

Original Research Article

Growth and neurodevelopmental outcome of high risk premature neonates at 1 year in a tertiary level NICU of central India

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ABSTRACT

Background: To study the outcome of growth and development till one year of age of very preterm neonates and moderate to late preterm admitted and discharged from a tertiary level NICU in central India.

Methods: 120 preterm babies admitted and discharged from NICU were enrolled consecutively. Out of them 82 were followed up for a period of 1 year. Physical parameter like weight, length and head circumference were recorded on admission and at 1, 3, 6 and 12 months of corrected gestational age. Developmental assessment was done at 12 months of corrected gestational age by DASII (developmental assessment scale for Indian infants).

Results: Among the 82 enrolled subjects 28 were very preterm (28-<32 weeks) and 54 were moderate to late preterm (32-<37 weeks). Overall growth (all the anthropometric parameters) was higher in the moderate to late preterm group. In very preterm babies weight gain was better from 6-12 months of postnatal age and was statistically significant ($p<0.005$). Length gain was higher in very premature babies group but not statistically significant and head growth was significantly higher in very preterm babies from 1 month to 1 year compared to moderate to late preterm babies ($p<0.05$). Neurodevelopmental delay was seen in 28% ($n=23$) of the study group at 1 year, 65.2% ($n=15$) were very preterm babies. Associated risk factors were RDS, hypoglycemia, NEC and sepsis. Developmental quotient was lower in very preterm (66.45) compared to moderate preterm babies (79.86).

Conclusions: Prematurity and its associated complications are linked to adverse physical and neurodevelopmental outcomes. Improved perinatal care, early assessment of development by appropriate tools and early intervention is a must to improve the outcome of these babies.

Keywords: Moderate to late preterm, Neurodevelopmental delay, Very preterm

INTRODUCTION

Prematurity is defined as gestational age of less than 37 completed weeks. It is further categorized by WHO into extremely premature (< 28 wks.), very premature (28-<32 wks.) and moderate to late preterm (32-<37 wks.).¹ These infants are anatomically and functionally immature and their mortality is high. Progresses in neonatology have eventuated in heightened survival of premature babies. While these medical success stories bring to light the strength of medical technology to rescue numerous tiniest

infants at birth, serious questions prevail about their growth and development and whether they will lead normal, productive lives. Studies have demonstrated higher rates of both major developmental handicaps such as cerebral palsy, mental retardation, blindness and deafness, and less severe developmental handicaps such as learning disabilities and attention deficits, in children born preterm.²⁻⁴ On reviewing the literature, studies pertaining to the mortality and morbidity of neonates in their follow up is predominantly based on the birth weight of the baby and this an attempt to study the

growth and development of the preterm babies based on their gestational age.

METHODS

Preterm babies admitted and discharged from a tertiary level NICU from March 2015 to July 2015 were enrolled consecutively and prospectively followed till one year corrected gestational age. Gross congenital malformation, drop outs and those not giving consent for the study were excluded from the study.

This study was approved by the institutional ethical Committee. Parental informed consent was obtained at the time of enrolment. Gestational age was recorded as per obstetrical estimates based on first trimester ultrasonography or if not available, by date of last menstrual period. Weight was taken on admission, on electronic weighing scale accurate to ± 10 gram, with baby being unclothed.

Length was measured using an infantometer and head circumference (HC) by a non-stretchable tape using standard techniques. Subsequently, measurements were repeated at discharge and then at 1, 3, 6, and 12 months of corrected age. Development was assessed at each follow up, DASII (developmental assessment scale for Indian infants) was used at 12 months of corrected gestational age. DASII is Indian modification of the Bayley developmental scales consisting of the motor and

the mental scales. Motor scale assesses control of gross and fine motor muscle groups. Mental scale assesses cognitive, personal and social skills development. Motor, mental and combined quotients were calculated using the revised Baroda norms.⁵ To improve follow up, periodic reminders were sent to parents through telephonic calls. Standard treatment was provided to the babies and appropriately intervened in the follow up whenever required.

