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A DIURNAL VARIATION IN NEONATAL MORTALITY IN A TERTIARY CARE NEONATAL UNIT: A RETROSPECTIVE STUDY

Paediatric Medicine

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ABSTRACT

The neonatal period is one of the most critical time periods for the survival of a child. The highest risk of dying is present during these first 28 days of life. To determine the distribution of neonatal mortality with respect to time, to determine the factors related to increased mortality in a particular period of time and to determine any modifiable risk factors which contribute to increased mortality rate. A retrospective observational study was conducted to determine the neonatal mortality in Special Newborn Care Unit (SNCU) of Midnapore Medical College from 01/07/2018 – 31/10/2019, a period of 16months. Day time (10 am to 10 pm) neonatal mortality accounts for 51.1% whereas night time (10 pm to 10 am) neonatal mortality accounts for 48.9%. Night time was subdivided into two halves: late night (10 pm - 4 am) and early morning (4 am -10 am). Highest mortality rate was noted between 4 am- 10 am (285, 58%). Whilst the overall mortality was higher in the day time as compared to night time, highest mortality rate was noted between 4 am-10 am. Neonatal mortality rate was noted to be higher during shifting (7 am – 8 am, 1 pm – 2 pm, 7 pm – 8 pm) time period of duty staff.

KEYWORDS

Extremely low birth weight (ELBW), meconium aspiration syndrome (MAS), respiratory distress syndrome (RDS), very low birth weight (VLBW)

INTRODUCTION

The neonatal period is one of the most critical time periods for the survival of a child. Around 130 million babies are born every year globally and out of these 4 million babies die during neonatal period[1]. Most (75%) neonatal deaths occur in first week of life and almost 25% during first 24 hours[2]. The mortality risk is 30-fold higher in the neonatal period than in the post neonatal period[3]. In India, the neonatal mortality rate (NMR) was 44 per 1000 live births in 2000 and this declined to 28 per 1000 live births in 2013 and 22 per 1000 live births in 2019[4].

The major causes of neonatal deaths include preterm births, severe infection, birth asphyxia, and congenital malformation[5]. The common causes of adverse neonatal outcome in developing countries like India include poor health status of women, illiteracy rate, lack of antenatal care and lack of facility-based health care services[6].

Various studies showed that there was significant diurnal variation in mortality rate in inpatients. It was noted that those patients got admitted in hospital in the night and early morning had higher mortality rate[7-10]. Appropriate care provided during this period will help to improve the chances of survival of a child and will lay down the foundations for healthy life. So hereby we are planning to study the factors influencing increased neonatal mortality particularly with respect to time period of day and to find out any modifiable (maternal, hospital care) risk factors responsible for the increased neonatal mortality in our setup. Addressing these issues can reduce the neonatal mortality to a significant extent.

OBJECTIVES

- To determine the distribution of neonatal mortality with respect to time.
- To determine the factors related to increased mortality in a particular period of time.
- To determine any modifiable risk factors which contribute to increased mortality rate.

METHOD

A retrospective observational study was conducted to determine the neonatal mortality in the Special Newborn Care Unit (SNCU) of Midnapore Medical College from 01/07/2018 – 31/10/2019, a period of 16 months. Babies with congenital anomalies, surgical disorders and ambiguous genitalia were excluded from the study.

Neonatal death related details were collected (birth weight, gestational age, sex, in-born/ out-born status, mode of delivery, maternal age, cause of death). Time of birth and time of admission to the neonatal unit were also collected. Further, time period was subdivided into a.10 am - 4 pm (Morning), b. 4 pm – 10 pm (Evening - Early Night), c. 10 pm – 04 am (Late Night) d. 4 am – 10 am (Early Morning). Birth rate, admission rate to SNCU, death rate during these time periods were calculated.

Ethical Issues

Asthis was a retrospective study, the Institutional Review Board granted a waiver of informed consent.

Data were entered in Microsoft excel and analysis was done using SPSS version 22. Quantitative variables were expressed as percentage, ratio. p value <0.05 was considered to be statistically significant.

