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Profile of neonatal mortality in special newborn care unit of tertiary care hospital

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ABSTRACT

Background: In India presently around 8 million LBW infant are born each year. India accounts for 24% of global neonatal mortality. Improving NMR is an essential component of reducing U-5MR. The aim of this study was to determine the causes of morbidity and mortality in neonates admitted in our hospital.

Methods: This study was conducted at SNCU of Kamala Raja Hospital, Gwalior providing level III neonatal care. This is a retrospective hospital based observational study. Data from SNCU online database were taken for a period of 3 year from March 2016 to March 2019. Data obtained included sex, birth weight, Gestation age, morbidity profile, Diagnosis, and Mortality profile, Duration of stay and outcome. Categorical variables were tabulated and Statistical analysis was done.

Results: A total of 12,027 neonates were recruited, 63.07% were males and 36.92% were females. 54.87% were extramural, while 45.13% were intramural neonates. Prematurity was the most common morbidity 56.98% in the admitted neonates. Major contributors to the neonatal morbidity were Birth asphyxia (24.61%), others (21.60%), Respiratory Distress(14.06%), Sepsis(13.77%). The mortality rate in the present study is 25.45%. Major contributors for neonatal mortality includes Respiratory distress (37.76%), Birth Asphyxia (26.75%), Sepsis(13.91%). Mortality was more in out born babies 33.03% compared to inborn babies 22.03%.

Conclusions: Improving antenatal care, more deliveries at institutions with SNCU facility, improved access to health facility, early identification of danger signs, timely referral of high risk cases, capacity building, can reduce neonatal mortality and its complications.

Keywords: Extramural, Intramural, Mortality profile, Outcome, Respiratory distress

INTRODUCTION

The measure of a civilization is how it treats its weakest members," said Mahatma Gandhi. Newborns are undisputedly the weakest members of ours society. Globally, Neonatal deaths now account for over 40% of the under -5 deaths and must be addressed to accelerate progress towards the Sustainable Development Goal-3 (SDG3), since reducing the neonatal mortality to 12 per 1000 live births by 2030 is one of the targets under SDG3.[1] India is the epicentre of world's neonatal mortality with every fourth dying newborn of the world being Indian.[1,2] Close to 700,000 newborns die every year in India - a horrifying rate of neonatal deaths every minute.[2] In India nearly 67% of infant deaths occur in the neonatal period. Half of the neonates die in the first week of life.[3] Neonatal mortality rate of India was reported as

29 and the early neonatal mortality as 20, which contributed 53% to the IMR.[3]

Madhya Pradesh 35, Odisha 32 and Uttar Pradesh 30 has neonatal mortality rate of >30. Four states Uttar Pradesh, Madhya Pradesh, Bihar, Rajasthan –alone contributes to 55% of total neonatal Death in India and to 15% of global neonatal deaths that occur every year. Madhya Pradesh has neonatal mortality rate of 35 which is higher than national average 24 and contribute around 67.70% to its IMR of 47.[4-6] By the end of 12th five year plan, the aim is to reduce IMR to 25 at national level and to 34 in Madhyapradesh.[7] Goal 3 of SDG targets to end preventable neonatal deaths and under 5 death to single digit by 2030 in India.[8] Preterm birth complication(34%), Infection(21%) and Birth Asphyxia(24%) are the three topmost causes of neonatal mortality worldwide.[1] Mortality risk is highest on the first day of life contributing upto 36% of all neonatal deaths-most of these due to birth Asphyxia.[1] Substantial decrease in the under 5 mortality has been achieved during the passing years but decline in neonatal mortality has been much slower[9] In order to accelerate progress it is important that preventing neonatal deaths should be prioritized.[9] Since NMR contributes a major portion to IMR and under-5 mortality(U5MR), there is an utmost need to bring down the neonatal deaths drastically to achieve these targets. SNCU, as a part of newborn care plays important role in the reduction of neonatal morbidity and mortality.[10]

Variation is seen among the neonates delivered in well-equipped health facility like Medical colleges and those referred from peripheral facility.[11] Regional diversity and socio cultural determinants largely affect neonatal health. It is important to study the mortality and morbidity pattern in a region as it helps in implementation of new treatment protocols, interventions and planning and policy making which helps in better outcome and improvement in the quality of life among survivors. There is scanty data available regarding morbidity and mortality of neonates of Gwalior region.

