**Pattern of Admission and Outcome in a Neonatal Intensive Care Unit (NICU) of a Tertiary Care Hospital in Dhaka, Bangladesh**

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**ABSTRACT**

**Background:** The neonatal period is a highly vulnerable time for an infant completing many of the physiologic adjustments required for life outside the uterus. As a result, there are high rates of morbidity and mortality. To reduce morbidity and mortality it is essential to know the neonatal disease pattern. Neonatal disease pattern changes from time to time and place. Analyzing the neonatal admission pattern helps the policy makers to make the better strategies and health care givers to serve better.

**Objectives:** This study aimed to determine the disease patterns and outcome of patients admitted to the Neonatal Intensive Care Unit (NICU) of Anwer Khan Modern Medical College Hospital, a tertiary care hospital in Dhaka, between January 2017 to December 2018.

**Methods:** Retrospective data from the medical records of all neonates admitted during the study period were reviewed and analyzed for age, weight, sex, reason for admission, duration of hospital stay, diagnosis and final outcome.

**Results:** The total number of neonates admitted during the study period was 262; 164 were male (62.6%), and 98 were female (37.4%). A total of 223 patients (85.12%) were born in the hospital while 39 (12.88%) were born at home. The majority were admitted during the first 48 hours of life (72.2%). A total of 5 patients (2%) weighed <1000 gm; 53 (20.2%) weighed 1000-1500 gm, and 89 (34%) between 1600-2499 gm. Prematurity and infection were the main reasons for admission (52.7% and 20%, respectively), followed by birth asphyxia (12%) and neonatal jaundice (6.8%). A total of 206 patients (78.6%) were improved and discharged, 43 left against medical advice (16.4%), 3 were referred for urgent cardiac intervention (1.1%) and 10 (3.9%) died.

**Conclusion:** Prematurity, neonatal infection and birth asphyxia were the major causes of neonatal morbidity and mortality.

**Key Words:** Prematurity; Low Birth Weight; Neonatal infection; Neonatal Jaundice; Perinatal Asphyxia

**Introduction**

The first month of life is the most crucial period for child survival. Despite progress over the past two decades, in 2017 alone, an estimated 6.3 million children and young adolescents died and 2.5 million of those children died in the first month of life. The risk of dying is highest in the first month of life. An estimated 2.5 million newborns died in the first month of life in 2017 - approximately 7,000 every day - about 36 percent died the same day they were born, and close to three-quarters of all newborn died in the first week of life. In 2017, neonatal mortality - the probability of dying in the first 28 days of life...
was estimated at 18 deaths per 1,000 live births globally. In Bangladesh neonatal mortality rate fell gradually from 93.7 deaths per 1,000 live births in 1968 to 18.4 deaths per 1,000 live births in 2017. Despite the considerable improvement in health outcomes in Bangladesh, the achievement remains vulnerable. The global community recognizes the crucial need to end preventable child deaths, making it an essential part of the Global Strategy for Women’s, Children’s, and Adolescent’s Health (2016-2030) and the third Sustainable Development Goal (SDG) to ensure healthy lives and promote wellbeing for all people at all ages. It is a challenge for Bangladesh to maintain momentum and achieve the target of Sustainable Development Goal (SDG) 3 of reducing the neonatal mortality rate (NMR) to 12 per 1000 live births by 2030. To achieve the target of Sustainable Development Goal (SDG) 3 it is important to know the neonatal disease pattern. In the developed countries, the main cause of mortality and morbidity in the neonatal period are non-preventable causes such as congenital abnormalities, but in the developing countries the preventable causes such as Infections, Jaundice, Birth Asphyxia and Pneumonia predominat. Disease pattern in neonatal intensive care unit is a sensitive indicator of the availability, utilization and effectiveness of mother and child health services in the community. Disease pattern changes between different places and time to time even at the same place. Therefore, regular review of the disease pattern in any particular setting is important for providing better services to the patients. We conducted this study to document the disease pattern and outcome of patients admitted to our neonatal intensive care unit. Knowing the disease pattern in the neonatal intensive care unit (NICU) and disease-wise mortality rate we can use our available resources best and can make requisite efforts to reduce morbidity and mortality.

