

Original Research Article

Distance from referral hospital as a risk factor for mortality and length of stay of neonates admitted in a tertiary care hospital

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Received: 09 September 2019

Revised: 09 October 2019

Accepted: 10 October 2019

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ABSTRACT

Background: Around 66% of infant and over 50% of under-five mortality occurs in newborn period. 99% of neonatal deaths occur in low and middle income countries. Most of these deaths can be prevented by suitable interventions at various levels. The premise of the study is that the neonates who require long transportation (>1 hour) have higher chances of mortality or prolonged stay in the hospital.

Methods: A retrospective retrieval of data and prospective interview was conducted in G.B Pant children's hospital Srinagar, an associated hospital of Govt. Medical College Srinagar in North India.

Results: During the period of study 1431 neonates from twelve districts of the state were referred to the hospital for treatment, out of whom, 102 (7.13%) could not be saved. Neonatal death rate was found highest (11.11%) in neonates referred from districts of category-III (>100 kms from the referral hospital), followed by category-II (50-100 kms from the referral hospital) and category-I (>50 kms from the referral hospital). Average length of stay was observed longest for the neonates referred from districts of category-III followed by category-II and category-I.

Conclusions: Several other studies found that transfer of sick neonates from another health facility were associated with relatively higher probability of morbidity and mortality after controlling for other predictors. Distance no doubt is a risk factor for neonatal outcome of referred neonates as we have observed in our study. To minimize neonatal deaths it is necessary to strengthen the perinatal services sick newborn care unit {(SNCUs) in district Hospitals}.

Keywords: Neonates mortality, Average length of stay, National health mission, SNCU

INTRODUCTION

Millions of newborn babies die every year worldwide due to various reasons. Around 66% of infant and over 50% of under-five mortality occurs in newborn period. Two thirds of infant mortality rate are contributed by deaths within first week of life.^{1,2} 99% of neonatal deaths occur in low and middle income countries.³ The first minutes after birth are the most important time for the survival of the neonates as it the transitional period from intra uterine to extra uterine life.⁴ Most of these deaths can be prevented by suitable interventions at various levels like

infrastructure development, manpower optimization, trainings and pre-natal diagnosis of high risk babies. As per SRS 2008, neonatal mortality rate in India is 35/1000 live births.⁵ This high mortality could be attributed to delay at three levels, which include a delay in recognition of severity of illness, delay in transport of the neonate and delay in delivery of appropriate health-care.⁶

Experience suggests that newborn intensive care units based in children's hospitals that are exclusively for out born babies have higher institutional mortality than perinatal center neonatal intensive care unit (NICUs) with

obstetrical services, even after adjusting for severity of illness.⁷

The concept of organizing perinatal services within geographic regions according to the level of care provided first emerged in the late 1960s to improve outcome for infants requiring neonatal intensive care.⁸ Government of India acting on the lines of improving peri-natal services established Special Newborn Care Units (SNCUs) in district hospitals through National Rural Health Mission (now NHM) to decrease neonatal mortality in the country. Under the Child health component of the mission the strategy is to augment the neonatal care facilities at the District Hospitals so that neonates do not die due of delay in treatment because of long transportation during their most precious moments of life. These babies are critically ill and the outcome is also dependent on the effectiveness of transport system.

The referral hospital of the present study is the tertiary care Children’s hospital in the Kashmir division attached to the Govt. Medical College. It has a 61 bedded step down neonatal care unit equipped with Ventilators, CPAPs, vital sign monitors, baby warmers and many higher end equipments run by highly professional faculty.

The premise of the study is that the neonates who require long transportation (>1 hour) have higher chances of mortality or prolonged stay in the hospital. As a Hospital Administrator of the Hospital, the investigator of this work has observed that the referral system in the District Hospitals has not improved as expected after the NHM initiative, with the result newborns from all the Districts of the division are transported during their precious moments of life. This study was under taken to find out the relation between distance covered/ time wasted in travelling, by the sick newborns referred from different districts and their outcome in terms of mortality and length of stay.