The data of the study were analyzed using the software MS excel and SPSS 18 for windows, appropriate univariate and bivariate analysis were carried out using t test and chi-square (χ^2) test for categorical variables. The critical levels of significance of the results were considered at 0.05 levels.

RESULTS

Total 120 babies were enrolled in the study, 17 died, 23 lost to follow up and 82 were followed up for 1 year corrected gestational age. Out of 82 babies, 28 were very preterm (28-<32 wks.) and 54 were moderate to late preterm (32-<37 wks.). 43 babies were male and 39 were female. The mean weight, length and head circumference of the overall study group at 1 year corrected age was 7.37 kg, 71.28 cm and 44.04 cm respectively.

The mean weight, length and head circumference of the study group (corrected age wise) are depicted in Table 1.

Table 1: Anthropometric parameters of the study group.

Age	Weight (in kg)		Length (in cm)		Hc (in cm)	
	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2
	Mean wt.(SD)		Mean length (SD)		Mean HC (SD)	
Admission	1.35(0.20)	1.74 (0.24)	39.91 (3.01)	44.42 (2.69)	28.71 (1.79)	31.16 (1.62)
1 month	1.76 (0.31)	2.20 (0.34)	44.09 (2.29)	47.81 (2.55)	29.99 (2.10)	32.99 (1.90)
3 months	2.73 (0.59)	3.62 (0.66)	50.60 (2.49)	54.60 (2.34)	34.21 (2.03)	36.77 (1.60)
6 months	4.50 (0.72)	5.63 (0.69)	59.00 (2.64)	61.85 (9.64)	38.78 (1.71)	40.66 (1.39)
12 months	6.79 (0.62)	7.68 (0.65)	69.49 (2.04)	72.21 (1.83)	43.11 (1.77)	44.53 (1.20)

Group 1- very preterm Group 2- moderate to late preterm

All the three anthropometric parameters were higher in the moderate to late preterm group from admission till 1 year of corrected age. The rate of gain in weight, height and head circumference were calculated in the above groups. This is depicted in the graphs 1, 2 and 3 respectively. The weight gain was higher in the moderate to late preterm babies from discharge till 6 months of age. The very preterm babies had significant catch up in weight from 6- 12 months of age ($p<0.005$) with higher weight gain velocity. The catch up in length was significant only during the 1st month in the very preterm babies when compared to the moderate to late preterm babies. It was observed that the head growth velocity was

higher from 1 month till 1 year of age in very preterm babies which was statistically significant ($p<0.05$) in comparison to their older counterparts but still lagged behind them at 1 year of corrected age.

The developmental indices of the study group are depicted in Table 2. The mean DQ of very preterm babies at 1 year of corrected age was 66.45 and moderate to late preterm was 79.86.

The overall DQ of the study group was 75.28 with motor DQ and mental DQ being 74.84 and 75.72 respectively. In our study, developmental delay was seen in 28%

(n=23) of the preterm babies (with mean DQ <70). Out of the 28 very preterm babies, developmental delay was seen in 15 (53.6%) babies and among the 54 moderates to late preterm babies, 8 (14.8%) had developmental delay. Out of 27 VLBW babies, 16 had developmental delay and 7 out of 55 LBW babies had delay.

Developmental delay was seen in 83.3% of babies who had hypoglycemia, hyaline membrane disease (76.9%), NEC (57.1%) and sepsis (41.6%) and is depicted in Table 3.

Table 2: Developmental quotients by DASII at 12 months' chronological age.

GA	Motor DQ (SD)	Mental DQ (SD)	Mean DQ (SD)
Very preterm	64.82 (12.12)	68.07 (14.51)	66.45 (13.02)
Mod to late preterm	80.04 (9.34)	79.68 (9.67)	79.86 (9.29)
Total	74.84 (11.95)	75.72 (13.26)	75.28 (12.39)

DQ=developmental quotient

Table 3: Developmental delay in various groups.

