

Growth and Neurodevelopmental Outcome of High Risk Newborn Infants at Age of 1 Year

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Abstract

Objective: This study was undertaken to know the growth and neurodevelopment outcome of high risk newborn successfully discharged from SNCU till one year of age with well designed follow up.

Method: This prospective study was conducted in sick newborn care unit (SNCU) of department of pediatrics, JLN medical college & hospital ajmer. All neonates admitted and successfully discharged from SNCU during the April 2018 to September 2018 were enrolled for the study and prospectively followed up till one year.

Results: Out of total 1011 neonates successfully discharged, 618(61.1%) infants were followed up to 1 year. Out of 618 infants, 18% infants had weight <3rd percentile, 8.2% infants had length <3rd percentile, 9.7% infants had head circumference <3rd percentile. Overall Growth failure was more in preterms and infants with developmental delay. Increased muscle tone seen in 10.2% infants while developmental delay was present in 13.1% infants. Neonatal hypoglycemia, meningitis and birth asphyxia were found to be major decisive factors associated with developmental delay.

Conclusion: All high risk neonates should be followed up and assessed periodically to identify growth failure and neurodisabilities for early interventions, thereby ensuring that high risk children maximize their potential and become productive and valued members of society.

Keywords: high risk infants, follow up, growth failure, neurodevelopment, early intervention

Introduction

Globally 2.5 million children died in the first month of life in 2018, approximately 1 million dying on first day and close to 1 million dying within the next 6 days (UNICEF 2018)[1]. Of these about 6 lakh are Indian[1]. Currently the average infant mortality rate for india is 33/1000 live births and neonatal mortality rate for india is 24/1000 live birth (SRS-2017)[2].

Numerous studies have shown that despite substantial improvement in the neonatal mortality, the incidence of chronic morbidities like cerebral palsy and adverse outcome among survivors has not declined much[3]. This is also associated with reports of increasingly high incidence of neuro-sensory impairment (blindness and deafness), cognitive, learning disabilities and

behavioral problems like ADHD and depression[4]. Regular follow up, systemic monitoring, timely and appropriate intervention can prevent or modify many of these disabilities.

There is little information about the details of the long term prognosis of infants who are discharged from SNCU in developing countries. Their real progress at home is still unknown, especially in poor-resource settings. Hence the study was initiated with the objective to know the growth and neurodevelopmental outcome of high risk babies till one year of age.

Materials and methods

This prospective study was conducted in sick newborn care unit (SNCU) of department of pediatrics, JLN medical college & hospital, Ajmer from April 2018 onward for 1 year & 6 month.

All neonates admitted and successfully discharged from SNCU during period of April 2018 to September 2018 were enrolled for the study and prospectively followed up till one year.

A regular follow-up in well baby clinic was done for those neonates who were successfully discharged from SNCU and details were recorded on institutional follow up performa as developed by UNICEF for National Health Mission (NHM). It includes five visits in follow up schedule i.e. 8 days, 1 month, 3 months, 6 months, and 1 year from discharge.

Physical growth assessment was done by measuring weight by electronic weighing machine with ± 5 gm accuracy, length by using infantometer and head circumference by non stretchable measuring tape. WHO growth charts were used to assess growth by plotting changes in weight, length and head circumference at 1 months, 3 months, 6 months and 1 year from discharge[5]. For preterm infants data were

recorded on WHO growth charts after 40 weeks of gestational age.

Neurodevelopmental assessment was done by using revised Trivandrum Development Screening Chart (2013) at 6 months and 1 year from discharge[6].

To assess neurologic deficit, tone assessment was done by using Amiel Tison method[7] and accordingly classified as normal or increased tone.

Data were recorded in pre-structured proforma and compiled in master chart. Data entry and statistical analysis was performed with the help of Microsoft Excel and SPSS version 25 (IBM SPSS Statistics inc. Chicago, Illinois, USA). Categorical variables were presented as number and percentage. Chi-square test was used to compare differences in categorical variables and independent t-test, p value < 0.05 (at 95% confidence interval) was considered to indicate statistical significance.

Prior approval for the study was taken from institutional ethical committee. Informed consent was taken from mothers.

Results

A total of 1011 neonates discharged from SNCU were included in this study, 618(61.1%) infants were followed up to 1 year, 348(34.4%) infants were lost to follow up and 45(4.4%) infants died during follow up (Table 1).

Table 1

S. N.	Follow up schedule	No.	%	Deaths during follow up
1.	8 th day	795	78.6	0
2.	1st month	783	77.4	33
3.	3rd month	762	75.4	3
4.	6th month	720	71.2	3
5.	1 year	618	61.1	6

Assessment of Growth

Out of 618 infants followed up to 1 year, 82% infants had normal weight while 18% infants had weight <3rd

percentile at age of 1 year. Among infants with weight <3rd percentile, 66% were preterms and 34% were terms. (Table 2)

Table 2: Weight of infants during follow up at 1 year (n=618)

Weight	No.	%	Term		Preterm	
			No.	%	No.	%
Normal	507	82.0	457	90.1	50	9.9
<3 rd percentile	111	18.0	38	34.0	73	66.0