METHODS

The design of the study is in two parts conducted in G B pant Children’s Hospital Srinagar, an associated tertiary care hospital of Govt. Medical college Srinagar Kashmir. First part is retrospective evaluation of patient records. All the neonates admitted in the NICU of the hospital from 1st February 2016 to 30th June 2016 were included in the study and their records were retrieved from the medical records section. The relevant data was recorded on a pre-designed proforma. The data so collected was

analyzed to obtain the required information. During the period of our study, patients were referred from ten districts of the Kashmir division and two districts of the Jammu division of the state. Following statistical tools were used to calculate the neonatal death rate and average length of stay (ALS) from the collected data.

Neonatal death rate was calculated by the formula

$$\text{Neonatal death rate} = \frac{\text{Total number of hospital deaths during the period} \times 100}{\text{Total number of discharges (including deaths) during the period}}$$

ALS was calculated by the formula

$$\text{ALS} = \frac{\text{Total patient days during the period}}{\text{Total discharges (including deaths) during the same period}}$$

Second part of the study is prospective data collection to calculate the average time, the transport taken to reach the hospital. The data was collected by interviewing the drivers and attendants of the patients who actually covered the distance along with the neonates from the various districts. The data collected was recorded on a pre-designed proforma. Simple statistical techniques like rates, ratio and proportions were used to infer the results. On the basis of distance from the referral hospital, the districts were categorized in three categories which are category I includes district Srinagar, Ganderbal, Pulwama and Budgam, which fall less than 50 kms from the referral Hospital and the transport take less than one hour to reach the hospital; category-II includes district Bandipora, Baramulla, Anantnag, shopian and Kulgam which fall between 50 to 100 kms from the referral hospital and the transport take one to two hours to reach the hospital and category-III includes district Dada, Ramban and Kupwara which fall more than 100 kms from the referral Hospital and the transport take more than two hours to reach the hospital.

RESULTS

The hospital in our study is a tertiary care children’s hospital of the Kashmir division of the state of Jammu and Kashmir. During the period of our study 1431 neonates from twelve districts of the state were referred to the hospital for treatment. 872 (60.94%) were male babies and 559 (39.06%) were female babies. Male: female ratio of the referred babies was found to be 1.56: 1. The demographic profile of the patients is shown in table 1.

Table 1: Demographic profile of the neonates referred.

District	Total neonates admitted	Male babies		Female babies	
		N (%)	N (%)	N (%)	N (%)
Srinagar	358	210 (58.66)		148 (41.34)	
Anantnag	168	93 (55.36)		75 (44.64)	
Bandipora	77	45 (58.44)		32 (41.56)	
Baramulla	179	120 (67.04)		59 (32.96)	

Continued.

District	Total neonates admitted	Male babies	Female babies
		N (%)	N (%)
Budgam	158	101 (63.92)	57 (36.08)
Kulgam	58	35 (60.34)	23 (39.66)
Kupwara	161	109 (67.70)	52 (32.30)
Pulwama	158	94 (59.50)	64 (40.50)
Shopian	74	39 (52.70)	35 (47.30)
Ganderbal	21	13 (61.90)	08 (38.10)
Doda	02	02 (100)	00
Ramban	17	11 (64.70)	06 (35.30)
Total	1431	872 (60.94)	559 (39.06)

Table 2 depicts the mortality of the neonates referred from three different categories of the districts. The highest mortality (death rate=11.11%) was observed in the neonates referred from districts of category III,

followed by the neonates referred from the districts of category-II (death rate=9.71%). Lowest mortality (4.02%) was observed in the neonates referred from the districts of category-I.

Table 2: Distance and mortality outcome.

Category	Distance from the referral hospital (kms)	Time consumed to reach the hospital (hour)	Total number of neonates discharged in the category	Deaths	Death rate (%)
Category-I	Upto 50	Within 1	667	28	4.02
Category-II	50-100	1-2	502	54	9.71
Category-III	>100	>2	160	20	11.11

Table 3: Average length of stay outcome.

