MAK HILL Publications Research Journal of Medical Sciences

Research Article
doi: 10.59218/makrjms.2024.5.284.288

OPEN ACCESS

Key Words
Neonatal mortality, NICU admission, low birth weight, preterm, sepsis, birth asphyxia

Corresponding Author
Banoth Ramesh,
Shri Vasantrao Naik Government Medical College Yavatmal, India

Author Designation
[1]Assistant Professor
[2]Senior Resident

Received: 20 December 2023
Accepted: 16 January 2024
Published: 9 February 2024

Citation: Vishal G.Chavan, Akshay N. Rekhate, Bharti Rathod and Banoth Ramesh, 2024. Evaluation of Neonatal Admission to Neonatal Intensive Care Init (NICU) in a Tertiary Care Hospital in Maharashtra: A Retrospective Study. Res. J. Med. Sci., 18: 284-288, doi: 10.59218/makrjms. 2024.5.284.288

Evaluation of Neonatal Admission to Neonatal Intensive Care Init (NICU) in a Tertiary Care Hospital in Maharashtra: A Retrospective Study

[1]Vishal G. Chavan, [2]Akshay N. Rekhate, [3]Bharti Rathod and [4]Banoth Ramesh
[1,4]Shri Vasantrao Naik Government Medical College Yavatmal, India

ABSTRACT
Neonatal mortality remains a significant public health concern, particularly in rural areas. India has a high neonatal mortality rate (NMR) of 31/1000 live births that of rural being 34 while urban is 17. This retrospective study aims to evaluate the neonatal NICU admission and investigate the month-wise variations in neonatal mortality and to identify the causes of neonatal deaths in a rural teaching hospital in Maharashtra. This was a record-based observational study of all the neonatal deaths born in a tertiary hospital of Maharashtra, India over a period of 1 year from January 2023 to December 2023. All the admitted babies to NICU were included in the study. Details of each neonatal death were analyzed. The total number of NICU admission during this time period was 4448 neonates with 383 (8.6%) neonatal death. The maximum NMR was 14.7% in the month of July followed by 11.6% in the month of Jan 2023. There was decreasing trend of death rate at the end of year. Among 383 neonates, 86.16% were low birth weight, 63% were male, 79.89% were preterm and 70.75% had duration of hospital stay >48 hr. The most common cause of neonatal death was sepsis (38.9%) followed by respiratory distress syndrome (RDS) (29.76%), birth asphyxia (17.23%), meconium aspiration (6.78%), and candida sepsis (2%). NMR showed decreasing trend at the end of year. Prevention of premature delivery, proper management of very low birth weight babies, and early detection and appropriate management of sepsis/ RDS/ Birth asphyxia have become important interventional strategies in reducing neonatal deaths.

INTRODUCTION

Neonatal admissions to the NICU represent a critical aspect of perinatal care, reflecting the burden of neonatal morbidity and mortality. Neonatal mortality, defined as the death of a newborn within the first 28 days of life, is a critical indicator of the overall health of a community. Neonatal deaths are the highest contributors to infant and under-5 mortality rate. Approximately 75% of the neonatal deaths occur in the 1st week of life, with nearly 25% of them occurring within the first 24 hours of life[1]. However, the global burden of neonatal death is primarily concentrated in developing countries, where care of neonates is practically nonexistent. Of the 4 million neonatal deaths that occur every year, 98% are in the poorest countries of the world. In India, as many as 1.72 million children die annually before reaching their first birthday and, of these, 72% die during their first month of life, the neonatal period[2].

According to the sample registration system statistical report 2016, the current neonatal mortality rate (NMR) in India is 24, ranging from 14 in urban to 27 in the rural areas[3]. The neonatal mortality rate varies by state. State level estimates shows that Jammu & Kashmir has the highest (2182) neonatal deaths per 100 000 live births in India. Subsequently, Madhya Pradesh (1743), Haryana (1592), Rajasthan (1564), Assam (1507), Odisha (1458) and Meghalaya (1438) have higher neonatal deaths per 100 000 live births. Whereas Maharastra have 711 neonatal deaths per 100 000 live births[4].

Moreover, the deaths occurring in NICUs have a major influence on infant mortality. Understanding the causes of death in NICUs and the preventable factors associated with death has the potential to decrease infant mortality[1]. During recent years, there is decreasing trend in infant mortality (deaths in infants 1–12 months of age), but practically no change in NMR is evident[5]. Although NMR is one of the important and sensitive indicators of the availability, utilization, and effectiveness of the health services in the community. It reflects the quality of service available. This research focuses on the evaluation of neonatal NICU admissions, analysis of month-wise variations in neonatal mortality, and identification of causes of neonatal deaths in a rural teaching hospital in Maharashtra.

