Original Article

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Paediatrics Section

Analysis of Five Years Data of Special Newborn Care Unit in a Rural Medical College: Scope for Improvement in Neonatal Mortality and Morbidity

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ABSTRACT

Introduction: Neonatal mortality is the most important contributor towards infant mortality. Special Newborn Care Units (SNCUs) are part of the facility based newborn care of National Health Mission (NHM) and cornerstones for reducing neonatal mortality.

Aim: To study the mortality and morbidity data of a tertiary care SNCU of rural tribal Eastern India and find out the focus area for improvement.

Materials and Methods: This was a retrospective observational study carried out on 19397 babies admitted in the SNCU of Midnapore Medical College, Midnapore, West Bengal, India, from February 2016 to January 2021. Data were collected from the SNCU admission register and computerised reporting data of SNCU. In this study, five years admission and mortality data of the SNCU was analysed.

Results: There were 67729 live births during the period between February 2016 and January 2021, out of which 8627 were admitted to the SNCU (inborn). There were 1195 deaths among the inborn babies, thus the mortality rate was13.8%. The number of outborn babies admitted during the study period was 10770, out of which 1357 babies died, thus the mortality rate was 12.6%. There was significantly higher mortality among inborn babies than outborn babies (13.8% vs. 12.6%). The major causes of admissions in the SNCU were prematurity (n=10167, 52.5%), Low Birth Weight (LBW) (n=11519, 59.3%), jaundice (n=4692, 24.19%), Hypoxic Ischaemic Encephalopathy (HIE) (n=4278, 22%) and sepsis (n=2161, 11.14%). The main causes of mortality were HIE (n=766, 30%), and sepsis (n=709, 27.78%), followed by respiratory distress syndrome (n=162, 6.3%), congenital malformations (n=77, 3%), and meconium aspiration syndrome (n=37, 1.45%).

Conclusion: Prematurity and LBW were the major causes of morbidity and mortality. Sepsis and HIE were the major direct causes of mortality. Hence to reduce neonatal morbidity and mortality focus should be on preventing the above causes.

Keywords: Hypoxic ishchaemic encephalopathy, Low birth weight, Neonatal death, Premature, Sepsis

INTRODUCTION

Neonatal Mortality Rate (NMR) in India is currently 22, with Infant Mortality Rate (IMR) of 28 and under-five mortality rate of 34. It is well-known that most of the childhood deaths occurs in the newborn period [1]. The NMR has decreased considerably in India, particularly after introduction of National Rural Health Mission in 2005, with establishment of Special Care Newborn Units (SCNUs) at district levels [2]. There is a lot of disparity in healthcare facilities between different parts of the country which is also reflected in the NMR [3]. Facility-based Newborn Care (FBNC) is the programme by NHM for care of sick newborns. Under this scheme, Newborn Care Corners (NBCC) have been established wherever deliveries are there and Newborn Stabilising Units (NBSU) in the Community Health Centres (CHCs). The SNCUs have been established in every district hospitals and medical colleges for management sick babies and preterm babies [4].

Studies had shown that during 2015, NMR of the Eastern India (28.52) lagged behind the national average (27.70), and far behind the Southern (19.71) and Western (20.24). However, West Bengal (21.91) was quite better than the other states of the region, i.e., Odisha (38.20), Jharkhand (27.72), Bihar (29.31), and Assam (27.27) [5]. As per the latest National Family Health Service (NFHS)-5 data, West Bengal had NMR of 15.5 (15.5 for rural and 16.1 for urban) reduced from 22 as per the NFHS-4 survey [6]. However, studies also showed that disparity across the districts of the state existed [7]. Hence, generating reliable local data is of utmost importance.

This study was undertaken to find out the local NMR and causes of death in the newborns in the SNCU of a rural medical college in the eastern India. The findings can help us to focus more on the leading causes for morbidity and mortality and improve the rates. Thus, the primary aim was to study the mortality and morbidity data of a tertiary care SNCU of rural tribal eastern India and find out the focus area for improvement.

MATERIALS AND METHODS

This was a retrospective observational study, carried out in the SNCU of Midnapore Medical College, Medinipur, West Bengal, India. This is a rural medical college in Eastern India and serves as the tertiary care referral hospital for the South West Bengal as well as the adjoining districts of Odisha and Jharkhand. The SNCU admits sick newborns delivered in the institution (inborn babies), and also admits sick babies who are born outside or away from the institution (outborn babies). The study period was from 01/02/2016 to 31/01/2021 (five years). The study was approved by the Institutional Ethics Committee, (vide letter no MMC/IEC2020 dated 21/01/2020).

