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Original Research Article

Morbidity and mortality profile of neonates admitted in special newborn care unit of a teaching hospital in Uttarakhand, India

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ABSTRACT

Background: India accounts for 24% of global neonatal mortality. It is important to study the mortality and morbidity pattern as it helps to implement new treatment protocols, interventions, planning and policy making which helps in better survival and improvement in the quality of life among survivors. The aim of the project study was to determine the causes of morbidity and mortality in neonates admitted in our hospital.
Methods: This study was conducted at Special Newborn Care Unit (SNCU) of Veer Chandra Singh Garhwali Government Institute of Medical Science and Research providing level II neonatal care. This is a retrospective hospital based observational study. Data from admission and discharge registers were extracted, compiled and analyzed from March 2016 to February 2018. Neonates taken against medical advice and those referred to tertiary care centers were excluded in calculation of survival outcome. Statistical analysis was done in form of percentage, proportions and chi square test was used to find statistical significance.
Results: 1582 neonates were admitted during the study period. 60.80% were inborn and 39.20% were outborn. 59.54% were male and 40.46% were female. Major causes of admission were jaundice (24.72%), sepsis (20.48%), birth asphyxia (18.52%), meconium aspiration syndrome (10.11%). Birth asphyxia was the major cause of mortality, followed by sepsis and prematurity. Mortality was more in outborn babies 14.67% compared to inborn babies 9.80%.
Conclusions: Neonatal jaundice, birth asphyxia and sepsis were the commonest causes of morbidity. Common causes of mortality were birth asphyxia and sepsis and prematurity. More deliveries at institutions with SNCU facility, early identification of danger signs and timely referral to tertiary care centers can prevent neonatal deaths.

Keywords: Garhwal, Morbidity, Mortality, Neonate, SNCU

INTRODUCTION

Globally 2.6 million new born died in 2016 which accounted for 46% of all under 5 deaths. Five countries (India, Pakistan, Nigeria, Democratic Republic of Congo and Ethiopia) accounted for half of all neonatal deaths. India accounts for 24% of global neonatal mortality. In the terms of absolute numbers this translates to 640000 deaths in the first four weeks of life.[1] Substantial decrease in the under 5 mortality has been achieved during the passing years but decline in neonatal mortality has been much slower.[2] In order to accelerate progress it is important that preventing neonatal deaths should be prioritized.[2]

At the National level, the neo-natal mortality rate (NMR) is 24. The percentage of neo-natal deaths to total infant deaths is 68.8 per cent. Among the bigger States/UTs, Uttarakhand 79.1 % registered the highest percentage of neo-natal deaths to infant deaths. The current neonatal mortality in Uttarakhand is 30 which is increasing compared to 28 in 2016 and 26 in 2015, whereas all other

states of India has shown promising decline, which is an alarming situation.[3]

Early neo-natal mortality rate i.e. number of infant deaths less than seven days of life per thousand live births forms an important component of infant mortality rate and more specifically of the neo-natal mortality rate. At the National level, the early neo-natal mortality rate for the year 2016 has been estimated at 19. The same is 24 in Uttarakhand and these deaths accounts for 54.4% of total neonatal deaths.[3]

There is change in the pattern of diseases with geographic regions and Uttarakhand has difficult terrain with frequent natural calamities which keeps the infrastructure growth slow. 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 Garhwal 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. Aim of the study was to explore the morbidity and mortality profile of neonates admitted in SNCU with objective of detailed analysis of outcome of admitted neonates.

METHODS

This is a retrospective hospital based observational study done in the SNCU of department of pediatrics Veer Chandra Singh Garhwali Government Institute of Medical Sciences and Research, Srinagar Garhwal and its attached hospital. The period of the present study was March 2016 to February 2018.

Data from admission and discharge registers were extracted, compiled and analyzed. Authors' SNCU caters to the population of hilly Garhwal region. Approximately 3000 deliveries are conducted per year in the hospital and majority of patients belong to economically backward class. This newborn unit serves as a referral centre for other districts of Uttarakhand. SNCU has facility of ventilators, phototherapy and exchange transfusion.

Inclusion criteria

All neonates admitted in SNCU.

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.

Following definitions were used for categorizing the neonates

Inborn

Babies delivered in the hospital.

Outborn

Babies delivered outside of hospital. WHO definitions were followed for prematurity, low birth weight (LBW), very low birth weight (VLBW), extreme low birth weight (ELBW).

Neonatal infections (sepsis, pneumonia, and meningitis)

These were diagnosed clinically aided with appropriate tests, which include sepsis screen, blood culture, chest radiograph, and cerebrospinal fluid analysis.