MATERIALS AND METHODS

The present retrospective observational study was conducted in the NICU of a rural tertiary care hospital of Maharashtra, India during a period from 1st January 2023 to 31st December 2023. As it was a retrospective record-based study over a period of 1 year, hence all the newborns admitted to NICU during that period were included for the study. There were no exclusion criteria. Indoor admission papers of mothers and neonates were studied in detail. The necessary information such as labor notes, perinatal events, neonatal clinical examination, and treatment with clinical progress was collected. The birth statistics was obtained from the birth register in the labor ward. Since this was a retrospective study, the requirement of informed consent was waived. Ethical approval was obtained from the Institutional Ethics Committee. The analysis of the data was done by descriptive statistics with percentages and proportions.

RESULTS AND DISCUSSIONS

Total number of deliveries during the study period (Jan to Dec 2023) was 8546, with 3081 LSCS and 5465 NVDS. There were a total of 8194 live births, of them 4448 neonates were admitted in NICU with 383 (8.6%) neonatal deaths during this time period. Year-wise total numbers of live births and neonatal deaths from 2018 to 2023 are shown in (Table 1), there was a decresing trend in neonatal deaths in our hospital.

Out of total 4448 NICU admission, there were 3405 (76.55%) inborn babies with 200 (5.87%) neonatal death wheeras 1042 (23.42%) outborn babies with 183 (17.56%) neonatal death. Thus, a total of 383 neonatal deaths during the study period.

Figure 1 show the month wise death rate trends for the year 2023. The maximum NMR was 14.7% in the month of July followed by 11.6% in the month of Jan. There was decreasing trend of death rate at the end of year.

Among 383 neonates, maximum (86.16%) were low birth weight, 63% were male, 79.89% were preterm and 70.75% had duration of hospital stay >48 hour as shown in (Table 2).

The most common cause of neonatal death was sepsis (38.9%) followed by respiratory distress syndrome (RDS) (29.76%), birth asphyxia (17.23%), meconium aspiration (6.78%), and candida sepsis (2%) as depicted in (Figure 2).

In the present study the neonatal mortality rate for the year 2023 was 8.61% which is comprable with the study done by Modi et al. (9.42%)[6] and Sridhar *et al*. (7.16%)[7]. However, the death rate in the present study was much lower than that observed in a study done from a tribal area of Maharashtra[8]. The male neonates have higher global biological risk of death than female neonates[9]. The same pattern was observed in current study as the majority (62.92%) of neonates who died were male. This male preponderance among admitted neonates was also documented by several studies conducted in various parts of India[10-14]. Male predominance might be due to higher susceptibility of male gender as well as due to social and cultural situations in India where comparatively male children are given more attention

Table 1: Year wise neonatal admition in NICU and neonatal death

	2018	2019	2020	2021	2022	2023
Total live birth	8866	8953	7534	5364	7560	8194
Neonatal admission	3044	3724	3200	3592	4261	4448
Death	462	345	294	363	390	383
Percentage of death	15.17%	9.26%	9.18%	10.10%	9.15%	8.61%

Table 2: Death profile based on birth weight, gender, gestational age and duration of hospital stay

Parameters	No of death	percentage of death
Birth weight (kgs)		
<1	82	21.40
1-1.5	106	27.67
1.5-2.5	142	37.07
>2.5	53	13.83
Gender		
Male	241	62.92
Female	142	37.07
Gestational age (Weeks)		
Preterm	306	79.89
Full term	77	20.10
Duration of hospital stay		
<48 hr	112	29.24
48 hr to 7 days	134	34.98
>7 days	137	33.77

by family members and preferentially brought to the health facilities. Out of all admitted neonates, in born (76.55%) neonates outnumbered the outborns (23.42%) which is similar to the studies done by Modi R *et al*.[6] Sridhar PV *et al*.[7], Ravikumar SA *et al*.[11] and Malkar, *et al*.[14]. Comparatively lower admission of outborn neonates might be partly due to delivery of high risk mothers at tertiary care centers where NICUs are located and partly due to nonreferral of neonates from primary and secondary level facilities. Hence, issues regarding the early detection of needy newborns and their prompt referral to NICU from peripheral health facilities should be identified and resolved compressively.

Birth weight and gestational age are the two important factors for assessing risk of newborns as well as determining prognosis. Definitely LBW (birth weight <2500 g) and prematurity (gestational age <37 weeks) have adverse impact on survival and well being of neonates. Preterm small for gestational age babies contributed more to early neonatal deaths[15]. In the present study, the number of preterm babies among admitted neonates was 306 (79.89%) and number of term babies was 77 (20.10%). This was in line with the findings from study conducted by Poyekar *et al*. (preterm- 78.2%)[10]. and Rashid R *et al*. (preterm-69.4%)[12]. Results also in concurrence with the study by Pradeep et al. who observed 78% of early neonatal deaths in preterm babies[16].

