IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 16, Issue 11 Ver. V (Nov. 2017), PP 13-19
www.iosrjournals.org

Pre-Admission Factors Influencing Neonatal Mortality

*Dr. B.Shalini[1],Dr. C.V Nikhila[2],Dr. M. Alimelu[3]
[1](Senior Resident, Department of Pediatrics, Gandhi Medical College, Secunderabad, India)
[2](Senior Resident, Department of Pediatrics, Gandhi Medical College, Secunderabad, India)
[3] (Professor of Pediatrics, Niloufer Hospital, Hyderabad, India)
Coressponding author: Dr. B.Shalini

Abstract :
Background: *Every year 70% of neonatal deaths take place because simple yet effective interventions do not reach the needy.*
Objective: *To study the pre-admission factors affecting neonatal outcome.*
Materials And Methods: *This was a hospital based study of 500 neonates admitted to NICU at Niloufer Hospital for Children, Osmania Medical College, a tertiary care centre.*
Results: *Among the 500 neonates, only 66% of the babies were stabilized prior to referral. Referral letter was given for 82% referrals and only 10% were accompanied by trained paramedic or doctor. Ninety four percent (94%) were brought without proper warm care. At admission 60% were hypothermic, 50% hypoxemic, 10% hypoglycemic and 26% babies had prolonged capillary filling time.*
There was a significant decrease in mortality among the neonates where intervention was done before transport and when the duration of transport was less than one hour. Hypothermia, hypoxia, hypoglycemia and prolonged capillary refill time at the time of admission were significant predictors of neonatal mortality.
Conclusions: *Low birth weight, prematurity, pre-referral stabilization, untrained person accompanying the baby, lack of awareness of danger signs and duration of transport >1hour were significant predictors of neonatal mortality thus emphasising the need for proper regionalization of peripheral care, appropriate pre referral stabilization and transport care of neonates.*
Keywords: *Danger signs, Neonatal mortality, Pre referral stabilization, Transport, Warm care*

Date of Submission: 01 -11-2017 Date of acceptance: 11-11-2017

I. Introduction

India contributes to about 20% of global births with 27 million live births each year with about 2 million under five annual deaths, India also accounts for a quarter of global child mortality[1,2]. Around 66% of infant and over 50% of under-five mortality occurs in newborn period [3]. Almost two third of the total neonatal deaths are within first week of life [4]. Neonatal care in India has witnessed a revolution in the last 10 years under the auspices of National Rural Health Mission (NRHM). Home visits by community health workers provide skilled care, early detection of danger signs and referral of sick newborns to health facility. Under NRHM, Special Newborn Care Units (SNCU) were established across the country. These units helped in a great reduction of Infant Mortality Rate (IMR) in the country. Though institutional delivery and in-utero transport of newborn is safest but unfortunately preterm delivery and perinatal illness cannot be always anticipated resulting in continued need of transfer of these babies after delivery [5, 6]. These babies are often critically ill and outcome is also dependent on effectiveness of transport system [7].

The facility of neonatal transport in our country is major gap in holistic newborn care. Effective transport of neonate depends largely on the mode of transport, trained transport team, adequate equipment, appropriate drugs and effective communication [8]. At the same time it is well known that transport of newborn by a skilled organised team reduces neonatal mortality and morbidity [9]. Most of neonates are transported in private or public vehicles without any pre-referral stabilization or care during transport. Many of these newborns thus transported are cold, blue and hypoglycemic and 75% of the babies transferred this way have serious clinical implications [10, 11, 12]. These complications further increase the morbidity and mortality among these sick neonates. A further fall in IMR can only be achieved by improving the Neonatal transport facilities.

Currently there is limited or no dedicated neonatal transport service in India [5]. Navjat Shishu Suraksha Karyakram (NSSK) launched by Government of India also emphasizes the role of safe neonatal transport [13]. The present study has been carried out to identify the determinant of mortality on extramural arrival of sick newborns and status of neonatal transport at tertiary care Centre.

1.1 Aims And Objectives

To study the pre admission factors, including transport facilities affecting neonatal mortality and to study the condition of the neonate at the time of arrival to the tertiary care centre.