Inclusion criteria: Newborn (neonatal) period was defined as the period from birth to first 28 days of life. All the neonates, who were admitted and received treatment in the SNCU were included in the study.

Exclusion criteria: Cases that were referred or left against medical advice were excluded from the study.

Study Procedure

The neonates were admitted through the SNCU triage at the SNCU emergency room (beside the SNCU in the mother and child hub). Admission criteria were any live born neonate with any of the following:

- Birth weight <1500 gm,
- Gestational maturity <37 completed weeks,
- Sepsis (either presumed sepsis or having proven sepsis)
- Respiratory distress (defined by presence of tachypnoea, respiratory rate >60/minute and/or intercostal or subcostal in-drawing
- Neonatal hyperbilirubinemia (yellow staining of palms and soles/serum bilirubin >15 mg% (wherever reports available), onset within day first three days of life
- History of birth asphyxia
- Lethargy/poor reflexes/refusal to feed
- Neonatal convulsion
- Hypothermia
- Hypoglycaemia
- Vomiting
- Suspected intestinal obstruction
- Congenital anomalies
- Any other sick neonate

The SNCU had 80 beds out of which 10 beds have intensive care facility. Five beds were equipped with ventilators. The SNCU had doctor-to-patient ratio of 1:7 and nurse-to-bed ratio of 1:6. It was also equipped with thermoregulation, intravenous medication and fluid therapy, phototherapy, blood transfusion facility, Continuous Positive Airway Pressure (CPAP) machine, portable X-ray and ultra-sonography.

All the admitted neonates were managed as per the standard FBNC guidelines. They were discharged whenever the breast feeding was established and baby was well. They were advised to attend the follow-up clinic on wednesday/thursday after seven days postdischarge or attend SNCU triage (SNCU emergency room beside the SNCU in mother and child hub) if there was any emergency.

Data regarding admission, birth weight, major cause of presentation, final diagnosis, and short term outcome was collected from the SNCU admission register and computerised reporting data of SNCU.

STATISTICAL ANALYSIS

Data were transferred to Microsoft Excel spreadsheet. Continuous variables were expressed as means and standard deviations, and categorical variables were expressed as percentages. Comparisons were made using Chi-square test. The p-value and 95% confidence interval were obtained with the online Medcalc software [8]. The p-value <0.05 was considered statistically significant.

RESULTS

In the study institute, there were 67729 live births during the study period of five years. Total inborn admitted were 8627, and there were 1195 deaths. Thus, the mortality rate was 13.85% [Table/Fig-1]. The average NMR for the hospital born babies was 17.6 during this period (1195 deaths out of 67729 live births, ignoring any death which may have occurred after referral/ discharge from the hospital).

The number of outborn babies admitted during the period February 2016 to January 2021 was 10770 out of which 1357 babies died, thus the mortality rate was 12.6% [Table/Fig-2].

Duration period	Live births	Admission in SNCU*	Neonatal deaths	SNCU* mortality	NMR**
2016-17	14252	1537	163	10.60%	11.4
2017-18	14381	2283	298	13.05%	20.7
2018-19	13542	1918	248	12.93%	18.3
2019-20	13002	1543	242	15.68%	18.6
2020-21	12552	1346	244	18.12%	19.4
Total	67729	8627	1195	13.85%	17.6

[Table/Fig-1]: Mortality among the Inborn babies in the SNCU 2016-2021.
*SNCU: Special newborn care unit; **NMR: Neonatal mortality rate

Duration period	Admissions	Deaths	Mortality
2016-17	1447	179	12.37%
2017-18	2653	312	11.76%
2018-19	2568	310	12.07%
2019-20	2322	284	12.23%
2020-21	1780	272	15.28%
Total	10770	1357	12.6%

[Table/Fig-2]: Mortality among the outborn babies admitted in the SNCU.

The overall mortality (inborn and outborn) was 13.16% (out of 19397 babies admitted in the SNCU, 2552 died). The difference of mortality between inborn babies and outborn babies (13.85% vs 12.6%) was significant (p=0.0139 and p<0.05, 95% confidence interval 0.2428% to 2.1642%). Numbers of premature and LBW babies were high in both groups [Table/Fig-3].

