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Original Research Article

Morbidity and mortality profile of neonates: a five-year retrospective study in a tertiary care neonatal unit in Kolkata

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ABSTRACT

Background: Neonatal mortality and morbidity pattern reflects a nation's efficiency and effectiveness of health care services. There is a paucity of reliable data in India on this, while India Newborn Action Plan (INAP) targets single digit neonatal mortality by 2030. Aim was to identify the morbidity and mortality profile of neonates admitted to a tertiary neonatal care unit.
Methods: This retrospective descriptive study was conducted at a tertiary care neonatal unit in Kolkata. Data of neonates admitted in this unit were extracted from admission, discharge, and death registers, compiled, and analyzed from January 2015 to December 2019. Neonates brought dead to the unit were excluded.
Results: A total of 10301 neonates were admitted during the study period of which 75.05% were inborn. Most of them were male (55.46%) and only 0.70% had differential sexual disorders. A total of 709 deaths were recorded during the study period equating to a rate of 6.9 deaths per 100 neonatal admissions. The major cause of admission was neonatal hyperbilirubinemia (19.30%) followed by congenital anomalies (11.15%), respiratory distress syndrome (10.58%), prematurity (9.72%), and birth weight <1800 grams. (9.51%), perinatal asphyxia (8.11%) and maternal sickness (8.09%). Among congenital anomalies, anomalies related to the gastrointestinal system were most frequent (30.81%). Congenital anomalies (29.9%) were the leading cause of neonatal mortality followed by perinatal asphyxia (17.07%).
Conclusions: The commonest causes of neonatal morbidity and mortality were congenital anomalies. Thus, special focus has to be given to the management of congenital malformation in tertiary care units.

Keywords: Anomaly, Morbidity, Mortality, Neonate, Profile

INTRODUCTION

Globally 2.5 million children died in the first month of life in 2018; which included about 1 million neonatal deaths occurring within the first 24 hours. In India, more than two-thirds of infant deaths occur during the neonatal period (SRS data 2016) which significantly contributes to under-five mortality rates.[1-2]

Currently, the Neonatal Mortality Rate (NMR) is 24 per 1000 live births at the national level and varies from 4·5 times to 8·0 times among states in India. There are high-performing states like Kerala with NMR 7 which is similar to Brazil or Argentina, while poor-performing states like Odisha's NMR resemble Sierra Leone. Though Kerala and Tamil Nadu have already reached the 2030 SDG target for NMR, which is 12 neonatal deaths per 1,000 live births, there are states like Uttar Pradesh with

rising NMR. A recent Lancet publication has shown that India won't be able to achieve either the SDG 2030 NMR target or the NHP 2025 targets as per the current performance of the states. To accelerate progress, it's important to prevent neonatal suffering due to preterm birth, birth asphyxia, sepsis, and birth defects.[3-4]

The current study has been undertaken to ascertain the predominant causes of morbidity and mortality among the neonates, admitted to the sick newborn care unit. There is a paucity of hospital-based data related to neonatal morbidity and mortality based on which resource allocation can be done efficiently to set up neonatal care units which costs crores for its establishment.

This study aimed to identify the morbidity profile of neonates admitted at a tertiary care sick newborn care unit and to recognize the mortality pattern of neonates admitted at a tertiary care sick newborn care unit.

METHODS

This is a retrospective (hospital record-based) descriptive study conducted at the neonatology department of IPGME&R, Kolkata which is a 100-bed tertiary care unit for neonates. Neonates who were admitted from January 2015 to December 2019 were included in this study. Total enumerative sampling technique was used.

Inclusion criteria

All neonates admitted to the department were included.

Exclusion criteria

Individual recordings in the register that were improperly filled were excluded from the study.

Data collection

Data files between 2015-2019 of the neonatology department of selected sick newborn care unit of Kolkata were extracted using a uniform extraction format; as per the standard NICU registers provided by Govt. of India. Data consisted of newborn information recorded in admission, discharge, and death registers such as date of admission, gestational age at birth, birth weight, status at birth, diagnosis, outcome status, and records of maternal information like parity, gestational age, and mode of delivery.

RESULTS

Data were coded and entered in Microsoft excel for accuracy. SPSS version 17.0 was used for analyzing the data. A *p*-value of <0.05 was considered statistically significant. Data analysis showed that a total of 10301 neonates were admitted and a total of 709 neonatal deaths occurred during the period between January 2015 to December 2019; equating to a rate of 6.9 deaths per 100 neonatal admissions (Table 1).

