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Morbidity pattern based on clinico-biochemical profile of neonates admitted in NICU of a tertiary care hospital in the mid north bank region of Assam

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ABSTRACT

Introduction: The neonatal period carries the highest risk of death per day compared to any other period during childhood. Of all newborn deaths three fourths result from three preventable and treatable conditions– complications due to prematurity, intrapartum related deaths (including birth asphyxia) and neonatal infections.

Objective: The study was to describe the morbidity pattern with outcome, based on clinical diagnosis and relevant biochemical parameters amongst neonates admitted in NICU in the tertiary care hospital.

Materials and Methods: A retrospective case record analysis of all the NICU admissions between January 2021 to March 2021 was done based on both electronic and hard data. The neonates with complete records of clinical presentation, relevant biochemical investigations were included in the study.

Results: Out of 624 neonates admitted in NICU during the study period, 622 were included in the final analysis. The proportion of fullterm and preterm among inborns (77.6% &18.8%) and outborns (76.2% & 21.8%) were similar, but the proportion of low-birth-weight babies in outborns was higher than in the inborns. The overall discharge rate was 85.5%. It was higher for inborn neonates as compared to outborn neonates (88.7% vs 79%). The death rate was higher in outborns than in inborns. The highest no of NICU admission was due to asphyxia related conditions followed by neonatal jaundice in both genders and in all inborn and outborn neonates. Out of total admissions in NICU, 72(11.6%) was due to infections causing neonatal sepsis, meningitis and acquired pneumonia.

Conclusion: While neonatal jaundice has a lower mortality rate, preventable conditions like birth asphyxia and infections remain major concerns for neonatal morbidity and mortality in this region. The study emphasizes the need for strengthened antenatal care, improved infection control, and increased access to trained neonatologists to ensure better outcomes for newborns.

1. Introduction

From the day of birth till the first 28-days of life - is the most vulnerable time for a child's survival and health.[1] This period carries the highest risk of death per day compared to any other period during childhood.[2] Since 1990 substantial progress has been achieved in reducing neonatal mortality. India's National Health Policy (NHP) 2017 set a target of 16 deaths per 1000 livebirths for neonatal mortality by 2025, the government has also fixed a target of less than ten neonatal deaths per 1000 livebirths to be achieved by 2030 under the India Newborn Action Plan and according to target 2 of SDG 3, India is to achieve 12 or less newborn deaths per 1,000 live births by 2030.[3,4] Of all newborn deaths three fourths result from three preventable

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and treatable conditions– complications due to prematurity, intrapartum related deaths (including birth asphyxia) and neonatal infections.[1]

The Indian government has made some important policy decisions to combat the major causes of newborn death by giving priority to those babies that are born too soon, too small for their gestational age or sick.[5] As per WHO Every Newborn Action Plan Neonatal Morbidity rate is a core impact indicator to be reported and monitored.[1]

With its demographic, cultural, economic, social and ethnic diversity, India does face numerous challenges with significant rural-urban, poor rich, gender, socio-economic, and geographical differences in neonatal deaths.[2,5,6] The current NMR of India is 24.9 but the national average often obscures the subnational variations, for example when NMR of Kerala is 3.4, it is 22.5 per 1000 live births (urban 15.2 and rural 23.4) in Assam according to NFHS-5.[7] Thus, achieving the NMR goals would be helped by a deeper understanding of trend and causes of neonatal deaths at smaller geographical levels.[8]

Keeping in mind all these determinants of NMR the study tries to understand "what is the morbidity pattern amongst neonates admitted in NICU in this tertiary care hospital in the mid north bank region of Assam and is there any differential morbidity pattern observed across different groups of neonates?"

General objective of the study was to describe the morbidity pattern and its outcome based on clinical diagnosis and relevant biochemical parameters amongst neonates admitted in NICU in the tertiary care hospital.

2. Objectives

1. To describe the clinical presentations amongst the neonates admitted in NICU.
2. To determine the biochemical characteristics of admitted neonates for select biochemical parameters.
3. To describe the outcome of neonates admitted in NICU.

