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Morbidity and Mortality Profile of Newborns Admitted to the Neonatal Intensive Care Unit of a Tertiary Care Teaching Hospital of Assam

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Abstract
Introduction: *India contributes to one-fifth of global live births and more than a quarter of neonatal deaths[1]. Neonatal mortality is one of the very important indicators, which reflect a country's development. It is of utmost importance to analyse the spectrum of neonatal diseases and the causes of mortality, which in turn will help in formulating strategies for control of neonatal mortality.*
Objective: *To study the morbidity and mortality profile of neonates admitted in Neonatal Intensive Care Unit (NICU).*
Methodology: *A retrospective observational study was done in the Neonatal Intensive Care Unit (NICU) to identify the main causes of neonatal morbidity and mortality of admitted neonates over a period of three years from January 2016 to December 2018.*
Results: *A total of 11,654 neonates were admitted in the NICU during the study period, 60.5% were in the Inborn and 39.5% were in the Outborn. 47.7% of total admissions in our NICU were LBW. The major causes of admission to NICU were observed to be jaundice, RDS, sepsis, Birth asphyxia and Meconium aspiration syndrome. NICU mortality during the study period was found to be 12.37%. Birth asphyxia, sepsis, RDS and MAS were found to be the main contributors of mortality in our NICU.*
Conclusion: *This study identifies Birth asphyxia as the most important cause of mortality. Outcomes of this study can be utilized in planning and modifying existing health care services for improved care of the newborn.*
Keywords: *NICU, Morbidity, Mortality, Birth asphyxia.*

Introduction

The neonatal period carries the highest risk of mortality per day than any other period during the childhood[1]. Each year, about 2.5 million newborns die before they are 4 weeks old according to 2018 data of UNICEF.

Globally, 46% of under–five deaths occur during the neonatal period[2], and the proportion of under–five deaths due to neonatal causes continues to rise[3],[4].

The common causes of neonatal mortality in India are asphyxia, prematurity and low birth weight, infections like pneumonia and gastroenteritis and a variety of surgical problems[5].

Besides mortality, it is of fundamental importance also to analyze the determinants of morbidity in this

group, as the early recognition and prevention of diseases contribute to reducing deaths[6]. Prematurity, LBW, infection, jaundice and asphyxia are the major morbidities affecting neonates in the developing countries which are easily preventable[7]. India has a major role to play in global efforts to decrease the preventable death of newborns and children under the age of five, given that it has the highest number of deaths among these two groups in the world[8].

The IMR and NMR are not uniform across the country. As per a recently published report by the Sample Registration Survey (SRS) in 2017, the IMR in Assam was the second worst in the country at 44 as compared to the National average of 33. The current NMR of India is 18 per 1000 live births in 2018 as per UNICEF data. The rate of the neonatal mortality varies widely among the different states of India, ranging from 11 per 1000 live births in Kerala to 48 per 1000 live births in Uttar Pradesh[1]. Wide disparities are also observed in survival rates across districts within state[1]. So it is important to study the mortality and morbidity pattern of a region as it helps in implementation of new treatment protocols, interventions and planning and policy making which helps in better outcome and improvement in the quality of life among survivors.

At present there is an evident paucity of literature regarding the neonatal morbidity and mortality patterns in the neonatal intensive care units (NICU) in Assam.

A better understanding of the morbidity and mortality profile of sick newborns admitted to neonatal intensive care units will help in formulating policies for further decrease in the neonatal mortality in Assam. Hence this study was designed to explore the morbidity and mortality profile of neonates admitted to a Neonatal Intensive Care Unit (NICU) of a tertiary care teaching hospital in Silchar, Assam.

Material and Methods

This was a retrospective hospital based observational study done in the Neonatal Intensive Care Unit (NICU) of Silchar Medical College and Hospital, Silchar, Assam.

This level III NICU serves as a referral centre for other districts of Silchar with a high percentage of referral of high risk pregnancies and sick newborns from peripheral hospitals.

Our NICU has a total of 60 radiant warmers with 45 in Inborn and 15 in Outborn unit. The neonatal unit is equipped with 20 phototherapy units, 2 bubble CPAP and 3 mechanical ventilators.

Retrospective cohort of neonates aged 0-28 days admitted to Neonatal Intensive Care Unit (NICU) during 1st January 2016 to 31st December 2018 formed the study population.

The newborns were categorised as inborn if delivered in our hospital and outborn if born outside. The key definitions used for the study are:

Preterm – live born neonate delivered before 37weeks from 1st day of last menstrual period(LMP) and confirmed clinically after delivery.

LBW (Low Birth Weight)– birth weight of 1500grams to 2499grams.

VLBW (Very Low Birth Weight) - birth weight of 1000 grams to 1499grams.

ELBW (Extremely Low Birth Weight)– birth weight <1000grams.

Early Neonatal period: less than 7 days postnatal age.