Table 1: Frequency and percentage distribution of neonatal morbidity and mortality with baseline characteristics.

Categories	Morbidity (n_1= 10301) (%)	Mortality (n_2=709) (%)
Sex		
Male	5713 (55.46)	411 (57.97)
Female	4548 (43.84)	286 (40.34)
DSD	40 (0.70)	12 (1.69)
Place of delivery		
Inborn	7731 (75.05)	439 (61.92)
Outborn	2570 (24.95)	270 (38.08)
Type of delivery		
NVD	3442 (33.42)	340 (47.96)
LSCS	6737 (65.4)	366 (51.62)
Forceps	122 (1.18)	3 (0.42)
Birth weight (grams)		
ELBW (<1000)	412 (3.98)	154 (21.72)
VLBW (1000-1499)	1160 (11.27)	113 (15.94)
Lbw (1500-2499)	4751 (46.13)	263 (37.09)
Normal weight (2500-4499)	3960(38.44)	178 (25.11)
High weight (≥4500)	18 (0.17)	1 (0.14)
Gestational age (weeks)		
Extreme preterm(<28)	206 (2.0)	103 (14.53)
Very preterm (28-<32)	790 (7.67)	96 (13.54)
Preterm 32-<37	3880 (37.67)	199 (28.07)
Term 37-40	5228 (50.75)	298 (42.03)
Post term >40	197 (1.91)	13 (1.83)

Male babies had higher morbidity (55.46%), and mortality (57.97%). Inborn babies were mostly affected with morbidity of 75.05% and mortality of 61.92%. Neonates weighing between 1500-2499 grams at birth tend to suffer more with morbidity of 46.13% and mortality of 37.09%. Neonates with a gestational age of 37-40 weeks were mostly affected with 50.75% being admitted with morbid conditions and 42.03% dying (Table 1).

The morbidity pattern of neonates (Table 2) showed most of the admissions were due to neonatal hyperbilirubinemia (19.30%), congenital causes (11.15%), respiratory distress syndrome (10.58%), prematurity (9.72%), birth weight <1800 grams. (9.51%), observation for maternal poor obstetric history (9.3%) and perinatal asphyxia (8.11%).

Data presented in table 3 depicted that the gastrointestinal system was mostly (30.81%) affected of which intestinal obstruction (6.97%) was common morbidity. Hydronephrosis (9.75%), ventricular septal defect (6.79%), atrial septal defect (6.70%), and

myelomeningocele (6.61%) were the most commonly occurring congenital morbidity.

The pattern of neonatal mortality as shown in Figure 1 depicts that congenital anomalies (29.90%) were the leading cause of neonatal mortality followed by perinatal asphyxia (17.07%) and respiratory distress syndrome (15.09%). Other causes of neonatal mortality included shock (14.95%), sepsis (9.87%), preterm birth (5.64%), neonatal bilirubin encephalopathy (2.54%), pneumothorax (1.41%), hypoglycemia (1.41%), DIC (1.27%), neonatal seizure (0.85%).

Mortality related to congenital anomalies

Congenital anomalies of GI tract (36.32%) and congenital heart diseases (35.85%) were the leading cause of mortality among neonates followed by multiple congenital anomalies (10.85%) and congenital anomalies of CNS (10.85%), conjoined twins (3.3%) (Figure 2).

Table 2: Frequency and percentage distribution of morbidity pattern among neonates (N=10301).

Indication for admission	Frequency (%)
Prematurity	1001 (9.72)
Birth weight <1800 grams	980 (9.51)
IUGR	99 (0.96)
Shock	28 (0.27)
ROP screening	52 (0.49)
Neonatal convulsion	60 (0.58)
Respiratory distress syndrome	1090 (10.58)
TTNB	598 (5.81)
Perinatal asphyxia	835 (8.11)
Apnea of prematurity	61 (0.59)
Bronchiolitis	27 (0.26)
Pneumonia	30 (0.29)
Pneumothorax	7 (0.07)
Pleural effusion	1 (0.01)
Diarrhoea	17 (0.17)
Hyperbilirubinemia	1988 (19.30)
Neonatal bilirubin encephalopathy	9 (0.09)
Hypoglycaemia	645 (6.26)
Feeding intolerance	206 (2.0)
Hypocalcemia	14 (0.14)
Hyponatremia	5 (0.05)
Hypothermia	15 (0.15)
Weight loss	13 (0.13)
Fracture	4 (0.04)
Burn injury	3 (0.03)
Birth injury	16 (0.16)
Sepsis	270 (2.62)
Umbilical sepsis	7 (0.07)
Shock	28 (0.27)
Observation for maternal poor obstetric history	959 (9.3)
Methemoglobinemia	1 (0.01)
Dehydration fever	55 (0.53)
NEC	4 (0.04)
Hepatomegaly	2 (0.02)
Bleeding problem	5 (0.05)
Anaemia	14 (0.14)
Congenital causes	1149 (11.15)
Abandoned	3 (0.03)