Materials and Methods

This descriptive study was conducted in the Neonatal Intensive Care Unit (NICU), Department of Pediatrics, Anwer Khan Modern Medical College Hospital, Dhaka, Bangladesh between January 2017 to December 2018. A total of 262 neonates admitted to the NICU at Anwer Khan Modern Medical College Hospital, both inborn and out born with in this period were included in this study. Neonates, who were kept under observation, including those referred from other facilities with suspected disease but labeled healthy after evaluation in NICU were excluded from the study.

Data of all neonates admitted into the neonatal unit were collected from the admission, discharge and death registers using a pretested structured questionnaire prepared in English. Data extracted included: The age of neonate on admission, sex, weight on admission and at birth, Gestational age, mode of delivery, place of delivery, history of birth asphyxia, main final diagnosis, and date of discharge, and outcomes (discharge, death or left against medical advice) and cause of death. The data were subjected to statistical analysis according to standard procedure. SPSS version 20 for Windows (SPSS Inc, Chicago, IL, USA) software was used for data recording and analysis. Since it was a descriptive study, percentage and frequencies were determined. Approval for the study was obtained from the hospital ethical committee.

Operational Definition

In this setting, disease diagnosis was based on clinical presentation and supportive laboratory results. Prematurity was described as live born neonates delivered before 37 completed weeks. For mothers who did not know dates of their last menstrual period, the new Ballard score was used to estimate the gestational age. Birth weight was classified using WHO weight classification. Sepsis and meningitis were diagnosed after isolating the pathogenic organism from the blood or cerebral spinal fluid whenever possible; otherwise, most of the other diagnoses depended on history, physical examination, and other supportive investigations. Birth asphyxia was diagnosed whenever a neonate had an Apgar score <6 in the fifth minute and/or was unresponsive to stimuli or convulsion not explained by other causes. For babies born outside health facilities with unknown Apgar scores, details were obtained from the mother about the neonate: if he/she did not cry immediately after birth; had
respiratory distress, floppiness, loss of consciousness, presence of convulsion, and loss of neonatal reflexes. In the present study, radiologic examination including X-ray was performed inconsistently; however, for the diagnosis of RDS, clinical criteria were used and risk factors like premature infant with signs and symptoms of rapid labored, grunting type of breathing manifesting immediately or within a few hours after delivery and with subcostal retraction, cyanosis, and decreased air entry in bilateral lung field or those who had chest X-ray examination with characteristic findings for RDS were also included. Both early onset neonatal sepsis (EONS) and late onset neonatal sepsis (LONS) were defined after assessing the risk factors for infection including prematurity, maternal infection during labor, and clinical signs and symptoms suggestive of infection. Neonates who presented to the NICU with a diagnosis of sepsis within 72 hours of birth are labeled as EONS, while those who came after 72 hours of birth are labeled LONS. Anthropometric assessment was carried out using Lubchenco curve.12 All other assessments were based on physician judgment as written in the patient card.

Results
The total number of neonates admitted during the study period was 262. There were 164 males (62.6%) while 98 (37.4%) were females, male babies outnumbered their female counterpart with a ratio of 1.7:1. Both inborn and outborn neonates were admitted. Of the 262, 223 (85.12%) were born in the hospital while 39 (12.88%) were born at home. The mode of delivery was mostly lower uterine caesarean section (LUCS) 206(78.6%), normal vaginal delivery (NVD) was 52(20%) and instrumental delivery 4(1.4%). The majority of the newborns (72.2%) were admitted during the first 48 hours of life [Figure 1]. Among the 262 neonates more than half 138(52.7%) were premature. Regarding the birth weight of these babies, 147 (56.2%) babies were low birth weight (<2500 gm), among them 5 patient were categorized as ELBW (2%), 53 as VLBW (20.2%) and 89 as LBW (34%) and rest 115(43.8%) had normal birth weight [Table 1]. Among the preterm neonates most common complication were respiratory distress syndrome 43(30.3%), neonatal jaundice 34(24%), sepsis 32(22.5%), apnea of prematurity 13(9.15%) [Figure 2]. Next to prematurity neonatal infections and perinatal asphyxia were the common causes of admission to the neonatal unit, at 20% and 12%, respectively among the term neonates. The major causes of infections were sepsis (65.4%), pneumonia (19.2%) and meningitis (15.4%) [Table 2]. Other causes of admission were Neonatal jaundice 18(6.8%), congenital heart disease 7(2.7%), Transient Tachypnea of Newborn 6(2.32%), Surgical problems 6(2.32%), Meconium Aspiration syndrome 2(0.76%) and Multiple congenital malformation (0.38%) [Figure 3].

