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"Postnatal Growth of Intrauterine Growth Restricted Newborns"

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ABSTRACT

Introduction: Intrauterine growth restriction plays a significant role in short and long term adverse outcome. It is reflected in the relatively high incidence of neurodevelopmental impairment and somatic growth failure. Growth in the first year of life gets an opportunity to recover its growth deficit of intrauterine life and to catch up with its normal birth weight siblings

Objective of the Study: To assess the postnatal growth of intrauterine growth restricted newborns at 3, 6 and 9 months of age.

Methodology: A Prognostic cohort study was conducted at Department of Neonatology, Bangabandhu Sheikh Mujib Medical University, Shahbag, Dhaka, Bangladesh from 1st April 2017 to 20th September 2018. It involved monitoring of 31 intrauterine growth restricted newborns and 39 normal birth weight neonates over a period of 9 months. Follow up were done at 3, 6 and 9 month of age. At every visit weight, length, occipitofrontal circumference and chest circumference were measured. Data was analyzed using SPSS 20 and plotted in tables and graphs. Data imputation was done for the missing data. Multiple regression analysis was done for confounder of growth when data was statistically significant.

Results: Mean birth weight were 1748 ±437.09 g and 2893.54±467.07g, birth length 44 ±4.2439 cm and 49.26±1.634cm, birth occipitofrontal circumference 30.76 ±2.380 cm and 34.35±1.083cm, birth chest circumference 24.39 ±1.940 cm and 29.15±2.933cm in IUGR and control group respectively which was statistically significant. There were catch-up weight gain in 3, 6 and 9 months of age in IUGR group but it was less than the normal birth weight group during the followed-up period. During the follow-up period, cacth up growth in length achieved in first 9 months of age. During the first 3 months there were no catch up growth in IUGR babies head circumference but it increases in normal rates. Mean chest circumference values at 3 months were statistically significant and after multiple regression analysis, it is significant for birth length. In general, IUGR babies when compared with the control group remained small in all the four growth parameters but it had catch up growth in first 9 months of age.

Conclusion: During the follow-up period, catch-up of growth achieved regarding weight, length, OFC and chest circumference but the growth parameters were lower than the appropriate for gestational age birth weight newborns.

Key Words: Postnatal Growth, Intrauterine Growth, Restricted Newborns, Normal birth weight, Retardation, Circumference.

INTRODUCTION

Intrauterine growth retardation, the terminology for infants whose birth weight is below 10th percentile for gestational age occurs in 3% to 10% of all pregnancies.[1-3] Newborns whose head circumference (HC), length and weight (Wt) are all proportionately reduced < 10 percentile for gestational age are considered to be symmetrical IUGR.[2] When newborns weight is reduced out of proportion to length and head circumference are considered as asymmetrical IUGR.[2] Growth in the first year of life is crucial not just for the time being but it has a lifelong implication for IUGR infant because it gets an opportunity to recover its growth deficit of intra uterine life in this period and to catch up with its normal birth weight siblings. In IUGR babies, especially preterm babies and those without congenital anomalies, the growth is very fast in first year of life.[4] When adequately fed, they do not lose weight and start gaining weight after 2 to 3 days of age. Their initial weight gain is rapid which subsequently slows down after three months of age.[5] It has been shown that body weight of small for gestational age infant at 2 years of age is about 10% lower as compared to appropriate for gestational age of identical maturity.[5,6] Such low birth weight

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survivors demonstrate significant growth retardation as reflected by body weight, length, chest circumference, in comparison to normal weight peers[7]. These children with poor growth have high rate of mortality and morbidity and they suffer from motor and developmental delay.[8,9] Infrequently infants with IUGR grow poorly and do not demonstrate catch up growth and these infants may benefit from recombinant human growth hormone therapy beginning at 4 years of age.[9] The clinical consequences may not be apparent until later in development; therefore, it is crucial to follow-up these infants. There is paucity of studies regarding growth and development of IUGR babies in Bangladesh. So the objective of this study was to assess the postnatal growth of intrauterine growth restricted newborns.