II. Materials And Methods

The present study was a prospective Observational study conducted at NICU of Niloufer Hospital for Women and Children, Osmania Medical College, Hyderabad, for a period of 1 year, from October 2015 to September 2016, on 500 neonates.

2.1 Inclusion Criteria

Out born babies with age <28 days of life admitted to NICU at Niloufer Hospital during the designated study period of 1 year.

2.2 Exclusion Criteria

Neonates of age more than 28 days life, inborn babies, abandoned neonates, babies referred with lethal congenital malformations or surgical problems, and neonates who left against medical advice (LAMA) were excluded from the study.

2.3 Statistical Analysis

Data entry was done using MICROSFT EXCEL 2013 and analysis was done using SPSS 19.0 version. Data presented as percentages and associations between different variables were studied using Pearson Chi Square test. P value of <0.05 was considered as existence of statistically significant difference.

2.4 Data Collection

Informed consent was taken from the attendants before start of study. The study was questionnaire based, where the receiving clinician documented the details and clinical parameters as observed on arrival of the baby, on a data capturing sheet. The subjects were assessed in terms of:

Sex (male, female); Birth weight (ELBW, VLBW, LBW, normal weight); Gestation age (very pre term, preterm, near term, term); Place of birth (home, hospital); Mode of delivery (normal vaginal delivery, emergency or elective caesarean section); Birth events (need for resuscitation and its details). Indication for referral (verbal or written); Referral letter provided or not; Referral given by (doctor, health care worker, attendant himself) and pre referral treatment given or not (as per referral note whenever available). They were assessed for mode of transport (ambulance, own vehicle, public transport); Duration of transport (<1hour, >=1hour); person accompanying (untrained person, doctor or paramedic); provision of warm care during transport (adequate, inadequate) and any treatment given during transport. The attendants were assessed regarding their knowledge of danger signs and whether they received any advice regarding care during transport like warm care and feeding. Condition of the baby on arrival to NICU was assessed for temperature, saturation, circulation and hypoglycaemia and vitals. After initial stabilization, neonates were assessed for maturity, clinical condition, outcome in terms of discharge and death.

Following definitions were used for assessment of neonates:

2.4.1 LBW: Birth weight less than 2.5 Kg irrespective of gestational age [14].
2.4.2 VLBW: Birth weight less than 1.5 kg.
2.4.3 ELBW: birth weight less than 1 kg.
2.4.4 Term baby: baby born >=37 weeks of gestation [15].
2.4.5 Late Preterm baby: Baby born before 37 completed weeks and after 34 weeks of gestation.
2.4.6 Preterm baby: baby born before 34 weeks of gestation
2.4.7 Very preterm: baby born before 32 weeks of gestation.
2.4.8 Hypoxia: Spo2 less than 90% measured in right upper limb and lower limb.
2.4.9 Hypothermia and its grading: Axillary temperature was taken by digital thermometer and observed temperature was graded as per standard guidelines of WHO [16].
2.4.10 Cyanosis: presence of dusky soles with perioral cyanosis and not the cyanosis of oral mucosa.
2.4.11 Delayed capillary filling time (CFT) was taken as more than three seconds [5].
2.4.12 Hypoglycemia as blood glucose measured by glucometer less than 40 mg/dl with reagent stripes [17].
2.4.13 Respiratory distress was defined as Respiratory rate more than 60 /minute in a quite baby associated with deep lower chest wall in drawing with or without nasal flaring and/ or expiratory grunting [18]. Sepsis, Birth asphyxia, Hyaline membrane disease (HMD), Meconium aspiration syndrome (MAS) were diagnosed as per standard guidelines provided by national neonatology forum [5].

III. Results

A total of 500 neonates were included in the study. The mean birth weight was 2.22 kg. Mean age of the neonates at presentation was 40 hours of life. Of the 500 neonates 58% were male and 42% were female. Percentage of neonates with low birth weight was 40%, very low birth weight was 10% and extremely low birth weight babies was 6%. Majority of them were born at term gestation accounting to 60%, while 4% were born at 34 – 36 weeks, 18% were born at 32 – 34 weeks and 18% were born at less than 32 weeks.

