

Morbidity and mortality profile of neonates admitted in a special care newborn unit of a tertiary care teaching hospital of Assam, India

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ABSTRACT

Objectives: The objective of study is to estimate the morbidity and mortality of newborns admitted at Special Care Newborn Unit (SCNU) of tertiary care hospital. **Materials and methods:** This hospital based retrospective study was carried out in SCNU, department of pediatrics, over a period of 4 years from 1st January 2016 to 31st December 2019. All newborns (0- 28 days) admitted into the SCNU during the study period were included in the study. Data were collected from the monthly reporting format and patient case records. Then they were compiled in MS excel and analyzed using appropriate statistical tools. **Results:** During this period of 4 years total 5649 number of patients were admitted in SCNU, inborn 3657 (64.7%) and out born 1992 (35.2%). 58.7% of babies were male. Almost equal number of normal weight (50.2%) and low birth weight babies (49.7%) were admitted. Similarly equal number of term (49.4%) and preterm babies (50.5%) were admitted. Birth asphyxia, babies with birth weight below 1800gm requiring special care, neonatal sepsis and jaundice requiring phototherapy were common morbidities requiring admission. Mortality was 11.4% which is higher in out born (14.3%) than inborn (9.9%). Birth asphyxia (53.9%) is the commonest cause of mortality followed by respiratory distress syndrome (RDS) with prematurity (23.2%) and neonatal sepsis (12.4%). Sepsis is higher in out born unit (18.5%) than inborn (7.7%). Highest number of death occurs in early neonatal period (88.5%) and among low birth weight baby (58.7%). First 72 hours of admission is crucial for survival as 78.2 % babies die during this period. **Conclusion:** Birth asphyxia, RDS with prematurity and neonatal sepsis are common cause of mortality. It is largely preventable by comprehensive antenatal, natal, neonatal care and health awareness among patients and society.

Keywords: Morbidity, mortality, neonates, inborn, out born, SCNU.

Globally around 15000 babies die every day before attaining their 5th birth day¹. Out of this around half of the babies are below one month of age. In terms of absolute numbers this translates to 7000 death every day and 26 lakhs death every year¹. In India alone 6.4 lakh babies die every year below one moth of age which is 24% of global burden¹.

National Family Health Survey-4 (NFHS-4)² which was conducted during 2015-16 was published on January 2018. The data reveals under five mortality as 49.5, infant mortality rate as 40.7 and neonatal mortality rate as 29.5 per thousand live birth with wide range of variation among the states. Kerala has achieved best healthcare indices (U5MR 7.1, IMR 5.6, NMR 4.4) while highest mortality figures are

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from Uttar Pradesh (U5MR 78.1, IMR 63.5, NMR 45.1). Our state Assam is still above the national average which is under 5 mortality 56.5, infant mortality 47.6 and neonatal mortality 32.8 per thousand live births. Above study also reveals that 60% of under five deaths occur in the neonatal period.

Therefore a lot of initiative has been taken by Government of India to reduce the neonatal mortality. Facility based newborn care is established in 3 levels. Level I care is at first referral unit as neonatal stabilization unit (NBSU), level II care as special care newborn unit (SCNU) at district hospital and level III care at regional level. New national health policy⁴ was announced on 2017 with the goal of reducing under-five mortality rate (U5MR) to 23, infant mortality rate (IMR) to 28, and neonatal mortality rate (NMR) to 16 by 2025. Our study region caters patients from nearby 6 districts of upper and middle part of Assam on the north bank, one district on the south bank and part of Arunachal Pradesh. Review of the literature reveals that there is no data regarding profiles of newborn from this area. Therefore a retrospective study was carried out to know the mortality and morbidity profiles of the newborns so that if required health policy can be modified in future which will be specific to the area.

