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RESEARCH ARTICLE

CASE FATALITY IN A NEONATAL INTENSIVE CARE UNIT: A HOSPITAL BASED PROSPECTIVE STUDY IN JAMMU & KASHMIR

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ABSTRACT

Background: India faces the biggest newborn health challenge of any country in the world as one fourth of global neonatal deaths occur in India. The common cause of neonatal mortality in India are asphyxia, prematurity and low birth weight, infections like pneumonia and gastroenteritis and a variety of surgical problems. It has been observed that improved level of newborn care can bring down the mortality rates. A study of Neonatal Intensive Care Unit (NICU) was undertaken at SKIMS Srinagar to determine the case fatality among the neonates at a Tertiary Care Teaching Hospital in Jammu & Kashmir.

Material and Methods: A descriptive case series hospital based prospective study was conducted over a period of one year from with effect from 1st January 2013 to 31st December 2013 in NICU of SKIMS Srinagar by administering a predesigned standardized questionnaire proforma to one or both parents of admitted neonates in a NICU of Sher-i-Kashmir Institute of Medical Sciences (SKIMS) Srinagar, Jammu and Kashmir-India.

Results: Neonatal Jaundice (NNJ) (26.7%) was the most common cause of morbidity and admission to NICU followed by Septicemia (19.1%) Prematurity (12.5%), Birth Asphyxia (7%) and Respiratory Distress Syndrome (RDS) (5.7%). It was observed that out of 1017 neonates admitted most were discharged (90.07%) whereas as 9.73% expired and only 0.2% left against medical advice (LAMA). Being insignificant in numbers the two neonates that left against medical advice (LAMA) were excluded from further analysis for the case fatality rate. It was observed that the case fatality rate was maximum in MAS (33.3%) followed by Congenital Anomalies (23.1%), Prematurity (18.9%), Birth Asphyxia (15.5%), RDS (15.5%), & Septicemia (9.3%). TheChi-squared test (χ^2) static value was 89.49585 and the p-value was less than 0.0001 indicating that type of disease is very strongly associated ($p<0.0001$) with the case fatality of a neonate.

Conclusions: The case fatality rate was maximum in MAS (33.3%) followed by Congenital Anomalies (23.1%), Prematurity (18.9%), Birth Asphyxia (15.5%), RDS (15.5%), & Septicemia (9.3%) and thetype ofdisease is very strongly associated ($p<0.0001$) with the case fatality of a neonate.

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INTRODUCTION

World over, four million newborn babies die in the first month of life (Lawn, 2005). In India, 26 million babies are born every year, and 1.2 million die in the first four weeks of life, which accounts for a quarter of global neonatal deaths. India thus faces the biggest newborn health challenge of any country in the world (National Neonatology Forum, 2012). India carries the single largest share (around 25-30%) of neonatal deaths in the world. Neonatal deaths constitute two-thirds of infant deaths in India; 45% of the deaths occur within the first two days of life (United Nations Children's Fund, 2008). The common cause of neonatal mortality in India are asphyxia, prematurity and low birth weight, infections like pneumoniaand gastroenteritis and a variety of surgical problems. It has been observed that improved level of newborn care can bring down the mortality rates (Jain, 1990). While high infant mortality rates were recognized by the British medical community at least as early as the 1860s, modern neonatal intensive care is a relatively recent advance (Baines, 1862). The neonatal intensive care units have a role in developing countries like India; although neonatal intensive care is among the more expensive services that any health care systems can provide (Blackman, 1991). The cost of establishing a neonatal intensive care unit runs into crores of rupees in India in which equipment cost formed two-thirds of the establishment cost and ancillary personnel salary

comprised the largest proportion of the running costs (Narang, 2005). Neonatal intensive care is cost intensive and rational use of neonatal unit services by targeting its utilization for the very low birth weight neonates and maintenance of community based home-based newborn care is required (Prinja, 2013). High neonatal mortality rate in a country reflects the poor availability of quality and quantity of infrastructure and utilization of neonatal care of that country. Improved neonatal care can lead to increased infant survival. In developing countries where budgetary constraints limit technological advances, the judicious implementation of neonatal intensive care measures can result in reduction of morbidity and mortality. To determine the burden of neonatal disease, understand patient needs, planning and organization the present study was under taken at SKIMS Srinagar to determine the morbidity and mortality pattern of among the neonates admitted to a NICU. The present study will help us to find out gaps if any in the required infrastructure for NICU of SKIMS Srinagar. The study was under taken with the objective to determine the morbidity and mortality pattern of among the neonates admitted to a NICU.