According to the United Nation Children's Fund (UNICEF), "The state of world's children's report 28% of neonates were born with low birth weight in India [17]. But in present study 86.16% of neonates were low birth weight. This reflects the poor maternal health, antenatal check-up and socio-economic status

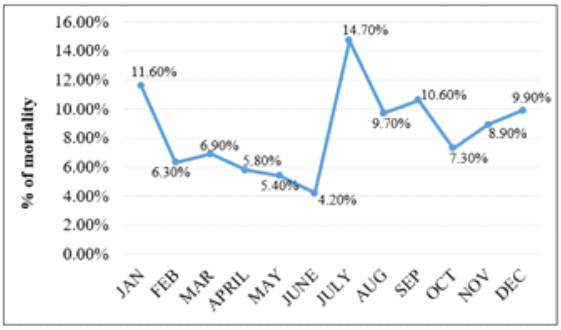

Fig. 1: Month wise death rate trends for the year 2023

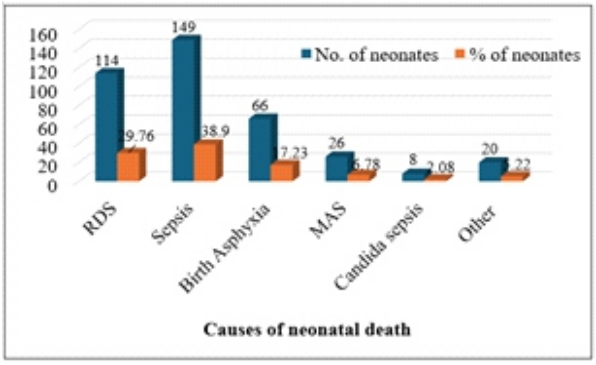

Fig. 2: Causes of neonatal deaths

of the rural society as our hospital caters people from rural areas and from low socio-economic groups. Various studies from all over India reported much higher LBW rates. This may be due much higher pre-term deliveries in their studies[6,11,18]. Prematurity and birth weight are important factors in determining survival of neonates in NICU, as in the present study, preterm neonates had roughly twice the risk of mortality

compared with term neonates. Moreover, the risk of death is greatest on the 1st day of life for a liveborn neonate. Globally, the proportion of deaths during the 1st day and week of life is consistent across the different regions and economical settings[9,19]. In the persent study, the percentage of early neonatal deaths was 64.22% (within week of life) with more of them occurring during the 48 hour to 7 days of life (34.98%). This finding is correlated with the study done by Poyekar *et al*[10].

The proportion of neonatal mortality in our institution has decreased from Jan to Dec with marginal increase in the month of July 2023. The reasons for the improvement were multifactorial. In our setting, the use of advanced ventilation strategies, strict infection control measures, improvement in knowledge, skills, and experience in managing preterm neonates.

Identification of causes of deaths is a guide to implement strategies to minimize the preventable

neonatal deaths and to reduce the overall infant mortality. The most common cause of neonatal death in current study was sepsis (38.9%) which is comparable with th study done by Pandya *et al*.[20]. Similarly, the study report by the Indian Council of Medical Research also states sepsis to be the major cause of neonatal death[21]. The other leading causes of neonatal deaths in present study were RDS, birth asphyxia and meconium aspiration. In India the major causes of death are pre-maturity, neonatal infections, intra-partum related complications/ birth asphyxia, and congenital malformations. Inter and intra state variation of causes of neonatal mortality is observed across the country. Furthermore, difference is also seen among the neonates delivered in well-equipped health facility like medical colleges and those referred from peripheral health facility[22].

Limitation:

- This is a hospital based study may not represent community as whole and outcome of newborn who left against medical advice was unknown.
- Due to retrospective nature of the study, epidemiological factors including maternal factors that could have influenced the health and outcome could not be analysed.
- Maternal details were not studied in the present study.
- The data were dependent on the extent of data available retrospectively from case records and reports.

CONCLUSION

Neonatal mortality is an indicator of health status of the community. This study identified sepsis and RDS among the most common reasons for NICU admission and mortality thereof. Neonatal death proportions have shown a downward trend during the study period, with marginal increase in the month of July 2023, which may be because of congenital malformations and perinatal asphyxia. Prevention of premature delivery, proper management of very low birth weight babies, and early detection and appropriate management of sepsis/perinatal hypoxia have become important interventional strategies in reducing neonatal deaths.

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