Neonatal Mortality and Morbidity in a Tertiary Care Hospital of Coastal South India

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Abstract

Introduction: Progress in new-born survival has been slow. There is a variation in neonatal death rates across states and geographical region of a country. Understanding the pattern of mortality is essential in improving new-born survival. This study was conducted to study the mortality and morbidity profile in Neonatal Intensive Care Unit (NICU) of a university teaching hospital. **Material and Methods:** This was a retrospective descriptive study including records of all neonates admitted in NICU from January 2015 to December 2016. **Results** 3623 neonates were admitted during the study period. Majority were preterm and low birth weight babies. Neonatal jaundice (41.4%) was the leading cause of admission. Major cause of morbidity was sepsis (26.2%). Average duration of stay were higher in out borns (8.4 days) compared to inborn (6.5 days) neonates. Among mortality a higher male predominance was seen. Neonatal sepsis (36.3%) was the single most common cause of mortality followed by respiratory distress syndrome (27.4%) and congenital malformations (18.6%). Out born neonates which were self-transported had higher mortality rate than transported by ambulance. **Conclusion** This study identifies sepsis, prematurity and low birth weight as the major causes of morbidity. Sepsis, respiratory distress syndrome and congenital malformations were the leading causes of mortality Understanding causes of neonatal mortality may help to implement interventions to promote new-born survival.

Key words: Mortality, Morbidity, New-born, Sepsis

Introduction

Neonatal period is the most unguarded period which influences the survival and overall wellbeing of a child[1]. Many illnesses affecting the neonates lead to morbidities and mortality among them. According to 2015 Global Health Observatory (GHO) data, neonatal deaths constitute roughly 45% of all under five deaths[2]. Worldwide, Neonatal mortality rate has seen a steady decline by 47% between 1990 and 2015 from 36 to 19 per 1000 live birth[2]. Total number of neonatal deaths fell from 5.1 million to 2.7 million during the same period[3].Of the 2.7 million deaths, 1 million deaths happen on the first day and approximately 2 million deaths in the first week of life[2,10]. Overall, there is decline in under-5 mortality at global level, however neonatal mortality

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still remains high and is a major contributor to under-5 mortality[2]. Currently several Asian countries, including India are in this phase, despite the developments in maternal and child health care services[4].

India contributes to nearly 25% of the mortality around the world[3,5,8]. According to the National Family Health Survey (NFHS) III report, Neonatal Mortality Rate (NMR) in India was 39 per 1,000 live births, being responsible for nearly 77% of all the infant deaths and nearly half of the under-five child deaths[6,7,9]. Also, there is a variation of neonatal death rates across states and geographical regions within India[3,6,7,11]. The challenge ahead of us is to meet every newborn target of ten or fewer neonatal deaths per 1000 live births in every country by 2035[12]. This study was conducted to find out the mortality and morbidity profile in Neonatal Intensive Care Unit (NICU) of a university teaching hospital.

Material and Methods

This was a retrospective descriptive study where two year data of all neonatal admissions (between 1st January 2015 and 31st December 2016) from NICU of a university teaching hospital were included. After obtaining approval from the Institutional Ethics Committee (IEC), necessary permissions were taken from the hospital authorities. The study hospital was visited on a pre-informed date for data collection. Medical records of all neonates in the above mentioned period were reviewed and data extraction from the records was done using a pre-tested proforma.

The proforma included the demographic profile, diagnosis at the time of admission to neonatal ICU, outcomes in terms of mortality and other types of discharges (referral, discharge against medical advice, cure), duration of stay in neonatal ICU and mode of transport used to bring the neonate to hospital. In the mode of transport, the type of ambulance used and self-transportation were documented. The ambulance service also included the State run service named as '108' ambulance. The neonates born in the study hospital were termed as inborn and neonates born in other hospitals or home were termed out born. The collected data were analysed using Statistical Package for the Social Sciences (SPSS) version 11.5. Results were expressed as proportions using appropriate tables. For comparison across the groups, Chi-square test was done and a *p*-value <0.05 was considered statistically significant.