Analysis of outcome showed that out of 262 neonates, 206 cases (78.6%) were improved and discharged to home, 43 cases (16.4%) left the hospital against medical advice (LAMA), 10 expired (3.9%) and 3 patient of complex congenital heart disease (1.1%) were referred for urgent cardiac intervention[ Figure 4]. The leading cause of death were prematurity (60%), followed by birth asphyxia (30%) and sepsis (10%) [Table 3]. The case fatality rate was highest in Perinatal asphyxia (9.4%) [Figure 5].

Table 1: Demographic Characteristics of the admitted neonates

| Variables         | Attributes | Frequency (number) | Relative frequency (%) |
|-------------------|------------|--------------------|-----------------------|
| Gender            | Male       | 162               | 62.6                  |
|                   | Female     | 98                | 37.4                  |
| Place of delivery | Hospital   | 223               | 85.12                 |
|                   | Home       | 39                | 12.88                 |
| Mode of delivery  | LUCS       | 206               | 78.6                  |
|                   | NVD        | 52                | 20                    |
|                   | Instrumental delivery | 4 | 1.4                  |
| Number of gestation | Singleton   | 235               | 90                    |
|                   |           | 24                | 9.16                  |
|                   | Twins      | 3                 | 1.14                  |
|                   | Triplets   | 53                | 20.2                  |
| Gestational age   | <34 weeks  | 113               | 43.2                  |
|                   | 34-36 weeks| 96                | 36.6                  |
|                   | 37-42 weeks|                   |                       |
| Birth Weight      | <1000 gm   | 5                 | 2                     |
|                   | 1000-1500 gm | 53           | 20.2                  |
|                   | 1600-2499 gm | 89           | 34                    |
|                   | >2500 gm   | 115               | 43.8                  |
Table 2: Disease pattern of the neonatal admissions

| Diagnosis | n (N=262) | %  |
|-----------|-----------|----|
| 1. Prematurity | 138 | 52.7 |
| With sepsis | 32 | 22.5 |
| With Respiratory distress Syndrome | 43 | 30.3 |
| With asphyxia | 12 | 8.45 |
| With jaundice | 34 | 24 |
| With apnea of prematurity | 13 | 9.15 |
| With necrotizing enterocolitis | 8 | 5.6 |
| 2. Neonatal infections | 52 | 20 |
| Sepsis Early onset | 21 | 40.4 |
| Late onset | 13 | 25 |
| Pneumonia | 10 | 19.2 |
| Meningitis | 8 | 15.4 |
| 3. Perinatal asphyxia | 32 | 12.02 |
| Hypoxic ischemic encephalopathy Stage I | 7 | 21.9 |
| Stage II | 16 | 50 |
| Stage III | 9 | 28.1 |
| 4. Neonatal Jaundice | 18 | 6.8 |
| 5. Transient Tachypnea of Newborn | 6 | 2.32 |
| 6. Meconium aspiration syndrome | 2 | 0.76 |
| 7. Congenital Heart disease | 7 | 2.7 |
| 8. Surgical problems | 6 | 2.32 |
| 9. Multiple congenital malformation | 1 | 0.38 |

Table 3: Major causes of neonatal deaths (n = 10)

| Cause | Deaths n (%) | Case fatality rate (%) |
|-------|--------------|------------------------|
| Prematurity with it’s complication (n=138) | 6(60) | 4.3 |
| Perinatal asphyxia(n=32) | 3(30) | 9.4 |
| Neonatal infection (n=52) | 1(10) | 2 |

Figure 1: Percentage of neonates according to their age at admission; indicating 72.2% admission occur within first 48 hours of birth.