Materials and methods

This retrospective hospital based study was carried out in SCNU, department of pediatrics, in tertiary care hospital from 1st January 2016 to 31st December 2019. All newborns (0- 28 days) admitted into the SCNU during the study period were included in the study. The SCNU has total 20 beds with 15 inborn and 5 out born beds. It is equipped with 20 radiant warmers, 12 phototherapy units, 4 (continuous positive airway pressure) CPAP and one ventilator. Hospital stay, drugs and investigations are provided free of cost to all babies in SCNU. Data were collected from the monthly record and patient files and compiled in MS excel. Data were analyzed using appropriate statistical tools.

Results

During study period, 30377 deliveries were performed in the hospital with an average 7595 per year. Caesarean

section comprised of 54.5%. Total delivery was increased by 11.2% while caesarean section was increased by 14.6% at

Table 1: Showing delivery load in the hospital

Categories	2016	2017	2018	2019	Total	Parameters
Total delivery	7113	7396	7854	8014	30377	7595/yr
LSCS	3730	4135	4345	4372	16582	54.5%
Live birth	6777	7086	7592	7681	29136	7284/year
Still birth	336	310	262	348	1256	4.1%
LBW	1881	1564	1622	1681	6748	22.2%

LSCS = Lower segment caesarian section, LBW = Low birth weight

2019 in comparison to 2016 with increase in total deliveries and caesarean section every year. Live birth was 29136 with average 7284/year and still birth was 1256 which was 4.1% of total deliveries. Incidence of low birth weight (birth weight <2500gm) newborn is 6748 (22.2%) of total deliveries (table 1). During this period of 4 years total 5649 number of patients were admitted in SCNU, inborn 3657 (64.7%) and out born 1992 (35.2%). Male babies were admitted more, overall male 58.7% and female 41.2%. Almost equal number of male babies was admitted in out born and inborn unit (59.3% vs 58.4%). Similarly equal

Table 2: Admission profile bases on gender, birth weight and gestation of neonates

Categories	In born N=3657	Out born N=1992	Total N=5649
Gender	Male	2136 (58.4%)	3319 (58.7%)
	Female	1521 (41.5%)	2332 (41.2%)
Birth weight	>2500 gm	1861 (50.8%)	2837 (50.2%)
	1500-2499gm	1507 (41.2%)	2228 (39.4%)
	1000-1499gm	259 (7.0%)	519 (9.1%)
	<1000gm	30 (0.8%)	65 (1.15%)
Gestation	>37 wks	1819 (49.7%)	2792 (49.4%)
	34-37wks	1256 (34.3%)	1874 (33.1%)
	<34 wks	582 (15.9%)	983 (17.4%)

number (50.2% vs 49.7%) of normal weight and low birth weight babies were admitted in the SCNU though in out born unit normal weight babies (46.5%) were less than low birth weight. Among LBW babies, babies between 1500-2499gm were 39.4 %, 1000-1499gm (Very low birth weight) was 9.1% and below 1000gm (Extremely low birth weight) was 1.15%. In out born unit more very low birth weight (VLBW) (13.05% vs 7%) and extremely low birth weight (ELBW) (1.7% vs 0.8%) babies were admitted. As per gestation almost equal number of term (49.4%) preterm (50.57%) were admitted. In out born unit babies <34 wks were admitted more (20.1%vs15.9%). These findings were shown in the table 2. Both in the inborn and out born unit birth asphyxia was the commonest cause of admission. In inborn unit it was 27.3 % while in out born unit 31.2%. It was

Table 3: Morbidity profile

Disease	Inborn	Outborn	Total
Preterm RDS	176 (4.8%)	121 (6.0%)	297 (5.25%)
MAS	229 (6.2%)	33 (1.6%)	262 (4.6%)
Other causes of Respiratory distress	77 (2.1%)	51 (2.56%)	128 (2.26%)
Birth Asphyxia	999 (27.3%)	623 (31.2%)	1622(28.7%)
Sepsis	354 (9.6%)	258 (12.9%)	612 (10.8%)
Congenital malformation	22 (0.06%)	17 (0.08%)	39 (0.69%)
Jaundice	753 (20.5%)	372 (18.6%)	1125 (19.9%)
Hypothermia	54 (1.4%)	26 (1.3%)	80 (1.4%)
Hypoglycemia	176 (4.8%)	34 (1.7%)	210 3.7%)
Other	817 (22.3%)	457 (22.9%)	1269 (22.4%)
Total	3657	1992	5649