MATERIALS AND METHODS

This descriptive case series, hospital based prospective study was conducted over a period of one year from with effect from 1st January 2013 to 31st December 2013 in NICU of SKIMS Srinagar. The information/ data was collected in a predesigned proforma and the information like the date & time of admission, date & time of birth, age at admission, gender, gestational age, place of delivery, weight at admission, residential address, dwelling place and diagnosis. All the treatment, including supportive treatment was recorded. The progress of the patient and eventual outcome following the management of the child were also recorded. On arrival in neonatal unit, baby was examined by PG Resident/ Senior Resident and then by neonatologist/pediatrician. The neonates were followed from the time of admission up to the time of discharge or death or LAMA. Neonatal information was collected at time of admission and finalized after discharge/death. Diagnosis was made primarily on the basis of clinical findings and the diagnostic support from laboratory and radiology was taken to confirm the clinical diagnosis and the diagnosis was modified based if necessary based on the result of the patient's laboratory and radiology findings or clinical response to instituted therapy. The WHO criteria and Modified Wigglesworth classification was used to find single cause for admission/ death and each neonate was labeled with at least one diagnosis according to modified Wigglesworth classification. Primary disease was considered as final diagnosis even the baby developed complications of primary disease or having more than one disease. WHO definitions were used for prematurity, low birth weight (LBW), very low birth weight (VLBW), extreme low birth weight (ELBW) and congenital malformation. Meconium aspiration syndrome was diagnosed on basis of history, clinical and radiological findings. Birth asphyxia syndrome was diagnosed clinically plus APGAR score. Sepsis evaluation was based on clinical and laboratory indices like complete blood counts (CBC), erythrocyte sedimentation rate (ESR), C- reactive protein (CRP) and Cultures collectively. Neonatal jaundice was diagnosed by assessing Serum Bilirubin level along with G6PD estimation in case of males. Pneumonia was diagnosed mainly on examination and radiological findings. Neonatal period was defined as from birth to 28 days in term neonates and 44 weeks of gestation in preterm. Diagnosis of Pre-maturity was clinical or based on WHO definition for pre-maturity (live born neonates delivered before 37 weeks from 1st day of last menstrual period) and low birth weight with birth weight less than 2500 grams. Weight of neonates are measured using electronic weighing machines having gram as smallest division. Gestational age was calculated from last menstrual period (LMP) and clinical assessment was made by modified Ballard scoring. NICU at SKIMS is a level-III NICU, where most of the babies referred are high-risk babies. The NICU has facilities of intensive care, ventilation, and exchange transfusion. Facilities available in the NICU include 10 incubators, 2 resuscitators, and 5 locally constructed phototherapy units. The NICU has 18 cots/ beds, with a nurse: Patient ratio which varies from 1:7 in the morning shift to 1: 15 during the afternoon and night shifts. In addition, there are usually, 2 consultants, 1 or 2 senior residents, 2 junior residents, and 3 or 4 interns covering the neonatal unit depending on the rotations. The inclusion criteria was all the sick neonates brought alive to neonatal unit with definitive symptomatology and diagnosis. Neonates brought dead to the neonatal unit were excluded from the study. Approval for the study was obtained from the hospital's ethical committee. The data thus collected was analyzed by SPSS version 20 and the frequency and percentages of various parameters of morbidity and mortality were calculated.

RESULTS AND OBSERVATION

The data analysis showed that there were 1017 neonates admitted to NICU during the one-year period of study i.e. 1st January-31st December 2013. The average length of stay (ALS) of the neonates admitted to NICU was 5.7 days. The average age on admission of the neonates was 4.84 days. The age wise distribution of admitted neonates revealed that about four-fifth (79.4%) of the neonates were in the age group of 0-7 days. About one-fifth (20.6%) of the neonates admitted were in the late neonatal period. Majority of neonates were males (58%)**.** The ratio of males (58%) and female (42%) neonates was 1:0.7. It was observed that the average gestational age of the neonates admitted to NICU was 36.15 weeks. The minimum and maximum gestational age of the neonates was 25 and 43 weeks respectively. Majority (60.6%) of the neonates were born at full term of gestation. The study showed that the average weight on admission of the neonates was 2525.7 grams. The minimum and maximum weight of the admitted neonate was 920 and 4350 grams respectively. Majority (58.3%) of the neonates were of normal weight (2500-3500 grams). Most (90%) of the neonates were born in health institutions. The study also showed that two-third (71.8%) of the neonates belonged to joint families whereas about one-third (28.2%) belonged to nuclear type of families. The distribution of neonates according to dwelling place revealed that two-third (68.3%) of the neonates admitted to NICU belonged to the families living in rural dwelling areas whereas approximately one-third (31.7%) belonged to the families living in urban dwelling areas (Table 1). Neonatal Jaundice (NNJ) (26.7%) was the most common cause of morbidity and admission to NICU followed by Septicemia (19.1%) Prematurity (12.5%), Birth Asphyxia (7%) and Respiratory Distress Syndrome (RDS) (5.7%) (Table 2). The data was analyzed for outcome of the total admitted neonates during the study period.