Figure 2: Causes of Preterm Admissions; Respiratory distress syndrome(RDS) (30.3%), neonatal jaundice 34(24%), sepsis 32(22.5%), apnea of prematurity 13(9.15%), perinatal asphyxia 12(8.45%) and necrotizing enterocolitis 8(5.6%).

Figure 3: Causes of neonatal admissions; showing prematurity is the most common cause of admission (52.7%), followed by Neonatal sepsis (20%), Perinatal asphyxia (12%)
Achieving the ambitious neonatal survival goals requires ensuring universal access to safe, effective, high quality and affordable care for neonates. It also requires an understanding of the levels and trends in neonatal mortality as well as the underlying causes of neonatal deaths. This study assessed the causes and outcomes of neonatal admissions in the Anwer Khan Modern Medical college Hospital. The study revealed that more male neonates 62.6% were admitted compared to female neonates 37.4%, representing male to female ratio of 1.7:1. Some studies have reported similar observation.\textsuperscript{13,14} While others archived the contrary.\textsuperscript{15} The preponderance of male neonates to suffer various conditions which usually result in admission cannot be explained by this study. However, this has been partly attributed to relatively well developed lungs in female neonates at the time of birth compared to males, as surfactant markers such as lecithin, phosphatidylglycerol, and phosphatidylinositol appear much early in females than males.\textsuperscript{16} In addition, a recent study has established the genetic influence in neonatal infection, revealing that x chromosome linked diseases are predominant in males than females.\textsuperscript{17} Additionally, cultural and social factors could contribute to male babies getting more attention by parents than females. Although the sex of a baby is nonmodifiable, this factor is significant from a program planning perspective, in that male infants may require greater attention.

The present study revealed that more than half of the newborns (72.2%) were admitted within the first two days of life; an observation which has been reported by similar studies conducted elsewhere.\textsuperscript{18-20} Among the 262 neonates more than half 138(52.7%) were premature and rest 124(47.3%) were term. Prematurity was the leading cause of admission in our NICU. This data is similar to study conducted by Elizabeth U and Modupe O. Oyetunde\textsuperscript{21} at Ibadan, Nigeria (54.9%) and Rahim F et al. (53%).\textsuperscript{22} Some other studies the contribution of preterm admission is comparatively less like MS Hoque, S Alam (28%)\textsuperscript{23}, Raghvendra Narayan (13%)\textsuperscript{24}, Veena Prasad and Nutan singh (20%).\textsuperscript{25} Although there are numerous factors associated with prematurity and low birth weight, the major contributors are low socioeconomic status, maternal infection, maternal under nutrition, and anemia.\textsuperscript{26} For more than 25 years, LBW has been observed to be one of the major risk factors for neonatal admissions in multiple studies conducted in many developing countries.\textsuperscript{27} In this study, LBW was found in 56.15% of patients; this can be compared to 55.4% in Karachi\textsuperscript{28} and 41.2% in Peshawar.\textsuperscript{29} Percentage of ELBW was 2.7%, VLBW 21.5%, LBW 32%, findings are very similar from the study conducted by Veena Prasad, Nutan singh\textsuperscript{25} and Bhagat Baghel, Anurup Sahu.\textsuperscript{30} Among the preterm LBW neonates most common complication were respiratory distress syndrome 43(30.3%), neonatal jaundice 34(24%), sepsis 32(22.5%), apnea of prematurity 13(9.15%), perinatal asphyxia 12(8.45%) and necrotizing enterocolitis 8(5.6%) similar to Quddusi et al.\textsuperscript{31} Prematures are not only
the principal contributors to neonatal morbidity and mortality but they are the ones who experience more health problems and consumed more health resources.32