3. Materials and Methods

3.1. Study setting

The present study was conducted in the Newborn Intensive Care Unit of Tezpur medical College and Hospital after obtaining ethics clearance from the concerned authority. This medical college established in Sonitpur district in the year 2013 , was the first medical college on the North bank of Brahmaputra River in the mid region of Assam. The district has mixed population groups, scheduled caste and scheduled tribes comprising 5.7% and 12.1% of total population of the district. The population group working in teagardens, given the status of MOBC (more other backward classes) or OBC, is another important ethnic group in the district. Apart from serving the population of Sonitpur district, the Newborn Intensive Care Unit of this medical college caters to the population of nearby 3 to 4 districts.

3.2. Study methodology

A retrospective case record analysis of all the NICU admissions between January 2021 to March 2021 was done based on both electronic and hard data. The neonates with complete records of clinical presentation, relevant biochemical investigations and other sociodemographic variables, were included in the study. Data collection was done from secondary records of registers maintained in the NICU and Biochemistry laboratory. Digital documents maintained in NICU were also utilised in the study. Data abstraction sheet was used as data collection tool. Diagnoses of the various causes of morbidity and mortality was based on standard definition followed in the paediatrics department. The primary disease was considered as the final diagnosis even though baby developed complications of the primary disease or having more than one disease. The overall morbidity pattern was determined based on both final diagnoses and the relevant record of biochemical parameters. In the study, neonatal jaundice was evaluated based on both clinical and biochemical index of serum bilirubin level. All 624 neonates admitted during the study period were considered for inclusion in the study. Neonates born in the medical college itself are termed as Inborn and those neonates born outside and referred to Neonatal Intensive Care Unit are termed as out born.

Ethics clearance was obtained from the institutional ethics committee of the Tezpur Medical College and Hospital.

3.3. Statistical analysis

Data was analysed with the help of MS Excel program.

4. Results

Out of 624 neonates admitted in NICU during the study period two neonates were excluded from analysis due to incomplete record. Thus, a total of 622 admitted neonates with an average duration of hospital stay of 6.4 days were included in the final analysis. Out of them 416(66.9%) neonates were inborn and 206(33.1%) were outborn. Of the total 206 outborn neonates, 104(50.5%) neonates were admitted as community referral. Table 1 depicts sociodemographic variables including outborn/inborn, term / preterm and weight categories and outcome distribution. It is observed from the Table1 that the proportion of fullterm and preterm among inborns (77.6% &18.8%) and outborns (76.2% & 21.8%) are similar, but the proportion of low-birth-weight babies in outborns (<1.5kg- 5.8% and 1.5–<2.5Kg -37%) was higher than in the inborns (<1.5kg-2.2% and 1.5–<2.5Kg -32.7%). The overall discharge rate was 85.5%. It was higher for inborn neonates as compared

to outborn neonates (88.7% vs 79%). The death rate was higher in outborns than in inborns. It was also observed that the percentage of preterm babies was higher among outborns than in inborns by approximately 3% point.

Analysis of outcome of neonatal admission according to gender reveals that among female admitted neonates the percentage of discharge, expired, LAMA and referred were 85.6% (220), 8.6% (22), 5% (13) and 0.8% (2) respectively and the corresponding figures among males were 85.5% (312), 6.8% (25), 5.5% (20) and 2.2% (8).

Table 2 describes the morbidity pattern based on the final diagnoses made at the time of discharge across gender and place of referral. The analysis showed that highest no of NICU admission was due to asphyxia related conditions followed by neonatal jaundice in both genders and in all inborn and outborn neonates. Out of total admissions in NICU, 72(11.6%) was due to infections causing neonatal sepsis, meningitis and acquired pneumonia and majority, 58% (42) of this was constituted by outborn neonates. On further analysis it was seen that among outborns, the majority of neonatal infection cases came as referral from community, that is 33 out of 42. When morbidity data was analysed according to gestational age, it was found that out of 480 term neonates 35% for asphyxia related conditions, 29.2% for neonatal jaundice and 11.5% for infections, was admitted in NICU and out of 123 preterms, 33.3% for low birth weight and IUGR, 22% for asphyxia related conditions and 13.8% for infections was admitted in NICU. Another observation made from the study is that the proportion of neonates with infection was higher among low-birth-weight babies 15% (35/233) than normal weight babies, 10% (37/372).

