

Morbidity and Mortality Profile of Neonates Admitted in Special Newborn Care Unit in a Tertiary Care Hospital: A Retrospective Study

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ABSTRACT

Introduction: Newborn period is the most vulnerable phase of life and deaths during first 28 days of life account for 70% of all infant deaths and 56% of all deaths of under-5 year in children. Children who die within the first 28 days of birth suffer from conditions and diseases associated with lack of quality care at or immediately after birth and in the first few days of life.

Aim: To study the morbidity and mortality profile of neonates admitted in Special Newborn Care Unit (SNCU) in a tertiary care hospital.

Materials and Methods: This hospital-based retrospective study was carried out in SNCU, Department of Paediatrics, Gauhati Medical College and Hospital (GMCH), Guwahati, Assam, India. The study period was from 1st July 2021 to 30th June 2022. A total of 7439 neonates (both inborn and outborn) from birth to 28 days of life admitted in SNCU during the study period were included in the study. Morbidity and mortality data of admitted neonates were collected from the monthly reporting format and patient records and compiled in MS Excel sheet and analysed using arithmetic mean and also expressed in percentages.

Results: During the study period, 7439 neonates were admitted in SNCU, of which, inborn were 4854 (65.3%) and outborn were 2585 (34.7%). Male and female in the study population were 4305 (57.9%) vs 3134 (42.1%) respectively. Normal birth weight and Low Birth Weight (LBW) babies were 4200 (56.5%) vs 3239 (43.5%). Term and Preterm (PT) babies 4424 (59.5%) vs 3015 (40.5%). Neonatal jaundice, birth asphyxia and neonatal sepsis were common morbidities requiring admission. Mortality was 12.1% which was higher in outborn (21.5%) than inborn (7.1%). Birth asphyxia (45.3%) was the most common cause of mortality followed by Respiratory Distress Syndrome (RDS) with prematurity (20.4%) and neonatal sepsis (15.1%). Birth asphyxia was higher in outborn (47.5%) than inborn (41.9%). Neonatal sepsis was higher in outborn (18.3%) than inborn (9.9%). Highest number of death occurred within seven days of birth (70.2%) and among LBW babies (61%).

Conclusion: Birth asphyxia, RDS with prematurity and neonatal sepsis are common causes of neonatal mortality. Outcomes of this study can be used for improving the existing healthcare services to reduce neonatal mortality.

Keywords: Birth asphyxia, Inborn, Low birth weight, Neonatal jaundice, Outborn

INTRODUCTION

Globally, 130 million babies are born every year and of these, four millions die during the newborn period, i.e., first four weeks of life. Most neonatal deaths occur in first week of life (75%) and almost 25% during first 24 hours [1]. The risk of mortality during neonatal period is 30-fold higher than during postneonatal period. Every year about 26 million babies (20% of global births) are born in India and almost 0.75 million die during neonatal period, which accounts for 30% global deaths [1]. According to National Family Health Survey-5 (NFHS-5) data, neonatal mortality rate is 24.9 per 1000 live birth in India and 22.5 per 1000 live births in Assam [2].

The millennium development goal 4 (reducing under-5 mortality by two-thirds) cannot be achieved without substantial reduction in neonatal mortality [1]. Children who die within first 28 days of birth suffer from conditions and diseases associated with lack of quality of care at or immediately after birth and in the first few days of life [3]. The knowledge of morbidity and mortality profile of neonates helps in developing and strengthening health policies for reducing neonatal mortality. The morbidity and mortality profile of neonates differ in different SNCU. There is a dearth of study of morbidity and mortality profile of neonates from this region of the country. The Department of Paediatrics, Gauhati Medical College and Hospital is a tertiary care teaching hospital where patients from all the over the state of Assam including from other Medical Colleges and North East Region are being referred and cared. Hence, this study was undertaken with the following aim to study the morbidity and mortality profile of neonates admitted in SNCU.

MATERIALS AND METHODS

This retrospective hospital-based study was carried out in SNCU, Department of Paediatrics, Gauhati Medical College and Hospital (GMCH), Guwahati, Assam, India. Morbidity and mortality data were collected from 1st July 2021 to 30th June 2022 and the analysis of data was done from December 2022 to January 2023. Ethical clearance was obtained from Institutional Ethics Committee (IEC) (No.MC/190/2007/pt-II/Dec.2022/12), GMCH.