Next to prematurity neonatal infections and perinatal asphyxia were the common causes of admission to the neonatal unit, at 20% and 12.02%, respectively among the term neonates similar to Preety Raikwar et al.33 and Sridhar PV.34 The major causes of infections were sepsis (65.4%), pneumonia (19.2%) and meningitis (15.4%). Neonatal sepsis is a global problem and has no boundaries. The variation in neonatal sepsis between developed and developing countries would be the degree of prevalence, as higher prevalence rates are recorded in developing countries.35

In this study, birth asphyxia was 12%, as compared to 13% of neonates in the study conducted in Pakistan36, 16.52% in Peshawar28 and 38% in a study in DSH.23 The important risk factors for birth asphyxia reported from a study conducted in Hyderabad, India include the lack of antenatal care, poor nutritional status, antepartum haemorrhage, maternal toxaemia and having a home delivery.37 Other causes of admission were Neonatal jaundice 18(6.8%), congenital heart disease 7(2.7%), Transient Tachypnea of Newborn 6(2.32%), Surgical problems 6(2.6%), Meconium aspiration syndrome 2(0.76%) and Multiple congenital malformation (0.38%). Higher incidences of jaundice in neonates have been reported from other studies in Bangladesh and Nigeria (30.71% and 17.25%, respectively).38,39 But in our center the percentage is low because in our center there is facility of Phototherapy in ward and cabin for the neonates who have normal vital parameters. Overall, the most prevalent indications of admission to our NICU were prematurity, infection, perinatal asphyxia. Studies conducted in other developing countries have reported similar findings.40,41

Analysis of outcome showed that out of 262 neonates, 206 cases (78.6%) were improved and discharged to home, 43 cases (16.4%) left the hospital against medical advice (LAMA), 10 expired (3.9%) and 3 patient of complex congenital heart disease (1.1%) were referred for urgent cardiac intervention (Figure 4). Neonates who did not survive, the leading causes of death were prematurity and LBW (60%), followed by birth asphyxia (30%) and neonatal infections (10%) similar to Syed R A and Tekleab AM.36,42 Prematurity was the leading cause of neonatal deaths in the study conducted in other developing countries.36,43 In this study case fatality rate was highest in perinatal asphyxia (9.4%). Higher incidences have been reported in developing countries partly due to the level of quality of prenatal, perinatal, and obstetrics and gynaecological care in general.44,45 The burden of perinatal asphyxia is huge, as it is responsible for over 42 million disabilities adjusted lives.20 Approximately 23% and 8% of birth asphyxia associated deaths occur in neonates and children under the age five years old respectively.46 Looking critically at these studies, it is obvious that prematurity, birth asphyxia and sepsis are among the leading cause of neonatal admission, which are largely consistent with the global pattern of neonatal mortality.47 These highlight the fact that many causes of neonatal deaths may be preventable. Obviously, the causes of these conditions are multifactorial and will need a multifaceted approach to curbing their contributions to neonatal deaths.

Limitation of Study

This is a hospital based study may not represent community as whole and outcome of newborn who left against medical advice was unknown.

Conclusion

Prematurity, Neonatal infection, birth asphyxia and neonatal jaundice were the major causes of neonatal admissions in our study and prematurity and perinatal asphyxia with hypoxic ischemic encephalopathy Stage III were the major causes of death. Variations in mortality rates are important because they permit inferences about quality of care and can yield important insights into how to improve efficacy and efficiency of care.

Recommendation

In the light of the findings of this study, the following recommendations are made:

1. Creating awareness among all the population for antenatal monitoring, prompt and timely transfer of
"at risk fetus" (i.e. baby in mother’s uterus) to enable the mother to deliver close to Special Care Baby Unit where prompt action will be readily available. 2. Identification of women who are likely to deliver between 24 and 34 weeks of pregnancy and treatment with corticosteroids speed up maturation of fetal lungs and further reduce complication related to prematurity.3 Every delivery should be encouraged to be attendant by trained personnel for prompt and timely resuscitation of babies at birth to reduce high case fatality and morbidity related to birth asphyxia.

Conflict of Interest: None

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