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Original Research Article

COMPARING NEONATAL INTENSIVE CARE UNIT OUTCOMES OF INTRAMURAL AND EXTRAMURAL NEONATES USING THE MODIFIED SICK NEONATE SCORE

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Abstract

Background: Neonatal period is the first 28 days of life since birth. It is considered as the most susceptible period for mortality and morbidity. A country's health status is measured in terms of infant mortality. Neonatal mortality accounts for 2/3 rd of the infant mortality. Current Neonatal Mortality Rate (NMR) in India is 34/1000 live births. Tamilnadu stands second lowest with 17/1000. India contributes to nearly 25% of global neonatal deaths. Even though there is a drastic decline in NMR, Average Annual Rate of Reduction (AARR) is only less with 3.5%. UN Millennium Development Goals 2015 had seen a reduction of 47% of under 5 mortality (U5MR). **Materials and Methods:** This prospective analytical study was conducted at the NICU .The study period was from December 2022 to November 2023. Data from a convenience sample of 210 neonates was recorded on a semi-structured proforma with the approval of the IRB and ethics committee. Informed consent was obtained from the parents of the neonates enrolled in the study. Basic demographic details like the place of birth, gender, and cause of admission were recorded in addition to the 8 parameters of the MSNS. These parameters are routinely recorded as a part of the newborn special neonatal care unit (SNCU) assessment, with the details recorded within 8 hours of admission. A total modified sick neonatal score was assigned based on the sum of the individual parameters. The patients were followed till the end of their NICU stay and the outcome was defined in terms of discharge or death. **Result:** 90 neonates were born at our institution, and 120 were referred from other institutions/came from home. This contrasted with several studies and could be explained by the better prognosis of inborn neonates at birth, lowering their need for intensive care was also the designated COVID facility for the district during the study. This could have impacted the number of deliveries occurring and thus reduced the number of inborn neonates requiring NICU admissions. Jaysheel et al had a similar distribution of intramural and extramural neonates. 51.46% of the neonates were preterm (less than 36 weeks of gestation), and 48.54% were born at term. 88.54% of the sample had a good outcome (was discharged), and 11.46% of the newborns did not survive. 5% of inborn babies had poor outcomes, whereas mortality was higher for out born newborns at 16%, which falls in the range (2% to 19%) of mortality rates in SNCUs nationwide. **Conclusion:** As a result, both intramural and extramural newborns' outcomes can be accurately predicted by the MSNS, with a higher range for inborn babies, which is indicative of a better prognosis. The score can be used for identification and timely action at every stage of the transport process. It can provide the family a prognosis and make communication between facilities easier. We can use this number to rank all infants and give admitted neonates priority when it comes to receiving treatments, ventilators, and other similar medical care. Its simplicity of use and the use of non-invasive measures offer the potential to enhance neonatal care in environments with limited resources and avoid neonatal mortality.

INTRODUCTION

Neonatal period is the first 28 days of life since birth. It is considered as the most susceptible period for mortality and morbidity. A country's health status is measured in terms of infant mortality. Neonatal mortality accounts for 2/3 rd of the infant mortality.[1] Current Neonatal Mortality Rate (NMR) in India is 34/1000 live births. Tamilnadu stands second lowest with 17/1000. India contributes to nearly 25% of global neonatal deaths. Even though there is a drastic decline in NMR, Average Annual Rate of Reduction (AARR) is only less with 3.5%. UN Millennium Development Goals 2015 had seen a reduction of 47% of under 5 mortality (U5MR).[2]

According to the National Family Health Survey-3 (NFHS-3) report, the current neonatal mortality rate (NMR) in India of 39 per 1,000 live births, accounts for nearly 77% of all the infant deaths (57/1000) and nearly half of the under-five child deaths (74/1000).[3] One of the millennium development goals (MDG-4) was to reduce child mortality 30/1000 live births by up to two-thirds by 2015. In most developing countries, a higher proportion of neonatal deaths are observed.[4] The rate of the neonatal mortality varies widely among the different states of India, ranging from 11 per 1000 live births in Kerala to 48 per 1000 live births in Uttar Pradesh. The neonatal mortality rate in Bihar 42 per 1000 live birth is more than that of the national figure due to the lack of health infrastructures. Bihar has experienced economic growth which was accompanied with improvement in many health indicators, including infant mortality rate. There are few studies that have described the neonatal mortality rates in Bihar. The country has achieved a significant reduction in under-five mortality and infant mortality figures over the past decade.[5]