RDS - Respiratory distress syndrome, MAS - Meconium aspiration syndrome

followed by other category which includes LBW babies below 1800gm of birth weight which 22.3% inborn and 22.9% out was born. Third common cause of admission is

Table 4: Outcome of admitted cases

Outcome	In born n= 3657	Out born n=1992	Total n=5649
Discharge	2953 (80.7%)	1425 (71.5%)	4378 (77.5%)
Referral	76 (2.0%)	85 (4.2%)	161 (2.8%)
LAMA	265 (7.2 %)	196 (9.8%)	461 (8.1%)
	363 (9.9%)	286 (14.3%)	649 (11.4%)
Death	Male 215 (5.8%) Female 148 (4.0%)	Male 166 (8.3%) Female 120(6.0%)	Male (6.7%) Female (4.7%)

LAMA = Left against medical advice

jaundice requiring phototherapy which was 20.5% and 18.6% in inborn and out born respectively. Neonatal sepsis was 9.6 %in inborn unit but higher in out born unit 12.9%. Among the respiratory morbidities, in inborn unit preterm respiratory distress syndrome (RDS) was 4.8%. Meconium

Table 5: Mortality profile based on gender, birth weight, gestation age at death and duration between admission and death

Categories		In born N= 363	Out born N=286	Total N= 649
Gender	Male	215 (59.2%)	166 (58.0%)	381 (58.7%)
	Female	148 (40.7%)	120 (41.9%)	268 (41.2%)
Birth weight	>2500 gm	149 (40.04%)	119 (41.6%)	268 (41.2%)
	1500-2499gm	139 (38.2%)	90 (31.4%)	229 (35.2%)
	1000-1499gm	58(15.9%)	57 (19.9%)	115 (17.7%)
	<1000gm	17 (4.6%)	20 (6.9%)	37 (5.7%)
Gestation	Term	206 (56.5%)	162 (56.6%)	368 (56.7%)
	Preterm	157 (43.2%)	124 (43.3%)	281 (43.2%)
Age at death	<1 day	71 (19.5%)	20 (6.9%)	91 (14.0%)
	1-7 days	265 (73.0%)	219 (76.5%)	484(74.5%)
	>7days	27 (7.4%)	47 (16.4%)	74 (11.4%)
Duration between admission and death	<1 day	97 (26.7%)	81 (28.3%)	178 (27.4%)
	1-3 days	189 (52.0%)	141 ((49.3%)	330 (50.8%)
	4-7 days	58 (15.9%)	43 (15.0%)	101 (15.5%)
	>7 days	19 (5.2%)	21(7.3%)	40 (6.1%)

aspiration syndrome (MAS) and transient tachypnea of the newborn (TTNB) were 6.2% and 2.1% respectively. Overall RDS among preterm babies is 176 out of 1838 (9.5%). Among out born respiratory morbidities, it was preterm RDS 6%, MAS 1.6%, other like TTNB 2.5%. Overall preterm RDS is 121 out of 1019 (11.8%) (table 3).

