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Original Research Article

A Retrospective Assessment of Neurodevelopmental Outcome among Babies Requiring Neonatal Intensive Care Unit (NICU) Stay During Their Initial Days: A Follow-Up Study

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Abstract:

Aim: The aim of the present study was to determine neurodevelopmental outcome of these babies requiring neonatal intensive care unit (NICU) stay during their initial days at the age of 2 years.

Methods: The present study was conducted in the Department of Pediatrics and total duration of study was one year. Retrospective analysis of data of 240 high risk newborns admitted in NICU for more than 48 hours. In this study of 240 babies, 200 babies were followed up for clinical assessment at the age of 2 years. These were contacted and followed up for clinical assessment including motor and neurological function, visiomotor integrative skills, language, executive function, behavioral issues and child behavioral checklist applied. Findings described in simple descriptive manner.

Results: In the present study, 48% were male and 52% females. 33% babies were preterm born prior to 37 weeks, 67% were term babies. 46% babies were born low birth weight. 52% were normal vaginal deliveries, 44% were cesarean and 2% were assisted deliveries. 34.5% babies required NICU stay for more than 8 days. 65% required less than 7 days of NICU stay. 12% babies required more than 30 days of NICU stay, 11% required 15-30 days, 12% required 8-14 days. 17.5% had behavioral issues, 12% had withdrawal, 16% had aggressiveness, 20% babies had features of attention deficit hyperactivity disorder and 2% had features related to autism. Immediate complications 25% babies had neonatal hypoglycemia, 8% babies had neonatal seizures, 64% babies required phototherapy for hyperbilirubinemia. 28% had neonatal sepsis requiring antibiotics.

Conclusion: Neonatal period is a critical period for proper neurodevelopment, having impact on child development. Babies with difficulties during transition period including prematurity, prolonged requirement for neonatal intensive care, resuscitation, ventilation, birth asphyxia, meconium complicating pregnancy had higher immediate as well as long term morbidities.

Keywords: Neurodevelopment, High risk, Babies, NICU.

Introduction

Improving outcomes beyond survival for high-risk newborns in resource-limited countries is an emerging challenge. As the survival rate of high risk newborns improve with advancing perinatal care services, the total number of infants with unique follow-up needs increase. Numerous studies have shown that despite reduction in neonatal mortality, the incidence of chronic morbidities and adverse outcomes have not declined much. Neurodevelopmental impairments include motor function deficits such as cerebral palsy, cognitive delay and sensory impairments such as visual and auditory deficits. This highlights the paramount importance of monitoring the growth and neurodevelopmental outcome of NICU graduates through a multidisciplinary approach. [1,2] In infants with physical, social, adaptive and cognitive developmental delay or having a diagnosed condition with high probability of resulting in developmental delay, early stimulation services need to be initiated. Compensatory mechanisms exist for all cerebral function and this plasticity of brain is encouraged by early stimulation. [3]

There are numerous studies evaluating the outcome of asphyxiated babies, preterm babies, and very and extremely low birth infants. However, there are very few studies that evaluate the outcome of a composite high risk cohort. In India, the neurological sequelae of a composite high risk cohort was evaluated by Chaudhari [4] at 3 years and by Paul [5] and Sukumaran [6] at 1 year, and Baburaj [7] evaluated the growth and development

of graduates from a rural NICU at 1 year. Luo [8] evaluated the mental and motor developmental scales of high risk infants using Gesell Developmental Scale at 6 and 12 months and performed psychometric test using Wechsler Intelligence Scale- Revised (WISCR) for Chinese Children at 6-7 years. Molteno [9] assessed and compared perinatal risk rating, the Dubowitz Neurological Assessment and the Infant Neuromotor Assessment in terms of predicting neurodevelopmental outcome of graduates from the Groote Schuur Hospital (GSH) neonatal intensive care unit (NICU) in South Africa at 1 year. Galbraith [10] described a 10 years' experience of neurodevelopmental outcome of high risk neonates till 1 year in Canada.