Inclusion criteria: A total of 7439 neonates (both inborn and outborn) from birth to 28 days of life admitted in SNCU during the study period were included in the study.

Exclusion criteria: Still-births neonates were not admitted in SNCU were excluded from the study.

The data was analysed according to age, gender, gestation (term, preterm), birth weight {normal birth weight, LBW, Very Low Birth Weight (VLBW), Extremely Low Birth Weight (ELBW)}, causes of admissions and deaths. Inborn neonates means admitted neonates are delivered in GMCH and outborn neonates means admitted neonates are delivered outside GMCH. Hospital stay, all treatment and investigations are provided free of cost to all neonates in SNCU.

STATISTICAL ANALYSIS

Data was collected from the monthly reporting format and patient records and compiled in MS Excel. Data was analysed using arithmetic mean and also expressed in percentages. Percentage is used to compare one quantity against another.

RESULTS

During the study period, a total 7439 neonates were admitted in SNCU, inborn were 4854 (65.3%) and outborn were 2585 (34.7%). The ratio of neonates of inborn and outborn was 1:9:1. The overall male and female was 4305 (57.9%) vs 3134 (42.1%) and ratio was 1:4:1.

The male and female of inborn was 2682 (55.3%) vs 2172 (44.7%) and ratio was 1:2:1. The male and female of outborn was 1623 (62.8%) vs 962 (37.2%) and ratio was 1.7:1. Results showed higher male admission in both the units [Table/Fig-1].

Categories	Inborn (n=4854) n (%)	Outborn (n=2585) n (%)	Total (n=7439) n (%)
Gender			
Male	2682 (55.3)	1623 (62.8)	4305 (57.9)
Female	2172 (44.7)	962 (37.2)	3134 (42.1)
Birth weight (gm)			
> 2500	2725 (56.1)	1475 (57)	4200 (56.5)
1500-2499	1723 (35.5)	816 (31.6)	2539 (34.1)
1000-1499	304 (6.3)	228 (8.8)	532 (7.2)
<1000 gm	102 (2.1)	66 (2.6)	168 (2.2)
Gestation (weeks)			
>37	2879 (59.3)	1545 (59.8)	4424 (59.5)
34-37	1384 (28.5)	641 (24.8)	2025 (27.2)
<34	591 (12.2)	399 (15.4)	990 (13.3)

[Table/Fig-1]: Admission profile based on gender, birth weight and gestation of neonates.

In the inborn unit, 2725 (56.1%) were normal birth weight [Table/Fig-1] while 2129 (43.9%) were LBW [Table/Fig-2]. In the outborn unit, 1475 (57%) were normal birth weight [Table/Fig-1] while 1110 (43%) were LBW [Table/Fig-2]. As per birth weight criteria overall 4200 (56.5%) were >2500 gm (normal birth weight) and 3239 (43.5%) were LBW.

Special Newborn Care Unit (SNCU)	Birth weight (1500-2499 gm) n (%)	Birth weight (1000 gm-1499 gm) n (%)	Birth weight <1000 gm n (%)	Low Birth Weight (LBW) neonates n (%)
Inborn	1723 (35.5)	304 (6.3)	102 (2.1)	2129 (43.9)
Outborn	816 (31.6)	228 (8.8)	66 (2.6)	1110 (43)
Total	2539 (34.1)	532 (7.2)	168 (2.2)	3239 (43.5)

[Table/Fig-2]: Admission profile based on Low Birth Weight (LBW) neonates.

As per gestation, overall 4424 (59.5%) were term babies [Table/Fig-1] and 3015 (40.5%) were PT babies [Table/Fig-3]. PT babies comprised 1975 (40.7%) and 1084 (40.2%), respectively in inborn and outborn unit [Table/Fig-3]. So, almost equal numbers of PT babies were admitted both in inborn and outborn unit.

Special Newborn Care Unit (SNCU)	Gestation (34-37 weeks) n (%)	Gestation <34 weeks n (%)	Preterm (PT) neonates n (%)
Inborn	1384 (28.5)	591 (12.2)	1975 (40.7)
Outborn	641 (24.8)	399 (15.4)	1084 (40.2)
Total	2025 (27.2)	990 (13.3)	3015 (40.5)

[Table/Fig-3]: Admission profile based on Preterm (PT) neonates.

