Research Article

Morbidity profile of neonates and biological factors associated with it among admitted newborn babies at tertiary care institute, Jamnagar

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ABSTRACT

Background: India is still among the high infant mortality rate countries and two third of the infant deaths occur during neonatal period. Neonatal mortality rates have reduced much less than postneonatal death. Morbidity and mortality during neonatal period are mostly due to endogenous factors and survival of the baby depends on timely referral, mode of transportation and treatment available to them. **Objectives:** Objectives of this study were to describe morbidity pattern among admitted neonates, to find out the association between various biological factors and neonatal morbidity and to study various factors related to referral among outborn neonates. **Materials and Methods:** The study was a hospital based cross-sectional study conducted at neonatal intensive care unit of Guru Gobind Singh Government Hospital, Jamnagar among 300 admitted neonates. **Results:** In the study 30.00% neonates were outborn, 88.00% were <7 days of age, and 63.67% were male. 32.33% were preterm babies, 59.67% had low birth weight, and 17% were of the birth order 3 or more. Antenatal and intranatal complications were reported by 36.33% and 23.33% mothers, respectively. Chief morbidities were neonatal jaundice (29.33%), respiratory distress syndrome (RDS) (16.33%), perinatal asphyxia (12.00%), infection/sepsis (10.00%), meconium aspiration syndrome (5.33%), and congenital anomalies (8.67%). Infection/sepsis was developed by 19.61% neonates of the birth order 3 or more and 17.14% neonates with intranatal complications. RDS was developed by 24.74% preterm babies and 25.71% with intranatal complications. Out of total outborn neonates, 36.67% were transferred to NICU after 2 days, 67.78% were referred from private institutions, 52.22% used ambulance or 108 services, and 46.67% had to travel for more than 100 km. **Conclusion:** Birth order 3 or more and any intranatal complication was significantly associated with infection/sepsis. Preterm neonates and intranatal complications showed the significantly higher proportion of RDS. Two third of the outborn neonates were referred by private institutes, and half of the outborn neonates had to travel more than 100 km to reach to NICU.

KEY WORDS: Neonatal Morbidity; Preterm; Low Birth Weight; Intranatal Complication

INTRODUCTION

The greatest risk of childhood death occurs during the neonatal period, which extends from birth through the first 28 days of life. About 40% of all deaths to children under five years of age and nearly two-thirds of infant deaths occur during the neonatal period.[1] Three-quarters of neonatal deaths happen in the 1st week the highest risk of death is on the 1st day of life. Globally, the main direct causes of neonatal death are estimated to be preterm birth (28%), severe infections (26%), and asphyxia (23%).[2] During the early neonatal period (0-7 days), the major causes of death are asphyxia, infection, complications of prematurity, and birth defects; infections cause most late neonatal deaths (8-28 days).[1] India is still among the high infant mortality

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rate countries with infant mortality rate of 37 per thousand live births.[3] Neonatal mortality rates have reduced much less than postneonatal deaths, with 748,000 newborns still dying each year from largely preventable causes.[4] In a study on burden of morbidities among rural neonates revealed that nearly half of the neonates had high-risk health problems and many of them had more than one morbidity with a case fatality of 10.3%.[5] Many other hospital based studies have been done to describe morbidity pattern of neonates. Neonatal mortality and morbidity are largely affected by endogenous factors such as gestational age, birth weight, and intrapartum complications.[6] Moreover, these factors vary from region to region within a country. It is also affected by availability of neonatal intensive care services. Hence, this study was designed to find the common causes for admission of newborn babies at neonatal intensive care unit (NICU), various factors associated with neonatal morbidity and also the conditions under which newborn babies are referred to NICU. Hence, the objectives of this study were, (i) to describe morbidity pattern among admitted neonates; (ii) to find out the association between various biological factors and neonatal morbidity; and (iii) to study various factors related to referral among outborn neonates that may determine the survival.