Table 3: Frequency and percentage distribution of congenital morbidities among neonates (N= 1149).

Congenital morbidities among neonates		Frequency (%)
Central nervous system (n=173, 15.06%)	Anencephaly	6 (0.52)
	Encephalocele	14 (1.22)
	Holoprosencephaly	2 (0.17)
	Hydrocephalus	69 (6.01)
	Myelomeningocele	76 (6.61)
	Microcephaly	4 (0.35)
	Dandy walker malformation	2 (0.17)
Cardiovascular system (n=326, 28.37%)	Congenital heart disease	72 (6.27)
	ASD	77 (6.70)
	VSD	78 (6.79)
	PDA	51 (4.44)
	Ectopia cordis	3 (0.26)
	TGA	5 (0.44)
	Congenital heart block	20 (1.74)
	Congestive cardiac failure	20 (1.74)
Congenital exposure to infections (n=24, 2.09%)	Tuberculosis	4 (0.35)
	Varicella	8 (0.7)
	Mother with hepatitis B	1 (0.09)
	Mother with HIV	3 (0.26)
	Congenital cataract	1 (0.09)
	Congenital STORCH	7 (0.61)
Gastrointestinal system (n=354, 30.81%)	Intestinal obstruction	80 (6.97)
	Anorectal malformations	49 (4.26)
	Cleft lip and palate	48 (4.18)
	Tracheo- oesophageal fistula	23 (2.0)
	Congenital diaphragmatic hernia	39 (3.39)
	Malrotation of gut	13 (1.13)
	Omphalocele	22 (1.91)
	Hirschsprung's disease	12 (1.04)
	Intestinal atresia	35 (3.05)
	Meconium ileus	5 (0.44)
	Pyloric stenosis	10 (0.87)
	Umbilical granuloma	2 (0.17)
	Inguinal hernia	14 (1.22)
	Umbilical hernia	2 (0.17)
Genitourinary system (n=132, 11.49%)	Hydronephrosis	112 (9.75)
	Ectopia vesicae	2 (0.17)
	ARPKD	8 (0.7)
	PUV	10 (0.87)
Musculoskeletal system (n=10, 0.87%)	Sacrococcygeal teratoma	7 (0.61)
	Clubfoot	2 (0.17)
	Congenital myopathy	1 (0.09)
Multiple congenital anomaly (n=91, 7.92%)	Down syndrome	28 (2.44)
	Conjoined twins	11 (0.96)
	Pierre Robbin sequence	1 (0.09)
	Hydrops fetalis	12 (1.04)
	Sirenomalia	2 (0.17)
	Dysmorphic	14 (1.22)
	Undifferentiated	23 (2.00)
Miscellaneous (n=39, 3.39%)	Cystic hygroma	11 (0.96)
	SOL	9 (0.78)
	Congenital adrenal hyperplasia	3 (0.26)
	Cystic adenoid malformation	1 (0.09)

Continued.

Congenital morbidities among neonates	Frequency (%)
Amniotic band syndrome	3 (0.26)
Lymphatic malformation	2 (0.17)
Haemangioma	4 (0.35)
Choanal atresia	6 (0.52)

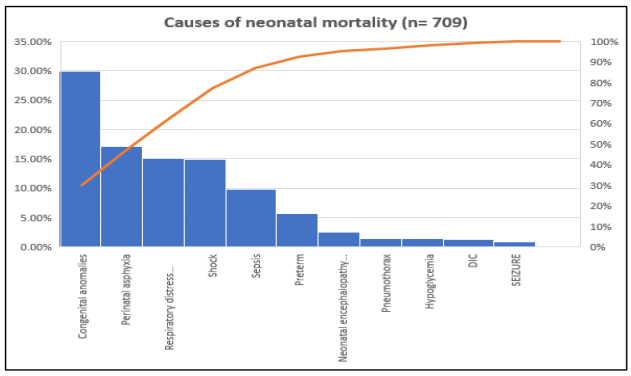

Figure 1: Causes of neonatal mortality (n= 709).

