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Original Research Article

Anthropometric outcome of extremely low birth weight and very low birth weight newborn at 12 months of corrected age associated with prenatal risk factors

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ABSTRACT

Background: Advancement of skill, technology and perinatal medicine has led to improve survival of low birth weight babies during the last few decades but they have reported high incidence of growth failure during infancy and early childhood. The objective of the study was to find out the influence of perinatal risk factors on anthropometric outcome.
Methods: A prospective cohort study conducted on 143 ELBW and VLBW babies admitted in Sick Newborn Care Unit (SNCU and PICU) of North Bengal Medical College and Hospital (NBMC), Darjeeling, West Bengal from 2016 to 2017 and discharged babies were followed up.
Results: Total 143 neonates were studied at NBMC among male 82(57.3%) and female 61(42.7%), 95 were AGA and 48 were SGA babies. Significant positive correlations were found among birth weight, gestational age, perinatal infection ($p<0.001$). The mean weight for age (Mean±SD) was 7.615±1.1092 kg with median 7.8 kg. The mean length for age (Mean±SD) was 72.6±3.74 cm with median 73 cm. The mean head circumference for age (Mean±SD) was 42.5±2.12 cm median 43 cm. Adverse neonatal outcome associated with CRIB II score ≥10. Total CRIB II score with parameters of growth (<-2 Z score) like weight for age, length for age, weight for length and head circumference for age shows significant correlation ($p<0.001$).
Conclusions: Perinatal risk factors are important determinant for future anthropometric outcome in very low and extremely low birth weight babies. They should be identified, and appropriate measures should be taken to achieve good outcome.

Keywords: Anthropometric outcome, Corrected gestational age, CRIB II, Growth parameters Perinatal risk Very low and extremely low birth weight baby factors II score

INTRODUCTION

More than 20 million infants worldwide representing 15.5 per cent of all births are born with low birth weight, 95.6 per cent of them in developing countries. The preterm infants have greater growth velocity than full term SGA. On the other hand growth retarded babies had slightly faster growth rates in first three months in compare to preterm AGA babies. Thereafter the growth slowed down in SFD babies and by the 18 to 24 months SFD babies were significantly lighter compare to preterm AGA babies. Preterm infants are at risk for a wide range of growth problems. There is a considerable controversy on which growth charts to use for monitoring of growth.

Several growth charts like Lubchenco and Battaglia growth charts Fenton growth charts and Olsen (2010) growth curve were used but Serial measurement of weight, head circumference and length plotted on growth curve provide valuable information in the growth assessment of the preterm infant. When an infant is full term corrected gestational age, the WHO growth curve is to be used for monitoring of growth. Infants should be plotted by corrected age and followed for catch up growth.[1-4] Several prenatal risk factors like gestational age, sex, birth weight, multiple gestation, perinatal infection, birth asphyxia, and clinical risk index for babies score-II (CRIBS II) have adverse anthropometric outcomes of very premature infants. CRIB II scoring system has five variables: (i) Birth weight (ii) Gestational age (iii) Base deficit (iv) Temperature on admission and (v) Sex. It is a risk index for newborn weighing less than 1500 grams. The score is divided according to gender and weight are compared with gestational age .The range of score for weight compared with gestational age in male is 0-15 and in female is 0-14 and for temperature the score is 0-5 and for base excess 0-7. At the end the scores are totaled. Better prognosis with lower scores attained the best favorable results with score of one

METHODS

Settings and design

A Prospective cohort study among 143 VLBW and ELBW babies admitted at SNCU & PICU at North Bengal Medical College & Hospital, Darjeeling, West Bengal from 2016 to 2017 and discharged babies were followed up.

Inclusion criteria

All preterm newborn of both sexes admitted in SNCU & PICU between 23 to 32 weeks of gestational age and birth weight <1500 grams.

Exclusion criteria

All preterm newborn less than 23 weeks of gestation, Birth weight <500 grams, Gross congenital malformation, genetic disorder, delivery room death and inborn error of metabolism.

Study tools

The study was conducted by using Measuring tape, infantometer, digital weighing scale, CDC and WHO standard growth chart, Proforma, SPSS V 20, statistical software and analyze-it in MS excel ultimate edition.

Data collection

1. Newborn data

- Gestational age.
- Gender and Birth weight by digital weighing scale.
- Blood analysis including base excess and temperature (Celsius) on admission.