Table 1. Showing socio-demographic distribution of neonates

Characteristic	Variable	Frequency (N)	Percentage (%)
Age of the neonate on admission	0-7 days	808	79.4
	8-14 days	124	12.2
	15-21 days	64	6.3
	22-28 days	21	2.1
Neonatal Period	Early (0-7 days)	808	79.4
	Late (8-28days)	209	20.6
Gender	Male	590	58.0
	Female	427	42.0
Gestational Age at birth	Pre-term (<37 weeks)	392	38.5
	Full Term (37-42 weeks)	616	60.6
	Post-term (>42 weeks)	9	0.9
Weight on admission	High Weight (>4000g)	17	1.7
	Normal Weight (2500-4000g)	593	58.3
	Low Weight (1500-2499g)	335	32.9
	Very Low Weight (1000-1499g)	68	6.7
	Extremely Low Weight (<1000g)	4	0.4
Place of delivery	Health Institution	915	90
	Home	102	10
Type of family	Joint Family	730	71.8
	Nuclear Family	287	28.2
Dwelling Place	Rural	695	68.3
	Urban	322	31.7
Grand Total		1017	100

Table 2. Showing morbidity pattern among neonates admitted to NICU

Disease	Frequency (N)	Percentage (%)
Neonatal Jaundice (NNJ)	272	26.7
Septicemia	194	19.1
Prematurity	127	12.5
Birth Asphyxia	71	7.0
Respiratory Distress Syndrome (RDS)	58	5.7
Hypernatremic Dehydration	43	4.2
Hypoglycemia	40	3.9
Seizure Disorder	35	3.4
Transient Tachypnoea of Neonates (TTN)	33	3.2
Meconium Aspiration Syndrome (MAS)	30	2.9
Congenital Anomalies	26	2.6
Pneumonia	24	2.4
Polycythemia	19	1.9
Meningitis	14	1.4
Diarrhea	8	0.8
Others	23	2.3

Table 3. Outcome of the neonates who were admitted to NICU

Outcome	Frequency (N)	Percentage (%)
Discharged	916	90.07
Expired	99	9.73
LAMA	2	0.2
Grand Total	1017	100

Table 4. Showing case fatality rate of the admitted neonates

Disease	Outcome				Total	
	Discharged		Expired			
	N	%	N	%	N	%
NNJ	269	99.3	2	0.7	271	100
Septicemia	176	90.7	18	9.3	194	100
Prematurity	103	81.1	24	18.9	127	100
Birth Asphyxia	60	84.5	11	15.5	71	100
RDS	49	84.5	9	15.5	58	100
Hypernatremic Dehydration	40	95.2	2	4.8	42	100
Hypoglycemia	39	97.5	1	2.5	40	100
Seizure Disorder	34	97.1	1	2.9	35	100
TTN	30	90.9	3	9.1	33	100
MAS	20	66.7	10	33.3	30	100
Congenital Anomalies	20	76.9	6	23.1	26	100
Pneumonia	22	91.7	2	8.3	24	100
Polycythemia	18	94.7	1	5.3	19	100
Meningitis	13	92.9	1	7.1	14	100
Diarrhea	8	100	0	0.0	8	100
Others	15	65.2	8	34.8	23	100
Total	916	90.2	99	9.8	1015	100

It was observed that out of 1017 neonates admitted most were discharged (90.07%) whereas as 9.73% expired and only 0.2% left against medical advice (LAMA) (Table 3). There were 1017 neonates admitted out of which the two (2) neonates that left against medical advice (LAMA). Being insignificant in numbers these two neonates were excluded from further analysis for the case fatality rate. It was observed that the case fatality rate was maximum in MAS (33.3%) followed by Congenital Anomalies (23.1%), Prematurity (18.9%), Birth Asphyxia (15.5%), RDS (15.5%), & Septicemia (9.3%). TheChi-squared test (χ^2) static value was 89.49585 (df =15) and the p-value was less than 0.0001 indicating that disease type is very strongly associated ($p<0.0001$) with the outcome of a neonate (Table 4).