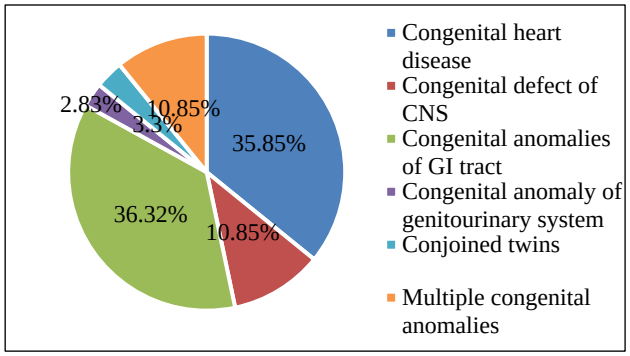

Figure 2: Mortality distribution based on congenital anomalies.

DISCUSSION

Accurate baseline data on neonatal mortality and morbidity from neonatal care units are scarce in India. These data are important not only for care providers and researchers but also have an impact on local and national health policymaking. This five-year retrospective study was done to document the mortality and morbidity profile of neonates admitted at the tertiary neonatal care unit of IPGME&R, SSKM Hospital.

It was found that a total of 10301 neonates were admitted and a total of 709 neonatal deaths were admitted in the sick neonatal care unit during the period of study from January 2015 to December 2019. The mortality rate is found as 68.83 per 1000 hospitalized neonates.

Morbidity profile of neonates

The gender-wise distribution of admitted neonates in the present study revealed male predominance (M: F ratio-1.26:1) male (55.46%), and female (43.84%). This finding is consistent with literature reported by Kotwal et al (male 58% and female 42%), Gunasekhar et al (male 56.48% and female 43.52%) and Kumar et al (male 54%, female 46%).[6,9,10] Mortality was also higher among males (57.97%), in comparison to females (40.34%) which is supported by the findings of studies mentioned earlier. None of the existing literature has reported differential sexual disorder (DSD) at birth as reported in our study i.e., morbidity of 0.70% and mortality of 1.69% of total neonatal admissions.

Inborn babies had higher mortality (75.05%) and morbidity (61.92%), in comparison to the outborn babies with morbidity of 24.95% and mortality of 8.08% respectively which is similar in the Indian context.[6-16]

Babies born through LSCS had higher morbidity (65.4%), and mortality (51.62%), whereas babies through NVD had morbidity (33.42%) and mortality (47.96%). Forceps delivery accounted for mortality of 1.18% and morbidity of 0.42%. This kind of finding based on the mode of delivery is not yet reported in existing literature.

Analysis of the weight parameter of admitted neonates revealed that the percentage of extremely low birth weight (<1000 grams), very low birth weight (1000-1499grams), and low birth weight(1500-2499grams), birth weight between 2500 grams to 4499 grams and ≥4500 grams was 3.98%, 11.27%, 46.13%, 38.44%, and 0.17%. The findings of the present study are comparable to the study by Gunasekhar et al, which revealed that 1.62% were <1000 grams, 7.07% were between 1000-1499gram, 34.93% were between 1500-2499grams, 56.38% were of >2500 grams.[9] Kotwal et al also revealed similar findings as ELBW (0.4%), VLBW (6.7%), LBW (32.9%), normal weight 58.3%, high weight i.e. >4000 grams 1.7%.[6]

Weight wise distribution of neonatal mortality revealed, mortality among neonates as, ELBW (21.72%), VLBW (15.94%), LBW (37.09%), birth weight between 2500 grams to 4499 grams (25.11%) and ≥4500 grams (0.14 %). Similar findings have been reported by Ranjan et al as ELBW (20.13%), VLBW (15.14%), LBW (18.5%), and more than 2.5 Kg (46.21%).[19]

Gestational age-wise segregation of admitted neonates showed, extreme preterm (2.0%), very preterm (7.67%), preterm (37.67%), term babies (50.75%), and post-term (1.91%) babies were admitted. Morbid babies belonged to the gestational age as follows, extreme preterm

(14.53%), very preterm (13.54%), preterm (28.07%), term babies (42.03%), post-term (1.83%). This finding is congruent with the findings of Malik et al who have reported neonatal admissions as preterm (44.45%), term (55.15%), and post-term (0.4%).[11] However, none of the studies have reported a detailed classification of mortality and morbidity based on the gestational age of neonates.