Results

During the study period, a total of 3623 neonates were admitted in the NICU. Out of the total admissions, 95.5% were inborn neonates and 4.5% were out born neonates. Admission rates among inborn neonates were 2.9%. Overall, 53.6% of the total inborn admissions were males and 52.5% of out born admissions consisted of males. Also, 1596 (44.1%) neonates weighed 2500 grams or above, 44% were low birth weight, 9.4% were very low birth weight and 2.5% were extremely low birth weight. 52.4% were term babies, 33.5% were late preterm and 14.1% were early preterm. The baseline characteristics of the study population have been depicted in Table 1.

Both among inborn and out born babies, higher proportion were delivered after 37 weeks of gestation (53% and 38.9% respectively). Out born neonates had higher mortality rates as compared to inborn neonates (15.4% v/s 5.5%). In addition, the DAMA was higher among the out born neonates (10.5% v/s 3.6%).

Average duration of stay were 6.5 days for inborn neonates and 8.4 days for out born neonates. In total, 88.3% of the total admissions were successfully discharged, 1.9% were referred for further management, 3.9% were discharged against medical advice and 5.9% succumbed to complications. Table 2 describes the morbidity details of the neonates. This reflects the various causes which led to these admissions to NICU. Neonatal jaundice (42.7%) was the most common cause for admission in NICU among inborn neonates, followed by sepsis (26.1%). Among the out born neonates, Sepsis (29.7%) was the most common morbidity.

Overall mortality rate was 5.9% (n=215) for the NICU admitted neonates; whereas for inborn neonates it was 5.5% and for out born neonates it was 15.4%. This difference was found to be statistically significant (p<0.0001).

Table 3 depicts the baseline characteristics of the deceased neonates in inborn and out born groups. Of the total deceased, 61.9% were males and 38.1% were females. 27.4% were term neonates and 72.6% were preterm neonates. Also, 18.6% neonates weighed 2500 grams or above, 30.7% were low birth weight, 33% were very low birth weight and 17.7% were extremely low birth weight.

Neonatal sepsis (36.3%) was the most common cause of mortality followed by Respiratory Distress Syndrome (RDS) seen in 27.4%. Other causes were congenital malformations (18.6%) followed by hypoxic ischemic encephalopathy (HIE) in 9.8%, Meconium Aspiration Syndrome (MAS) was seen in 5.1% and Intra Ventricular Haemorrhage (IVH) in 2.8% respectively. There was no statistically significant difference observed across the categories for inborn and out born neonates.

Table 4 describes the causes of death among deceased neonates.

Table 5 describes the association of type of transport used to reach the study hospital with the outcomes among the out born neonates. For the analysis we considered the mortality rate and all other types of discharges from the hospital including cure, referral and DAMA. In total, 02 (2.3%) of the total out born neonates transported through state run ambulance succumbed to the complications. Also, 09 (23.7%) neonates transported through other ambulances and 14 (40%) in self-transportation were among the deceased. This difference was found to be statistically significant (p<0.0001)

Table 1: Baseline characteristics and outcomes of admitted neonates in the study hospital (n=3623)

Characteristics		Place of birth		
		Inborn No. (%)	Out born No. (%)	Total No. (%)
Gender	Male	1857 (53.6)	85 (52.5)	1942 (53.6)
	Female	1604 (46.4)	77 (47.5)	1681 (46.4)
Birth weight	>2500 grams	1551 (44.8)	45 (27.8)	1596 (44.1)
	1500-2499 grams	1508 (43.6)	86 (53.1)	1594 (44.0)
	1000-1499 grams	0315 (09.1)	26 (16.0)	0341 (09.4)
	<1000grams	0087 (02.5)	05 (03.1)	0092 (02.5)
Period of Gestation at delivery	>37 weeks	1834 (53.0)	63 (38.9)	1897 (52.4)
	34-37 weeks	1162 (33.6)	51 (31.5)	1213 (33.5)
	<34 weeks	0465 (13.4)	48 (29.6)	0513 (14.1)
Outcome	Death	0190 (05.5)	25 (15.4)	0215 (05.9)
	Discharged	3083 (89.1)	115 (71.0)	3198 (88.3)
	Referral	0063 (01.8)	05 (03.1)	0068 (01.1)
	DAMA#	0125 (03.6)	17 (10.5)	0142 (03.9)
Total		**3461**	**162**	**3623**