Ninety eight percent (98%) of the neonates were born out of institutional delivery. Mode of delivery was equally distributed between normal vaginal delivery and lower segment caesarean section. Of the 50% delivered through LSCS, 26% were born of emergency LSCS and 24% were born of elective LSCS. Resuscitation at birth was done in 24% of the total neonates with tactile stimulation being the most common type of resuscitation required (41%). Only 66% of the babies were stabilized prior to referral and 34% of the neonates were referred without any intervention prior to referral. The most common indication for referral was prematurity and LBW.

Table 1. Indication for referral

Indication	Frequency	Percent
LBW / pre term	250	50%
Meconium aspiration	160	32%
Birth asphyxia	110	22%
Sepsis	90	18%
Respiratory distress syndrome	70	14%
Neonatal jaundice	50	10%
Others	10	2%
Total	500	100%

Among the 500 neonates, only 10% of the attendants were aware of danger signs. Most of the neonates were transported by ambulance (70%), remaining by auto rickshaw (22%), two wheeler (6%) and public transport (2%). Duration of transport was less than one hour in 58% of the babies. Referral letter was given for 82% referrals but only 10% were accompanied by trained paramedic or doctor.

Table 2. Frequency distribution of mode of transport

Mode of transport	Frequency	Percent
Ambulance	350	70%
Auto	110	22%
Two wheeler	30	6%
Public transport	10	2%
Total	500	100%

Advice regarding care during transport was given to only 4% of the attendants. Ninety four percent (94%) were brought without proper warm care. At admission 60% were hypothermic, 50% hypoxemic, 10% hypoglycemic and 26% babies had prolonged capillary filling time. Mortality of the present study was 110 (22%). Of the 110 deaths, 52 deaths (47%) were within 1 hour of arrival to the hospital and the most common cause of death was preterm, low birth weight accounting to 30% of the total deaths.

Table 3. Cause of death

Cause	Frequency	Percent
PT/LBW	33	30%
HIE	29	27%
MAS	22	20%
SEPSIS	20	18%
OTHERS	6	5%
TOTAL	110	100%

Sex of the neonate had no significant effect on the mortality. Birth weight of <2.5kgs and gestational age <37weeks had significant effect on neonatal mortality with p value of <0.05. Those neonates who received pre-referral intervention had lesser mortality when compared to those who weren't stabilized prior to referral. Significant increase in mortality was seen in the group which lacked awareness of danger signs and those neonates who were accompanied by untrained person. Mode of transport did not have a significant influence on mortality. Neonates with duration of transport for less than 1 hour had significant lesser mortality when compared to neonates who took more than 1 hour to reach the tertiary care centre.(p value <0.05)

Table 4. Assessment of correlation of pre admission factors with neonatal mortality and P value obtained.

variable	category	death	survival	total	P value
SEX	Male	70	270	340	0.26
	female	40	120	160	
BIRTH WEIGHT	>=2.5kgs	20	200	220	0.001
	>2.5kg	90	190	280	
GESTATIONAL AGE	>=37weeks	30	270	300	0.001
	<37 weeks	80	120	200	
PRE REFERRAL INTERVENTION	Yes	50	60	110	0.001
	No	60	330	390	
AWARENESS OF DANGER SIGNS	No	110	340	450	0.001
	Yes	0	50	50	
ACCOMPANYING PERSON	Untrained	80	370	450	0.002
	trained	30	20	50	
DURATION OF TRANSPORT	<1hr	30	260	290	0.001
	>=1hr	80	130	210	

Hypothermia, hypoxia, hypoglycaemia and hypo perfusion at the time of admission to the hospital, were significantly associated with increased neonatal mortality (P <0.05).