Meconium aspiration syndrome (MAS)

This was diagnosed both radio-graphically and clinically based on history of being born through meconium-stained amniotic fluid, chest radiograph.

Neonatal jaundice

This was diagnosed after assessment of serum bilirubin and found to be in pathological zone in age, weight, and gestation-specific range. Congenital malformations were diagnosed mainly on the basis of clinical presentations.

Statistical analysis

Data was entered in excel sheets and calculation was done for percentage and proportions. chi square test was used for calculating statistical significance and post hoc test for pair wise comparisons using bonferroni correction of p value. Descriptive statistics was analyzed with trial version of Graph pad prism v 7.04. post hoc tests were done using analyst at v1.5.4 for android.

RESULTS

A total of 1582 neonates were admitted during the study period (Table 1). Out of this 962 (60.80%) babies were inborn and rest 620 (39.20%) were out born. Total male babies were 942 (59.54%) and female babies were 640 (40.46%) giving a male: female ratio of 1.5:1 (1.3:1 inborn vs 1.7:1 outborn). 1025 (64,79%) were term and 557 (35.21%) were preterm. 61.12% of inborn neonates were admitted within 24 hours while only 37.74% 0f outborn were admitted within 24 hours. Significantly higher number of inborn babies were admitted compared to outborn babies in first 3 days of life (83.99% vs 51.61%).

Table 1: Admission profile based on gender, birth weight, gestational age and age at admission.

	Inborn n (%)	Outborn n (%)	Total n (%)	p value
Gender				
Male	546 (56.76%)	396 (63.87%)	942 (59.54%)	0.0049
Female	416 (26.30%)	224 (36.13%)	640 (40.46%)	
Birth weight				
≥ 4000gms	3 (0.31%)	0 (0%)	3 (0.19%)	0.9999
2500-3999gms	534 (55.51%)	391 63.062%)	925 (70.80)	0.0295
1500-2499gms	355 (36.90%)	204 (32.90%)	559 (23.14)	0.9999
1000-1499gms	57 (5.93%)	21 (3.39%)	78 (4.80%)	0.9999
<1000gms	13 (1.35%)	4 (0.65%)	17 (1.07%)	0.9999
Gestation (in completed weeks)				
>37weeks	648 (66.94%)	377 (61.40%)	1025 (64.79%)	0.0759
34-36weeks	238 (24.59%)	179 (29.15%)	417 (26.36%)	
<34weeks	82 (8.47%)	58 (9.45%)	140 (8.85%)	
Age				
Within 24 hours	588 (61.12%)	234 (37.74%)	822 (51.96%)	<0.0001
2-3days	220 (22.87%)	86 (13.87%)	306 (19.34%)	0.0001
4-7days	152 (15.80%)	92 (14.84%)	244 (15.42%)	0.9999
8-14days	2 (0.21%)	99 (15.97%)	101 (6.38%)	
15-28days	0 (0.00%)	109 (17.58%)	109 (6.89%)	

Table 2: Morbidity profile.

Disease	Inborn n (%)	Out born n (%)	Total n (%)	p value
Neonatal jaundice	193 (20.06%)	198 (31.94%)	391 (24.72%)	<0.001
Sepsis	186 (19.33%)	138 (22.26%)	324 (20.48%)	0.9999
Birth asphyxia	206 (21.41%)	87 (14.03%)	293 (18.5%)	0.0049
Meconium aspiration	111 (11.54%)	49 (7.90%)	160 (10.11%)	0.4231
Respiratory distress syndrome	22 (2.29%)	9 (1.45%)	31 (1.96%)	0.9999
Respiratory distress other	60 (6.24%)	13 (2.10%)	73 (4.61%)	0.0028
Congenital malformation	18 (1.87%)	10 (1.61%)	28 (1.77%)	0.9999
Hypothermia	18 (1.87%)	13 (2.10%)	31 (1.96%)	0.9999
Preterm	83 (8.63%)	47 (7.58%)	130 (8.21%)	0.9999
Hypoglycemia	9 (0.94%)	03 (0.48%)	12 (0.76%)	0.9999
Others	56 (5.82%)	53 (8.55%)	109 (6.89%)	0.8043

Table 3: Outcome of total admitted cases

Outcome	Inborn n (%)	Outborn n (%)	Total
Discharged successfully	681 (70.79%)	320 (51.61%)	1001 (63.27%)
Referred	93 (9.67%)	125 (20.16%)	218 (13.78%)
Leave against medical advise	114 (11.85%)	120 (19.35%)	234 (14.79%)
Expired	74 (7.69%)	55 (8.87%)	129 (8.15%)