Most newborn deaths are preventable by improving the quality of care during delivery and care at birth. Simple interventions like skilled birth attendance and access to emergency obstetric care can reduce NMR. With this background, the present study was conducted with aim of studying the socio demographic profile of neonates admitted to SNCU and to explore the difference between the morbidity pattern of inborn and out born neonates if any and their causes to recommend improvement measure.

METHODS

This study is a retrospective, descriptive study of medical record carried out in the Special Newborn Care Unit (SNCU) Kamala Raja Hospital Gwalior. The period of present study was 3 year from March 2016 to March 2019.

Inclusion criteria

All neonates admitted before 28 days of life.

Exclusion criteria

Neonates taken against medical advice and those referred to tertiary care centers were excluded in analysis of survival outcome as their final outcome was not known. After obtaining ethical committee approval, data of all admitted babies were recorded by analyzing all the case sheets from the records section and SNCU online software database. Data was collected as Inborn or out born, admission, sex, gestation age, age at presentation, indication of admission, duration of hospitalization, procedure done during hospitalization and outcome. Primary Diagnosis was considered as final diagnosis even if the baby developed complications of primary disease or having more than one disease.

Following definitions were used for categorizing the neonates

Intramural

- Babies delivered in the hospital.

Extramural

- Babies delivered outside of hospital.

WHO definitions were used for term, Preterm, Low Birth weight (LBW), VLBW, ELBW

Meconium Aspiration Syndrome

- Diagnosed on basis of history, clinical and radiological finding.

Birth Asphyxia

- Diagnosed on basis of APGAR<7 at 1 min.

Neonatal jaundice

- Diagnosed after assessment of serum bilirubin and in pathological zone as per AAP charts.

Sepsis

- Diagnosed by clinical and appropriate lab screening test.[12]

Congenital malformation

- Diagnosed on clinical features and diagnostic facilities like Ultrasound, Echocardiography, X rays, and Electrocardiography (ECG).

Statistical analysis

The data was filled in EXCEL sheet and categorical variable were tabulated. Calculation was done as percentage and proportions. Chi square test was used for calculating statistical significance.

RESULTS

Between March 2016 to March 2019, a total of 12027 newborn were admitted during study period .Out of this total newborn admitted 5428(45.13%) were inborn i.e. they were born at the same health facility where SNCU is located and 6599(54.86%) were outborn they were born at facilities where there is no SNCU or at home .The gender distribution among the admitted newborns was 7586(63.07%) males and 4441(36.92%) females giving a male: female ratio of 1.7:1 (1.5:1 inborn vs 2:1 outborn). The gestation age distribution had 56.98% neonates were in between 34 to <37 weeks, 23.03% in 37 to <42 weeks and 19.98% in 34 to <37 weeks. Majority of the neonates were low birth weight (61.47%). Higher numbers of inborn babies were stay compared to outborn babies within first 7 days of life (72.98% vs 71.64%). (Table 1)

Out of the total babies admitted in SNCU, 7925 were discharged successfully, 3061 expired, 92 neonates were referred to other centers for need of surgical intervention or due to unavailable resources and 949 neonates were leave against medical advice (Table 2). Out of the remaining 10986 neonates 7925 (65.89%) were discharged successfully and 3061 (25.45%) expired. The difference in discharge and death was significant among inborn and out born neonates.(Table 3)

Table 1: Profile of the Admitted Neonates.