In the inborn unit neonatal jaundice 2650 (54.6%) was the most common cause of admission followed by birth asphyxia 513 (10.6%). In outborn unit, birth asphyxia 891 (34.5%) was the most common cause of admission followed by sepsis 281 (10.9%). Babies having jaundice requiring phototherapy were 2650 (54.6%) in inborn and 429 (16.6%) in outborn. Overall neonatal jaundice 3079 (41.4%), birth asphyxia 1404 (18.9%) and neonatal sepsis 383 (5.1%). Neonatal sepsis 102 (2.1%) vs 281 (10.9%), RDS 157 (3.2%) vs 119 (4.6%), Meconium Aspiration Syndrome (MAS) 74 (1.5%)

vs 110 (4.2%) and major congenital malformation 58 (1.2%) vs 105 (4.1%) in inborn and outborn unit, respectively which was more in outborn babies [Table/Fig-4].

Disease	Inborn (n=4854) n (%)	Outborn (n=2585) n (%)	Total (n=7439) n (%)
Respiratory Distress Syndrome (RDS)	157 (3.2)	119 (4.6)	276 (3.7)
Meconium Aspiration Syndrome (MAS)	74 (1.5)	110 (4.2)	184 (2.5)
Others causes of respiratory distress	4 (0.08)	2 (0.08)	6 (0.08)
Birth asphyxia	513 (10.6)	891 (34.5)	1404 (18.9)
Sepsis	102 (2.1)	281 (10.9)	383 (5.1)
Major congenital malformation	58 (1.2)	105 (4.1)	163 (2.2)
Jaundice	2650 (54.6)	429 (16.6)	3079 (41.4)
Hypothermia	11 (0.23)	4 (0.15)	15 (0.2)
Hypoglycaemia	2 (0.04)	0	2 (0.03)
Others	1283 (26.4)	644 (24.9)	1927 (25.9)

[Table/Fig-4]: Morbidity profile of admitted neonates.

In inborn unit 4111 (84.7%) patients were discharged successfully while 165 (3.4%) patients left the SNCU against medical advice. In outborn unit 1704 (66%) patients were discharged successfully while 170 (6.6%) patients Left Against Medical Advice (LAMA). Overall LAMA was 335 (4.5%) [Table/Fig-5].

Outcome	Inborn (n=4854) n (%)	Outborn (n=2585) n (%)	Total (n=7439) n (%)
Discharged successfully	4111 (84.7)	1704 (66)	5815 (78.2)
Discharged on request	82 (1.7)	67 (2.2)	149 (2.0)
Left Against Medical Advice (LAMA)	165 (3.4)	170 (6.6)	335 (4.5)
Referral	152 (3.1)	88 (3.4)	240 (3.2)
Death	344 (7.1)	556 (21.5)	900 (12.1)

[Table/Fig-5]: Outcome of admitted neonates.

Mortality rate was overall 900 out of 7439 (12.1%) whereas in inborn unit it was 344 out of 4854 (7.1%) and outborn 556 out of 2585 (21.5%) [Table/Fig-5]. Among the total 900 deaths, overall 560 (62.2%) were male and 340 (37.8%) were female. In inborn unit 201 (58.4%) were males and 143 (41.6%) were females whereas in outborn unit 359 (64.6%) were males and 197 (35.4%) were females [Table/Fig-6].

Categories	Inborn (n=344) n (%)	Outborn (n=556) n (%)	Total (n=900) n (%)
Gender			
Male	201 (58.4)	359 (64.6)	560 (62.2)
Female	143 (41.6)	197 (35.4)	340 (37.8)
Birth weight (gm)			
>2500	81 (23.5)	270 (48.6)	351 (39)
1500-2499	108 (31.4)	165 (29.7)	273 (30.3)
1000-1499	98 (28.5)	83 (14.9)	181 (20.1)
<1000	57 (16.6)	38 (6.8)	95 (10.6)
Gestation			
Term	133 (38.7)	381 (68.5)	514 (57.1)
Preterm	211 (61.3)	175 (31.5)	386 (42.9)

[Table/Fig-6]: Mortality profile based on gender, birth weight and gestation of neonates.