Distribution of hyper bilirubinaemia across clinical diagnosis is demonstrated in Table 3 . A total of 186 neonates excluding those who were primarily diagnosed with neonatal jaundice, were investigated for Se bilirubin level. On analysis of these data, it was seen that a significant no of neonates has raised Se bilirubin level along with their primary clinical diagnoses. One neonate with neonatal hypoglycaemia had a Se bilirubin level more than 20mg/dl. Eighty-four (84) neonates with asphyxia related conditions, 25 neonates with neonatal sepsis and 23 neonates in the low birthweight and IUGR category were investigated for Se bilirubin level and out of them 44 (52.4%), 10(40%), 9(39%) respectively had a bilirubin level of $\geq$ 10 mg/dl.

Of the total admitted neonates 65 were screened for Se creatinine level and 36 out of them had Se creatinine level above 0.8mg/dl. A total of 256 neonates were investigated for CRP and out of them 62 had CRP >10mg/L.

On outcome analysis it was observed that birth asphyxia and perinatal asphyxia contributed highest no of deaths ie 30 out of 47(63.8%) to the total neonatal deaths, followed by other Low Birth Weight (1000 gm - 2499 gm) and ELBW 7/47(15%) Neonatal sepsis and pneumonia 6/47(12.7%), Prematurity and other complications (shock, neonatal aspiration of meconium and any other diagnoses) 4/47(8.5%). Neonatal death was 8.9% in preterms and 7.5% in term babies.

Table 4 describes the preterm neonates and their outcome and morbidity. The percentage of hypoglycaemic neonates was 4.9% in preterm groups and it was similar in term (4.2%) neonates also. When in term neonates 4 out of 480 were diagnosed with RDS (0.83%), in preterm it was 4 out of 123(3.3%).

5. Discussion

The results of this study is compared with few published studies on morbidity and mortality profile of neonates admitted in NICU/SNCU of secondary and tertiary care hospitals. Similar to our study finding of male preponderance was observed in many other studies (>50%-60%)[9–13] except a study conducted by J Maheswari et al in Puducherry.[14]

Studies conducted in other tertiary care hospitals in India found percentage of neonatal deaths to be 8.15%, 9.73% and 5.9%[9,10,13] and this is comparable to our finding of 7.6% neonatal deaths. On the other hand, Chintha et al, Panda PK and Gunashekhar R etal observed in their respective studies slightly higher percentage of neonatal deaths (10.1%, 11% and 13.59%).[11,12,15] Like our study, higher neonatal deaths among outborn neonates were reported by Kumar et al and Kannan et al also in their studies conducted in tertiary care hospitals.[9,13] The present study observed a higher neonatal death among females (8.6%) compared to male (6.9%).

Neonatal mortality pattern differs in different parts of the country. Kumar et al noticed birth asphyxia (36.42%) to be the commonest cause of neonatal admission followed by neonatal sepsis.[9] But in their study, the birth asphyxia (18.5%) was only the third common cause of neonatal deaths, whereas we found it to be the commonest cause of both morbidity and mortality in neonates. Highest percentage of death was accounted to NNJ (24.72%) in their study followed by neonatal sepsis. Like the present study finding, neonatal sepsis was higher among outborns compared to inborns in their study too.

Kotwal et al found neonatal jaundice (26.7%) followed by septicaemia (19.1%) and prematurity as the common morbidity, in a study conducted in NICU of SKIMS Srinagar for a period of 1 year.[10] The commonest cause of death was prematurity (24.2%) followed by septicaemia (18.2%), Birth asphyxia (11.1%) and meconium Aspiration syndrome (10.1%). Panda et al found in their retrospective case record analysis of all the SNCU admission in 3 months between April and June 2018, in Orissa that the commonest indication for admission in inborn were prematurity and related complications (23%), Birth asphyxia (19%) and Neonatal Hyperbilirubinemia (18%).[12]For outborn the commonest causes were prematurity with its complications

