Study of a spectrum of neonatal mortality of neonates admitted in NICU of tertiary care hospital

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ABSTRACT:
The neonatal phase of an infant's life is vulnerable period. Low birth weight and premature babies were universally accepted as high-risk factors of morbidity and neonatal deaths. Hence to study mortality pattern of neonates in NICU of tertiary care hospital in metropolitan city, a cross sectional study of 420 neonates admitted in NICU during 06 months periods was studied. About 93% of the admitted neonates were in the early neonatal period and 7% presented in late neonatal period. There were 58.33% males out number their 41.67% female counterparts. About 267 (63.57%) neonates were of preterm gestation and 36.33% were full-term. The weight parameter of neonates showed that 63.1% were low birth weight and 36.9% were of normal weight. 75% of the admitted neonates were delivered in our Institute and 25% referred from outside for neonatal intervention study identified a greater number of LBW, pre-termed babies. 12.62% neonatal mortality was found among admitted neonates. It was observed that bleeding PV or PROM was the highest risk factor (21.05%) followed by multiple pregnancy (20.18%) and PIH 1(15.79%). 30.2% neonates showed cause of death as severe perinatal asphyxia followed by respiratory distress syndrome (26.4%). Birth Asphyxia 16(30.2%), prematurity with respiratory distress syndrome 14(26.4%), septicemia 13(24.5%) Meconium Aspiration Syndrome 7(13.2%) followed by Congenital Anomalies 2(3.77%) were the top five major contributors to the mortality in our study. The most common cause of neonatal mortality was birth asphyxia in our study. No significant association was found between gender, gestational age and birth weight of neonates with mortality rate of the neonates (p>0.05). A significant association was observed between hospital stay and mortality rate of neonates ((X^2=32.75, p<0.00001). Neonates stayed for three or more days at NICU were 84% less likely to die to neonates who stayed for less than three days (OR = 0.16, with 95% CI 0.08 to 0.32) By proper health education and strengthening of antenatal services along with awareness of neonatal problems in low-birth-weight babies, the incidence of very low birth weight and their complications can be reduced.

INTRODUCTION:
The perinatal and neonatal period, in spite of its shortness, is considered as most critical phase of life as it accounts for very high morbidity and mortalities but most of these are preventable. Low infant birth weight and premature babies are at a higher risk and are universally acknowledged as the ranking causes of morbidity and neonatal deaths (1) Out of 26 lakh neonatal deaths occurring worldwide per year, 6.4 lakh neonatal deaths occur in India. Preterm birth is one of the major clinical problems in obstetrics and neonatology, as it is associated with increased perinatal mortality and morbidity (2) The major direct causes of the deaths were pre-term, infections and asphyxia (23% to 27%) identified in a report which was published in the Lancet (3). As of 2019, in India, the neonatal mortality rate is 21.7/1000 live births (4). The 2030 Agenda for Sustainable development (WHO) calls for reduction in neonatal mortality to 12/1000 live births (5). Most neonates can be taken care at home under the guidance and supervision of mother or health-care professional. On the other hand, low birth weight and preterm neonates are fragile and vulnerable. It demands high level of skills and technology in a special care nursery or neonatal intensive care unit for their intact survival. Apart from high mortality, many avoidable disabilities such as cerebral palsy, mental sub normality, learning disabilities, and recurrent seizures have their origin in perinatal period (6, 7). It is encouraging to note that

neonates with a birth weight of 1 kg had a mortality of 95% in 1960 whereas they now have 95% chances of survival. Despite improvement in the neonatal care & facilities, neonatal mortality remains high particularly in the developing countries. By studying the factors associated with neonatal death, mortality in neonates can be reduced by following necessary interventions & care. The objective of this study is to assess neonatal mortality and associated factors in tertiary care hospital of metropolitan city.