Out of 618 infants followed up to 1 year, 91.8% infants had normal length while 8.2% infants had length <3rd percentile at age of 1 year. Among infants with length <3rd percentile, 58.8% were preterms and 41.2% were terms. (Table 3)

Table 3: Length of infants during follow up at 1 year (n=618)

Length	No.	%	Term		Preterm	
			No.	%	No.	%
Normal	567	91.8	474	83.6	93	16.4
<3 rd percentile	51	8.2	21	41.2	30	58.8

Out of 618 infants followed up to 1 year, 90.3% infants had normal head circumference while 9.7% infants had head circumference <3rd percentile at age of 1 year. Among infants with head circumference <3rd percentile, 53% were terms and 47% were preterms. (Table 4)

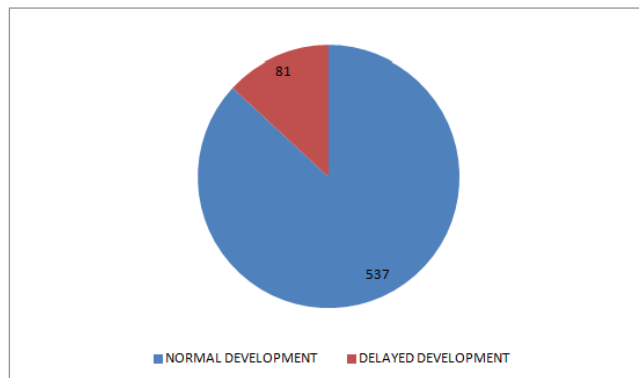
Table 4: Head circumference of infants during follow up at 1 year (n=618)

Head circumference	No.	%	Term		Preterm	
			No.	%	No.	%
Normal	558	90.3	463	83.0	95	17.0
<3 rd percentile	60	9.7	32	53.0	28	47.0

Neuro-Developmental Assessment

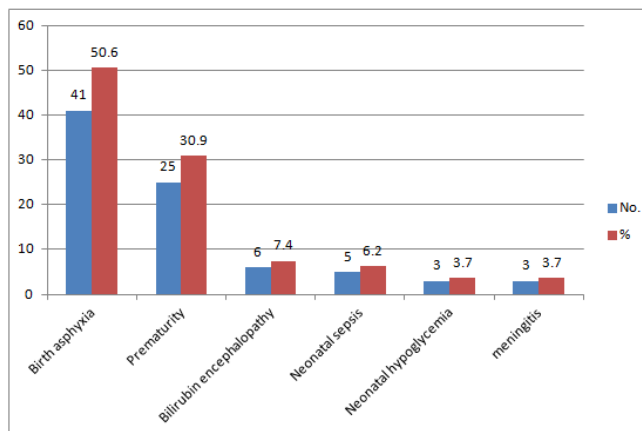
13.1% (81) infants had developmental delay while 86.9% (537) infants had normal development at 1 year of age. (Figure 1)

Figure 1: Developmental screening of infants during follow up at 1 year (n=618)



Among infants with developmental delay, causes of NICU admission were – Birth asphyxia(50.6%), Prematurity(30.9%), Bilirubin encephalopathy(7.4%), Neonatal sepsis(6.2%), Neonatal hypoglycaemia(3.7%), and Meningitis(3.7%). (Figure 2)

Figure 2: Disease profile of infants with developmental delay (n=81)



Neonatal hypoglycaemia, Meningitis and Birth asphyxia were found to be major decisive factors associated with developmental delay. (Table 5)

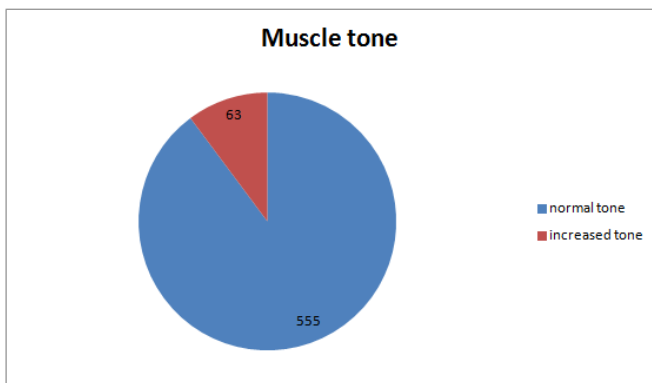
Table 5: Distribution of neonates according to disease profile leading to developmental delay.