Table 1: Sociodemographic profiles and outcome of the neonates admitted in NICU

Socidemographic and outcme variables	Inborn, n=416 Frequency (%)	Outborn, n=206 Frequency (%)	Total, N=622, Frequency (%)
Male	242(58.2)	123(59.7)	365(58.7)
Female	174(41.8)	83 (40.3)	257(41.3)
General	209(50.2)	93(45.1)	302(48.6)
OBC	156(37.5)	83(40.3)	239(38.4)
SC	10(2.4)	7(3.4)	17(2.7)
ST	41(9.9)	23(11.2)	64(10.3)
Fullterm (37-<42 Weeks)	323(77.6)	157(76.2)	480(77.2)
Postterm (=>42 Weeks)	15(3.6)	4(2)	19(3)
Preterm (<37 Weeks)	78(18.8)	45(21.8)	123(19.8)
<1.5kg	9(2.2)	12 (5.8)	21(3.4)
<2.5kg	136(32.7)	76(37)	212(34.1)
>2.5 -4kg	258(62)	114(55.3)	372(59.8)
>4kg	13(3.1)	4(2)	17(2.7)
Discharged	369(88.7)	163(79)	532(85.5)
Expired	25(6)	22(10.7)	47(7.6)
LAMA	18(4.3)	15(7.3)	33(5.7)
Referred	4(1)	6(3)	10(1.6)

Table 2: Morbidities across gender and place of admission

Morbidities	Female n, (%)	Male n, (%)	Inborn n, (%)	Outborn n, (%)
Birth Asphyxia, perinatal asphyxia and HIE	83(32.3)	121(33.1)	140(33.6)	64(31)
Neonatal jaundice	61(23.7)	96(26.3)	111(26.7)	46(22.3)
Infection (Acquired Pneumonia /neonatal sepsis/meningitis)	32(12.5)	40(11)	30(7.2)	42(20.4)
Other Low Birth Weight (1000 gm - 2499 gm), ELBW and IUGR	31(12)	27(7.4)	36(8.6)	22(10.7)
Neonatal Aspiration of Meconium	14(5.4)	14(3.8)	26((6.3)	2(1)
Neonatal Hypoglycaemia	11(4.3)	16(4.4)	22(5.3)	5(2.4)
Transient Tachypnoea of Newborn	10(3.9)	13(3.6)	19(4.6)	4(2)
Congenital Diseases	5(1.9)	8(2.2)	8(1.9)	5(2.4)
RDS	3(1.2)	7(1.9)	5 (1.2)	5(2.4)
Any other diagnoses	7(2.7)	23(6.3)	19(4.6)	11(5.3)
Grand Total	257	365	416	206

Table 3: Level of hyperbilirubinemia in neonates admitted with following clinical diagnoses

Clinical Diagnoses	Bilirubin level (mg/dl), (n=186)		
	5-9.9n, (%)	10-14.9 n,(%)	15-19.9n, (%)
Birth Asphyxia& HIE of newborn	34(41.5)	38(48)	6(66.7)
Infection (Acquired Pneumonia and neonatal sepsis)	15(18.3)	10(12.6)	
Other Low Birth Weight (1000 gm - 2499 gm), E.L.B.W., (IUGR)	15(18.3)	8(10.1)	1(11.1)
Neonatal Aspiration of Meconium	5(6)	8(10.1)	
Neonatal Hypoglycaemia	5(6)	4(5.1)	
Congenital Malformation and congenital Pneumonia	2(2.4)	3(3.8)	1(11.1)
RDS	2(2.4)	2(2.5)	1(11.1)
Any Other Diagnosis	4(4.9)	6(7.6)	
Grand Total	82	79	9

Table 4: Preterm neonates according to outcome and morbidity

Total preterm babies admitted, n=123	Frequency (%)
Discharged	103(83.7)
Other Low Birth Weight	43(35)
Birth Asphyxia	26(21.1)
Neonatal sepsis and pneumonia	17(13.8)
Neonatal jaundice	15(12.2)
Neonates with hypoglycaemia	7(5.7)
Neonates with RDS	4(3.3)

(21%), neonatal hyperbilirubenimia (20%), neonatal sepsis (19%), birth asphyxia (18%). The pattern of common neonatal morbidities was similar to the present study but prevalence was found to be different, may be because it was a SNCU at secondary level.