Year	Preterm babies (<37 weeks)		p-value	LBW babies (<2.5 kg)		p-value*
	Inborn	Outborn		Inborn	Outborn	
2016-17	797 (51.85%) n=1537	734 (50.7%) n=1447	0.5300	956 (62.2%) n=1537	856 (59.15%) n=1447	0.0865
2017-18	1163 (50.9%) n=2283	1482 (55.9%) n=2653	0.0004	1376 (60.3%) n=2283	1559 (58.76%) n=2653	0.2719
2018-19	1053 (54.9%) n=1918	1478 (57.56%) n=2568	0.0755	1196 (62.36%) n=1918	1457 (56.73%) n=2568	0.0001
2019-20	737 (47.76%) n=1543	1044 (44.96%) n=2322	0.0873	940 (60.9%) n=1543	1254 (54%) n=2322	<0.0001
2020-21	722 (53.64%) n=1346	957 (53.76%) n=1780	0.9469	860 (63.9%) n=1346	1065 (59.83%) n=1780	0.0205
Total	4472 (51.83%) n=8627	5695 (52.8%) n=10770	0.1789	5328 (61.76%) n=8627	6191 (57.48%) n=10770	<0.0001

[Table/Fig-3]: Prematurity and Low Birth Weight (LBW) among admitted babies in the SNCU.
*Chi-square test was applied; p-value <0.05 was considered significant

The percentage of premature babies in inborn and outborn admissions were not significantly different (51.83% vs 52.8%, p-value=0.1789). However, the proportions of LBW babies were significantly high in the inborn admissions compared to outborn (61.76% vs 57.48%, p<0.0001 and 95% CI 3.01 to 5.78) [Table/Fig-3].

There were 5010 (58%) male neonates and 3617 (42%) female neonates in the inborn group (M:F ratio was 1.38:1). In the outborn group there were 6514 (60.5%) and 4256 (39.5%) were male and female neonates, respectively (M:F ratio 1.5:1). Thus in both groups male babies outnumbered the female babies. However, statistically more male babies were in the outborn group (p=0.0049).

Major causes of death were HIE and sepsis, followed by RDS, MAS and congenital malformations [Table/fig-4].

The outborn babies admitted to the hospital were referred from over 60 government and private hospitals. Some of them came directly from the community. Most outborn cases (21.56%) came from primary care setups [Table/Fig-5].

Disease	Inborn		Outborn	
	Admissions	Deaths N=1195	Admissions	Deaths N=1357
HIE	2465	431 (36.07%)	1813	335 (24.69%)
Sepsis	457	199 (16.65%)	1704	510 (37.58%)
Jaundice	2133	0	2559	0
Congenital malformation	179	38 (3.18%)	407	39 (2.87%)
RDS	242	71 (5.94%)	301	91 (6.70%)
MAS	125	21(1.76%)	88	16 (1.18%)

[Table/Fig-4]: Major causes of admissions and death.
HIE: Hypoxic ischaemic encephalopathy; Jaundice: Jaundice requiring admissions; RDS: Respiratory distress syndrome, MAS: Meconium aspiration syndrome

than outborn babies (13.8% vs. 12.6%, p=0.0139) in the present study. The proportion of LBW babies among inborn babies was significantly higher than the outborn babies (61.76% vs 57.48%, p<0.0001, [Table/Fig-3]. This may be reason for higher mortality in the inborn babies than the outborn babies.

It could also be seen from the [Table/Fig-3] that the proportions of both LBW and prematurity were high in both inborn as well as outborn babies, thus remains the major contributors towards morbidity and mortality, similar to other studies such as Panigrahy BK et al., Babu MC et al., and Rakholia R et al., [10,11,13].

The major causes of admissions in the SNCU were jaundice, HIE and sepsis. The major causes of death in the inborn babies were HIE (36%), sepsis (16.6%) and RDS (5.94%) [Table/Fig-4]. In the outborn babies sepsis (37.58%) was the major causes of death followed by HIE (24.69%) and RDS (6.7%). The studies done by Mundlod S and Thakkarwad S (Telangana), Panigrahy BK et al., (Odisha) and Soni LK et al., (Chhatisgarh) also reported HIE as the major cause of mortality [9,10,14]. Panigrahy BK et al., (Odisha) and Rakholia R et al., (Uttarakhand) found sepsis as a major cause

Year	Inborn (Tertiary level)	SDH/DH (Secondary level)	PHC/BPHC/RH (Primary level)	Private hospitals	Community level	Total
2016-2017	1537 (51.50%)	262 (8.78%)	638 (21.40%)	413 (13.84%)	134 (4.49%)	2984 (100%)
2017-2018	2283 (46.25%)	517 (10.47%)	1011 (20.48%)	646 (13.10%)	479 (9.71%)	4936 (100%)
2018-2019	1918 (42.75%)	548 (12.22%)	956 (21.32%)	505 (11.26%)	559 (12.45%)	4486 (100%)
2019-2020	1543 (39.92%)	505 (13.06%)	855 (22.12%)	427 (11.46%)	535 (13.85%)	3865 (100%)
2020-2021	1346 (43.05%)	392 (12.54%)	723 (23.12%)	201 (6.42%)	464 (14.87%)	3126 (100%)
Total	8627 (44.47%)	2224 (11.46%)	4183 (21.56%)	2192 (11.31%)	2171 (11.20%)	19397 (100%)