Neonatal jaundice was found to be the most common cause of admission 391(24.72%). It was significantly higher in outborn neonates compared to inborn neonates. Other prominent causes were sepsis 324 (20.48%), birth asphyxia 293 (18.52%), meconium aspiration syndrome 160 (10.11%). 130 (8.21%) neonates were admitted for care of preterm with low birth weight (Table 2). A total of 93 inborn babies and total of 125 out born babies were referred to other centers for need of surgical intervention or due to unavailable resources. 234 neonates were discharged against medical advice (Table 3). Out of the remaining 1130 neonates 1001 (88.58%) were discharged successfully and 129 (11.42%) expired. The difference in discharge and death was not significant among inborn and outborn neonates (Table 4).

Table 4: Outcome analysis after excluding LAMA and referral.

Outcome	Inborn n (%)	Outborn n (%)	Total	p value
Discharged successfully	681 (90.20%)	320 (85.33%)	1001 (88.58%)	0.0618
Expired	74 (9.80%)	55 (14.67%)	129 (11.42%)	

Table 5: Mortality profile based on gender, birth weight, gestational age and age at death.

	Inborn n (%)	Outborn n (%)	Total n (%)	p value
Gender				
Male	47 (63.51%)	42 (76.36%)	89 (69.00%)	0.1186
Female	27 (36.49%)	13 (23.64%)	40 (31.00%)	
Birth weight				
≥4000gms	1 (1.35%)	0 (0.00%)	1 (0.78%)	0.4579
2500-3999gms	31 (41.89%)	18 (32.73%)	49 (37.98%)	
1500-2499gms	27 (36.49%)	28 (50.91%)	55 (42.63%)	
1000-1499gms	8 (10.81%)	6 (10.91%)	14 (10.85%)	
<1000gms	7 (9.46%)	3 (5.45%)	10 (7.75%)	
Gestation				
Term	38 (51.36%)	39 (70.91%)	77 (59.69%)	0.1005
Preterm	36 (48.65%)	16 (29.09%)	52 (40.31%)	
Age at death				
Within 24 hours	37 (50.00%)	26 (47.27%)	63 (48.83%)	0.7185
2-3days	17 (22.97%)	9 (16.36%)	26 (20.15%)	
4-7days	14 (18.92%)	12 (21.82%)	26 (20.15%)	
8-14days	2 (2.70%)	3 (5.45%)	5 (3.87%)	
≥15days	4 (5.41%)	5 (9.09%)	9 (6.98%)	

Table 6: Causes of mortality.

Cause	Inborn n (%)	Outborn n (%)	Total n (%)	P value
Birth asphyxia	23 (35.38%)	34 (47.22%)	47 (36.43%)	0.3629
Sepsis	16 (24.62%)	21(29.17%)	39 (30.23%)	
Prematurity	12 (18.46%)	10 (13.89%)	22 (17.05%)	
Meconium aspiration	7 (10.77%)	4 (5.56%)	11 (8.52%)	
Congenital malformation	4 (6.155)	1 (1.39%)	5 (3.88%)	
Others	3 (2.33%)	2 (2.78%)	5 (3.88%)	

Of the 129 deaths 57.36% (47 male and 27 females) were in inborn neonates and 42.64% (42 males and 13 females) were in outborn neonates. Further mortality rate in male babies was 13.59% and in female babies was 8.37%. The mortality rate of inborn babies was 9.80% (11.34% in males and 7.94% in females) and that of outborn babies was 14.67% (17.5% in male and 9.63%) in female (Table 5).

Birth asphyxia was the major cause of mortality 36.43% followed by sepsis 30.23% and prematurity 17.05%. Other causes were meconium aspiration syndrome 8.25%, congenital malformations 3.88% and acute renal failure 1.55% (Table 6). Comparing the mortality in different weight groups highest number of mortality was observed in 1500-2499grams (42.63%) followed by 2500-3999grams (37.98%).

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 the hilly 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 hilly Garhwal region.