Cause of SNCU admission	Total No.	Developmental delay	%
Birth asphyxia	195	41	21.0
Prematurity	426	25	5.9
Neonatal jaundice	141	6	4.2

Neonatal sepsis	174	5	2.9
Neonatal hypoglycaemia	9	3	33.3
Meningitis	9	3	33.3

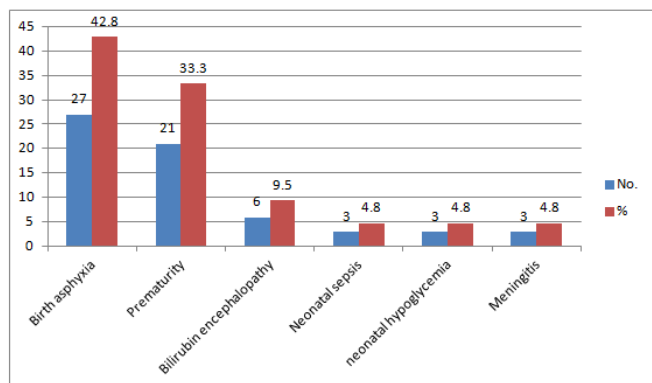
10.2% (63) infants had increased muscle tone while 89.8% (555) infants had normal muscle tone at 1 year of age. (Figure 3)

Figure 3: Muscle Tone of infants during follow up at 1 year(n=618)



Among infants with increased muscle tone, causes of NICU admission were – Birth asphyxia(42.8%), Prematurity(33.3%), Bilirubin encephalopathy(9.5%), Neonatal sepsis(4.8%), Neonatal hypoglycaemia (4.8%), and Meningitis(4.8%). (Figure 4)

Figure 4: Disease profile of infants with increased muscle tone (n=63)



Neonatal hypoglycaemia, Meningitis and Birth asphyxia were found to be major decisive factors associated with increased muscle tone. (Table 6)

Table 6: Distribution of neonates according to disease profile leading to hypertonia.

Cause of SNCU admission	Total No.	Hypertonia	%
Birth asphyxia	195	27	13.8
Prematurity	426	21	4.9
Neonatal jaundice	141	6	4.2
Neonatal sepsis	174	3	1.7
Neonatal hypoglycaemia	9	3	33.3
Meningitis	9	3	33.3

Discussion

A total of 1011 neonates were followed up. Out of these 618 infants(61.2%) were followed up to 1 year, 348 infants(34.4%) were lost to follow up and 45 infants(4.4%) died during follow up.

In the growth assessment of infants during follow up at the age of 1 year, out of 618 infants 111 infants (18%) had weight < 3rd percentile, 51 infants (8.2%) had length <3rd percentile and 60 infants (9.7%) had head circumference <3rd percentile. Growth failure was more prevalent in preterms. Out of all Infants with <3rd percentile weight, 73(66%) were preterms and 38(34%) were fullterms. Infants with <3rd percentile length, 30(58.8%) were preterms and 21(41.2%) were fullterms. Study by Modi M et al[8], Westerberg A C et al[9] and Boo NY[10] et al also established that chances of postnatal growth failure were more in preterm infants. Other factors associated with growth failure in infants were faulty feeding, developmental delay, comorbidities like recurrent gastroenteritis and respiratory illnesses, cerebral palsy, seizure disorder, congenital heart disease etc. Infants with <3rd percentile head circumference, 28(47%) were preterms and 32(53%) were fullterms. Study by I cordes et al[11] finds that birth asphyxia in full term newborn is associated with microcephaly in later life.

Developmental delay was present in 81(13.1%) infants at 1 year of age. Out of these 81 infants, initial causes of NICU admission were – 41(50.6%) Birth asphyxia,

25(30.9%) Prematurity, 6(7.4%) Bilirubin encephalopathy(7.4%), 5(6.2%) Neonatal Sepsis, 3(3.7%) Neonatal hypoglycemia and 3(3.7%) Meningitis. The chances of developmental delay in post natal period were more in infants with neonatal hypoglycemia(33.3%), meningitis(33.3%) and birth asphyxia(21%). The incidence of developmental disability in NICU survivor was described to be 10-20% by Budden et al[12], 15% by Paul et al[13], 15.6% by Sukumaran et al[14] and 22% by Das S et al[15].

This study revealed that at the age of 1 year 63(10.2%) infants had increased muscle tone (hypertonia) and 555(89.8%) infants had normal muscle tone. Initial causes of admission in NICU of Infants with increased muscle tone were – Birth asphyxia (42.8%), Prematurity(33.3%), Bilirubin encephalopathy(9.5%), Neonatal sepsis(4.8%), Neonatal hypoglycemia(4.8%) and Meningitis(4.8%). While the chances of developing muscle tone abnormality in post natal period were more in infants with neonatal hypoglycemia(33.3%), meningitis(33.3%) and birth asphyxia(13.8%). Study by Baburaj et al[16] found tone abnormalities in 8.5% infants while higher prevalence of tone abnormalities were found in study by Das S et al[15] 37.4% and Choudhari S et al[17] 35.2%.

This study revealed that neonatal hypoglycemia, meningitis and birth asphyxia were most decisive factors of adverse neurodevelopmental outcome later on in life. Study by Das et al[15] found that out of total neonates admitted with birth asphyxia, 23% have developmental delay and out of total neonates admitted with hypoglycemia, 46.67% have developmental delay later on in life. In Luo YF et al[18] study 6.5% neonates were admitted with hypoglycemia and 85.7% of them had mental retardation. Study by Kumar M et

al[19] found that neonates admitted with pyogenic meningitis, 14.6% infants had developmental delay.

Conclusion

This study gives insight that all high risk neonates should be followed up and assessed periodically to identify growth failure and neurodisabilities for early interventions, thereby ensuring that high risk children maximize their potential and become productive and valued members of society.

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