Variables	Intramural(I) n=5428 (45.13%)	Extramural(E) n=6599 (54.86%)	Total 12027	p-value
Sex				
Male	3216(59.24%)	4370(66.22%)	7586(63.07%)	<0.001
Female	2212(40.75%)	2229(33.77%)	4441(36.92%)	
Birth Weight Wise Classification at Admission				
>=2500gm	2192(40.38%)	2436(36.91%)	4628(38.48%)	<0.001
1500 - 2499gm	2575(47.43%)	3165(47.96%)	5740(47.72%)	
1000 - 1499gm	552(10.16%)	824(12.48%)	1376(11.44%)	
< 1000gm	109(2.00%)	174(2.63%)	279(2.31%)	
Gestation				
>37 weeks	1321(24.33%)	1449(21.95%)	2770(23.03%)	0.0026
34- 37 weeks	3073(56.61%)	3781(57.29%)	6854(56.98%)	
< 34 weeks	1034(19.04%)	1369(20.74%)	2403(19.98%)	
Duration of Stay				
< 1 day	265(4.88%)	435(6.59%)	700(5.82%)	<0.001
1-3 day	1708(31.4%)	2346(35.55%)	4054(33.70%)	
4-7 day	1993(36.71%)	1947(29.50%)	3940(32.75%)	
>7 day	1462(26.93%)	1871(28.35%)	3333(27.71%)	
Average Duration of stay	5.98	6.15		

Table 2: Survival Outcome of Admitted Neonate.

Outcome	Intramural(I)	Extramural(E)	Total
Discharge	4027(74.18%)	3898(59.06%)	7925(65.89%)
Referred	17(0.31%)	75(1.13%)	92(0.76%)
Leave against medical advice	246(4.53%)	703(10.65%)	949(7.89%)
Expired	1138(20.96%)	1923(29.14%)	3061(25.45%)

Table 3: Outcome analysis after excluding LAMA and Referral.

Outcome	Intramural(I)	Extramural(E)	Total	p value
Discharge	4027(77.96%)	3898(66.96%)	7925(72.13%)	<0.001
Expired	1138(22.03%)	1923(33.03%)	3061(27.86%)	
	5165	5821	10986	

Major contributors to the neonatal morbidity were Birth asphyxia(24.61%), others(21.60%), Respiratory Distress(14.06%), Sepsis(13.77%) and Jaundice(10.65%)

(Table 4). Respiratory distress, Birth Asphyxia, Sepsis were the most common mortalities accounting to (37.76%), (26.75%) and (13.91%) respectively. (Table 5)

Table 4: Morbidity profile.

Morbidity	Intramural(I) n=5428(45.13%)	Extramural(E) n=6599(54.86%)	Total 12027	p value
Respiratory Distress syndrome	730 (13.44%)	962 (14.57%)	1692 (14.06%)	
Meconium aspiration syndrome	494 (9.1%)	170 (2.57%)	664 (5.52%)	
Other cause of respiratory Distress	115 (2.11%)	73 (1.1%)	188 (1.56%)	
HIE/ Moderate –Severe Birth Asphyxia	1323/19 (24.72%)	1598/20 (24.51%)	2960 (24.61%)	
Sepsis/Pneumonia/Meningitis	603/6/26 (11.69%)	915/10/97 (15.48%)	1657 (13.77%)	<0.001
Major Congenital Malformation	167 (3.07%)	788 (11.94%)	955 (7.94%)	
Jaundice requiring Phototherapy	681 (12.54%)	600 (9.09%)	1281 (10.65%)	
Hypothermia	6 (0.11%)	18 (0.27%)	24 (0.19%)	
Hypoglycemia	3 (0.05%)	4 (0.06%)	7 (0.05%)	
Others	1255 (23.12%)	1344 (20.36%)	2599 (21.60%)	

Table 5: Cause of mortality.

Variable	Intramural(I) n=1138 (37.17%)	Extramural(E) n=1923 (62.82%)	Total 3061	p value
Respiratory Distress syndrome	480 (42.17%)	676 (35.15%)	1156 (37.76%)	
Meconium aspiration syndrome	56 (4.92%)	32 (1.66%)	88 (2.87%)	
HIE/ Moderate –Severe Birth Asphyxia	321 (28.20%)	498 (25.89%)	819 (26.75%)	
Sepsis/Pneumonia/Meningitis	115 (10.10%)	311 (16.17%)	426 (13.91%)	<0.001
Major Congenital Malformation	68 (5.97%)	249 (12.94%)	317 (10.35%)	
Prematurity	87 (7.64%)	121 (6.29%)	208 (6.79%)	
Others	11 (0.96%)	35 (1.82%)	46 (1.5%)	
Cause not established	0 (00)	1 (0.05%)	1 (0.03%)	

Table 6: Mortality Profile.