MATERIALS AND METHODS

This study was a hospital based cross-sectional study. NICU of Guru Gobind Singh Government Hospital, Jamnagar is a tertiary care institute that caters services to inborn babies (delivered in the same hospital) and also outborn babies (delivered at other institutes or at home) from urban and rural areas of the district and is also a referral center for adjacent districts. Low birth weight (LBW) is associated with majority of neonatal morbidity and mortality causes. Various studies conducted in India showed that 60-80% of the admitted neonates are LBW. Considering 60% proportion of LBW among admitted neonates, sample size was calculated using formula

$$n = Z^2_{(1-\alpha/2)} P\,(1\text{-}P)/\varepsilon^2$$

Where,
n = Sample size
$Z_{(1-\alpha/2)}$ = is the function of confidence level. At 95% confidence level this value is 1.96
P = is anticipated proportion
ε = relative precision which is taken as 10% of P

At P = 0.6 (i.e., 60%), using the formula sample size was calculated as 256. 10% sample size was added to this for non-response making it to 282 which was rounded up to 300. The study population was neonates admitted in NICU of Guru Gobind Singh Government Hospital, Jamnagar during October-December 2014. Pre-structured questionnaire was used to collect data of obstetric profile of mother, birth history of neonate, referral details in case of outborn baby, etc., information was gathered preferable from the mother or from the adult attendant. Clinical information was recorded from the case paper only. Data were entered in Microsoft Excel 2007 and analyzed in Epi-Info software version 3.2.2.

Statistics

Chi-square test was used as a test of significance, and 95% confidence interval was calculated for proportion. A $P < 0.05$ was deemed statistically significant.

RESULTS

This hospital based cross-sectional study was conducted among 300 admitted neonates in NICU during October 2014-December 2014. Out of 300 studied neonates, 210 (i.e., 70.00%) were inborn and 90 (i.e., 30.00%) were outborn neonates.

Age and gender wise distribution of admitted neonates revealed that majority, i.e., 88.00% were <7 days of age at the time of admission and nearly two third (i.e., 63.67%) were male (Table 1).

Obstetric profile of the mothers of admitted neonates showed that 65 (21.67%) mothers were Gravida 3 or more and 97 (32.33%) had preterm delivery. Antenatal complication which includes medical as well as obstetric complication were reported by 109 (36.33%) and any type of intranatal complication such as prolonged labor, fetal distress, and premature rupture of membrane were reported by 70 (23.33%) mothers (Table 2).

One fourth of the admitted neonates (26.33%) were delivered through cesarean section. Birth weight of 121 (40.33%) neonates was found to be normal (i.e., 2500 g or more) while 52 (17.33%) had very LBW (<1500 g). Half of the neonates (i.e., 53.33%) were the first live child and for 51 (17.00%) neonates, their birth order was third or more (Table 3).

Analysis of the morbidity pattern of admitted neonates showed that neonatal jaundice was present in 88 (29.33%) followed by 49 (16.33%) having respiratory distress syndrome (RDS), 36 (12.00%) had perinatal asphyxia, and 30 (10.00%) had infection such as pneumonia or meningitis or sepsis. Meconium aspiration syndrome (MAS) was found in 16 (5.33%) neonates and 26 (8.67%) had congenital anomalies (Table 4).

Analysis of various factors associated with infection or sepsis revealed that 19.61% neonates of the birth order 3 or more developed infection/sepsis as compared to 8.03% neonates of birth order one or two. This difference was statistically significant. In the study, 6.19% preterm and 11.82% full term neonates developed infection/sepsis, but this difference was statistically not significant. History of antenatal complication

Table 1: Age and sex wise distribution of admitted neonates

Age and sex distribution	Inborn (*n*=210) (%)	Outborn (*n*=90) (%)	Total (%)
Age group (days)			
<7	192 (91.43)	72 (80.00)	264 (88.00)
7-28	18 (8.57)	18 (20.00)	36 (12.00)
Sex			
Male	127 (60.48)	64 (71.11)	191 (63.67)
Female	83 (39.52)	26 (28.89)	109 (36.33)