2. Anthropometric assessment like weight, length, head circumference, chest circumference by using WHO growth chart/fetal-infant growth chart/CDC growth chart accordingly.

Anthropometric assessment on follow up of discharged babies at 1st, 3rd, 6th, 9th, 12th months.

The final CRIB II score (ranged from 0 to 27) was obtained by the arithmetic sum of the individual scores: (i) Birth weight (ii) Gestational age (iii) Base deficit (iv) Temperature on admission and (v) Sex. The scores were further classified into four levels as follows; Level 1: 0 to 5, Level 2: 6 to 10, Level 3:11 to 15, Level 4 above 155.

Very low birth weight (VLBW): Less than 1,500 gm (up to and including 1,499 gm).

Extremely LBW (ELBW): Less than 1,000 gm (up to and including 999 gm).

Small for gestational age (SGA): birth weight more than 2SD below the mean or less than the 10th percentile of a population specific weight versus gestational age plot.

Statistical analysis

Independent t test, Pearson correlation and chi-square test were used to analyze the data. All tests were tailed with p value <0.05 as significant and performed by SPSS v 20, Chicago.

RESULTS

Total 143 babies were studied, 82(57.3%) were males and 61(42.7%) were females. Survivors representation were 105 (73.4%) while non-survivors' representation were 38 (26.6%), 95 were AGA and 48 were SGA babies (Table 1).

Birth weight ranged from 500 to 1500grams with mean was 1199.6±244.14 and the median was 1240 gm (Table 1).

The mean gestational age (Mean±SD) was 29.65±2.032 weeks with range 24-32 weeks and the median was 30 weeks (Table 1).

28 (19.6%) had PIH, 39 (27.3%) had multiple gestation, 18 (12.6%) had perinatal infection and 25 (17.5%) had birth asphyxia (Table 1).

Significant positive correlations were found among birth weight, gestational age, perinatal infection, ($p<0.001$).

The mean weight for age (Mean±SD) was 7.615±1.1092 kg with range 5.0-11 kg and the median was 7.8 kg (Figure 1).

Table 1: Clinical Profile of the study sample including perinatal risk factors.

Characteristic	Result n= 143	
	No of Cases	Percentage
Birth weight (gms)		
500-1000	34	23.8%
1000-1500	109	76.2%
Gestation		
24-≤28 weeks	37	25.9%
>28-≤32 weeks	106	74.1%
Intrauterine growth category		
Appropriate for gestational age (AGA)	95	66.4%
Small for gestational age (SGA)	48	33.6%
Sex		
Male	82	57.3%
Female	61	42.7%
Pregnancy induced hypertension	28	19.6%
Multiple gestation	39	27.3%
Infection or sepsis	18	12.6%
Birth asphyxia	25	17.5%

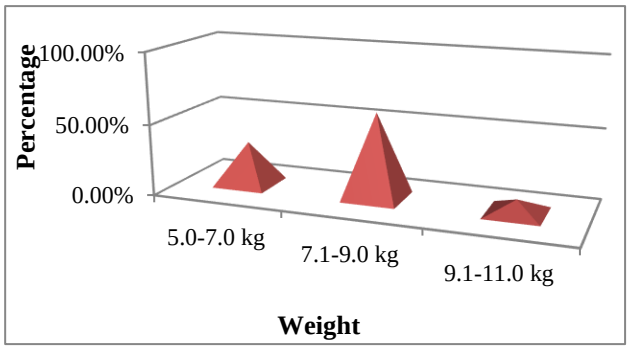

Figure 1: Frequency distribution of cases according to weight at 1 year of age.

The mean length for age (Mean±SD) was 72.6±3.74 cm with range 64.0-79.5 cm and the median was 73 cm (Figure 2).

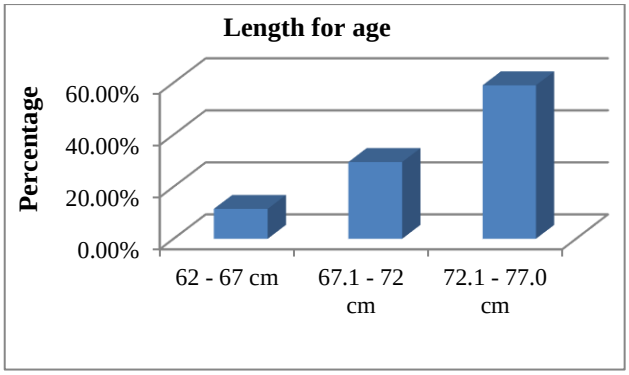

Figure 2: Frequency distribution of cases according to length for age at 1 year of age.