	Development delay (n=23)	Normal development (n=59)	P value
Very preterm (n=28)	15(53.6%)	13 (46.4%)	<0.001
Moderate-late preterm (n=54)	8 (14.8%)	46 (85.2%)	
VLBW (n=27)	16 (59.3%)	11 (40.7%)	<0.001
LBW (n=55)	7 (14.5%)	48 (85.5%)	
Hypoglycemia(n=6)*	5 (83.3%)	1 (16.7%)	0.001
HMD (n=13)*#	10 (76.9%)	3 (23.1%)	<0.001
NEC (n=7)*	4 (57.1%)	3 (42.9%)	0.073
Sepsis (n=36)*\$	15 (41.6%)	21 (58.4%)	0.015

* Risk factors were present during the admission in NICU. 1 or more risk factors were associated with the neonate. # HMD diagnosed postnatally on chest X-ray. \$ sepsis was considered positive in babies who had positive sepsis screen or culture proven sepsis.

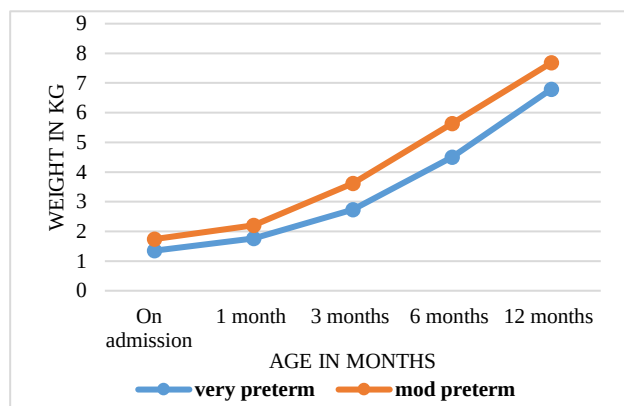


Figure 1: Comparison of increase in weight in the two groups.

DISCUSSION

Numerous studies from developed and developing countries have shown increasing adverse long-term outcome in these high-risk neonates, despite substantial improvements in neonatal care and mortality.

Many of these neonates tend to have higher incidence of growth failure, ongoing medical illnesses and poor cognitive performance in later age.

Our study anthropometric parameter correlated well with the study of Baburaj et al at 1 year of age.⁶ Birth length in

our group was slightly higher, may be due presence of higher number of moderate to late preterm.

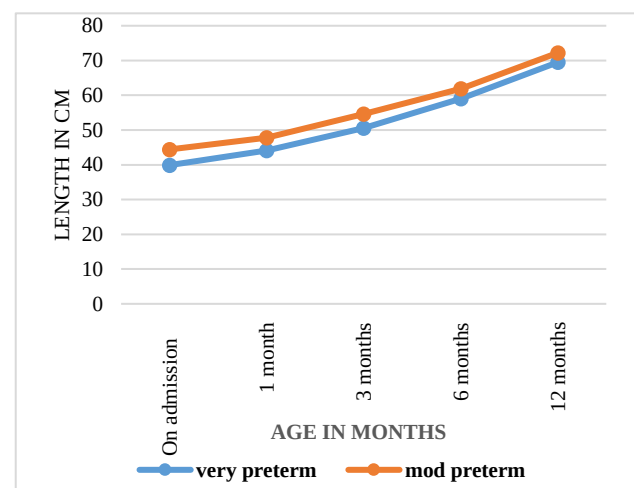


Figure 2: Comparison of increase in length in the two groups.