DISCUSSION

Accurate data on the neonatal disease volume and pattern are useful for many reasons. It is important for the providers of care, investigators, local and national health administrators, and for decision makers to design interventions for prevention and treatment and to implement and evaluate health care programs. The data from NICUs of hospitals in India is very limited and there are very few published reports from these hospitals. Perhaps this is the first published data concerning Neonatal Intensive Care Unit issue in Jammu & Kashmir. This is a hospital-based study and may not present what is going on in the community. So, the results of this study should be compared cautiously with other similar studies, because NICU of SKIMS Srinagar doesn't have a birthing site and only out-born neonates are admitted here. It was found that a total of 1017 neonates were admitted in the NICU during the period of study i.e. 1St Jan-31st Dec 2013. Only outborn neonates are admitted in SKIMS Srinagar. The volume of patients admitted were similar to various national and international studies. A study conducted by Aijaz N, *et al*. (2012) at Karachi found that the average length of stay (ALS) was 6.5 days whereas the average length of stay (ALS) of the neonates admitted to NICU in our study was 5.7 days which is lesser. The age wise distribution of admitted neonates in our study revealed that most the neonates were in the age group of 0-7 days (79.4%) group followed by 12.2% in 8-14 days age group similar to the study by Anjum, Z.M. and Shamoon, M. (2009). These findings are logical and expected as neonates in early neonatal period are at risk of contracting diseases and at risk neonates are identified by healthcare workers immediately if they are born in hospitals. Our study also showed that males (58%) outnumber their female (42%) counterparts which is consistent with local literature reported by Kumar MK, *et al*. (2012), (60 % male versus 40 % female) and international studies from Pakistan by Seyal, T, *et al*. (2011) (59.55 % male versus 40.5% female) and by UgwuGi, M.G. (2012) of Nigeria (54.3% male versus 45.7 % female). The average age of gestation of neonates was 36.15 week which was similar to a study conducted by Nahar, J. *et al*. (2007) in which it was35.6 ± 3.4 weeks. In this study about two-third of the neonates were of full term (60.6%) gestation and one-third were preterm (38.5%) which was similar to another study conducted by Gauchan, E. *et al*. (2011) in which there were 67.5 % term babies and 31.3% preterm babies. Our findings are understandable because probably Janani Suraksha Yojana (JSY) & Janani Shishi Sawasthaya Karyakram (JSSK) Scheme of National Rural Health Mission (NRHM) has enhanced the Ante-natal check up, hospital deliveries and neonatal care among the general population. The average weight of the neonates on admission in our study was 2525.7 grams which was similar to a study conducted by Nahar J, *et al*. (2007) [14]in which it was 2420 ±808 gm. The weight parameter analysis revealed that the number of neonates having weight Extremely Low Weight (<1000 grams), Very Low Weight (1000-1499 grams) and Low Weight (1500-2499 grams), Normal Weight (2500-4000 grams) and High Weight (>4000grams) was 0.4%, 6.7% and 32.9%, 58.3% and 1.7% respectively. The results of our study are comparable to a similar study done by Hussain S. (2014) which revealed that 2.25% were <1000 grams, 12.2% were between 1000-1499 gram, 39.35% were between 1500-2499 grams, 42.25% between 2500-4000 grams, and 3.95% were more than 4000gram. Our study also revealed that most of the admitted neonates were delivered in health institutions (90%) and only small number were delivered at home (10%). The findings of our study are comparable the findings of Rahim, F, *et al*. (2007) whereas Jan AZ, *et al*. (2013) found that 66% were delivered at hospital, 28% were delivered in home and 6% were delivered at other place. The findings of more number of health institution deliveries in our study are probably due to Janani Suraksha Yojana & Janani Shishu Sawasthaya Karyakram Scheme of National Rural Health Mission. It is reasonable to accept that the disease pattern in neonates can change with time and geographical location. Reporting of neonatal disease pattern from time to time contributes to identify deficiencies and assists health planners and workers to pay their due attention. In our study it was observed that most common indication for admission was Neonatal Jaundice (26.7%) similar to other studies by Gauchan *et al*. (2011) and Narayan, (2012). This may probably be due to location of the population at higher altitude in all these studies. In contrast to our study Respiratory Distress Syndrome was the most common cause of admission in Aijaz *et al*. (2012) study. Prematurity was the most common cause of admission in Nahar *et al*. (2007) and Seyal *et al*. (2011) studies. Birth asphyxia was the most common cause of admission in Anjum and Shamoon, (2009), Quddusi, *et al*. (2012) and Tabassum *et al*. (2013) studies. In our study it was also revealed that Neonatal Jaundice (26.7%), Septicemia (19.1%), and Prematurity (12.5%), Birth Asphyxia (7%), Respiratory Distress Syndrome (5.7%) were the top five most common indications for admission to NICU which constitutes about three-fourth of the total admissions.