The mean head circumference for age (Mean±SD) was 42.5±2.12 cm with range 37.0-45.0 cm and the median was 43 cm (Figure 3).

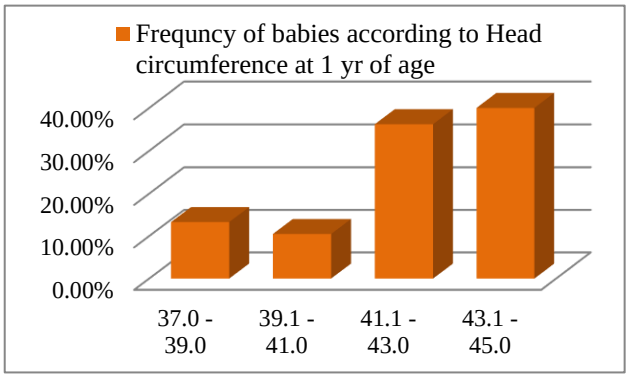

Figure 3: Frequency distribution of babies according to head circumference at 1 year of age.

The mean total CRIB II score (Mean± SD) was 8.021±3.883 with range 3-18 and the median was 7 and as the total score increases neonatal outcome become poor (p <0.001). Adverse neonatal outcome associated with CRIB II score ≥ 10. Total CRIB II score with parameters of growth like weight for age (<-2 Z score, p<0.001), length for age (<-2 Z score, p<0.001), weight for length (<-2 Z score, p<0.001) and head circumference for age (<-2 Z score, p<0.001) shows significant correlation (Table 2 and 3).

Table 2: Sample distribution according to CRIB II score and outcome.

CRIB II Score Level	sample distribution according to total score		Outcomes				p value
			Discharged(N= 105)		Expired (N=38)		
Level I (0-5)	52	36.4%	52	49.5%	0	0	< 0.001
Level II (6-10)	56	39.2%	53	50.5%	3	7.9%	
Level III (11-15)	27	18.9%	0	0	27	71.1%	
Level IV (>15)	8	5.5%	0	0	8	21.1%	

The Frequency distribution of Growth outcome among surviving infant were as follows (n=105): underweight (weight for age < -2 Z score) were 27 (25.7%), stunting (length for age < -2 Z score) were 36 (34.3%), wasting (weight for length <-2 Z score) were27 (25.7%), microcephaly were 26 (24.8%) respectively (Figure 4).

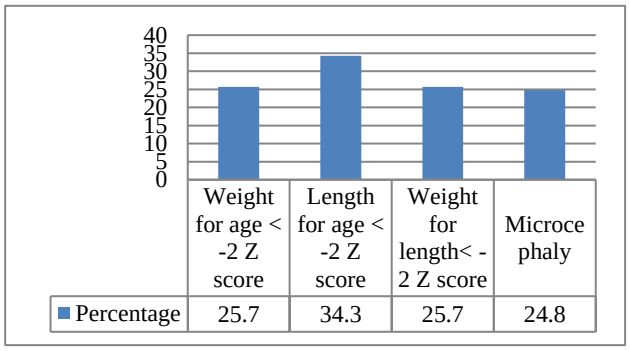

Figure 4: Frequency distribution of babies according to growth outcome.

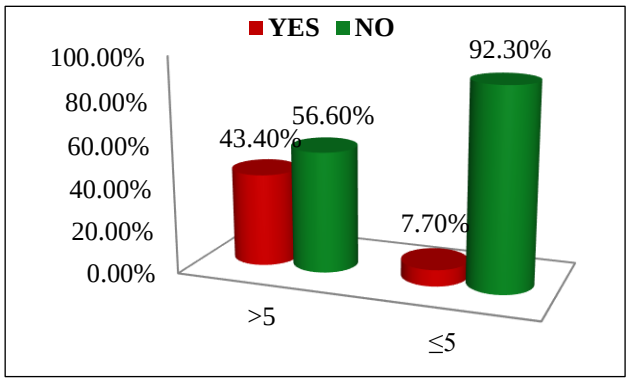

Figure 5: Total score vs weight for length (<-2 Z score): percentage of cases in each group.