Congenital malformation is admitted only 0.06% and 0.08% in inborn and out born respectively. It is because the hospital did not have facility of pediatric surgery, so the babies with congenital malformation were to be referred. In inborn unit 80.7% of patients were discharged successfully while 7.2% patients left the SCNU against medical advice and we referred 2% of patients for better treatment which is not available at the hospital. Similarly in out born unit 71.5% of patients were discharged while 9.8% patients left against medical advice and we had to refer 4.2% of patients to higher facility for treatment which is not available at the hospital mainly for surgical interventions (table 4). Mortality is overall 649 out of 5649 (11.4%) where as in inborn unit it is 363 out of

3657 (9.9 %) and out born 286 out of 1992 (14.3%). Among the 649 deaths 381 (58.7%) were male and 268 (41.2% were female). In inborn unit 59.2% Male and 40.7% female baby were admitted where as in out born unit male was 58.0% and female was 41.9%. In both units male mortality is higher than female. Term babies were more than Preterm (56.7% vs. 43.2%). 14 % of babies

died within 24 hours of birth while 74.5% died between 1-7 days resulting in cumulative early neonatal death 88.5% and late neonatal death (after 7 days of age) was 11.4%. Among the death, 58.7% were low birth weight babies and only 41.2% were of normal weight. Among low birth weight, 35.2% was in between 1500-2499gm, 17.7% was between 1000-1499gm and 5.7% was below 1000gm. Death after

N P et al⁵(inborn 59.3%. out born 40.7%), and Malik S et al⁸ (inborn 57.2%,and outborn 42.8%). 58.7% of the neonates were male and 41.2% were female which is similar to the studies done by Baruah M N et al⁷ (58.4%, 41.6%), Anuradha D et al¹¹ (56.5%,43.5%) and Kumar R et al (59.5%, 40.4%) . Significantly higher males were admitted in both inborn and out born unit. Gender bias as a cause of more admission to be further evaluated. A study from Uttar Pradesh found that expenditure on male is four fold higher than female¹⁴ though such study regarding gender bias is lacking in this region. In present study equal number of normal weight (50.2%) and low birth weight (49.7%) neonates were admitted though in other study there were more number of low birth weight neonates like Anuradha D et al 74.2% and Saharia NP et al 60%. In our study term neonate admission is 49.4%

Table 6: Disease specific mortality

Disease	Inborn n= 363	Outborn n=286	Total n=649
Prematurity with RDS	81 (22.3%)	70 (24.4%)	151(23.2%)
MAS	17 (4.6%)	4 (1.39%)	21 (3.2%)
Birth asphyxia	210 (57.8%)	140 (48.9%)	350 (53.9%)
Sepsis	28 (7.7%)	53 (18.5%)	81 (12.4%)
Congenital malformation	1 (0.27%)	0	1 (0.15%)
Others	25 (6.8%)	19 (6.6%)	44 (6.7%)
Cause not established	1 (0.27%)	0	1 (0.15%)

taking admission to the SCNU took place in 27.4% of cases within 24 hours where as between 1-3 days 50.8%, 4-7 days 15.5% . Beyond 7 days of admission it was only in 6.1%. Thus among death babies, 78.2 % of the babies died within

Table 7: Proportionate mortality

Category	Inborn	Out born	Total	Parameters
Birth weight	>2500gm	149/1861 (8.0%)	119/976 (12.19%)	268/ 2837 (9.4%)
	1500-2499gm (LBW)	139/1507 (9.2%)	90/721 (12.48%)	229/ 2228 (10.2%)
	1000-1499 (VLBW)	58/259 (22.3%)	57/260 (21.9%)	115/ 519 (22.1%)
	<1000gm (ELBW)	17/30 (56.6%)	20/35 (57.1%)	37/ 65 (56.9%)

LBW = Low birth weight, VLBW = Very low birth weight, ELBW = Extremely low birth weight

72 hours of admission (table 5). Birth asphyxia was the major cause of mortality which was 53.9% (inborn 57.8% and out born 48.9%). It was followed by Pre term RDS in 23.2% (inborn 22.3% and out born 24.4%) and Sepsis in 12.4 % (inborn 7.7%, out born 18.5 %). Other causes of death were MAS 3.2%, Miscall nous (other) causes 6.7%. Congenital malformation as a cause of mortality was only 0.15% (table 6). Proportionate mortality according to the birth weight was that with decreasing birth weight mortality increases significantly. In inborn unit, mortality for normal weight baby was only 8%which increases with decreasing weight like in LBW 9.2%, VLBW 22.3% and ELBW 56.6%. Among out born patient mortality in normal weight was 12.19% which also increases with decreasing weight as in LBW 12.48%, VLBW 21.9% and ELBW 56.6% of cases (table 7).