RESULTS

In our SNCU, 5519 babies got admitted from 01/07/2018 – 31/10/2019. Out of the 5519, 1000 babies expired. Baseline characteristics of the 1000 deaths are described in Table 1.

Table 1: Baseline Characteristics Of The 1000 Deaths

Baseline characteristics	Frequency	Percentage	p value
Maternal age			0.096
<20 years	309	30.9	
20-24 years	443	44.3	
25-30 years	205	20.5	
>30 years	43	4.3	
Gestation			0.0001
Pre-term	35	3.5	
Term	608	60.8	
Post-term	357	35.7	
Mode of delivery			
Lower segment Caesarean section	264	26.4	0.001
Normal vaginal delivery	736	73.6	
Sex			
Female	392	39.2	0.068
Male	597	59.7	
Birth weight	723	72.3	
Low birth weight			0.0001
Normal	277	27.7	
In-born/out-born status			
In-born	487	48.7	0.001
Out-born	513	51.3	

There were significantly more deaths among low-birth-weight babies compared to babies with normal birth weight (p=0.0001, p<0.001). There were significantly more deaths in term babies compared with pre-term and post-term babies (p=0.0001, p<0.001). There were

significantly more deaths among out-born babies compared with in-born babies (p=0.001, p<0.01). Significantly higher deaths were noted among babies who delivered vaginally compared with those born by caesarean section (p=0.001, p<0.01). (73.6%).

Table 2: ***Time To Time Variation In Mortality Rate***

Time	Frequency	Percentage
0:00-0:59	46	4.6
1:00-1:59	34	3.4
2:00-2:59	27	2.7
3:00-3:59	29	2.9
4:00-4:59	24	2.4
5:00-5:59	36	3.6
6:00-6:59	33	3.3
7:00-7:59	52	5.2
8:00-8:59	44	4.4
9:00-9:59	45	4.5
10:00-10:59	54	5.4
11:00-11:59	42	4.2
12:00-12:59	40	4
13:00-13:59	53	5.3
14:00-14:59	44	4.4
15:00-15:59	31	3.1
16:00-16:59	33	3.3
17:00-17:59	41	4.1
18:00-18:59	41	4.1
19:00-19:59	57	5.7
20:00-20:59	47	4.7
21:00-21:59	56	5.6
22:00-22:59	46	4.6
23:00-23:59	44	4.4

Distribution of lower segment caesarean section (LSCS) in our hospital with respect to time is as follows: 10 am - 4 pm (19%), 4 pm - 10 pm (33%), 10 pm - 4 am (30%), 4 am - 10 am (18%). It is highly evident from the records that the least no of LSCS cases were performed between 2 am - 5 am (7%).

Time to time variation in mortality rate is shown in Table 2.

Distribution of birth, admission to SNCU and death with respect to time is shown in Figure I.

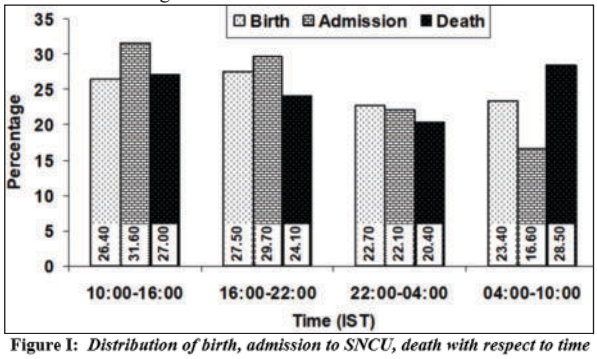

Figure I: ***Distribution of birth, admission to SNCU, death with respect to time***

Maximum births were noted between 16.00 - 22.00 and the least births between 22.00 - 4 .00. Maximum admissions to SNCU were between 10.00 - 16.00 and the least from 4.00-10.00. Maximum death rate was recorded between 4.00 - 10.00, whereas least was between 22.00 - 4.00.