Late Neonatal period: more than 7 days postnatal age.

Data collection and analysis:

The data was collected in a predesigned standardized proforma. Data from admission and discharge registers were extracted and compiled. Data on birth weight, gestational age, gender, age at admission, initial presenting symptoms at admission, final diagnosis and outcome in regards to whether the newborn was discharged after completion of treatment, left against medical advice (LAMA), referred or expired were collected. Data was analysed using appropriate statistical tools.

Results

Table 1: The number of deliveries by NVD and LSCS and the number of live births and stillbirths.

YEAR	2016	2017	2018	TOTAL
Total deliveries	10,070	10,711	9494	30,274
NVD	6068	6674	5470	18,211
LSCS	4002	4037	4024	12,063
Live birth	9697	10,221	9046	28964
Still birth	373	490	448	1311

The total number of deliveries during the period from 1st January 2016 to 31st December 2018 was 30, 274 with an average of 10,091 per year. Of this, 60.1% were NVD and 39.8% were LSCS. 4.26% were stillborn.

Table 2: Profile of babies admitted in Inborn and Outborn based on birth weight and gender.

		INBORN	OUTBORN	TOTAL
Total admission		7053 (60.51%)	4601 (39.48%)	11,654
Gender	male	3965 (56.21%)	2857 (62.09%)	6822 (58.53%)
	female	3088 (43.78%)	1735 (37.70%)	4823 (41.38%)
Birth weight	>2.5kg	3771 (53.45%)	2321 (50.44%)	6092 (52.27%)
	1.5-2.49 kg	2691 (38.15%)	1756 (38.16%)	4447 (38.1%)
	1-1.49kg	479 (6.79%)	338 (7.34%)	817 (7.01%)
	<1kg	112 (1.58%)	186 (4.04%)	298 (2.55%)

There was a total of 11654 admissions during the study period of which 60.5% were in the Inborn and 39.5% were in the Outborn unit.

Male babies were predominant in both Inborn and Outborn admissions. In Inborn, the male:female ratio was 1.28 and in Outborn, it was 1.64. The overall male:female ratio was 1.41.

Low birth weight babies (<2.5kg) constituted 46.5% of total admissions in Inborn and 49.5% of total admissions in Outborn.

Table 3: Morbidity profile of babies admitted in the Inborn and Outborn units of NICU.

CAUSE OF ADMISSION	INBORN (7053)	OUTBORN (4601)	TOTAL (11,654)
RDS	1327 (18.81%)	632 (13.73%)	1959 (16.80%)
MAS	515 (7.30%)	407 (8.84%)	922 (7.91%)
Other causes of respiratory distress	216 (3.06%)	123 (2.67%)	339 (2.90%)
Birth Asphyxia	757 (10.73%)	601 (13.06%)	1358 (11.65%)
Sepsis	1317 (18.76%)	1222 (26.55%)	2519 (21.61%)
Jaundice	1556 (22.06%)	664 (14.43%)	2220 (19.04%)
Congenital malformation	62 (0.87%)	39 (0.84%)	101 (0.86%)
Others	1303 (18.47%)	913 (19.84%)	2246 (19.27%)

Morbidity profile was observed to be different in Inborn and Outborn. In Inborn, major cause of admission was Jaundice (22%) followed by RDS (18.8%) and Sepsis (18.6%) and in Outborn, Sepsis (30.09%) was the predominant cause.

Table 4: Outcome of neonates admitted in Inborn and Outborn.

OUTCOME	INBORN (7053)	OUTBORN (4601)	TOTAL (11,654)
Discharge	6178 (87.5%)	3413 (74.17%)	9591 (82.29%)
Referral	70 (0.99%)	64 (1.39%)	134 (1.14%)
LAMA	192 (2.72%)	295 (6.41%)	487 (4.17%)
Death	613 (8.69%)	829 (18.01%)	1442 (12.37%)

The overall NICU mortality during the study period was found to be 12.37%. On comparing the Inborn and Outborn mortality rates, it can be observed that the Inborn mortality (8.69%) is lower than that of Outborn (18.01%).

Neonates who left against medical advice (LAMA) was also found to be higher in Outborn than in Inborn. (6.41% in Outborn and 2.72% in Inborn).

Table 5: Cause wise mortality data.

CAUSE OF DEATH	INBORN (613)	OUTBORN (829)	TOTAL (1442)
Birth asphyxia	354 (57.74%)	374 (45.11%)	728 (50.48%)
Sepsis	115 (18.76%)	275 (33.17%)	390 (34.15%)
RDS	69 (11.25%)	93 (11.21%)	162 (11.23%)
MAS	19 (3.09%)	29 (3.49%)	48 (3.32%)
Congenital malformation	12 (1.95%)	11 (1.32%)	23 (1.59%)
Other causes	44 (7.17%)	47 (5.66%)	91 (6.31%)

Birth asphyxia was the major cause of death in both Inborn and Outborn babies. It was responsible for nearly half (50.48%) of total deaths. The next leading cause was Sepsis accounting for a total of 390 deaths (34.15%). Other causes were RDS (11.23%), MAS (3.32%) and congenital malformation (1.59%).