Discussion

In our study 64.7%of the babies were inborn while 35.2% were out born which is comparable to other studies like Kumar R et al⁹ (inborn 60.8%, out born 39.2%) , Saharia

and the rest were preterm. Among preterm, babies between 34-37 weeks gestation was 33.1% whereas 17.4% baby was <34 weeks of gestation. This finding is comparable to Rakholia et al¹³ (Term 49.6%, 34-37 weeks-42.4% and <34 wks 7.9%) but findings were totally opposite to Kumar R et al (term 64.7%, pre term 35.2%). The common morbidities seen in the admitted neonates were Birth Asphyxia (28.7%), Jaundice requiring phototherapy (19.9%), other (22.4%) and Sepsis (10.8%). Other neonates include all LBW neonates below 1800gm which require special care. The common causes of morbidity were similar across various studies^{5,7,9,13}. Higher incidence of birth asphyxia is due to late arrival of the patient for delivery leading to unplanned intervention or delayed intervention, delayed referral from periphery, delayed treatment because of high delivery load with limited human resources. In our study ,high incidence of sepsis is seen in out born (12.9%) than inborn(9.6%) patients which is comparable as in Saharia NP et al (out born 18.4% and inborn 8.6%) and Ranjan A et al¹⁰(out born 17.2%, inborn 8.5%). The high incidence of sepsis in out born is

related to unhygienic delivery practices in the periphery, overcrowding of neonatal unit, lack of adequate manpower and non compliance with asepsis protocol during neonatal care. The incidence of neonatal jaundice in present study is 19.9% (inborn 20.5% and out born 18.6%) which is different across the studies as shown by Saharia NP et al 26.6%, Kotwal YS et al¹¹26.7%, Malik S et al 14.9% , Rakholia R et al 12.9%. Other causes for admission were pre term RDS (5.25%), MAS(4.6%), other cases of respiratory distress like TTNB (2.26%), hypothermia (1.4%), hypoglycemia (3.7%) and congenital malformation (0.69%). Since there was no facility of pediatric surgery for surgical intervention of neonates, only few cases (0.69%) of congenital malformation were admitted. Out of the total 5649 admitted neonates, 161 (2.8%) patients were referred to other centre while 461(8.1%) patients left against medical advice (LAMA). Out of the remaining 5027 babies, 4378(77.5%) were discharged successfully and 649(11.4%) neonates expired. Rate of successful discharge is less than Baruah MN et al (83.3%) but more than Rakholia R et al 66.5% and NNPD³ 69.3%. Incidence of LAMA is comparable to other studies like Rakholia et al 8.3%, Baruah MN et al (7.5%) and NNPD (7.5%). The mortality rate in the present study is 11.4% (inborn 9.9%and out born 14.2%). Mortality rate varies among different studies which depend on infrastructure of the treating facility and also the condition of the patient at the time of admission. Out born mortality is much higher than inborn mortality. This reflects the issues like delayed referral, lack of pre transport stabilization, in adequate functioning of peripheral neonatal stabilization units ((NBSU.) The Mortality rate of our study is higher than other study as shown by Baruah et al 7.5%, Kumar R et al 8.1%, Kotwal YS et al 9.7%, but lower than NNPD 16.9%, Rakholia R et al 20.53% and Ranjan A et al 23.4%.