With better understanding of physiology and pathology of low birth weight newborns and with the advent of fine technology people looking after such low birth weight newborns became more concerned about the long term outcome. Now tons of stationery is being used for the sole purpose of neurodevelopmental follow up of low birth weight babies. The neonatology has improved by leaps and bounds in last century and it is now becoming synonymous with the care of low birth weight babies. With early intervention programmes, problems of premature and low birth weight babies can be predicted early and natural history can be improved.

The aim of the present study was to determine neurodevelopmental outcome of these babies requiring neonatal intensive care unit (NICU) stay during their initial days at the age of 2 years.

Materials and Methods

The present study was conducted in the Department of Pediatrics, N.M.C.H, Patna, Bihar, India and total duration of study was one year .Retrospective analysis of data of 240 high risk newborns admitted in NICU for more than 48 hours. In this study of 240 babies, 200 babies were followed up for clinical assessment at the age of 2 years. These were contacted and followed up for clinical assessment including motor and neurological function, visiomotor integrative skills, academic achievement, language, executive function, behavioral issues and child behavioral checklist applied. Findings described in simple descriptive manner.

Details regarding birth history, clinical condition, duration of NICU stay, complications and follow up were taken from records. Objective of this study was to determine the neurodevelopmental outcome of these high-risk newborns at the age of 2 years and to determine mortality and morbidities in this group. These were contacted and followed up for clinical assessment including motor and neurological function, visiomotor integrative skills, language, executive function, behavioral issues and child behavioral checklist applied. Parents were given appropriate advice regarding their child. Findings described in simple descriptive manner.

Inclusion Criteria

Records showing complete history, clinical diagnosis, appropriate investigation and management details were included.

Exclusion Criteria

Neonates who had NICU stay for less than 48 hours, without significant problems and those with surgical/chromosomal disorders were excluded.

Statistical package for the social sciences (SPSS) version 20 was used for statistical analysis. Qualitative (categorical) variables were represented by frequency and percentage analysis. The study was conducted after due consideration of all ethical issues.

Results

Table 1: Demographic data

Variables	N (%)
Gender	
Male	96 (48)
Female	104 (52)
Gestation	
<27/6	2 (1)
28-33/6	28 (14)
34-36/6	36 (18)
37-41/6	134 (67)
Birth weight (kg)	
1.1-1.4	24 (12)
1.5-2.4	68 (34)
2.5-4	104 (52)
>4	4 (2)
Number of babies	
Singleton	117

Twins	22
Mode of delivery	
Singleton	168 (84)
Twins	32 (16)
Mode of delivery	
LSCS	88 (44)
NVD	104 (52)
Assisted	4 (2)
NICU duration (days)	
<7	130 (65)
8-14	24 (12)
15-30	22 (11)
>30	24 (12)

In the present study, 48% were male and 52% females. 33% babies were preterm born prior to 37 weeks, 67% were term babies. 46% babies were born low birth weight. 52% were normal vaginal deliveries, 44% were cesarean and 2% were assisted deliveries. 34.5% babies required NICU stay for more than 8 days. 65% required less than 7 days of NICU stay. 12% babies required more than 30 days of NICU stay, 11% required 15-30 days, 12% required 8-14 days.

Table 2: Distribution of behavioral abnormalities

Distribution of behavioral abnormalities	Present N (%)	Absent N (%)
Withdrawn	24 (12)	176 (88)
Aggressive	32 (16)	168 (84)
Autism	4 (2)	196 (98)
Somatic problems	22 (11)	178 (89)
ADHD	40 (20)	160 (80)

17.5% had behavioral issues including excessive anxiety, 12% had withdrawal, 16% had aggressiveness, 20% babies had features of attention deficit hyperactivity disorder and 2% had features related to autism.