Category	Distance from the referral hospital (kms)	Time consumed to reach the hospital (hour)	Total number of inpatient days in the category	Total number of babies discharged (including deaths) in the category	ALS (days)
Category-I	Upto 50	Within 1	3129	695	4.5
Category-II	50-100	1-2	3020	556	5.4
Category-III	>100	>2	1267	180	7.03

Table 3 depicts the ALS of the neonates referred from the three categories of the districts. ALS of neonates referred from category-III districts was observed to be longest (ALS=7.03 days) among all the three categories of districts, followed by neonates referred from the districts of category-II (ALS=5.4 days). ALS was observed shortest (4.5 days) for the neonates referred from districts of category-I.

69 and female 33 neonates in our study was observed as 2.09: 1. The mortality is proportionately higher in male neonates 13: 1 as compared to female neonates 17: 1, which signifies that mortality of male neonates is higher as compared to the female neonates.

DISCUSSION

Mortality and length of stay are two commonly used outcomes for comparing health care delivery in NICU. During the study period out of 1431 neonates admitted, 1323 (92.52%) were discharged after successful treatment however 102 (7.13%) neonates could not be saved. In a study by Punitha et al in one of medical college hospitals of South India reported that 93.4% of the referred neonates were treated successfully and 6.6% neonates died during their study period.⁹ Male: female ratio of referred babies in our study was found 1.56: 1. Male: female ratio in the above mentioned study was observed as 1.4: 1.⁹ The mortality ratio between the male

In our study we observed that as the distance of transportation of the sick neonates increase, it leads to loss of first few golden moments of the survival. The neonatal death rate of neonates referred from category-III districts was observed as 11.11% which is highest among the neonates referred from all the categories of districts. The neonatal death rate of the neonates referred from districts of category II, was observed as 9.71% and the neonatal death rate was observed as lowest (4.02 %) of the neonates referred from districts of category-I. The mortality is therefore lowest for those neonates referred from the districts of category-I, who took less than one hour to reach the referral hospital. The mortality was on the other hand found highest among the neonates referred from the districts of category-III, who took more than two hours to reach the referral hospital. The mortality was found intermediate among the babies referred from the

districts of category-II. Several other studies found that transfer of sick neonates from another health facility were associated with relatively higher probability of morbidity and mortality after controlling for other predictors.¹⁰⁻¹³ Narang et al in their study found that the transportation time of more than 1 hour duration were significant predictors for mortality among the transported neonates.¹⁴ Rosenberg et al reported that a referral hospital with 25% of patients transferred from another ICU when compared with another with a 0% transfer rate would have 14 excess deaths per 1000 admissions.¹⁵ The ambulances for transportation of sick neonates particularly in rural areas are not equipped for neonatal transport. Appropriate equipment's and vehicle customized for neonates should be available for safe transport.

Our results for ALS of the referred neonates from the districts of three categories showed the similar trend as for the mortality indicator. ALS for the neonates of the category-III, districts was observed longest as 7.03 days. The ALS for neonates referred from category-II, districts was observed as 5.4 days. ALS was observed shortest (4.5 days) among the neonates of category-I, districts. Negi et al in a study also found a direct relation between the distance covered by the sick neonates and the their average length of stay in the hospital.¹⁶

CONCLUSION

Distance no doubt is a predictor of neonatal outcome of referred neonates as we have observed in our study besides many other such studies. To minimise neonatal death, the perinatal services (SNCUs in district hospitals) need to be strengthened and the components of the NHM need to be implemented on ground, particularly in the districts which are more than 1 hour journey from the referral centres. Simultaneously it is also imperative to adhere to strict neonatal transport protocol, stabilisation of babies before transportation. The transport of sick neonates should be accompanied by trained personnel, who have at least basic training in neonatal resuscitation. The ambulances for neonatal transport should be equipped with transport ventilator, incubator, oxygen reserve. Appropriate prior communication with the referral hospital will help to manage the referred neonates more efficiently on the arrival to the hospital.

ACKNOWLEDGEMENTS

I acknowledge the support of the medical records section of the hospital for extending their support to complete the current work. I also feel gratitude to the drivers of vehicles ferrying the patients from the districts to the referral hospital of the study, for their co-operation and sparing time to answer the queries.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Pandita KK. Distance from referral hospital as a risk factor for mortality and length of stay of neonates admitted in a tertiary care hospital. *Int J Community Med Public Health* 2019;6:4912-6.