METHODOLOGY:
Prospective Cohort study was conducted to assess the prevalence of neonatal mortality and its associated factors among neonates admitted in Neonatal Intensive care Unit (NICU) at Rajiv Gandhi medical college and CSM Hospital, Thane, India, for a period of July to December 2020. The institutes ethical committee approved the study protocol. All neonates admitted in NICU during study period were considered as the study population. Neonates whose parents refused to give consent and neonates brought death were excluded from study. Socio-demographic characteristics, maternal factors (age, ANC follow up, mode of delivery, place of delivery, maternal HIV status, parity, multiple delivery, gravidity, residence and medical illness during pregnancy), fetal factors (sex, birth weight, status at birth, diagnosis of disease, gestational age, APGAR scores at birth, neonate's HIV status) and health care providers related factors (medication given at admission, vital signs taken at admission, schedule for the provision of the prescribed medications). were noted and collected in MS-Excel and exported into SPSS version 22.0 statistical software package for Microsoft Windows (SPSS Inc., Chicago, IL) for statistical analysis. The assumptions for normality were checked. The descriptive statistics was done and the results were presented using texts, tables, charts, mean, standard deviation and percentage. Chi-square test has been applied to check the association between parameters at 5% level of significance. Risk of mortality was calculated using Odds Ratio (OR) at 95% confidence level. Statistically significant level was fixed at a 0.05. If probability value from test statistics is less than or equal to 0.05 it will be considered to be significant.

OBSERVATIONS AND RESULTS:
In this prospective study 420 neonates fulfilling the inclusion criteria indicators towards morbidity and mortality were studied. Among 420 neonates 245 (58.33%) male and 175 (41.67%) female neonates were found. Out of total 420 neonates 14 were extreme low birth weight with 11 (78.6%) being male neonates, 3 (21.4%) being female neonates. 201 babies belong to low birth weight out of which 99(49%) were female babies and 102(51%) were male babies. Out of 420 neonates 50 were Low birth weight of which 29(58%) male neonate and 21(42%) were female neonates. Among 420 neonates 155 were normal weight of which 103(66.5%) male neonate and 52(33.5%) were female neonates. (Table 1)

Birth Weight	Female	Male	Grand Total
Extreme	3 (21.4%)	11(78.6%)	14
Low	99(49%)	102 (51%)	201
Very low	21 (42%)	29 (58%)	50
Normal	52 (33.5%)	103 (66.5%)	155
Grand total	**175**	**245**	**420**

Table 1: Gender specific weights of neonates

Out of 420 neonates 390 (92.64%) neonates were from 0 to 5 days age group and other are 30 (7.36%) were more than 5 days of age at admission. It was also reported that 267 (63.57%) neonates are preterm and 153(36.43%) are term neonates whereas 155 (36.90%) are normal weight, 251(59.76%) are of low birth weight and (3.33%)14 were shown extreme low birth weight. Among various maternal risk factors for mothers of neonates who were admitted in neonatal intensive care unit, it was observed that bleeding PV was the highest risk factor (21.05%) followed by 20.18% multiple pregnancy and 15.79% PIH (Table 2).

Maternal Risk Factor	Frequency	%
Bad Obstetric History	12	10.53%
PIH	18	**15.79%**
Eclampsia	8	7.02%
Diabetes Mellitus	3	2.63%
Gestational Diabetes Mellitus [GDS]	3	2.63%
Neonatal Death	1	0.88%
Multiple Pregnancy	23	20.18%
Chronic Infection [TB]	2	1.75%
Hypertension	2	1.75%
Prom [>18hrs.]	3	2.63%

Epilepsy	1	0.88%
Maternal Fever within 72 hours of labour	0	0.00%
Prolonged Labour [>24HRS]	4	3.51%
Bleeding PV	24	21.05%
Foul Smelling Liquor	2	1.75%
Use Steroids	3	2.63%
Hypothyroidism	5	4.39%

Table 2: Maternal risk factors

249(59.29%) vaginal deliveries and 171 (40.71%) by LSCS procedure were delivered among 420 babies. Among these vaginal deliveries, 08 (3.2%) required Forceps and 02 (0.8%) required vacuum instrumentation. It was also observed that 377 (89.76%) did not require resuscitation after birth. 43(**10.24%**) neonates required resuscitation after of which 20 (4.66%) required bag and mask, 15(3.7%) required chest compression and 8 (1.88%) required and intubation. It was observed that out of 420 neonates 53 (12.62%) neonates died whereas 367(87%) babies survived through the delivery process. Among these 367 babies 355 were discharged safely from the hospital, and 7 were transferred to other institute for pediatric surgical intervention whereas 5 babies were relieved on the basis of LAMA. Out of 420 neonates 247 (59%) neonates had a stay more than 3 days in NICU while 173(41%) were discharged within 3 days, which were admitted under observation for IUGR, TTN or for mild birth Asphyxia.