In inborn deaths male:female ratio was 1:4:1 whereas in outborn deaths male: female ratio was 1:8:1 and overall deaths male:female ratio was 1:6:1. So, in both the units male mortality was higher than female. Overall term babies were more than PT 514 (57.1%) vs 386 (42.9%) [Table/Fig-6]. Among the death, 351 (39%) were normal birth weight babies and 61% were LBW babies.

Neonatal age at death shows that only 37 (10.8%) of inborn and 44 (7.9%) of outborn deaths occurs within first 24 hours of life while majority of deaths occurred between 1-7 days of life [Table/Fig-7]. Study of duration between admission and death shows that most of deaths occurred between 1-3 days of admission, inborn 139 (40.4%) and outborn 266 (47.8%) [Table/Fig-7]. After this period next maximum deaths were occurred in >7 days both in inborn and outborn unit [Table/Fig-7]. Among all deaths 55.3% of deaths occurred within 72 hours of admission.

Categories	Inborn (n=344) n (%)	Outborn (n=556) n (%)	Total (n=900) n (%)
Age of neonates at the time of death			
<1 day	37 (10.8)	44 (7.9)	81 (9)
1-7 days	203 (59)	348 (62.6)	551 (61.2)
>7 days	104 (30.2)	164 (29.5)	268 (29.8)
Duration between admission and death			
<1 day	38 (11)	55 (9.9)	93 (10.3)
1-3 days	139 (40.4)	266 (47.8)	405 (45)
4-7 days	75 (21.8)	111 (20)	186 (20.7)
>7 days	92 (26.7)	124 (22.3)	216 (24)

[Table/Fig-7]: Mortality profile based on age of neonates at the time of death and duration between admission and death.

Birth asphyxia was the major cause of mortality which was 408 (45.3%) (inborn 41.9% and outborn 47.5%). It was followed by RDS with prematurity 184 (20.4%) (Inborn 30.8%, outborn 14%), Sepsis 136 (15.1%) (inborn 9.9%, outborn 18.3%), major congenital malformation 74 (8.2%) (inborn 7%, outborn 9%) and MAS 34 (3.8%) (inborn 2.3%, outborn 4.7%) [Table/Fig-8], respectively.

Disease	Inborn (n=344) n (%)	Outborn (n=556) n (%)	Total (n=900) n (%)
RDS with prematurity	106 (30.8)	78 (14)	184 (20.4)
MAS	8 (2.3)	26 (4.7)	34 (3.8)
Birth asphyxia	144 (41.9)	264 (47.5)	408 (45.3)
Sepsis	34 (9.9)	102 (18.3)	136 (15.1)
Major congenital malformation	24 (7)	50 (9)	74 (8.2)
Others	28 (8.1)	36 (6.5)	64 (7.1)

[Table/Fig-8]: Disease specific mortality.

Proportionate mortality according to the birth weight was that with decreasing birth weight mortality increases significantly. Overall proportionate mortality of normal weight baby was 8.3% which increases with decreasing weight as in 1500-2499 gm babies 10.7%, 1000-1499 gm babies 34% and <1000 gm babies 56.5%. In inborn unit, mortality of normal weight baby was 3% which increases with decreasing weight as in 1500-2499 gm babies 6.3%, 1000-1499 gm babies 32.2% and <1000 gm babies 55.9%. Among outborn babies mortality in normal weight babies 18.3% which also increases with decreasing weight as in 1500-2499 gm babies 20.2%, 1000-1499 gm babies 36.4% and <1000 gm babies 57.6% of cases [Table/Fig-9].

Birth weight (gm)	Inborn	Outborn	Total
>2500	81/2725 (3%)	270/1475 (18.3%)	351/4200 (8.3%)
1500-2499	108/1723 (6.3%)	165/816 (20.2%)	273/2539 (10.7%)
1000-1499	98/304 (32.2%)	83/228 (36.4%)	181/532 (34%)
<1000	57/102 (55.9%)	38/66 (57.6%)	95/168 (56.5%)

[Table/Fig-9]: Proportionate mortality.

DISCUSSION

Neonatal jaundice, birth asphyxia and neonatal sepsis are common morbidities requiring admission. Birth asphyxia, Respiratory Distress Syndrome (RDS) with prematurity and neonatal sepsis are common causes of neonatal mortality [Table/Fig-8].