Table 5. Parameters at the time of admission and P value obtained

Parameter	Observed Value	Death	Survival	Total	P Value
Temperature	>36.5^{0}c	0	200	200	0.001
	=<36.4^{0}c	110	190	300	
Spo_2	>90%	0	250	250	0.001
	=<89%	110	140	250	
Grbs	>45mg/Dl	70	380	450	0.001
	=<44mg/Dl	40	10	50	
Cft	<3sec	10	360	370	0.001
	=>3sec	100	30	130	

IV. Discussion

In the present study 220 (44%) neonates had normal birth weight, 200 (40%) were LBW, 50 (10%) were VLBW and 30 (6%) were ELBW. In a study by Narang et al [19], birth weight among the transported neonates were <1 kg (10.3%), 1-1.5 kg (35.3%), 1.5-2.5 kg (38.3%) and >2.5 kg (16%). A study conducted by Punitha et al [20] in Tamil Nadu showed birth weight distribution >= 2.5 kg 193(55%), 1.5-2.5kg 127(36%), 1 - 1.5 kg 18(6%), <1kg 10(3%).

Table 6. Comparision of birth weight distribution with other studies.

weight	Narang et al [19]	Punitha et al [20]	Present study
>=2.5kg	16%	55%	44%
1.5-2.5kg	38.5%	36%	40%
1-1.5kg	35.3%	6%	10%
<1kg	10.3%	3%	6%

Table 7. Comparision of gestation age distribution

Gestation age	Gourav et al[21]	Present study
>=37 weeks	64%	60%
<37 weeks	36%	40%

The most common indication for referral in the present study was prematurity and low birth weight 250 (50%). Meconium aspiration syndrome 160 (32%), birth asphyxia 110 (22%), sepsis 90 (18%), NNJ 50(10%) were among the other indications for referral. This was similar to the observations made by Narang et al[19], Punitha P et al[20], Gaurav Porwal et al [21].This shows that prematurity and low birth weight continue to be major public health problems in present study and same has been consistently observed in other studies.

Table 8. Comparision with other studies.

SL No:	STUDY OBSERVATIONS	CONCLUSION
1. Kumar et al[22]	Biochemical and Temperature disturbances are more common in babies transported on their own. Survival was 89% compared to 96.2% in babies transported by specialised neonatal transport service.	Specialized neonatal transport service could improve the survival of sick babies at birth.

2.Singh H et al [22]	Common indications for referral: Hyperbilirubinemia (35.4%), prematurity(27.3%), birth asphyxia(17.3%) and sepsis(15.5%). Mortality was higher in hypothermic babies ($p<0.001$). The outcome of babies referred after 72hrs of age was unfavorable.	Referral of newborns to tertiary care centers is far from satisfactory and needs improvement.
3. Fok et al [24]	Clinical condition of neonates on arrival to tertiary care center showed: Hypothermia (26.3%), academia (24%), hypercapnia (23.4%), hypoxemia (23.4%), central cyanosis (18.7%) and circulatory failure (15.8%).	Infant transport in the community is appallingly unsatisfactory which result in unwarranted mortality and morbidity.
4. Shah et al[25]	Out born infants admitted to freestanding pediatric hospitals were at higher risk of death, nosocomial infection and oxygen dependency at 28days of age when compared to out born infants admitted to perinatal centers.	Out born infants had better outcomes if they were admitted to perinatal centers.
5. Modi N et al[26]	Among the reasons for admission: suspected sepsis (24%), preterm care (14%), phototherapy (13%), observation of LBW babies (8%) Among the neonatal deaths: 4% were inborn and 18% were out born admissions. Among the causes of deaths: RDS (49%), lethal Congenital malformations (22%), Asphyxia (20%) and sepsis (5%).	Although the pattern of admissions and deaths still reflects the substantial problems of suspected sepsis, asphyxia, and congenital malformations, problems of immaturity may be on the increase.
6.Orimadegun et al[27]	Problems in outborns: Hypothermia (53.6%), Perinatal asphyxia (48.5%), Hemorrhage (26.5%), Cephalhematoma (12.9%), Prematurity (9.9%) and neonatal tetanus (4.2%). Outcome of newborns: Mortality rate of outborns was 12.6% compared to 6.3% in inborn ($p= 0.019$)	Out born babies who were referred had greater risk of morbidity than inborn.
7. Present study	Babies were not stabilized prior to referral (34%), and at admission showed hypothermia (60%), hypoglycemia (10%), hypoxia (50%) and hypoperfusion (26%).	Emphasised the need for pre-referral stabilization and adequate care during transport.