[Table/Fig-5]: Distribution of admitted newborns according to the place of birth.
SDH: Sub divisional hospital; DH: District hospital; PHC: Primary health centre; BPHC: Block primary health centre; RH: Rural hospital

DISCUSSION

In the Midnapore Medical College, there were 67729 live births during the five-year study period. The sick babies were admitted in the SNCU. Assuming there was negligible deaths outside SNCU after referral/ discharge, the average NMR at Midnapore Medical College, for the above five years, was 17.6 per 1000 live births (1195 deaths out of 67729 live births). The NMR for the inborn babies only was calculated, because the denominator live birth for the outborn babies was not known. The NMR of 17.6 is close to the reported NMR of West-Bengal. The state had NMR of 15.5 (15.5 for rural and 16.1 for urban) as per the NFHS -5, reduced from 22 during the NFHS-4 survey [6].

Total newborn babies (inborn and outborn) admitted to the SNCU were 19397, out of which 2552 babies died (overall mortality in the SNCU was 13.16%). The above mortality (13.16%) was similar to many other recent studies done in similar setups of the country. Mundlod S and Thakkarwad S from Adilabad (Telengana), Panigrahy BK et al., from Koraput (Odisha), Babu MC et al., from Nellore (Andhra Pradesh) and Saharia NP et al., from Gouhati (Assam), found the mortality to be 13.7%, 12.2%, 12.3% and 13%, respectively [9-12]. However, in some centres the mortality was higher. Studies from Raigarh (Chhatisgarh) and Nainital (Uttarakhand) had reported the mortality to be 20.19% and 20.5% [13,14]. While, some centres had shown lower mortality rates. Studies form Jhalwar (Rajasthan), Mumbai, and Puducherry reported the mortality to be 9.8%., 1.55% and 1.02%, respectively [15-17].

Most of the studies reported, that the mortality in the outborn babies was higher than in the inborn babies [10,11,13,15]. However, there is a slight but significant higher mortality among the inborn babies of mortality in the outborn babies [10,13]. It was inferred from the above discussions that decreasing the rates of LBW and prematurity would also decrease overall morbidity and mortality among the newborns. Reducing incidences of HIE by paying more attention to antenatal care and neonatal resuscitation would go a long way to reduce the neonatal deaths. Similarly more attention should also be provided for proper aseptic measures.

In both inborn and outborn groups of neonates, male babies outnumbered the females (M:F ratio 1.5:1). This observation was similar to most of the studies such as Mundlod S and Thakkarwad S (Telengana), Babu MC et al., (Andhra Pradesh), Rakholia R et al., (Uttarakhand), Soni LK et al., (Chhatisgarh), Ram B and Dagal KC (Rajasthan) and Ravikumar SA et al., (Tamil Nadu), Shah HD et al., (Gujurat) [9,11,13-15,18,19]. Only one study of Maheswari K and Sharma N (Puducherry) found more number of female babies than males among SNCU admissions [17]. The same study (Maheswari K and Sharma N) also interestingly reported a very low neonatal mortality. It seemed that male babies were more prone for morbidity and mortality than the female babies.

In this study, the number of outborn babies was more than that of the inborn babies. Most of the outborn babies came directly from primary healthcare setups, which may be due to the failure of referral network system. This perhaps reflects that suitable facilities are not available at the secondary care level, leading to higher referral to the tertiary centre [19].

Sepsis is one of the preventable causes of mortality and morbidity, which can be addressed with simple measures such as hand washing and other aseptic precautions right from the delivery rooms.

Neonatal morbidity and mortality are closely related to the quality of the antenatal and perinatal care, which can reduce the incidences of prematurity, LBW and birth asphyxia significantly [20,21].

Limitation(s)

This was a retrospective study with data from the admission records of the SNCU. The causes of death and admissions were determined according to the above data. The NMR determined was that of a single institute, which was determined by the mothers coming for deliveries. Being a tertiary referral centre, more number of high risk and complicated deliveries are conducted here. Also, there was no data of mortality or morbidity as per the place of referral for outborn babies.

CONCLUSION(S)

Prematurity and LBW were the major causes of morbidity and mortality. Sepsis and HIE were major direct causes of mortality. Hence, to reduce neonatal morbidity and mortality focus should be on preventing prematurity and LBW in general as well as reducing sepsis and HIE with appropriate measures. Further prospective studies should be carried out in future to understand the causative factors of the morbidity and mortality in newborns.

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