Table 3: Complications

Complications	N (%)
Neonatal hypoglycemia	50 (25)
Neonatal seizures	16 (8)
Phototherapy for hyperbilirubinemia	32 (64)
Neonatal sepsis	56 (28)

Immediate complications 25% babies had neonatal hypoglycemia, 8% babies had neonatal seizures, 64% babies required phototherapy for hyperbilirubinemia. 28% had neonatal sepsis requiring antibiotics.

Discussion

Neonatal period is very critical and forms very foundation for the future of the child. It is often associated with many problems including prematurity, neonatal sepsis, congenital anomalies, birth asphyxias, respiratory distress and so on. [11] With the advancement in technology and advances in perinatal care, survival rates of high-risk newborns have improved. Despite the reduction in neonatal mortality, chronic morbidities and adverse outcomes have not declined. These include cerebral palsy, cognitive delay, visual and auditory deficits signifying the need for regular monitoring of growth and development.

In the present study, 48% were male and 52% females. 33% babies were preterm born prior to 37 weeks, 67% were term babies. 46% babies were born low birth weight. 52% were normal vaginal deliveries, 44% were cesarean and 2% were assisted deliveries. 34.5% babies required NICU stay for more than 8 days. 65% required less than 7 days of NICU stay. 12% babies required more than 30 days of NICU stay, 11% required 15-30 days, 12% required 8-14 days. Yau [12] described that body weight, length and head circumference of SGA infants were less than those of AGA infants and this pattern of growth and the changes in body composition had been persistently observed in SGA infants of different gestational-age groups, different clinical status and different body proportionality. Differences between postnatal enteral nutrition and placental nutrition, or different energy utilization, in SGA infants were hypothesized to account for this observation. Advancement in neonatal intensive care has made survival of extreme preterm babies possible but not able to prevent neurodevelopmental abnormalities during childhood. These are the babies who are more prone to have morbidities including hyperactive

airway disease or asthma during childhood, seizure disorders, motor abnormalities, intellectual disabilities but possibility of these morbidities are not restricted to preterm babies.

17.5% had behavioral issues, 12% had withdrawal, 16% had aggressiveness, 20% babies had features of attention deficit hyperactivity disorder and 2% had features related to autism. Godbole [13] also found out easily elicitable items at three and six months of age (inability to achieve social smile at three months and absence of pulling to sit position, transfer of objects and voluntary reach at six months) that predicted adverse neurodevelopmental outcome at one year in high risk babies. This suggests that the results of early developmental assessment are good predictors of long-term outcomes, i.e., the predictive value of the infant developmental scales tests are significant.

Immediate complications 25% babies had neonatal hypoglycemia, 8% babies had neonatal seizures, 64% babies required phototherapy for hyperbilirubinemia. 28% had neonatal sepsis requiring antibiotics. In Luo's [14] study 6.5% had hypoglycemia, but 85.7% of them had mental retardation. Luo [14] described hypoglycaemia, preterm labour, low-birth weight, severe anaemia, polycythemia and hyperbilirubinemia as the risk factors in descending order of importance, associated with lower mental developmental delay. In a study by John Curtis 2002, NICU children had shorter memory span and a study measuring health status and health related quality of life showed poor outcome in NICU graduates. [15,16] Most of previous studies show nearly 15% neurodevelopmental impairment among survivors and particularly in low-birth-weight babies. [17,18] So babies which required intensive care need to follow up for neurodevelopment for early detection and management. [19,20]

Conclusion

Neonatal period is a critical period for proper neurodevelopment, having impact on child development. Babies with difficulties during transition period including prematurity, prolonged requirement for neonatal intensive care, resuscitation, ventilation, birth asphyxia, meconium complicating pregnancy had higher immediate as well as long term morbidities. Long term morbidities included hyperactive airway disease/asthma, seizure disorder, academic problems, motor and gait abnormalities, and behavioural abnormalities in childhood.

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