In this study the most common mode of transport used was ambulance 350 (70%), followed by Auto 110 (22%), two wheeler 30 (6%), and public transport 10 (2%). Unlike in other previous studies, in which the most common mode of transport was public and private vehicles. In a study in 2001 by Sehgal Arvind, it was observed that only 5% of neonates were transported in ambulances. Thus, the neonatal transport in India has taken a giant leap in the last decade.

Table 9. Comparision with other studies for %neonates transported by ambulance.

STUDY	% NEONATES BROUGHT BY AMBULANCE
Present study	70%
Sehgal Arvind	5%
Narang et al	29.6%
Sunil Kumar Rao et al	2.5%
Pankaj Buch et al	26.8%
Deepak Rathod et al	36%

Similar observation was made in studies conducted by Sehgal et al were none of the babies were accompanied by a trained person and a study by Agarwal et al, in 12% cases, health personnel were sent along with the babies. In a study by Narang, et al the baby was accompanied by health personnel in 47 (15.6%) neonates when compared to 10% in the present study. This serious gap in neonatal care is in accordance with previous studies. Recent evidences suggest that peripheral hospitals do not intimate before referral to higher centre. The mortality in this study was 22% with preterm and low birth weight being the most common cause of death. In a study by Punitha et al during the study period 23(6.6%) neonates died. Respiratory distress syndrome and septicemia being the major causes of mortality.

In the present study mortality was inversely related to gestational age, birth weight and time taken to reach hospital ($P < 0.05$) similar to the study by Narang et al. rolonged neonatal transport (>1 h) was found to increase

the mortality among transported neonates in the present study. Similar observations were made by Manish et al and Sehgal et al. Hypoglycemia, hypothermia, poor perfusion and oxygenation were shown to be associated with high mortality with p value <0.01 in transported neonates similar to the study by Gourav Porwal et al Karnataka. These observations were similar to those of, Pankaj Buch et al, Arvind Sehgal et al and Abhay Bang et al and Sunil kumar et al i.e. factor contributing to high mortality were LBW, prematurity, hypothermia, delayed CRT, cyanosis and long transport time.

V. Conclusion

Low birth weight, prematurity, pre-referral stabilization, untrained person accompanying the baby, lack of awareness of danger signs and duration of transport >1hour were significant predictors of neonatal mortality.The neonate being hypothermic, hypoxic, hypoglycaemia or hypoperfused at the time of arrival to the tertiary care centre had significantly affected the death rate. Majority of the attendants were not aware of the danger signs. The acute neonatal physiology is affected during the transport and adversely affects the outcome. Early recognition of acute physiology of newborns to assess need of referral, ensuring stable vital parameters before and during transport arrests progression of morbidity, helps recovery and decreases mortality.

The present study laid stress on the fact that standing at the receiving end of delayed referral, tertiary centers could do little. There is a clear need to strengthen primary health care providers, to conduct certified programs on neonatal transport to all the newborn care providers, increasing public awareness of danger signs and provision of special newborn ambulances with trained staff. As temperature maintenance by transport incubator is not available at majority of places due to resource limited setup, kangaroo mother care used by attendant or mother is a useful way to maintain temperature along with other local alternative methods like thermocol boxes, plastic wrap. The concept of back transport of stable neonates is lacking in India, which can adds to the poor quality of care at the referral center.