Table 2: Obstetric profile of mothers of admitted neonates

Obstetric profile	Inborn (*n*=210) (%)	Outborn (*n*=90) (%)	Total (%)
Gravida			
<3	162 (77.14)	73 (81.11)	235 (78.33)
≥3	48 (22.86)	17 (18.89)	65 (21.67)
Gestational duration			
Pre term	66 (31.43)	31 (34.44)	97 (32.33)
Full term	144 (68.57)	59 (65.56)	203 (67.67)
Any antenatal complication	75 (35.71)	34 (37.78)	109 (36.33)
Any intranatal complication	52 (24.76)	18 (20.00)	70 (23.33)

was found in 109 neonates, of whom 11.93% developed infection/sepsis while this proportion was 8.90% in those with no antenatal complication. However, this difference was statistically not significant. Proportion of neonates having infection/sepsis was higher among those with any intranatal complication (i.e., 17.14%) compared to those with no intranatal complication (7.83%). This difference in proportion was statistically significant (Table 5).

Association of same factors with RDS was analyzed. It was found that 23.53% of neonates of birth order 3 or more and 14.86% of the birth order one or two developed RDS. However, this difference was statistically not significant. Higher proportion of preterm babies (24.74%) developed RDS compared to 12.32% full term babies. This difference was statistically highly significant. Proportion of neonates having RDS was same among those with antenatal complication (16.51%) and those with no antenatal complication (16.23%). RDS was developed by 25.71% of neonates with intranatal complication while this proportion was much less (13.48%) with no history of intranatal complication and this difference was statistically significant (Table 6).

Few characteristics of outborn neonates were studied and analyzed. Out of total 90 outborn neonates, 33 (36.67%) were referred to NICU after 2 days, 61 (67.78%) were referred by private institutions, 47 (52.22%) used ambulance or 108 services to reach to NICU and 42 (46.67%) had to travel more than 100 km (Table 7).

Table 3: Birth history of admitted neonates

Birth history	Inborn (*n*=210) (%)	Outborn (*n*=90) (%)	Total (%)
Mode of delivery			
Normal	142 (67.62)	79 (87.78)	221 (73.67)
LSCS	68 (32.38)	11 (12.22)	79 (26.33)
Birth weight			
<1.5 kg	36 (17.14)	16 (17.78)	52 (17.33)
1.5 kg-2.5 kg	91 (43.33)	36 (40.00)	127 (42.33)
≥2.5 kg	83 (39.52)	38 (42.22)	121 (40.33)
Birth order			
1	107 (50.95)	53 (58.89)	160 (53.33)
2	67 (31.90)	22 (24.44)	89 (29.67)
≥3	36 (17.14)	15 (16.67)	51 (17.00)

LSCS: Lower segment cesarian section

Table 4: Morbidity pattern of admitted neonates

Morbidity pattern	Inborn (*n*=210) (%)	Outborn (*n*=90) (%)	Total (%)
Jaundice	79 (37.62)	9 (10.00)	88 (29.33)
RDS	35 (16.67)	14 (15.56)	49 (16.33)
Perinatal asphyxia	19 (9.05)	17 (18.89)	36 (12.00)
Infection/sepsis	14 (6.67)	16 (17.78)	30 (10.00)
MAS	16 (7.62)	-	16 (5.33)
Congenital anomaly	8 (3.81)	18 (20.00)	26 (8.67)
Others	7 (3.33)	5 (5.56)	12 (4.00)

MAS: Meconium aspiration syndrome, RDS: Respiratory distress syndrome

DISCUSSION

This study was conducted to understand the morbidity pattern among the admitted neonates at NICU of the tertiary care hospital. NICU caters services to inborn as well as outborn neonates referred by government and private institutions across the district and also adjacent districts. Understanding the pattern of morbidity, various factors associated with some major conditions which may lead to death and referral conditions will help in identifying high-risk neonates.