Variable	Intramural(I) n=1138 (37.17%)	Extramural(E) n=1923 (62.82%)	Total 3061	p value
Birth Weight / Admission Weight				
≥2500gm	233(20.47%)	512(26.62%)	745(24.33%)	
1500 - 2499gm	517(45.43%)	860(44.72%)	1377(44.98%)	0.0004
1000 - 1499gm	299(26.27%)	426(22.15%)	725(23.68%)	
< 1000gm	89(7.8%)	125(6.5%)	214(6.99%)	
Gestation				
Term	496(43.58%)	984(51.17%)	1480(48.35%)	
Preterm	640(56.23%)	938(48.77%)	1578(51.55%)	0.0001
Post term	2(0.17%)	1(0.052%)	3(0.09%)	
Duration (Between Admission And Death)				
< 1 day	216(18.98%)	306(15.91%)	522(17.05%)	
1-3 day	602(52.89%)	1020(53.04%)	1622(52.98%)	<0.001
4-7 day	196(17.22%)	310(16.12%)	506(16.53%)	
>7 day	124(10.89%)	287(14.92%)	411(13.42%)	
Age At Death				
<1 day	185(16.25%)	139(7.22%)	324(10.58%)	
1-3 Day	770(67.66%)	1140(59.28%)	1910(62.39%)	<0.001
>7 day	183(16.08%)	644(33.48%)	827(27.01%)	

During management 96.48% of neonates received intravenous antibiotics, 43.95% received oxygen therapy, while 11.28% of neonates received phototherapy. 11% of neonates managed in step down care.

Average Duration of stay (admission to discharge, referred and LAMA) in SNCU is 5.98 days in inborn and 6.15 days in outborn. 33.70% neonates stay for 1-3 days, 32.75% stay for 3-7 days, 27.71% stay for >7 days while 5.82% stay for <1day.

Total 3061 neonate expired after admission (out of 12027) constitute 25.45% mortality rate. 37.17% were in inborn neonates and 62.82% were in outborn neonates. 52.98% neonate died within duration of 1-3days, 62.39% neonates died within 1st 7 day followed by 13.71% neonates died >7 days. 44.98% neonate died due to Low birth weight. Comparing the mortality in different weight groups highest number of mortality was observed in 1500-2499grams (44.98%) followed by 2500-3999grams (24.33%). The mortality rate of inborn babies was 22.03% and that of outborn babies was 33.03%. 51.55% neonate died due to prematurity. (Table 6)

DISCUSSION

Data pertaining to disease pattern and mortality are useful for health care providers and policy makers to modify and plan treatment or interventions and evaluate the effectiveness of health care initiatives respectively. There is less number of newborn units in these areas and number of level 3 Neonatal Intensive Care Units (NICU) is still lesser. Data pertaining to morbidity and survival from NICUs in India are less and this is probably the first study of its kind from the Gwalior region.

This study depicts the morbidity pattern in the SNCU. The inborn and out born admission rate (45.13% and 54.86%) is similar to other studies (28.5% and 71.5%) similar to a study by Orimadegun and Owa JA et al. [13-15] in Nigeria, a developing country (44.7% vs 55.3%). Majority of the admission were males as compared to females(63.07% vs 36.92%) similar finding in other studies.[16-18] Significantly higher males were admitted in both inborn and outborn groups. Gender bias as a cause for higher number of male admissions needs to be further evaluated. In a study conducted in adjoining state of Uttar Pradesh it was found that the expenditure of health care is nearly fourfold higher in household with male newborn and female newborn use cheaper treatment options.[19] In present study of the total neonates 76.96% were preterm and 23.04% were term which is comparable to the studies by Rakholia R et al, and Modi R et al.[12,20]