References

[1]. Siddhartha Gogia, Siddharth Ramji, Piyush Gupta, Tarun Gera, Dheerajshah, Joseph L Mathew et al Indian Pediatrics 2011:48;537-46.
[2]. SRSBulletinhttp://www.censusindia.gov.in/vital_statistics /Vital Rates/Vital_rates.aspx.
[3]. World health organization; managing newborn problems; 2003.
[4]. Baqui AH, Darmstadt GL, Williams EK; Rates, timing and causes of neonatal deaths in rural India: implications for neonatal health programs. Bulletin WHO 2006: 706-713.
[5]. NNFclinicalpracticeguidelines.http://www.nnfi.org/images/pdf/nnf_cpg_consolidated_file-january102011.pdf
[6]. Kemply ST,Sinha AK,.Census of neonatal transfers in London and the south East of England. Arch Dis Child Fetal Neonatal ed 2004;89;F521-F26.
[7]. Rashid A,Bhutta T,Berry A. A regionalized transport service,the way ahead? Arch Dis Child 1999; 80; 488-92
[8]. Babinard J, Roberts P. Maternal and child developmental goals: What can transport sector do? The World Bank group. Transport paper. Available from: http://www.siteresources.worldbank.org/inttransport/tp12_maternal_helath.pdf.
[9]. Kumar P, Kumar C, Venkatlakshmi A. Long distance neonatal transport-the need of hour. Indian pediatr 2008; 45:920-22.
[10]. Britto J, Nadel S, MaconochieI, Levin M. Morbidity and severity of illness during interhospital transfer: Impact of a specialized pediatric retrieval team.BMJ 1995; 311:836-39.
[11]. Agostino R, Fenton AC, Kollee LAA. Organization of neonatal transport in Europe.prenat Neonatal med 1999; 4:20-34.
[12]. Leslie AJ, Stephenson TJ.Audit of neonatal intensive care transport: closing the loop. Acta pediatr 1997; 86:1253
[13]. Ministry of Health and family Welfare. Participant Module Navjat Shishu Suraksha Karyakram. New Delhi, Government of India, 2009.
[14]. Klaus MH, Fanaroff A. care of the High Risk neonate 5thed.Philadelphia:W.B.Saunders Company, 2001;65-99,130-145
[15]. Manual of neonatal care- John P Cloherty, Seventh edition.
[16]. WHO. Thermal control of the newborn: a practical guide. Maternal and safe motherhood Programme. Division of family health: Geneva, Switzerland, 1993
[17]. Cornblath M, Howdon JM, and Williams AF.Contraversies regarding definition of neonatal Hypoglycaemia: Suggested operational threshold, Pediatrics: 2000; 105:1141-5
[18]. Ministry of Health and family Welfare. Participant Module of Facility based IMNCI.New Delhi, Government of India, 2009.

[19]. Narang M, Kaushik JS, Sharma AK, Faridi M.Predictors of mortality among the neonates transported to referral centre in Delhi, India: Indian J Public Health 2013;57:100-4.
[20]. Punitha P, K.S.Kumaravel, Pugalendhiraja K V, Santhosh kumar A study on the current status of neonatal transport to a special newborn care unit:Stanley Medical Journal (4)Vol 3 | Issue 3 | July-September | 2016 Pediatr Int. 2007 Aug; 49(4): 452-8
[21]. Dr. Gaurav Porwal ,Dr. Ramanath Mahale Dr. Kanchan Mahale Dr. Chetan G Dr. Rajiv Aggarwal clinical profile and outcome underlying neonatal Transport from periphery to a tertiary care center In South India.
[22]. Kumar P, Kumar C, Venkatlakshmi A. Long distance neonatal transport-the need of hour. Indian pediatr 2008; 45:920-22.
[23]. Singh H, Singh D, Jain B K.Transport of referred sick neonates: How far from ideal? Indian Pediatr. 1996;33: 851-853.
[24]. T F Fok, S P Lau. High risk infant transport in Hong Kong. The bulletin journalof the Hong Kong medical association. 1984; 36: 39-45.
[25]. Shah P, Shah V, Qiu Z. Improved outcomes of outborn preterm infants if admitted to perinatal centers versus freestanding pediatric hospital. The Journal of Pediatrics. 2005; 146 : 626-31.
[26]. Modi N, Kirubakaran C. Reasons for admission, causes of death and costs of admission to a tertiary referral neonatal unit in India. J Trop Pediatr. 1995;41(2):99-102
[27]. Orimadegun AE, Akinbami FO, Tongo OO. Comparison of Neonates born outside and inside hospitals in a Children Emergency Unit, Southwest of Nigeria. Pediatric Emergency Care. 2008; 24(6):354-35.