Sustainable Development Goal 2030 focuses mainly on reduction in neonatal mortality to achieve U5MR. Seventy five percent of neonatal deaths occur in first week of life. Three major causes (78%) which contribute to neonatal mortality in developing countries are prematurity & low birth weight, neonatal infections and birth asphyxia. In India, the neonatal care saw a revolution under the auspices of National Health Mission (NHM). After reduction in NMR, the goal is to reduce the morbidity of neonates by disease specific intervention. So, identifying the pattern of medical illness in an area will help the health care providers to plan service priorities.

MATERIALS AND METHODS

Study Design: A prospective analytical study.

Study Duration: December 2022 to November 2023.

This prospective analytical study was conducted at the NICU. The study period was from December 2022 to November 2023. Data from a convenience sample of 210 neonates was recorded on a semi-structured proforma with the approval of the IRB and ethics committee. Informed consent was obtained from the parents of the neonates enrolled in the study. Basic demographic details like the place of birth, gender, and cause of admission were recorded in addition to the 8 parameters of the MSNS. These parameters are routinely recorded as a part of the newborn special neonatal care unit (SNCU) assessment, with the details recorded within 8 hours of admission. A total modified sick neonatal score was assigned based on the sum of the individual parameters. The patients were followed till the end of their NICU stay and the outcome was defined in terms of discharge or death. Neonates with conditions incompatible with life, were referred to another center from our NICU, or took leave against medical advice were excluded from the sample. Neonates who had exceeded the 8-hourtime limit for data collection were also excluded to avoid the stabilization effect in the NICU.

Statistical Analysis: The data was entered into a Microsoft excel spreadsheet, and the final analysis was done using statistical package for social sciences (SPSS) software, IBM manufacturer, Chicago, USA, version 25.0. A p value of less than 0.05 was considered statistically significant for the purpose of this study.

RESULTS

90 neonates were born at our institution, and 120 were referred from other institutions/came from home. This contrasted with several studies and could be explained by the better prognosis of inborn neonates at birth, lowering their need for intensive care was also the designated COVID facility for the district during the study. This could have impacted the number of deliveries occurring and thus reduced the number of inborn neonates requiring NICU admissions. Jaysheel et al had a similar distribution of intramural and extramural neonates.

51.46% of the neonates were preterm (less than 36 weeks of gestation), and 48.54% were born at term. 88.54% of the sample had a good outcome (was discharged), and 11.46% of the newborns did not survive. 5% of inborn babies had poor outcomes, whereas mortality was higher for out born newborns at 16%, which falls in the range (2% to 19%) of mortality rates in SNCUs nationwide.

The mean duration of admission was 4.39 days, with a median stay of 3 days (IQR 2-5). Inborn and out born babies stayed in the NICU for almost the same duration (4.37 and 4.39 days, respectively), possibly due to a shorter stay due to early deaths in neonates with poorer outcomes. Overall, the leading causes of admission were prematurity and related complications, birth asphyxia, and neonatal hyperbilirubinemia. These findings correlate with the global trends in NICU admission. The leading causes of admission for inborn newborns were prematurity and related complications (40.88%) and neonatal

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hyperbilirubinemia (15.47%), among others, the same as the overall trend for our study.

Table 1: Baseline characteristics of neonates' distribution

Baseline characteristics of neonates	N	Percentage
Gestational age		
Preterm	105	51
Term	100	49
Birth weight		
<1.5	43	20.70
1.5-2.49	98	47.80
>2.5	65	31.46
Gender		
Female	98	45
Male	112	55
Place of Birth		
Inborn	95	44.15
Outborn	115	55.85
Outcome		
Discharged	185	88
Expired	25	12

Table 2: Association of parameter of MSNS with inborn/outborn.