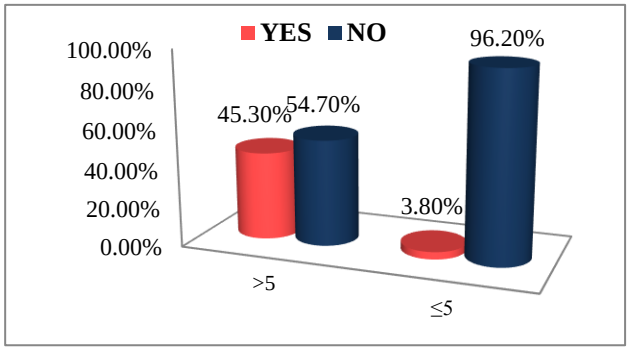

Figure 6: Total score vs head circumference for age (<-2 Z score): percentage of cases in each group.

The Chi-square (χ^2) test revealed significant association between total score and weight for length (<-2 Z score) and head circumference for age (<-2 Z score) with p value<0.01. The risk of weight for length (<-2 Z score) and circumference for age (<-2 Z score) were more for total score >5 as compared to total score ≤5 (Figure 5 and 6).

Table 4: Growth outcome comparison among surviving children based on gender.

Growth outcome		Gender				p value
		F (n=44)		M (n=61)		
Length for age (<-2 Z score)	N	30	68.2%	39	63.9%	0.040
	Y	14	31.8%	22	36.1%	
Weight for length (<-2 Z score)	N	31	70.1%	47	77.1%	0.296
	Y	13	28.9%	14	622.9%	
Head circumference for-age (<-2 Z Score)	N	31	70.1%	48	78.7%	0.231
	Y	13	28.9%	13	27.3%	

Table 5: Pearson Correlation between intra uterine growth condition and long-term growth outcome (N=105).

Growth parameters	Pearson Correlation	Intrauterine growth condition
Weight (in kg)	Pearson Correlation	-0.365**
	Sig. (2-tailed)	0.000
Length (cm)	Pearson Correlation	-0.435**
	Sig. (2-tailed)	.000
Head circumference (cm)	Pearson Correlation	-0.398**
	Sig. (2-tailed)	0.000
Weight for age (<-2 Z Score)	Pearson Correlation	-0.436**
	Sig. (2-tailed)	0.000
Length for age (<-2 Z score)	Pearson Correlation	-0.398**
	Sig. (2-tailed)	0.000
Weight for length (<-2 Z Score)	Pearson Correlation	-0.456**
	Sig. (2-tailed)	0.000
Head circumference for-age (<-2 Z score)	Pearson Correlation	-0.456**
	Sig. (2-tailed)	0.000

Growth outcome comparison between surviving children based on gender did not show statistically significant difference: stunting, wasting, microcephaly in case of female child is 31.8%, 28.9%, 28.9% and in male child the percentage is about 36.1%, 22.9%, 27.3% respectively (Table 4).

Pearson Correlation revealed growth parameters were negatively correlated with intrauterine growth condition.

That is as there is increase in appropriate for gestational age there is decrease in the chances of adverse growth outcome (Table 5).

Chi-square (χ^2) test and Independent t test showed positive correlation between intrauterine growth condition i.e. AGA and SGA babies with growth outcome ($p < 0.05$) (Table 6 and 7).

Table 6: Intrauterine growth condition and growth outcome correlation by Chi-square (x^2) test.

Growth parameters		Intrauterine growth Condition n=105				p value
		AGA n=81		SGA n=24		
Weight for age (<-2 Z score)	Yes	12	14.8%	15	62.5%	< 0.001
	No	69	85.2%	9	37.5%	
Length for age (<-2 Z score)	Yes	20	24.7%	16	66.7%	< 0.001
	No	61	75.3%	8	33.3%	
Weight for length (<-2 Z score)	Yes	12	14.8%	15	62.5%	< 0.001
	No	69	85.2%	9	37.5%	
Head circumference for-age (<-2 Z score)	Yes	12	14.8%	14	58.3%	< 0.001
	No	69	85.2%	10	41.7%	

Table 7: Independent t test shows comparison of growth parameters with intrauterine growth condition.