During the study period, 7439 neonates were admitted in SNCU, inborn 65.3% and outborn 34.7%. Similar findings were reported by other studies done by Kumar R et al., in Uttarakhand, India showed (inborn 60.8%, outborn 39.2%) [4]. Rahman K and Begum R at Tezpur, Assam, India showed (inborn 64.7%, outborn 35.2%), Randad K et al., in Mumbai, India showed (inborn 76.46%, outborn 23.54%), Mendu SB et al., in rural area of Telangana state, India showed (inborn 82.76%, outborn 17.24%), Anupama D et al., at Silchar, Assam showed (inborn 60.5%, outborn 39.5%) and Prasanna CL et al., at Andhra Pradesh showed (inborn 58.5%, outborn 41.5%) [4-9].

There was male preponderance with 57.9% were male babies and 42.1% were female babies. Similar findings were reported from the studies done by Kumar R et al., in Uttarakhand, India (59.54% vs 40.46%), Rahman K and Begum R at Tezpur, Assam (58.7% vs 41.2%), Anupama D et al., at Silchar, Assam (58.53% vs 41.38%), Sharma AK and Gaur A at Gwalior, Madhya Pradesh (63.07% vs 36.92%), Som M et al., at in Odisha (60.2% vs 39.8%) and Modi R et al., in Gujarat, India (56.36% vs 43.63%) [4,5,8,10,12]. Higher number of male admissions needs to be further evaluated.

In the present study overall 43.5% babies were LBW. In other studies, the LBW admissions were Rahman K and Begum R at Tezpur, Assam showed 49.8%, Anupama D et al., at Silchar, Assam showed 47.7%, Sharma AK and Gaur A at Gwalior, Madhya Pradesh showed 61.5% and Rakholia R et al., in Uttarakhand, India showed (61.6%) which was higher than the present study [5,8,10,13]. In the present study overall 59.5% babies were term and 40.5% were PT which was comparable to the study done by Modi R et al., in Gujarat, India showed (54.3% vs 45.7%) [12]. Other studies done by Rahman K and Begum R at Tezpur, Assam showed (49.4% vs 50.6%) and Rakholia R et al., in Uttarakhand, India showed (49.65% vs 50.35%), where the number of term and PT babies were almost equal [5,13].

Neonatal Jaundice was found to be the most common cause of admission in 41.4% neonates. Similar studies were done by Kotwal YS et al., in Jammu and Kashmir, India showed neonatal jaundice 26.7% [14], Rahman K and Begum R at Tezpur, Assam showed neonatal jaundice 19.9% and Anupama D et al., at Silchar Assam showed neonatal jaundice 19.04%, respectively which was lower than the present study [5,8]. Significantly higher number of jaundice babies were admitted in inborn unit (54.6% vs 16.6%). This is because the jaundice babies were diagnosed early during regular postnatal round and phototherapy started as and when required. In the present study the overall incidence of birth asphyxia was 18.9%. The study conducted by Rahman K and Begum R at Tezpur, Assam showed 28.7%, and Anupama D et al., at Silchar, Assam showed 11.65% [5,8]. The incidence of birth asphyxia was higher in outborn babies compared to inborn babies (outborn 34.5%, inborn 10.6%). This findings was similar with studies conducted by Rahman K and Begum R at Tezpur, Assam showed (outborn 31.2%, inborn 27.3%) and Anupama D et al., at Silchar, Assam showed (outborn 13.06%, inborn 10.73%) [5,8]. It may be due to delayed referrals of high risk mothers, lack of access to health facilities, inadequate quality of antenatal, intranatal care and lack of effective neonatal resuscitation. The overall incidence of neonatal sepsis was 5.1%. Other studies done by Rahman K and Begum R at Tezpur, Assam showed 10.8%, and Anupama D et al., at Silchar, Assam showed 21.61% which was higher than the present study [5,8]. The overall incidence of LAMA was 4.5% which was comparable to the studies done by Rahman K and Begum R at Tezpur, Assam showed 8.1%, and Anupama D et al., at Silchar, Assam showed 4.17% [5,8].