MATERIALS AND METHODS

This Prognostic cohort study was conducted from 1st April 2017 to 20th September 2018 in the department of neonatology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh. Prior approval from Institutional Review Board (IRB) was taken for this research work. All IUGR (weight <10th percentile) infants admitted in this NICU during study period were included in this study. Appropriate for gestational age neonates were included as control group. Neonates with multiple gestation, congenital malformation and TORCH infection were excluded. After taking informed written consent from the parents / guardians, meticulous history of the newborn were taken, physical examination were done and required information were recorded in a data collection form. Newborn gestational age was calculated based on 1st day of last menstrual period, antenatal ultrasonogram and by modified New Ballard scoring. Gestational age and sex of both groups were matched. Anthropometry like weight, length, chest circumference and head circumference were measured at 3, 6, and 9 months of age and done by investigator. The newborns weight were taken without clothing soon after birth on an electronic scale with a precision of 10 g [Model 914, SALTER]. The length were measured by infantometer in cm ; Occipital Frontal Circumference (OFC) and chest circumference were measured by measuring tape in cm. Follow up were ensured by time to time communication with the parents/ legal guardian.

After collection, data were entered into a personal computer and were edited, analyzed, and plotted in tables and graphs. Categorical and continuous variables were expressed as number (percentage) and mean± standard deviation (SD) respectively. Comparisons were performed by chi-square test for categorical variables, independent t-test for quantitative variables. Multiple regression analysis was done for confounder of growth when data was statistically significant. In this follow up study, losses of follow up were adjusted by simple mean imputation method. $P < 0.05$ was considered statistically significant. Data was analyzed using the IBM SPSS (statistical package for social sciences) Statistics version 20.0 (IBM Corp., Armonk, NY, USA).

RESULTS

Among total eligible 49 IUGR infants 34 were finally analysed and they were compared with 39 appropriate for gestational age infants. There was no statistically significant difference between IUGR and control group in baseline characteristics except birth weight (table -1 & fig-1). There was statistically significant difference in anthropometric parameters at birth between two groups (table-2). When the weight gain and length during the first nine months of life for IUGR babies were compared with appropriate for gestational age babies, it was found that there was no significant difference in both groups (table-3 & fig-2). When OFC and chest circumference were compared between two groups, there was statistically significant difference at 3 months of age but at 6 and 9 month of age it was not found statistically significant (table—3). When multiple regression analysis was done for OFC it was significant for both birth weight and length (table-4 & fig-3); when multiple analysis was done for chest circumference it was significant for only birth length (table-5 & fig-4).

DISCUSSION

The outcome of IUGR babies depends on whether it was symmetrical or asymmetrical, cause of IUGR and duration of exposure and severity of IUGR. In this study, there was no significant difference regarding weight gain between IUGR and appropriate for gestational age group which demonstrated that weight gain was more in IUGR group but it did not crosses the appropriate for gestational age group. Different studies found that there is catch-up weight gain occurs in first years of age which was similar to our result.[10-15] Meharban et al.[7] also found that body weight of small for gestational age infants were about 10% lower as compared to appropriate for gestational age of similar maturity. Current study showed that catch up growth in length occurred more in the IUGR group in first 9 months of age compared to appropriate for gestational age group. Low et al.[16] showed that rate of length growth was greater than weight gain during the initial 3 months in the IUGR babies which was similar to our study. Bhatia et al.[10] showed a spurt in length increases between 6 to 9 month of age which correlates to our study. Other studies also concluded that length increases significantly in the first years of life which is similar to our study[1, 11-17]. The study results showed head circumference at 3 month was statistically significant ($p = 0.018$) which indicates there was no catch-up of growth but it increases in normal rates;

and after multiple regression analysis it demonstrated that if birth weight and length was more, head circumference were more. Low et al.[16] showed that IUGR infants had smaller head circumference in relation to appropriate for gestational age babies which were similar to our study. At 6 to 9 months it was not statistically significant which indicates that catch up of head circumference occurs at 6 and 9 months of age. Srivastava et al.[15] showed that growth of head circumference occurred in IUGR infants throughout the first 9 month of age compared to appropriate for gestational age infants which is similar to our study. Many other studies found that catch up growth of head circumference occurs in the first years of life which is similar to our study.[1,10-17] At 3 month the mean chest circumference value was statistically significant and after multiple regression analysis it was also significant for birth length. It indicated that birth length influences the growth of chest circumference in first 3 month life. Low et al.[16] found that chest circumference had increases in the first 3 month of age but it is at its normal rates which is similar to our results. At 6 and 9 months, catch up growth of chest circumference occurred but it was lower than the appropriate for gestational age infants which correlates with other studies.[15,16]

CONCLUSION

So we concluded that catch up of growth achieved regarding weight, length, OFC and chest circumference at 9 months of age. However head circumference and chest circumference growth were delayed in first 3 months of age. The growth parameters at 9 months were lower than the appropriate for gestational age birth weight babies.