DAMA: Discharge Aagainst Medical Advice

Table 2: Morbidity profile of the neonates admitted during the study period (n=3623)

Causes	Inborn (n=3461) No. (%)	Out born (n=162) No. (%)	Total No. (%)
Jaundice	1477 (42.7)	23 (14.2)	1500 (41.4)
Sepsis	0903 (26.1)	48 (29.7)	0951 (26.2)
Prematurity & Low Birth Weight	0520 (15.0)	22 (13.6)	0542 (15.0)
Respiratory Distress Syndrome	0143 (04.1)	14 (08.6)	0157 (04.3)
Hypoxic Ischemic encephalopathy	0129 (03.7)	11 (06.8)	0140 (03.9)
Malformations	0099 (02.9)	09 (05.5)	0108 (03.0)
Seizures	0072 (02.1)	23 (14.2)	0095 (02.6)
Meconium Aspiration Syndrome	0048 (01.4)	12 (07.4)	0060 (01.7)
Hypoglycemia	0047 (01.3)	0	0047 (01.3)
Hypothermia	0023 (00.7)	0	0023 (00.6)

Table 3: Baseline characteristics of deceased neonates during the study period (n=215)

Characteristics		Inborn No. (%)	Out born No. (%)	Total No. (%)	p-value
Gender	Male	117 (61.6)	16 (64.0)	133 (61.9)	0.815
	Female	073 (38.4)	09 (36.0)	082 (38.1)	
Birth weight	>2500 g	036 (19.0)	04 (16.0)	040 (18.6)	0.910
	1000-2499g	121 (63.7)	16 (64.0)	137 (63.7)	
	<1000 g	033 (17.3)	05 (20.0)	038 (17.7)	
Gestation	Term	052 (27.4)	07 (28.0)	059 (27.4)	0.947
	Preterm	138 (72.6)	18 (72.0)	156 (72.6)	
Total		**190 (100)**	**25 (100)**	**215 (100)**	

Table 4: Causes of death among the neonates admitted during the study period (n=215)

Causes	Inborn No. (%)	Out born No. (%)	Total No. (%)	p-value (χ2 test)
Sepsis	68 (35.8)	10 (40.0)	78 (36.3)	0.681
RDS	52 (27.4)	07 (28.0)	59 (27.4)	0.947
Malformations	36 (19.0)	04 (16.0)	40 (18.6)	1.000
HIE	19 (10.0)	02 (08.0)	21 (09.8)	1.000
MAS	09 (04.7)	02 (08.0)	11 (05.1)	0.621
IVH	06 (03.1)	00	06 (02.8)	1.000
Total	**190 (100)**	**25 (100)**	**215 (100)**	

Table 5: Association between mode of transport and outcomes among the out born neonates (n=162)

Transport to study hospital	Outcome		Total	χ2 for trend; p-value
	Mortality No (%)	Others No (%)		
State run ambulance	02 (02.3)	087 (97.7)	89 (54.9)	30.03; <0.0001*
Other ambulance	09 (23.7)	029 (72.3)	38 (23.5)	
Self-transport	14 (40.0)	021 (60.0)	35 (21.6)	
Total	**25 (15.4)**	**137 (84.6)**	**162 (100)**	