Mortality Pattern:
Among 420 admitted neonates in NICU, 367 were survived and 53 were dead. Hence 12.62% mortality has been observed among admitted neonates. Within

367 survived babies 217 (59.13%) were male and 150 (40.87%) were female whereas among 53 dead neonates 25 (47.16%) were female and 28 (52.83%) were male. Under death category of 53 neonates; 29 (55%) were pre-term and 24 (45%) were reported to be full term. 32 (60%) Low and 21 (40%) normal weight babies were observed within dead neonates. Out of 420 admitted neonates, mortality rate among male 28 (11%) and female 25(14%) was observed in this study. There was no significant association in gender and neonatal mortality (X^2=0.76, p=0.38). In this group of neonates Mortality rate was observed as 15% for Pre-term & 11% for Full term for Neonates. There was no significant association has been found between gestational age and mortality of neonates (X^2=1.876, p=0.17). Also, low birth weight neonates had Mortality rate at 14% and it was 11% for normal birth weight Neonates. There was no significant association observed in birth weight and neonatal mortality (X^2=0.3847, p=0.5351). However, neonates who stayed in the Hospital for up to 3 days reported 24% Mortality rate whereas Neonates who stayed less than 3 days displayed 5% Mortality rate. There was significant association (X^2=32.75, p<0.00001) was observed in hospital stay duration and neonatal mortality (Table 3)

Character	Variable	Total neonates	Mortality count	Mortality Percentage	Statistic Value X2	Odds Ratio (OR)	95% CI	P-value
Gender	Male	245	28	11%	0.76	1.29	0.72to 2.3	0.3833
	Female	175	25	14%				
Gestation	Term	227	24	11%	1.876	1.5	0.84to 2.7	0.1707
	Preterm	193	29	15%				
Birth Weight	>2.5	183	21	11%	0.3847	1.2	0.67to 2.2	0.5351
	<2.5	237	32	14%				
Hospital Stay	< 3 days	173	41	24%	32.754	0.16	.08to 0.32	<0.00001
	> 3days	247	12	5%				

Table 3: Association of Mortality Pattern with various characters in the study

Neonates stayed for three or more days at NICU were 84% less likely to die to neonates who stayed for less than three days as OR = 0.16, with 95% CI 0.08 to 0.32(Table 3) Among 53 deaths of neonates, distribution of causes of mortality has been checked. It

was observed that severe perinatal asphyxia (30.2%) was the major reason of morality in neonates. Other reasons are Prematurity with RDS 14 (26.4%) followed by (25%) Septicemia (Figure 1)
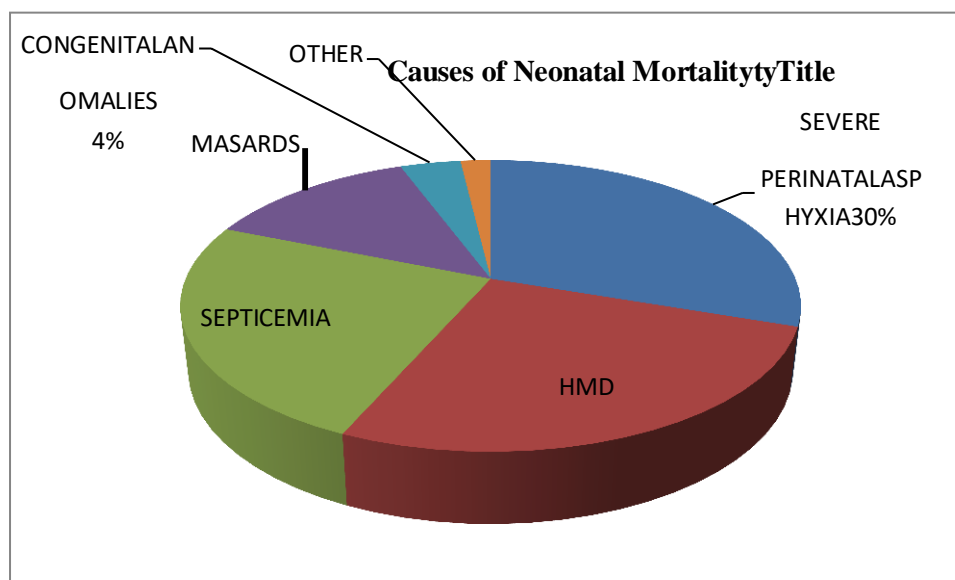
Figure1: Causes of Neonatal Mortality

DISCUSSION:

This prospective study was done in order to study given treatment, outcome and the pattern of mortality of admitted neonates in NICU. In our study it was observed that about 390(93%) neonates were in the early neonatal period age group and about 30 (7%) presented in late neonatal period for admissions which is similar to a study by Anjum, et al. [9]. These findings are logical and expected as neonates in early neonatal period are at risk neonates are identified by healthcare workers immediately if they are born in hospitals.