Out of 300 studied neonates, 70.00% were inborn and 30.00% were outborn. The same proportion of inborn and outborn babies was observed by Sridhar et al. in his study.[7] Age and gender distribution of neonates showed that majority of them (88.00%) were admitted in the early neonatal period, i.e., before 7 days of age. In a study conducted by Prasad and Singh, 85.53% newborn were found to be 0-10 days old at admission.[8] First 7 days of life is the crucial period particularly when birth weight is low, preterm delivery or any intranatal complication is there. Nearly two third neonates (63.67%) were male. Similar male preponderance of admission to NICU was observed in the studies by Sridhar et al. (59.23%)[7] and Roy et al. (62.65%).[9] Obstetric history

Table 5: Factors associated with infection/sepsis (*n*=30)

Factors	Infection/sepsis		*P* value
	Yes (%)	No (%)	
Birth order≥3			
Yes (*n*=51)	10 (19.61)	41 (80.39)	χ^2=6.30, at df=1 *P*=0.012
No (*n*=249)	20 (8.03)	229 (91.97)	
Gestational duration			
Pre term (*n*=97)	6 (6.19)	91 (93.81)	χ^2=2.32, at df=1 *P*>0.05
Full term (*n*=203)	24 (11.82)	179 (88.18)	
Antenatal complication			
Yes (*n*=109)	13 (11.93)	96 (88.07)	χ^2=0.71, at df=1 *P*>0.05
No (*n*=191)	17 (8.90)	174 (91.10)	
Intranatal complication			
Yes (*n*=70)	12 (17.14)	58 (82.86)	χ^2=5.18, at df=1 *P*=0.02
No (*n*=230)	18 (7.83)	212 (92.17)	

Table 6: Factors associated with RDS (*n*=49)

Factors	RDS		Total
	Yes (%)	No (%)	
Birth order≥3			
Yes (*n*=51)	12 (23.53)	39 (76.47)	χ^2=2.33, at df=1, *P*>0.05
No (*n*=249)	37 (14.86)	212 (85.14)	
Gestational duration			
Pre term (*n*=97)	24 (24.74)	73 (75.26)	χ^2=7.42, at df=1, *P*=0.006
Full term (*n*=203)	25 (12.32)	178 (87.68)	
Antenatal complication			
Yes (*n*=109)	18 (16.51)	91 (83.49)	χ^2=0.00, at df=1, *P*>0.05
No (*n*=191)	31 (16.23)	160 (83.77)	
Intranatal complication			
Yes (*n*=70)	18 (25.71)	52 (74.29)	χ^2=5.88, at df=1, *P*=0.015
No (*n*=230)	31 (13.48)	199 (86.52)	

RDS: Respiratory distress syndrome

Table 7: Referral history of extramural cases (*n*=90)

Referral history	*n* (%)	95% CI (%)
Referred after 2 days	33 (36.67)	26.75-47.49
Referred from private hospital	61 (67.78)	57.10-77.25
Used ambulance or 108 service	47 (52.22)	41.43-62.87
Travelled more than 100 km	42 (46.67)	36.07-57.49