Gender specific mortality is that out of 649 death, 58.7% (inborn 58.0% and out born 58.7%) are male and 41.2% (inborn 41.9% and out born 41.2 %%) are female. Among the total mortality of 11.4%, male contribution is 6.7% and female is 4.7%. Term babies were more than Preterm (56.7% vs 43.2%) which similar to studies done by Kumar R et al (59.6% vs 40.3%). Analysis of age at birth shows that it occurred 88.5% in early neonates and only 11.4% in late neonatal period which is similar to Baruah MN et al which found that 77.5% death occurred in early neonatal period. . Birth weight specific mortality shows that it is more in low birth weight babies (58.9%) in comparison to normal weight (41.2%). Trend is similar in both out born and inborn babies.

The present study is similar to other studies like Ranjan et al where normal weight baby among dead was 46.2% and LBW was 53.7% but Baruah MN et al published much higher prevalence of mortality among low birth weight babies which is 70.6%. Analysis of time interval between admission and death revealed that it took place in 27.4% of cases within 24 hours of admission, in between 1-3 days 50.8% and in 4-7 days 15.5%. Beyond 7 days of admission it was only 6.1%. .Thus 78.2 % of death occurred within 72 hours of admission. Similar trend was shown by Kumar et al which showed that 68.9% death was within 72 hours of admission.

Disease specific mortality revealed that three common causes of death are birth asphyxia (53.9%), RDS with prematurity (23.2% and sepsis (12.4%) which is similar to different studies (5,7,9,10,13) though incidence of these three causes vary among studies. Incidence of mortality due to birth asphyxia in our study was 53.9% (inborn 57.8% and out born 48.9%) which much higher than Baruah MN et al (29.3%) Ranjan et al¹⁰ (20.84%, Kumar R et al 36.4% but similar to some other study like Saharia NP et al (57%), a study done at Guwahati Medical college, the region's premier teaching institute. This high incidence of birth asphyxia may be due to late arrival of patients to the facility for seeking treatment leading to unplanned interventions, referral of all complicated cases to the hospital due to lack of other such well equipped and cheap facility in the area, delay in taking interventions during delivery and resuscitation due to high patient load and low care giver.

Incidence of death due to RDS with prematurity is 23.2 % (inborn22.3% outborn24.4%) which is similar to Saharia NP et al (19.8%), Kumar R et al (17.05%) and Baruah MN et al 15.9%. Overall incidence of Sepsis is 14.9% which is similar to Kotwal YS et al (18.2%), Saharia et al 15.7%, Ranjan A et al 17.9%. Present study also shows much higher incidence of mortality due to sepsis in out born (18.5%) compared to inborn (7.7%). This trend of high out born sepsis is published by some other studies also like Kumar R et al (out born 15.2%, inborn 8.6 %.). High incidence of sepsis is due to unhygienic delivery practices in the periphery, overcrowding of neonatal unit, lack of adequate manpower and non compliance with asepsis protocol during neonatal care. Other causes of mortality were MAS 3.2%, miscellaneous (other) causes 6.7%. Congenital malformation as a cause of mortality is only 0.15%. It is because of non availability of the pediatric surgery unit, only few cases of congenital anomalies were admitted, others were referred to

other facility. Proportionate mortality reveals that lower the birth weight higher the probability of death. Mortality of baby with birth weight 2500 gm or more is only 9.4% which increases to 10.2% in the babies whose weight is 1500 – 2499 gm. But in the babies with 1000 - 1499gm it becomes 22.1% and below 1000 gm babies death is almost half of admitted babies (56.9%). Similar trend is also shown by Baruah MN et al and Modi R et al⁶ also.

Limitation of the study: The present study is a hospital based retrospective study. Therefore like prospective study we could not analyze the epidemiological factors related to neonatal health especially socio economic back ground, maternal antenatal, intra natal and post natal factors that could have influenced the outcome.

Conclusion

Our study shows that birth asphyxia, jaundice and sepsis are common morbidities requiring admission. Birth asphyxia is the commonest cause of mortality followed by RDS with prematurity and neonatal sepsis.

Conflict of interest: None. **Disclaimer:** Nil.

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