The present study revealed that, neonatal hyperbilirubinemia (19.30%), congenital causes (11.15%), respiratory distress syndrome (10.58%), prematurity (9.72%), and birth weight <1800 grams. (9.51%), observation for maternal poor obstetric history (9.3%) and perinatal asphyxia (8.11%), hypoglycemia (6.26%), TTNB (5.81%), sepsis (2.62%), feeding intolerance (2%), were the major cause of neonatal admissions. A recent Mexican study by Lona Reyes has also reported congenital anomalies as the second leading cause of neonatal admission.[20] However, most of the existing Indian literature has reported sepsis as the leading cause of admission.[6-16]

Detailed segregation of causes of admission revealed some social causes of neonatal admission in the current study, such as abandonment (0.03%), fracture (0.04%), and burn injury (0.03%) which is unique to this study.

Mortality profile of neonates

A total of 709 babies died during five years out of a total of 10301 admissions. Causes of neonatal mortality were found as, congenital anomalies (29.90%), perinatal asphyxia (17.07%), RDS (15.09%), shock (14.95%), sepsis (9.87%), preterm (5.64%), neonatal encephalopathy due to hyperbilirubinemia (2.54%), pneumothorax and hypoglycemia (1.41% each), DIC (1.27%), seizure (0.85%). is supported by the findings of Gunasekhar et al and sepsis accounted for only 9.87% of neonatal deaths in this study which is lower than the findings of Malik et al and Baruah et al.[9,11,12]

Congenital anomalies of neonates

The findings of the present study revealed congenital anomaly as an important cause of morbidity (11.15%) and mortality (29.90%) among neonates which is quite higher than the existing Indian studies where morbidity varied from 1.2% to 2,77%.[6-16] Anomaly of the gastrointestinal system (30.81%) was the most common anomaly of which intestinal obstruction (6.97%) was common morbidity. Hydronephrosis (9.75%), ventricular septal defect (6.79%), atrial septal defect (6.70%), myelomeningocele (6.61%) was the most common congenital cause of neonatal admission. Congenital anomalies of the GI tract (36.32%) and congenital heart diseases (35.85%) were the leading cause of mortality among neonates followed by multiple congenital anomalies (10.85%) and congenital anomalies of CNS (10.85%), conjoined twins (3.3%). Though Sharma et al reported that craniofacial anomalies as the most commonly occurring congenital anomaly (84%) and Sankar et al reported musculoskeletal anomalies (25%) as the most commonly occurring anomaly followed by anomalies of the central nervous system (CNS) (18%), genitourinary system (14%), congenital diaphragmatic hernia (12%), cardiovascular system (10%), gastrointestinal (7%).[13,18] Existing literature has barely shown detailed system-wise congenital anomalies among neonates.

The current study comprises quite a large sample size in comparison to the existing literature in the Indian context.[5-17] It includes complete segregation of neonatal profile on admission and has found differential sexual disorders at birth, neonatal admissions based on their gestational age and mode of delivery, and causes of neonatal admissions such as neonatal burn, fracture, and abandonment which are underreported. The current study has found a vast type of congenital anomalies that cause neonatal morbidity. It has also been reported that poor maternal obstetrical history also leads to a significant contribution to neonatal admissions (9.3%) exposing them to healthcare-associated infections which are unique findings of this study.

This study has some limitations. This is a hospital-based study thus the findings might not reveal true community findings. We were unable to separate inborn errors of metabolism at birth.

CONCLUSION

Prematurity, sepsis, and birth asphyxia are the leading causes of mortality and morbidity among neonates worldwide. This study shows that perinatal asphyxia and term neonatal death is still major cause of mortality even in tertiary care set which could be prevented by adequate antenatal care. Until and unless infrastructural development is made at the district level to deal with congenital malformation, there will be a huge load of such babies in the apex institutions. Thus, to reach the goal of the India Newborn Action Plan i.e. digit neonatal mortality and stillbirth rate by 2030 emphasis has to be given to antenatal care, antenatal detection of congenital anomalies and their management should be incorporated at public healthcare facilities.

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