	00	00
Hypoglycaemia	11	5.72	00	00
Feeding Intolerance	19	9.89	00	00
Hypocalcaemia	02	1.04	00	00
Seizures	07	3.64	00	00
Birth defects	04	2.08	02	1.04
NEC	01	0.52	00	00
IVH	04	2.08	02	1.04

Respiratory distress syndrome (RDS) emerged as the most prevalent morbidity, affecting 40.10% of cases, with a mortality rate of 2.60%. Neonatal jaundice was highly prevalent, affecting 95.83% of neonates, with no associated mortality observed. Other common morbidities included transient tachypnea of the newborn (12.5%), meconium aspiration syndrome (5.72%), and congenital pneumonia (7.81%), with associated mortality rates of 0% to 1.04%. Perinatal asphyxia, apnea, and sepsis were also observed in varying frequencies, with associated mortality rates of 0.52%. Congenital heart disease, hypoglycemia, feeding intolerance, hypocalcemia, seizures, birth defects, necrotizing enterocolitis (NEC), and intraventricularhemorrhage (IVH) were less common, each affecting less than 10% of neonates, with mortality rates ranging from 0% to 1.04%. [Table-III]

Table-IV: Association between Category of Prematurity and Clinical Outcome (n=192)

Prematurity category	Outcome		
	Death	Discharged	p-value
Extreme preterm <28 completed weeks	07	11	0.04
Very preterm 28- <32 completed weeks	05	46	0.001
32 to <37 completed weeks	03	120	0.50
Total (%)	15(7.81%)	177(92.18%)	

For extreme preterm infants (<28 completed weeks), there were 7 deaths, and11 being discharged. In the very preterm category (28 to <32 completed weeks), mortality was slightly lower at 5, while a higher number (46) were discharged. Among infants born between 32 to <37 completed weeks, mortality was further decreased to 3, with the majority (120), being discharged. Overall, 7.81% of cases resulted in death, while 92.18% were discharged. The statistical analysis yielded a significant p-value of 0.001, underscoring the association between the prematurity category and clinical outcome. [Table-IV]

Discussion:
The demographic characteristics of the study population, as outlined in Table-I, reveal key insights into the distribution of preterm neonates in terms of sex, place of birth, birth weight, and gestational age. The majority of preterm neonates were male (54.16%) and born in the hospital (97.91%). Most neonates had a birth weight between 1.5- <2.5 kg (64.06%), and a gestational age between 32-37 completed weeks (64.06%). These findings align with global trends in preterm birth demographics, highlighting the need for targeted interventions to address the specific needs of preterm neonates based on their gestational age and birth weight.[11] Maternal risk factors, provide critical insights into the antecedents of preterm birth in the study population. Premature rupture of membranes (PROM) was the most prevalent risk factor (22.39%), followed by inadequate antenatal care (16.66%) and urinary tract infections (UTIs) (11.79%). These findings emphasize the multifactorial nature of preterm birth, with maternal infections and poor antenatal care playing significant roles in predisposing neonates to adverse outcomes.[12] Respiratory distress syndrome (RDS) emerged as the most prevalent morbidness, affecting 40.10% of the preterm neonates in this study, consistent with existing literature.[11] RDS is a leading cause of morbidity and mortality rate among preterm infants, attributed to immature lung development and surfactant deficiency.[13] The observed fatality rate of 2.60% emphasizes the severity of RDS and the critical need for advanced respiratory support and surfactant replacement therapy in the management of affected neonates.[14] Neonatal jaundice was highly prevalent in the study population, affecting 95.83% of neonates, although no associated mortality was observed. While neonatal jaundice is common among preterm infants due to increased bilirubin production and reduced hepatic clearance, prompt monitoring and phototherapy have significantly reduced associated mortality rates.[15] The absence of mortality in this cohort underscores the effectiveness of standard jaundice management protocols in the NICU.Meconium aspiration syndrome (MAS) and congenital pneumonia were notable morbidities in this study, affecting 5.72% and 7.81% of preterm neonates, respectively.According to a study by Ramaswamy et al., Meconium aspiration syndrome (MAS) affects approximately

6.8% of preterm neonates.[16] MAS occurs when meconium-stained amniotic fluid is aspirated into the airways, leading to airway obstruction and respiratory distress.[17] Similarly, congenital pneumonia, often secondary to intrauterine infection or perinatal aspiration, poses significant respiratory challenges for preterm infants.[18] While mortality rates associated with MAS and congenital pneumonia were low (1.04% and 0.52%, respectively), timely recognition and supportive care are essential to prevent adverse outcomes.The association between the prematurity category and clinical outcomes was statistically significant, highlighting the impact of gestational age on neonatal morbidity and mortality. Extremely preterm infants (<28 completed weeks) had the highest mortality rate, emphasizing the vulnerability of these neonates to life-threatening complications.[19] Similarly, in another study by Ancel et al., extremely preterm infants had significantly higher mortality rates compared to those born at later gestational ages. As gestational age increased, mortality rates decreased, emphasizing the importance of gestational age-specific care and interventions in optimizing neonatal outcomes.[20] Despite advancements in neonatal care, including improved respiratory support and infection prevention strategies, preterm birth remains a significant global health challenge, particularly in resource-limited settings.[21]

Limitation:

Limitations of the study included potential data limitations due to its retrospective nature and the possibility of selection bias.

Conclusion:
This study underscores the multifactorial nature of preterm birth, with maternal infections and inadequate antenatal care playing significant roles. Respiratory distress syndrome (RDS) emerged as the most prevalent morbidity, highlighting the critical need for advanced respiratory support in preterm neonates. Additionally, the significant association between the prematurity category and clinical outcomes emphasizes the importance of gestational age-specific care interventions.

Recommendation:
Strengthening antenatal care services is essential to identify and manage maternal risk factors associated with preterm birth. Implementing protocols for early identification and management of respiratory distress syndrome (RDS) can significantly reduce associated morbidity and mortality in preterm neonates. Continuous education and training programs for healthcare professionals on the management of common morbidities in preterm infants are essential. Tailoring care interventions based on gestational age, especially for extremely preterm infants, can optimize outcomes and reduce mortality rates.

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