Parameters of MSNS	InBorn (N=95)	Outborn (N=115)	Total	P value
Cause of admission				
Prematurity and related complications	37 (40.88)	58 (51.09)	95(46.59)	0.0001
Sepsis	2 (2.21)	5 (4.80)	7 (3.66)	
Respiratory distress syndrome	2 (2.76)	5 (4.80)	7 (3.66)	
Birth asphyxia	8 (9.39)	15 (13.54)	23 (11.71)	
Neonatal hyperbilirubinemia	14 (15.47)	7 (6.55)	21 (10.49)	
IUGR	3 (3.31)	1 (0.44)	4 (1.71)	
Baby of covid positive mother	4 (4.97)	2 (0.87	6 (2.68)	
Respiratory effort				
Apnea or grunt	6 (7.18)	9 (6.99	15 (7.07)	0.702
Tachypnea (respiratory rate >60/min) with or without retractions	26 (28.18)	36 (31.44)	62 (30)	
Heart rate				
Bradycardia or asystole	1 (0.55	4 (3.49)	5 (2.20)	0.002
Tachycardia (>160/min)	3 (2.76)	11 (9.61)	14 (6.59)	
Random blood sugar (mg/dl)				
<40	3 (2.76)	10 (8.73)	13 (6.10)	0.040
40-60	22 (24.31)	24 (20.96)	46 (22.44)	
>60	66 (72.93)	81 (70.31)	147(71.46)	
Birth weight(kg)				
<1.5	15 (17.13)	27 (23.58)	42 (20.73	0.065
1.5 to 2.49	42 (45.86)	57 (49.34)	99 (47.80)	
2.5 or above	33 (37.02)	31 (27.07)	64 (31.46)	

DISCUSSION

When transferring neonates to different facilities, a number of grading systems have been employed. Scores that is comparatively simple to use and have had noteworthy results in outcome prediction include TOPS, MINT, and SNS. With an AUC of 0.89 for derangement of more than two parameters, sensitivity of 81.6%, specificity of 77.93%, and correlation between all components of TOPS and fatality, Mathur et al.'s findings were similar to ours.20As observed in our post-transport MSNS, oxygen saturation was found to be statistically significant in both pre- and post-transport TOPS scores in another investigation.[6]

This finding highlights the significance of sustaining oxygen saturations during transport. This may have an impact on our mode of transportation because only fully equipped ambulances are able to provide continuous monitoring. Numerous studies have also suggested the necessity of a paediatric transport team with specialized training, which may be difficult to implement in the existing environment given the requirement for more qualified staff.[7]

We might teach the transport workers to use predictive scores like MSNS for longer, higher-risk transits, allowing them to document the condition and take appropriate action in the event of sudden changes in the parameters. When it comes to advising parents on the prognosis in the pre-transport phase, facilitating monitoring during transport, and improving inter-facility communication, MSNS can assist with communication at every stage of the transfer. Broughton et al. showed that this kind of pre-transport communication can enhance newborn outcomes in their study on the MINT score.[8]

While our study provided good results, it had its own limitations in terms of the score parameters as well as the application of the score. Since the sample only included patients from a single center, a multi-center

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study is required to validate the efficiency of the score across different systems.[9] The MSNS system does not take maternal conditions like diabetes, bleeding disorders, obstetric complications, and infections into consideration. These can affect the growth of the neonates and, in turn, their postnatal outcomes. We also should have considered the day of life on admission and the mode of transport to the facility- both might have a role in the relatively poor outcomes displayed by the extramural group.[10]

CONCLUSION

As a result, both intramural and extramural newborns' outcomes can be accurately predicted by the MSNS, with a higher range for inborn babies, which is indicative of a better prognosis. The score can be used for identification and timely action at every stage of the transport process. It can provide the family a prognosis and make communication between facilities easier. We can use this number to rank all infants and give admitted neonates priority when it comes to receiving treatments, ventilators, and other similar medical care. Its simplicity of use and the use of non-invasive measures offer the potential to enhance neonatal care in environments with limited resources and avoid neonatal mortality.

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