The common morbidities seen in the admitted babies are Birth asphyxia(24.61%), others(21.60%), Respiratory Distress(14.06%), Sepsis(13.77%) and Jaundice(10.65%). Other studies reported higher rates of Birth asphyxia and Sepsis.[13,21,22] Out of the total admitted neonates 92 were referred to other centers and 949 were leave against

medical advice. Out of the remaining 10986 neonates 7925 were discharged successfully and 3061(27.86%) expired. The rate of successful discharge was 66.57% by Rakholia R et al, and 69.3% by NNPD.[23] This may be because of the level of care being provided by the centers. Level III NICU takes more morbid and terminally ill newborns and the expected mortality remains high in these set ups. 7.89% neonates were leave against medical advice. This rate is comparable to other studies by Baruah MN et al,(7.5%), Rakholia R et al, (8.3%) and NNPD (0.7%).[20,24] This may be because of lower understanding of the seriousness of the condition of neonate and the benefit of full treatment.

The Neonatal Mortality Rate of 25.45% in the current study is higher than developed countries like Canada (7.6%) suggested that minimal and timely interventions can reduce neonatal death rates.[12] The mortality rate is slightly better than countries like Nepal (26.6%).[25] Of the 3061, 37.17% were inborn and 62.82% were out born. The mortality rate of inborn babies was 22.03% and that of out born babies was 33.03%. This is higher with the findings of Baruah MN et al, 6.6% vs 13.6% and Modi R et al, 6.57% vs 13.22%.[12,24]

All of 61.47% of neonates admitted had LBW and 76.96% of neonates admitted were preterm baby. The study has done in a developing country such as Pakistan by Hussain (53.8%) and in South Africa by Hoque et al. (43.7%) found the very high incidence of LBW. [26,27] However, higher number of preterm reported by Manzar et al (22%), Lala and Talsania (10.20%), and NNPD (14.5%).[28-30] This could be explained by the special characteristics of the institution dealing with a much higher number of high-risk pregnancies leading to higher number of LBW and premature babies. The most common causes of mortality in our study was prematurity (51.55%) inborn vs outborn (56.23% vs 48.77%), RDS (37.76%), and birth asphyxia (26.75%) and Sepsis (13.91%). Similar pattern of outcome has been reported by study conducted by Sridhar and Rashid et al.[8,10,21] Birth asphyxia is an important cause of neonatal morbidity and mortality, its incidence in our study is 24.61% which is similar to findings of Chandra et al.[31] In contrast the study report published by ICMR reports Sepsis (32.8%) as the major cause for neonatal mortality followed by Birth asphyxia (22.3%) and Prematurity (16.8%).[18] Other studies have reported prematurity as the commonest cause of mortality, this may partly be because of the fact that premature babies needs more specialized care and owing to infrastructure lack they are being referred from our hospital to better equipped centers whenever the parents are willing. The major causes of mortality remain same across studies.[12,20,21,32,33] The reason for deaths related to RDS and Prematurity could be due to poor maternal health condition, inadequate antenatal checkups, and delay in referrals from peripheral hospitals. Comparing the mortality in different weight groups highest number of mortality was observed in 1500-2499 grams (44.98%) followed by 2500-3999

grams (24.33%). Mortality was more in babies less than one week compared to late neonatal death 73.47% vs 26.53% similar to Baruah MN et al, Sridhar PV et al, and NNPD.[21,23,24] Further 17.05% of neonates succumbed in the first 24 hours which compares to that reported by Sridhar 42.3% and Prasad V et al, 40.2%.[34]

This study has some limitations, as this was a hospital based retrospective study, the cause of death was determined using the data available in case record sheets, Neonates who went LAMA and those who were referred to other centers, were excluded from outcome analysis in the study and could hence modify the results. The results from this study cannot be a complete reflection of the problem in the community as a whole. Multicenter, prospective studies including major centers providing neonatal care in the region will provide a better idea.

CONCLUSION

Despite many advances in the neonatal care, access to skilled health care resources is limited. Equipped facility, quality antenatal care, skilled health care providers, timely referral, strong link between communities and health facility, and prompt intervention at the health facilities can reduce neonatal mortality rate.

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