RECOMMENDATION

- Large sample size and follow up for an extended period is required.
- Comparison among IUGR and appropriate for gestational age babies need to be gestational age specific.

CONFLICT OF INTEREST

Nil

SOURCE OF FUNDING

Nil

AUTHOR CONTRIBUTIONS

Conceptualization: Mohammad Abul Khayer, Sanjoy Kumer Dey, Shaheen Akhter

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All authors contributed to the final version of the manuscript.

All authors read and approved the final manuscript.

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Ethical Clearance: Ethically approved by the department.

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Table 1: Baseline characteristics of enrolled newborn.

Birth parameter	No. of patients (n) (%) IUGR	No of patients (n) (%) AGA	P value
Mode of delivery			
NVD	6 (19.3)	5 (12.8)	
LUCS	25 (80.7)	34(87.2)	0.337 NS
Place of delivery			
BSMMU	26(83.9)	29(74.4)	
Home	1(3.2)	2(5.1)	0.629 NS
Others	4(12.9)	8(20.5)	
Sex distribution			
Male	18 (58.1)	22(56.4) 17(43.6)	0.538NS
Female	13 (41.9)		
Birth weight (cat.)			
(1000- 1499)	9(29.0)	0	0.0001S
(1500– 2499)	22(71.0)	5(12.8)	0.0001S
≥ 2500	0	34(87.2)	0.0001S
Gestational age(weeks)			
<34	5(16.1)	5(12.8)	
34--<37	11((35.5)	11(28.2)	0.677NS
≥37	15(48.4)	23(58.9)	
Socioeconomic status			
Low	1(3.2)	1(2.6)	
Middle	27(87.1)	34(87.2)	0.528 NS
High	3(7.7)	4(10.2)	

Table 2: Anthropometry at birth.

Variables	IUGR (mean±std. deviation)	AGA (mean±std. deviation)	p-value
Birth weight(g)	1748.39±437.09	2916.54±467.07	0.000S
Length (cm)	44.00±4.243	49.26±1.634	0.000S
OFC (cm)	30.76±2.380	34.35±1.083	0.000S
Chest circumference (cm)	24.33±1.940	29.15±2.833	0.000S

Independent t-test for continuous data. P < 0.05 were considered as significant. S- Significant. Std. standard deviation.

Table 3: The measures of physical growth of infants of both IUGR and AGA group at 3, 6 and 9 months of age.

	3 month			6 month			9 month		
	Mean	SD	P value	Mean	SD	P value	Mean	SD	P value
Weight (gm)									
IUGR	3885.8	670.2	0.620	5131.6	841.0	0.317	6333.5	1067.4	0.243
AGA	4614.6	835.8		6117.5	784.4		7134.1	911.8	
Length (cm)									
IUGR	57.7	3.8	0.075	64.4	4.3	0.093	70.2	4.2	0.119
AGA	59.6	1.8		65.5	3.3		72.6	3.1	
OFC (cm)									
IUGR	36.6	2.1	0.018	40.0	1.6	0.613	42.4	1.6	0.665
AGA	39.5	1.5		43.0	1.5		44.9	1.8	
Chest circumference (cm)									
IUGR	34.1	3.2		39.1	3.1		42.2	2.9	
AGA	38.3	2.0	0.009	41.7	6.6	0.881	45.3	1.8	0.155

Independent t-test for continuous data. p<0.05 were considered as significant, NS- not significant, S- significant, g-gram.

Table 4: Multiple regression analysis for OFC at 3 month.

Model	Unstandardized coefficient		Standardized coefficient	P value
	b	Std. error	β	
Constant	18.198	2.823		0.0001[S]
Birth weight	0.001	0.0001	0.239	0.038[S]
Birth length	0.376	0.064	0.656	0.0001[S]
Chest circumference	0.81	0.061	0.120	0.192[NS]

Dependent variable: OFC 3 month. Independent variables: (constant), Birth weight, Birth length, Feeding History. NS- not significant, S- significant.