The type of diseases in our study are similar to other studies conducted by Islam MN, *et al*. (2000), Parkash and Das, (2005), Nahar *et al*. (2007), Anjum and Shamoon (2009), Elhassan M. Elhassan, *et al*. (2010), Hoque, *et al*. (2011) , Gauchan *et al*. (2011), Prasad and Singh, (2011), Seyal *et al*. (2011), Narayan (2012), Kumar *et al*. (2012), Aijaz *et al*. (2012), Quddusi *et al*. (2012), Jan *et al*. (2013), Rahim F, *et al*. (2007), Syed Ali, *et al*. (2013), Tabassum *et al*. (2013), and Hussain, (2014). However, the pattern of disease in our study was not similar to the above-mentioned studies, which is probably due to different racial stock and climatic conditions of Kashmir. The major causes of morbidity were prematurity (60.7%), LBW (48.2%), jaundice (23.3%), SPA (10.8%), TTN (10.8%), RDS (6.4%) and sepsis (6.4%) in Nahar *et al*. (2007). In Syed R Ali *et al*. (2013), study Prematurity, infections, Birth asphyxia and NNJ were the main causes of admission to the neonatal unit, at 27.9%, 20.33%, 13%, and 11.3% respectively. It is essential to know the outcome of the admissions for evaluating the effectiveness of care provided in a hospital setting. There is a great variation in neonatal

mortality statistics between NICUs from different parts of the world. This variation probably reflects the difference in the attending population, antenatal care, admission criteria, specific exclusion & inclusion criteria and level of neonatal care. In our study it was observed that out of 1017 neonates admitted, 916 (90.07%) of the neonates were discharged, 99 (9.73%) died and 2 (0.2%) left against medical advice (LAMA). However, there were only 63 (6.19%) were institutional deaths. The neonatal mortality (9.73%) in NICU of SKIMS Srinagar is similar to a study conducted by Sarkar S, *et al* (2010) (9.7%), and Tariq P, and Kundi, (1999) (9%). Unlike observations in our study higher rates have been reported by Arafa and Alshehri, (2003) (22.4%), Kasirye-Bainda and Musoke, (1992) (24.6%), Agbere *et al* (1998) (27%), Aijaz *et al*. (2012) (13.8%), Islam *et al*. (2000) (20.6%), Kumar *et al*. (2012) (13.6 %), Hoque *et al*. (2011) (13.8%), Rahim *et al*. (2007) (14.87%) Parkash and Das (2005) (25.5%), Seyal *et al*. (2011) (30.9%) and Prasad and Singh (2011) (18.69%). Low neonatal mortality rates were found by Sankaran *et al* (2002), (4%) & Zullini *et al* (1997) (6%) respectively. The case fatality rate of a disease indicates the killing power of that disease and demands breakthrough technology and drugs to reduce the case fatality rate which provides us an indication for the area of neglect and the need to take corrective measures in this regard. It also provides us the indication of prognosis of the case. Our study showed that Meconium Aspiration Syndrome (MAS) (33.3%) followed by Congenital Anomalies (23.1%), Prematurity (18.9%), Birth Asphyxia (15.5%) and Respiratory Distress Syndrome (RDS) (15.5%) were the top five most common conditions having high case fatality rate.

Limitations of study

- Hospital based study and does not represent community data
- We were unable to diagnose inborn errors of metabolism due to lack of diagnostic facilities

CONCLUSION

The case fatality rate was maximum in MAS (33.3%) followed by Congenital Anomalies (23.1%), Prematurity (18.9%), Birth Asphyxia (15.5%), RDS (15.5%), & Septicemia (9.3%).

Recommendations

- Public enlightenment on the need to patronize quality health care delivery systems.
- Improving facilities for neonatal care especially care of the preterm neonate.
- Further studies to evaluate the risk factors and causes of neonatal infections in our environment will assist in appropriate interventions to bring about a reduction in these cases.
- There is a need for timely referral to a tertiary care hospital from peripheral and non-tertiary setups to prevent and control neonatal mortality and morbidity.

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