Independent t test for comparison of growth parameters with Intrauterine growth condition				
Intrauterine growth Condition		Weight (kg)	Length (cm)	Head circumference (cm)
AGA N=81	Mean	7.84	73.4	42.92
	Median	7.8	74.00	43.00
	Std. Deviation	0.98	3.4	1.87
	Minimum	5.5	65.0	37.0
	Maximum	11.0	80.0	45.0
SGA N=24	Mean	6.81	69.00	41.0
	Median	6.55	69.00	40.5
	Std. Deviation	1.18	3.2	2.34
	Minimum	5.5	62.0	37.0
	Maximum	10.0	76.0	45.0
P value		<0.001	<0.001	< 0.001

The comparison contribution of different perinatal factors like intrauterine growth condition, PIH, multiple gestation, infection, birth asphyxia with gender revealed statistically insignificant with p value >0 .05 (Table 8).

Table 8: Influence and comparison of different perinatal factors with gender.

Precipitating causes		Gender				p value
		Females (n=61)		Males (n=82)		
Intrauterine growth Condition	AGA	41	67.2%	54	65.9%	0.812
	SGA	20	32.8%	28	34.1%	
PIH	N	50	82%	65	79.3%	0.587
	Y	11	18%	17	20.7%	
Multiple gestation	N	47	77%	57	69.5%	0.610
	Y	14	23%	25	30.5%	
Infection	N	58	95.0%	79	96.3%	0.613
	Y	3	4.9%	3	3.6%	
Birth asphyxia	N	50	81.9%	68	82.9%	0.640
	Y	11	18.1%	14	17.1%	

DISCUSSION

Male premature are more than female and has higher susceptibility of mortality.[6] In our study, authors find male to female cases were 1.3:1 respectively, with higher mortality in males. For good quality of newborn care simple but useful method of risk-adjustment approach is important.[7] authors find positive associations between the birth weight, gestational age, temperature, base excess and the mortality. Low gestational age and birth weight are associated with higher mortality ($p < 0.001$). Non-survivors had a higher mean CRIB II score than survivors. For predicting mortality of VLBW babies, Cut off value of CRIB score at which maximum sensitivity of 97.5% and specificity of 50% is 9.5 that corresponds with studies done by Ezz-Eldin ZM et al, Jafrashteh A et al, Jasik BM et al, and Heidarzadeh. M et al.[8-11]

Authors find the prevalence of moderate to severe growth retardation (<-2 Z score) like wasting 25.7%, stunting 34.3%, under nutrition 25.7% and microcephaly 24.8% among total study population that are quite comparable with studies done by Pradip k. Sharma et al,and Modi et al, but microcephaly is about 15% more in our study.[12,13] This difference is due to socioeconomic factors and significant postnatal morbidities. Detailed nutritional history and parental heights were also not available in our study.

Authors compared the study population according to moderate to severe growth retardation (<-2 Z score) in all four fields like head circumference for-age (<-2 Z score), length for age (<-2 Z score), weight for age (<-2 Z score), weight for length (<-2 Z score) and showed that AGA babies had microcephaly 14.8%, stunting 24.7%, wasting 14.8%, under nutrition 14.8% and in SGA babies had 58.3%, 66.7%, 62.5% and 62.5% respectively. There are considerable differences between mean Z score (weight for age, weight for length, length for age, and head circumference for age) in two groups of population (<0.05). It was similarly observed by Ane C. Westerberg

et al 14 that Very low birth weight infants showed catch-up growth during the first year but their weight and length remained less than full-term peers. Growth deficiencies were more pronounced among infants subjected to early growth restriction despite increased catch-up growth. Pradip k. Sharma et al, had shown that there was significant growth difference between VLBW SGA and AGA children.[12] Authors also have found significant difference in the growth of AGA and SGA babies.

Limitation of this study was done in small sample size (n=143) with one year follow up period so authors might miss some delayed growth outcome.

CONCLUSION

Perinatal risk factors including CRIB II score proved to be important parameters for assessing anthropometric outcome of ELBW & VLBW babies for Indian scenario. They should be identified and appropriate measures should be taken to achieve good future outcome.

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Ethical approval: The study was approved by of North Bengal Medical College & Hospital, Darjeeling, West Bengal ethics committee.

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