Table 5: Multiple regression analysis for chest circumference at 3 month.

Model	Unstandardized coefficient		Standardized coefficient	P value
	b	Std. error	β	
Constant	13.172	5.318		0.016 [S]
Birth weight	0.002	0.001	0.340	0.24 [NS]
Birth length	0.352	0.121	0.432	0.005[S]
OFC	0.036	0.329	0.027	0.913[NS]

Dependent variable: chest circumference 3 month, Independent variables: (constant), Birth weight, Birth length, Feeding History. NS- not significant, S- significant.

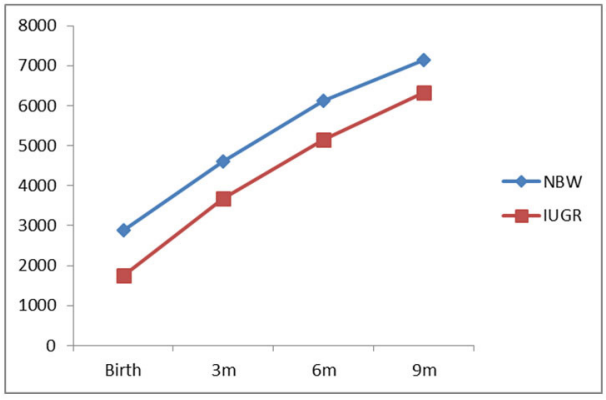

Figure 1: Mean values for weight (grams) at 3, 6 and 9 months of age for two groups.

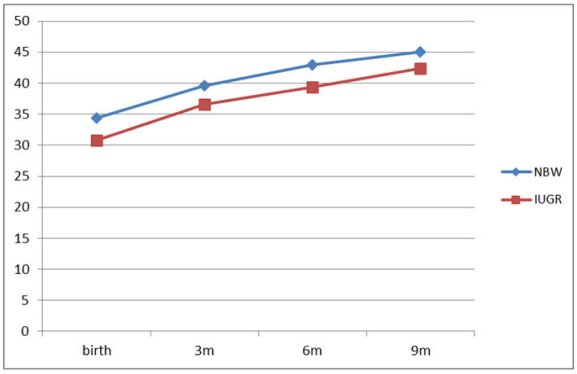

Figure 3: Mean values for head circumference (centimeters) at 3, 6 and 9 months of age for two groups. P < .05 considered as significant.

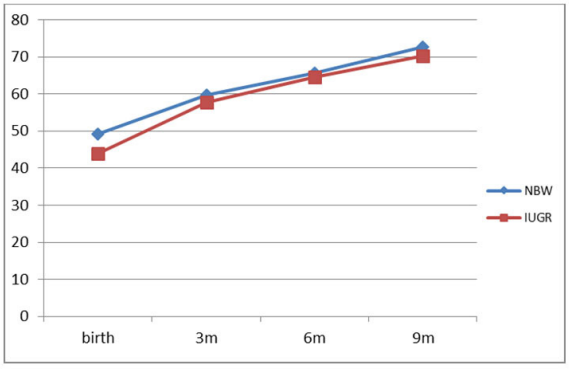

Figure 2: Mean values for length (centimeters) at 3, 6 and 9 months of age for two groups. P < .05 considered as significant.

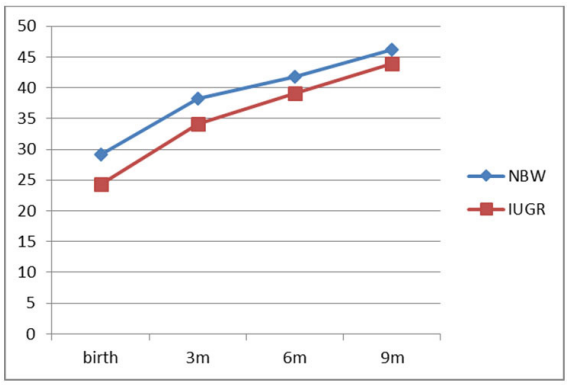

Figure 4: Mean values for chest circumference (centimeters) at 3, 6 and 9 months of age for two groups.