In another study by Das et al, weight at birth, 1 month and 3-month was slightly higher than our study.⁷ In present study, very preterm had significant lag in growth of all physical parameters at 1 year of age. This corroborated well with studies of Baburaj et al, Sridhar et al, C M Drillien and Babson who had similar observations.^{6,8-10}

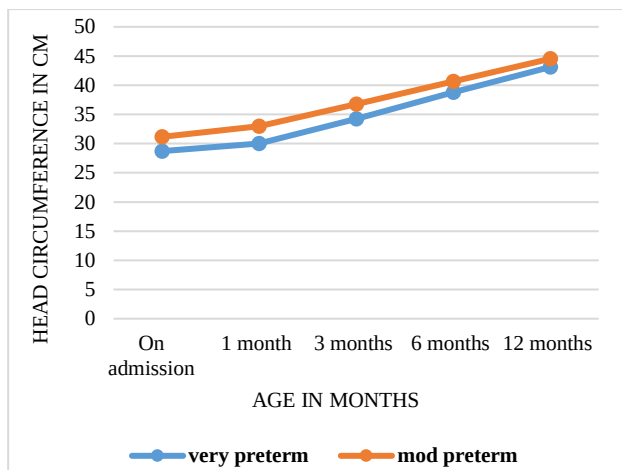


Figure 3: Comparison of increase in head circumference in two groups.

The very preterm babies had significant ($p < 0.05$) increase in weight compared to moderate preterm in the latter half of the year but could not catch up to the final weight.

Head circumference increased rapidly in very preterm ($p < 0.05$) compared to moderate to late preterm which correlated well with literature (Baburaj et al, Sridhar et al, and Babson) which states that the most premature babies had significantly faster head growth.^{6,8,10}

Length velocity was not statistically significant between the two groups which were also inferred by Babson in his study.¹⁰

In our study at 1 year corrected age, DASII was used to assess the development of child and delay was found in 28 % ($n=23$) of the study group (having either motor or mental DQ of less than 70). Modi et al found 45.7% delay in the premature babies group, Baburaj et al reported 6.9% at 8 months and none at 1 year of age, Paul V K et al found 15% delay in the high-risk group of infants at 1 year of age.^{11,6,12}

There seems to be a wide range of developmental delay among various studies. In our study, there were no extreme premature and ELBW babies when compared to Modi et al who had higher developmental delay.¹¹ The preterm study sample was smaller in Baburaj et al study in comparison to our study.⁶

The developmental delay was higher in very preterm (53.6%) and VLBW (59.3%) group which was similar to studies of Chaudhari et al and Khan et al and was statistically significant.^{13,14}

In our study, the motor DQ was 74.8 ± 14.11 , mental DQ was 75.72 ± 11.27 and mean DQ 75.28 ± 12.29 . Developmental quotients observed in our study was lower than most of the other studies.^{9,14} Mukhyopadhyay study also had similar quotients.¹⁵ It may have been due to various reasons, ours being the tertiary referral center,

inclusion of only NICU admitted preterm infants, tendency to loss to follow up of healthier babies in our center and scarcity of proper neurorehabilitation.

Mean DQ by DASII of very preterm was 66.45 and 77.79 in moderate to late preterm which correlated well with other studies indicating the impact of gestational age. Neonates who had risk factors like RDS, hypoglycemia, NEC, shock had more developmental delay compared to low risk babies.¹³

CONCLUSION

In the present study, we concluded that the very preterm babies showed considerable lag in growth and development at 1 year of age when compared to their older counterparts.

Since the very preterm babies showed catch up growth around the middle and later part of the year, efforts to improve the longer follow up of these babies, nutritional status and adequately stimulating environment will help in optimizing the growth outcome of these babies.

Incidence of neurodevelopmental delay was significantly high with lower gestational ages and associated risk factors.

Most developmental delays go undetected in the early years of life. Improved perinatal care, early assessment of development by appropriate tools, emphasizing the parent's involvement and early intervention at the grass root level will bring down the incidence of developmental challenges in this vulnerable group.

Studies based on gestational age are scarce, most studies are based on the birth weight of the neonates. Longer follow up study based on the gestational age are required to have a better outlook in these babies.

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