**p*-value significant at 0.05 level

Discussion

This study was conducted to know the morbidity pattern, outcome and various causes of mortality in neonates admitted in NICU of a university teaching hospital. In this study, of the total of 3623 admissions, 95.5% were inborn when compared to 4.5% out born neonates. There was male predominance with respect to NICU admissions. Similar finding with respect to the gender distribution was reported by several studies[1,6,13,14,15,16]. Overall, 45.9% of admissions were of low birth weight and 47.6% were preterm neonates. This was in line with the findings from the study conducted by Modi et al[1]. Neonatal jaundice was the single most cause of admission in NICU and this was similar to the findings from study done by Harsha et al[13]. Sepsis, respiratory distress syndrome, meconium aspiration syndrome and birth asphyxia were the other leading causes of admission. Duration of stay in NICU was slightly higher for out born when compared to inborn babies. This may be due to the fact that the inborn neonates arrive at the NICU earlier and faster as compared to out born neonates. Due to this the out born neonates would need higher and longer duration of care at the hospital. The preterm birth rate was 14.7% of which 8.4% developed RDS, 0.4% developed IVH and 0.2% developed Retinopathy of Prematurity (ROP). This is in contrast to Kong X et al study, where higher incidence of RDS, IVH and ROP were observed in preterm babies[17].

Successful discharge was higher (88.3%) and mortality rate was lower (5.9%) in this study compared to the study by Gauchan et al[18]. Neonatal mortality was higher in low birth weight and preterm babies, similar to several other studies[6,16,17]. Of the total out born preterm babies, mortality rate was 18.2% which was higher than the mortality rate observed in inborn preterm babies (8.5%). Higher neonatal mortality in out born preterm babies addresses the need for intrauterine transport to higher centres which may reduce the mortality in out born preterm babies.

Worldwide, prematurity, sepsis and birth asphyxia are the leading causes of death among neonates[19]. In our study, neonatal sepsis (36.3%) was the major cause of mortality. Sepsis as a cause of neonatal mortality was higher in our NICU compared to the global rate of 26% . This implies the need for sepsis control measures which is a preventable cause of death. Respiratory distress syndrome and congenital malformations were ranked second and third. Also level of congenital malformations as a cause of death in our study was similar to that of a study by Wang et al[20]. The study hospital is a tertiary care University teaching hospital which may explain the higher rate of neonates with congenital malformations.

The mortality rate was higher among out born neonates when compared to inborn neonates. This finding was similar study by Panda et al[21]. Among out born neonates, those who were brought to the hospital by ambulances had lesser death rates when compared to those brought by any means of self-transport. Among the ambulance services, private ambulance transportation carried a higher risk when compared to the

State run ambulance. This could reflect the availability of emergency care within the ambulance as compared to the other vehicles, which can eventually reduce the complications and thereby death rates. It could also be that availability and accessibility of ambulance services in certain areas, could influence the transport pattern of people during emergencies. Studies comparing the association between mode of transport and outcomes are limited. This can bring about the need for well-equipped transport mechanism to be made available for neonates during emergencies.

In India, which has a population close to 1.3 billion, there is a need to have a database both at national and regional levels, with analyses of neonatal, infant and child (under the age of 5 years) deaths. This could help in assessing and targeting the health resources towards child survival measures across all over with special emphasis on areas with high child mortality[22].

The limitations of this study include, the data was not representative of the community as it was hospital based study, and still-born rates were not taken in to consideration. Sepsis prevention measures, intrauterine transport, early referral of neonates to centres with better facilities and transport through well-equipped ambulances may help to reduce neonatal mortality as observed from analysis of neonatal mortality in this study, however we have not done interventional study to prove the same.

Conclusion

LBW and prematurity formed a major proportion of admitted neonates in the study hospital. Neonatal sepsis, respiratory distress syndrome and congenital malformations were the major causes of mortality. Understanding causes of neonatal mortality may help to implement interventions to promote new-born survival.

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