DISCUSSION

In our study we found that the overall mortality is higher in the day time from 10 am to 10 pm (511,51.4%) as compared to night time from 10 pm to 10 am (489, 48.9%). Overall day time mortality (511,51.4%) was high compared to night time mortality (489,48.9%). Reasons are the increased number of normal deliveries and LSCS during this time period. The study showed that there is a huge increase in the admission of sick babies in the early morning. This is because the parents who could not admit their babies in the night due to the lack of transportation have admitted their babies in the morning. It was seen mostly in the rural areas. In that mean time the conditions of the baby worsen and more sick babies are admitted in the SNCU. In the morning, the rates of NVD and LSCS are also increased which enhanced the SNCU admission and ultimately resulted in a high mortality rate.

Highest mortality rate was noted between 4 am-10 am (285, 58%). Between 4 am - 10 am the mortality rate is high[8]. It might be due to factors like less manpower, tiredness, sleep deprivation, fatiguability of the hospital staff which leads to physical exertion, lack of physical activity, and periods of emotional stress which causes error of judgement and proper care while monitoring the babies that's why the babies become more-sick and mortality rate is high in early morning[11-12].

From this study it is evident that mortality rate is low in the time period between 2 am -5 am. This may be due to the smaller number of deliveries conducted during this period in our hospital with only a smaller number of critically ill babies getting admitted in the SNCU. Least no of LSCS were also performed during this period (7%). Postponing the emergency delivery cases after 5 am leads to delivery of more sick babies. Lack of appropriate intervention at the right time leads to delivery of increased number of asphyxiated babies. It is also another important reason for increased mortality between 4 am- 10 am. It is generally observed that babies delivered by an emergency LSCS has a higher mortality rate compared to those born by normal delivery[13].

From this study it was evident that, neonatal mortality rate is higher during 7 am - 8 am, 1 pm - 2pm, 7 pm – 8 pm time period because in this time period there is a change of shift of hospital staffs and nurses. This variation could be the interpersonal variation in explanation of the facts i.e., communication skills of the attending staffs, stress and duty of the staff. Poor neonatal monitoring and care during this period might be associated with it.

Mortality rate in our study is 18.1%. It varies between studies[12].The mortality rate depends upon the skill of treating staff, infrastructure of hospital partially. From this study it is evident that the common causes of death were birth asphyxia (338, 33.8%), neonatal sepsis (256, 25.6%), prematurity (136, 13.6%), ELBW (89,0.9%) and RDS (65, 6.5%). Rate of prolonged labour is higher in night time[14-15]which leads to neonatal asphyxia[11,16]. Lack of timely management of normal cases leads to increased birth of babies with birth asphyxia. It is also another reason for increased mortality rate in early morning. Kumar R, *et al* showed in his study that in his study birth asphyxia contributes around 36.4 % followed by neonatal sepsis 30.2%[5].

Onset of labour in primigravida often starts in early afternoon[5,15] so that if nulliparous women presented with prolonged labour higher chance for emergency LSCS in late night will be there. The common causes of the latest NMR in 2020 in developing countries like Indiaare poor health status of women, illiteracy, lack of empowerment, early marriage, frequent pregnancy, lack of resources, poor infrastructure, lack of antenatal care, deliveries by unskilled attendants or relative and poor accessibility and infrastructure of the facility-based health care services.

In our study out of 1000 death 48.7%(487) were inborn 59.7% (597) were out born and the mortality rate in male babies is 10.8% (597) and female babies is 7.09% (392). It is similar to other studies[12,13].

This study demonstrates diurnal variation in neonatal mortality in a tertiary care neonatal centre. A multifaceted approach with utmost care and attention is needed to reduce the neonatal mortality. In terms of modifiable risk factor in neonatal mortality (hospital care based) equal time distribution of duty hours is needed at the night shift.

CONCLUSIONS

Even though the overall mortality was higher in the day time as compared to night time, highest mortality rate was noted between 4 am - 10 am. Neonatal mortality rate is noted to be higher during shifting (7 am - 8am, 1 pm – 2 pm, 7 pm – 8 pm) time period of duty staff.

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