In our study 60.80% babies were inborn and 39.20% were outborn which is comparable to other studies.[4-6] 59.54% of the neonates were male and 40.46% were female which is similar to studies by Baruah MN et al, Patil R et al, Rakholia R et al.[5-7] 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.[8]

In present study of the total neonates 64.79% were term and 35.21% were preterm which is comparable to the studies by Rakholia R et al, and Modi R et al.[7,9] Most of the inborn neonates (61.12%) were admitted within 24 hours of birth while 37.74% of the outborn neonates were admitted within 24 hours of birth. Significantly higher numbers of neonates if born in the hospital are admitted in first 3 days (83.99% vs 51.61%) compared to born outside. This shows that chances of getting prompt treatment were high whenever institutional delivery occurs in a facility with SNCU. Also transport to a health care facility is not readily available and condition of road is poor owing to hilly terrain. Most of the neonates 86.73% in present study were admitted in first week after birth. This compares to study by Prasad V et al, who reported 85.5% of the neonates were admitted in first ten days of life.[10]

Neonatal jaundice was found to be the most common cause of admission in 24.72% neonates. This is similar to studies by Kotwal et al, Saini et al, and Prasad V et al.[10,12,13] Significantly higher number of jaundiced neonates have been admitted in outborn which may be because of missing or not evaluating jaundice early. Other prominent causes were sepsis in 324 (20.48%), birth asphyxia in 293 (18.52%), meconium aspiration syndrome in 160 (10.11%), 74 (4.68%) neonates were admitted for care of preterm with low birth weight. The commonest causes of neonatal morbidity are similar across various studies.[6,7,10-12,14]

Out of the total admitted neonates 218 were referred to other centers and 234 were discharged against medical advice. Out of the remaining 1130 neonates 1001 were discharged successfully and 129 (11.42%) expired. The rate of successful discharge was 66.57% by Rakholia R et al, and 69.3% by NNPD.[15] 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. 14.79% neonates were discharged against medical advice. This rate is high when compared to other studies by Baruah MN et al, (7.5%), Rakholia R et al, (8.3%) and NNPD (0.7%).[5,7] This may be because of lower understanding of the seriousness of the condition of neonate and the benefit of full treatment.

Mortality rate in present study is 11.41%. Mortality rate reported varies between studies. This partly depends on the infrastructure of the treating facility. Mortality rate 16.9% NNPD 18.69% Prasad and 20.53% by Rakholia R et al.[7]

Of the 129, 57.36% (47 male and 27 females) were inborn and 42.64% (42 males and 13 females) were outborn. Further mortality rate in male babies was 13.59% and in female babies was 8.37%. The mortality rate of inborn babies was 9.80% (11.34% in males and 7.945 in females) and that of outborn babies was 14.67% (17.5% in male and 9.63%) in female. This is in consonance with the findings of Baruah MN et al, 6.6% vs13.6% and Modi R et al, 6.57% vs 13.22%.[5,9] Though the proportion of deaths in inborn neonates was lower there was no statistically significant difference in the mortality between inborn and outborn or between male and female neonates.

Birth asphyxia was the major cause of mortality 36.43% followed by sepsis 30.23% and prematurity 17.05%. Though there is no significant difference in the cause of death among inborn and outborn neonates the case fatality rate of birth asphyxia and sepsis was higher in outborn neonates (39.08% vs11.1%) and (15.21%) vs 8.60% respectively. Other causes were meconium aspiration syndrome 8.25%, congenital malformations 3.88% and acute renal failure 1.55%. 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.[6,7,9,11,14]

Comparing the mortality in different weight groups highest number of mortality was observed in 1500-2499 grams (42.63%) followed by 2500-3999 grams (37.98%). Mortality in extremes of weight was highest 58.82% in less than 1000gms which is comparable to NNPD (55%). Mortality was more in babies less than one week compared to late neonatal death 92.25% vs 7.75% similar to Baruah MN et al, Sridhar PV et al, and NNPD.[5,11,15] Further 48.84% of neonates succumbed in the first 24 hours which compares to that reported by Sridhar 42.3% and Prasad V et al, 40.2%.[10]

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. Multicentre, prospective studies including major centers providing neonatal care in the region will provide a better idea.

CONCLUSION

With advances in diagnostic and treatment modalities as well as government initiatives to decrease the neonatal mortality significant achievements have been made. The infant mortality rate and neonatal mortality rate which

plays an important role in health planning, has shown a considerable decline, still much is left to be done. Our study shows that neonatal jaundice birth asphyxia and sepsis are the commonest causes of admission. Common causes of mortality were birth asphyxia and sepsis and prematurity. Most of the morbidities and subsequent mortalities can be prevented by developing infrastructure and training staff for providing effective neonatal resuscitation, practice hand hygiene for prevention of sepsis and effective implementation of IMNCI for early diagnosis of danger signs, timely intervention and timely referral to tertiary care centers.

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