Kannan R et al found in their study conducted in a tertiary care hospital 2016 that Neonatal jaundice (42.7%) was the most common cause for admission in NICU among inborn neonates, followed by sepsis (26.1%).[13] Among the out born neonates, Sepsis (29.7%) was the most common morbidity.[13]

Maheswari et al in their study in a tertiary teaching hospital of Puducherry for 24 months found that neonatal jaundice (19.2%), neonatal sepsis (12.1%), transient tachypnea of newborn (11.7%), Hypoxyic Ischemic encephalopathy (10.9%) and respiratory distress syndrome (10.3%) were the common morbidities for admission in NICU.[14] In the study the maximum number of deaths were seen in neonates < 1 kg. According to gestational age death was common in preterm 6(75%) and the commonest cause of death was prematurity with respiratory distress syndrome and sepsis 5(62.%).

Das et al in a hospital based cross-sectional study conducted in NICU Agartala Government medical college for one year found perinatal asphyxia (31.15%), neonatal sepsis (23.22%), neonatal hyperbilirubinemia (18.08%), Hyaline membrane disease/ respiratory distress syndrome (9.17%), meconium aspiration (6.67%) as the common morbidities.[16] These were the common neonatal morbidities in our study too. However, the neonatal sepsis was more in the intramural cases 348(24%) compared to extramural cases 153(23%) in the above-mentioned study.

Som et al found HIE/moderate to severe Birth asphyxia (29.09%), prematurity/ LBW (25%), Jaundice (15%), Infection (sepsis/ pneumonia/meningitis) (15%) to be the commonest morbidities amongst the admitted neonates in SNCU of Orissa.[17] In the present study the highest percentage of neonatal admission among both outborns and inborns, was due to birth asphyxia followed by neonatal jaundice and neonatal sepsis.

In a prospective study on outborn neonates admitted in NICU of a tertiary care hospital of central India Bokade et al found sepsis (37.37%), Prematurity with respiratory distress syndrome (14.5%), Perinatal asphyxia (17.53%) jaundice (9.73%) as the commonest cause of admission in their study.[18] These were the commonest cause of NICU admission among outborns in the present study too but the order was reversed.

In another prospective study conducted in NICU of district hospital in Gadchiroli, Maharashtra, for a period of 2 years, Adikane et al found modarate to severe birth asphyxia 1718(42.46%), followed by Sepsis 874(21.60%) and Jaundice requiring phototherapy 648(16.02%) as the major causes of morbidity.[19] The major cause of mortality amongst the neonates were moderate to severe birth asphyxia 116(25.27%), respiratory distress syndrome 109(23.75%) and Sepsis 95(20.70%). Similar type of findings, except NJ being the second commonest condition for NICU admission, was seen in our study too. In a meta-analysis and systematic review done by Olusanya B O et al mentioned that pooled data of 3 reports from Pakistan, Egypt and India studying the role of sepsis on the risk severe hyperbilirubinaemia, indicated an increased risk of severe hyperbilirubinaemia in infants diagnosed with sepsis.[20]

6. Conclusions

From the study it was found that birth asphyxia is the commonest cause of NICU admission in this part of North East. 13% of neonates with birth asphyxia expired and thus it contributed the highest number of neonates to the total neonatal deaths. Neonatal jaundice though was found to be the second common cause of admission but its contribution to total neonatal deaths was less as majority (98.7%) of them were discharged. Another important condition for admission was infection causing acquired pneumonia, meningitis and neonatal sepsis and it is of utmost concern that the infection was more prevalent among the outborn neonates, mostly coming as outborn community referral. Neonatal death was higher among females than male, higher in outborns than inborns. Based on the findings of present study and other studies included in discussion part it can be said that still, birth asphyxia/RDS and neonatal sepsis are the common causes of both neonatal morbidity and mortality.

Recommendation: In this region, preventable morbidities like birth asphyxia and related conditions, still being the predominant cause of both morbidity and mortality in neonates it is felt that more in-depth studies are needed

to address this issue. In view of high prevalence of neonatal sepsis among the neonates, it is recommended that MOs in peripheral health institutions, ANMs and ASHAs should be periodically trained on infection prevention practices. Besides since, most of the neonatal sepsis cases come as community referral, a monitoring and supportive supervision system for HBNC should be developed. To combat LBW and IUGR occurrence, ANC also needs to be strengthened through supportive supervision and awareness programmes. Last but not least we need more doctors trained in neonatal care at the peripheral health institutions.

7. Source of Funding

None.

8. Conflict of Interest

None.

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