CI: Confidence interval

of the mother was obtained which revealed that nearly one-fourth (21.67%) mothers were Gravida 3 or more. Frequent and closely spaced pregnancies make the mother and the newborn babies vulnerable to various risk factors and serious outcomes. Nearly one-third (32.33%) mothers reported that the recent delivery was preterm. Similar observations of preterm babies were made by Sridhar et al.[7] (28.58%) and Garg et al.[10] (28.57%) in their studies. Higher proportion of preterm neonates (50.35%) was observed by Rakholia et al. in her study.[11] Any medical or obstetric complication during the antenatal period was observed in 36.35% mothers of admitted neonates. Intranatal complications were reported by 23.33% mothers that include premature rupture of membranes, prolonged labor causing fetal distress, and meconium stained liquor. These antenatal and mainly intranatal complications may develop serious survival issues during the early neonatal period. Birth weight is considered as one of the most important factors that determine survival and growth of the baby. It is associated with large number of health problems during neonatal period and aggravates the situation. In our study, 59.67% neonates were LBW, and 17.33% had very LBW (<1500 g). Almost same proportion of LBW babies (60.61%) and very LBW (18.59%) were observed by Rakholia et al. in her study.[11] Prasad and Singh reported little higher proportion of LBW babies (65.62%) which was because hospital predominantly caters to the population of hilly region with a high degree of poverty.[8] Neonatal jaundice was present in 29.33% babies followed by RDS in 16.33%, perinatal asphyxia in 12.00%, and infection/sepsis in 10.00% babies. However, this morbidity pattern was different for inborn and outborn neonates. Among outborn neonates, a higher proportion was found of congenital anomalies (20.00%) followed by perinatal asphyxia (18.89%), infection/sepsis (17.78%), and RDS (15.56%). This may be due to unavailability of intensive care facility and trained staff to deal with complication at peripheral health institutions and private hospitals. Sridhar et al. reported in his study that major causes of admission to NICU were neonatal sepsis (28.8%), RDS (23.85%), neonatal jaundice (7.02%), and MAS (5.47%).[7] Rakholia et al. found that the chief causes of admission in sick newborn care unit were RDS (21.91%) followed by sepsis/pneumonia/meningitis in 19.00%, perinatal asphyxia in 16.37%, jaundice in 12.9%, and MAS in 9.71%.[11] Similar findings were also reported by Prasad and Singh in their study.[8] In a study regarding morbidities and mortalities among outborn neonates it was observed that systemic infections (28.4%), hyperbilirubinemia (27.9%), seizures (11.7%), hypoglycemia (11.5%), hypoxic ischemic encephalopathy (8.3%), anemia (8.9%), and hypocalcemia (8.6%) were common morbidities.[12] Sepsis or any infection such as pneumonia/meningitis or diarrhea and RDS are major causes of neonatal mortality. In this study, analysis was performed to find any association of these conditions with various factors such as antenatal or intranatal complication, gestational age, and birth order of the baby. It was found that birth order 3 or more and any intranatal complication was significantly associated with infection/sepsis. Higher birth order can lead to LBW and intranatal complication makes newborn babies more vulnerable to infection. Preterm neonates and intranatal complications showed significantly higher proportion of RDS which may be due to LBW or meconium aspiration or fetal distress during prolong labor. Roy et al. found in his study that the commoner neonatal complications in both very LBW and

extremely LBW babies were RDS, neonatal jaundice and sepsis.[13] Bang et al. found in their study that case fatality was 33.33% among the preterm babies.[5] Niswade et al. reported in their study that mother's health was an important determinant of the pregnancy outcome. Those in poorer health, with fever or sickness, tended to have babies with lower birth weights, to have lost the pregnancy or to have a stillborn. Among neonates that died early, 10-12% of mothers were in poorer health and 18-19% of mothers were unable to perform physical activities.[14] Vogel et al. found in their WHO Multi-Country Study on maternal and newborn health that the risk of late fetal death, and early neonatal death were consistently increased in mothers with placental abruption, ruptured uterus, systemic infections/sepsis, pre-eclampsia, eclampsia, and severe anemia.[15] Gandhi et al. also documented in their study that the two risk factors of neonatal sepsis were PROM and cesarean section as 77% neonates of mothers who had PROM developed sepsis, and this association was statistically significant.[16] Outborn neonates who were referred to NICU were found to have a higher proportion of infection/sepsis, respiratory distress or perinatal asphyxia. Survival of such babies depends on timely referral, mode of transportation and proper treatment available to them. Few variables were analyzed in this study like 36.67% neonates were transferred to NICU after 2 days, 67.78% were referred from private institutions, 52.22% used ambulance or 108 services to reach to NICU, and 46.67% had to travel for more than 100 Km.

Limitation of the Study

Since this was a hospital based cross-sectional study, all the morbidities could not be assessed. A longitudinal study can give a better picture of neonatal morbidity, mortality and factors associated with it. This study could find out some crucial factors related to referral among outborn neonates, and further research is being planned to study these variables and outcome in detail.

CONCLUSION

This study describes the common morbidity profile of admitted neonates at NICU. Majority of the neonates were <7 days of age at the time of admission and more than half were male. Three out of five admitted neonates were LBW and more than one-fourth were preterm babies. Common morbidities were neonatal jaundice, RDS, perinatal asphyxia, infection/sepsis, MAS, and congenital anomalies. Birth order 3 or more and any intranatal complication was significantly associated with infection/sepsis. Preterm neonates and intranatal complications showed the significantly higher proportion of RDS. Among the outborn neonates, two third were referred by private institutions, more than half used an ambulance to reach NICU, and nearly half had to travel more than 100 km.

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