Table 6: Age at death of babies in Inborn and Outborn

AGE AT DEATH	INBORN (613)	OUTBORN (829)	TOTAL (1442)
< 24 hours	10 (1.63%)	29 (3.49%)	39 (2.70%)
24hours – 7 days	548 (89.39%)	676 (81.5%)	1224 (84.88%)
>7 days	55 (8.97%)	124 (14.95%)	179 (12.41%)

On analysing the age of babies at death, it was observed that majority of deaths in the NICU (84.88%) occurred between 24 hours to 7 days age. The early neonatal death contributed to 87.5% of total deaths (558 out of 1442), whereas late neonatal death was only 55 out of 1442, which accounted to 12.41%.

Discussion

During our study period, from January 2016 to December 2018, there were a total of 11,654 admissions in NICU of which 60.51% babies were Inborn and 39.48% were outborn. The percentage of babies in Inborn and Outborn is comparable to that of other studies done by Kumar R et al, Sharma A K et al and Malik et al[9],[10],[11]. There was male

predominance with respect to NICU admissions. Similar finding with respect to the gender distribution was reported by several studies[11],[12],[13],[14],[15],[16]. Also, the male:female ratio was higher in Outborn than Inborn. Gender bias as a cause for higher number of male admissions in Outborn needs to be further evaluated. However, it is also possible that the true rate of illness was lower in female neonates. Low birth weight constituted 47.7% of total admissions in our NICU, which was slightly higher than that observed in their studies by Sridhar R et al[17], Baruah et al[15], and lower than that obtained by Malik S et al[11] and Niru Prabha Saharia et al[17].

On analysis of morbidity profile of admitted neonates, the major causes of admission to NICU were found to be jaundice, RDS, sepsis, Birth asphyxia and MAS. Morbidity profile was similar to that obtained in their studies by Kumar R et al[9], Baruah et al[15], Malik S et al[11], Sharma AK et al[10] and Kannan R et al[18].

Out of the total 11,654 admitted neonates, 134 were referred to other centers and 487 left against medical advice (LAMA). Out of the remaining 11,033 neonates 9591(82.29%) were discharged successfully and 1442 (12.37%) expired.

Mortality rate in our NICU(12.37%) was similar to that obtained in their study by Kumar R et al[9] (11.41%) and Niru Prabha Saharia et al[17] (13%). Mortality rate reported varies among different studies from different parts of the country. Mortality rate was 20.53% in a study by Rakholia R et al[19], Baruah et al[15] (10.2%), Sridhar PV et al[20](7.16%).

The mortality data shows much higher mortality in outborn (18.01%) compared to inborn (8.69%). Studies by Kannan R et al[18], Baruah et al[15] and Panda et al[21] also shows higher mortality in outborn neonates. The higher outborn mortality may be due to issues like inadequate functioning of peripheral neonatal facilities like NBSUs, delayed referral, lack of pre-transport stabilisation.

In our NICU, 87.5% deaths occurred within the first seven days of life. This is in concordance with the findings by Malik S et al[11] and Baruah et al[15].

Majority of deaths in the Early neonatal period emphasises on the importance of care during immediate postnatal period.

On analysing the major causes of neonatal death in our NICU, we observed that birth asphyxia contributed to 57.74% deaths in Inborn unit and 45.11% deaths in Outborn unit. Asphyxia was the leading cause in other studies done by Sridhar PV et al[20], kailash Chandra et al[22] and Niru Prabha Saharia et al[17]. This high number of deaths due to asphyxia may be caused by poor obstetric care at the peripheries and late referral of mother. Other causes of mortality in our NICU were sepsis, RDS, and MAS.

Limitations of the Study

This study has some limitations, as this was a hospital based retrospective study, the cause of death was determined using the data available in case record sheets. As the majority of the patients presenting to us belong to low socio-economic status, the results from this study cannot be a complete reflection of the problem in the community as a whole. Multicentre, prospective studies including major centers providing neonatal care in the region are needed.

Conclusion

Data pertaining to disease pattern and mortality are useful for health care providers and policy makers to modify and plan treatment or interventions and evaluate the effectiveness of health care initiatives respectively. This study analyzed the morbidity and mortality profile of neonates admitted to Neonatal Intensive Care Unit (NICU) of a tertiary care teaching hospital in Silchar, Assam.

From our study, we could conclude that jaundice, sepsis, RDS and birth asphyxia are the leading cause of admission in our NICU. The findings of the study highlight that major contributors to the neonatal mortality in our setup are Birth asphyxia, sepsis and RDS.

Improving the antenatal care, maternal health and timely intervention by referral to tertiary centers will help improve neonatal outcome.

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