Overall mortality rate was 12.1% which was similar with the studies done by Rahman K and Begum R at Tezpur, Assam (11.4%) and Anupama D et al., in Silchar, Assam (12.37%) [5,8]. The mortality data shows much higher mortality in outborn (21.5%) compared to inborn (7.1%). Studies by Rahman K and Begum R at Tezpur,

Assam showed higher outborn mortality (outborn 14.3%, inborn 9.9%), and Anupama D et al., at Silchar, Assam showed higher outborn mortality (outborn 18.01%, inborn 8.69%) [5,8]. The higher outborn mortality may be due to inadequate functioning of peripheral neonatal facilities like Newborn Stabilisation Unit, delayed referral, lack of pretransport stabilisation. Gender specific mortality shows that male:female death was 62.2% vs 37.8%. The study done by Rahman K and Begum R at Tezpur, Assam showed the similar trend of male:female deaths was 58.7% vs 41.2% [5]. Term babies were more than PT (57.1% vs 42.9%), which was similar to study done by Kumar R et al., in Uttarakhand, India (59.6% vs 40.3%) and Rahman K and Begum R at Tezpur, Assam (56.7% vs 43.2%) [4,5]. A total of 70.2% deaths occurred within the first seven days of life. This was inconcordance with the study done by Rahman K and Begum R at Tezpur, Assam showed 88.5%, and Anupama D et al., at Silchar, Assam showed 87.6% [5,8]. Majority of death in early neonatal period emphasises on the importance of care during early neonatal period.

On analysis of the major causes of neonatal death in SNCU it was observed that birth asphyxia contributed 41.9% deaths in inborn and 47.5% deaths in outborn and overall 45.3% deaths in SNCU. Birth asphyxia was the leading cause of death in other studies done by Rahman K and Begum R at Tezpur, Assam showed overall 53.9% (inborn 57.8%, outborn 48.9%), Anupama D et al., at Silchar, Assam showed overall 50.48% (inborn 57.74%, outborn 45.11%) [5,8].

Incidence of death due to RDS with prematurity was 20.4% which was similar to the study done by Kumar R et al., in Uttarakhand, India showed 17.5% and Rahman K and Begum R at Tezpur, Assam showed 23.2% [4,5]. Overall incidence of sepsis was 15.1%. Similar findings were reported by Rahman K and Begum R, at Tezpur, Assam showed 12.4% [5]. Anupama D et al., at Silchar, Assam showed 34.15% which was higher than the present study [8]. Outborn unit shows high incidence of mortality due to sepsis than inborn unit (18.3% vs 9.9%). This was similar to the study done by Kumar R et al., in Uttarakhand, India showed (outborn 29.17%, inborn 24.62%), Rahman K and Begum R at Tezpur, Assam showed (outborn 18.5%, inborn 7.7%), Anupama D et al., at Silchar, Assam showed (outborn 33.17%, inborn 18.76%) [4,5,8]. High incidence of death due to sepsis in outborn may be due to unhygienic delivery practices in the periphery, lack of adequate manpower and non compliance of asepsis protocol during neonatal care. Death due to sepsis can be reduced by timely intervention. Proportionate mortality reveals that lower the birth weight higher the probability of death (>2500 gm: 8.3%, 1500-2499 gm: 10.7%, 1000-1499 gm: 34%, <1000 gm: 56.5%). Similar trend was also shown by Rahman K and Begum R at Tezpur, Assam (>2500 gm: 9.4%, 1500-2499 gm: 10.2%, 1000 gm-1499 gm: 22.1%, <1000 gm: 56.9%) [5]. Outcomes of this study can be used for improving the existing healthcare services to reduce neonatal mortality. Regular training of doctors, nurses,

improvement of infrastructure and adequate manpower is important to improve neonatal outcome.

Limitation(s)

The present study was a hospital-based retrospective study. Therefore, the present study could not analyse the epidemiological factors, socio-economic background, antenatal, intranatal and postnatal factors that could have influenced the outcome.

CONCLUSION(S)

The present study shows that neonatal jaundice, birth asphyxia and neonatal sepsis are common morbidities requiring admission. Birth asphyxia is the most common cause of mortality followed by RDS with prematurity and neonatal sepsis. Improvement of maternal health, proper antenatal, intranatal and neonatal care and timely intervention by referral to tertiary centres will help to improve neonatal outcome.

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