Our study involved 58.33% male and 41.67% females' neonates. Admissions of male neonates were more than those of females. It is consistent with local literature reported by Kumar et al. [10] and international studies from Pakistan by Seyal et al. [11] and by UgwuGiMG [12] of Nigeria. This may be related to the preference of male child in the society and biological vulnerability of the males to infection.

In our study about 63.57% neonates were of preterm gestation. In contrast, study conducted by Gauchan et al. [14] in which there were 67.5% term babies and 31.3% preterm babies. Our findings are understandable because probably Janani Suraksha Yojana (JSY) and Janani Shishu Swasthya Karyakram (JSSK) Scheme of National Rural Health Mission (NRHM) has enhanced the ante-natal checkup, hospital deliveries and neonatal care among the general population.

The weight parameter of neonates showed that 63.1% were low birth weight and 36.9% were of normal weight. Study done by Hussain [15] which revealed that 57.75% low birth neonates were present in their study. This may be due to poor mental health status, poor socio-economic status, rural region mothers.

In Our study 75% admitted neonates were of institutional delivery hence less number neonates delivered at out born and referred to NICU. More number of health institution deliveries and no home delivery in our study are probably due to Janani Suraksha Yojana and Janani Shishu Swasthya Karyakram Scheme of National Rural Health Mission. Similar studies [11, 13, 16] were found and showed up with a greater number of neonates delivered at institutional level.

In our study it seen that respiratory distress syndrome and Prematurity 302(48%) followed by, hypoglycemia 76(12%), septicemia 65(10%), neonatal jaundice 39(6%), are top five most common indications for admission to NICU which constitutes about three fourth of the total admissions. The other indications were Seizure disorder, Transient Tachypnoea of Newborn, Congenital Anomalies, cong. Pneumonia, Meningitis and others The causes of neonatal admissions in our study are similar to other studies [8-10, 14-17]. In contrast to our study Prematurity was the most common cause of admission in other studies [11, 13].

our study of 420 Neonates, 59% patients were stayed in hospital for more than 3 days after the delivery. Average length of hospital stay was 8.17 days. A study conducted by Aijaz et al. [8] at Karachi found that the average length of stay (ALS) was 6.5 day.

The neonatal mortality 53 out of 420 (12%) in NICU in our study. Similarly, 9.7% neonatal mortality found by Sarkar, et al. [8] and 9% was in the study by Tariq, et al. [10]. Higher neonatal mortality (13.6% to 30.9%) has been reported by various studies [11, 16, 18-20].

The type of contributing factors of neonatal mortality provides us an indication for the area of neglect and the need to take corrective measures in this regard. Birth Asphyxia (30.2%), Prematurity & hyaline membrane disease (26.4%), Meconium Aspiration Syndrome (MAS) with RDS (13.2%) followed by Congenital Anomalies were the top five major contributors to the mortality in our study. The most

common cause of neonatal mortality was Birth Asphyxia in our study which is similar to studies conducted by Anjum, et al. [9] and Hoque, et al. [18] have found that birth asphyxia is the most common cause of neonatal mortality. The type of diseases contributing to mortality in our study are similar to

type of diseases observed by other studies conducted at different places nationally and internationally by Nahar, et al. [13], Anjum, et al. [9], Prasad, et al. [19], Hoque, et al. [18], Seyal, et al. [11], Narayan [17], Ali, et al. [20].

CONCLUSION:

Prematurity is the primary cause behind these neonatal deaths. Analysis of the data shows that preterm neonates suffer a large number of intercurrent problems during the neonatal period, especially increased likelihood of resuscitation in the delivery room, hypothermia, hypoglycemia, jaundice requiring phototherapy, respiratory pathologies, sepsis, antibiotic use, feeding Intolerance, mechanical ventilation, contributing to a high neonatal mortality rate. Uplifting the socioeconomic status of women, nutritional counselling to reduce anemia, maternal malnutrition should be considered to reduce the incidence of premature and low birth weight babies. Antenatal steroid therapy needs to be more vigorously implemented.

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