Original Article

Pattern of intrauterine growth retardation among low birth weight neonates

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ABSTRACT

Background: *There is an association between intrauterine growth retardation (IUGR) and subsequent development of diabetes mellitus, coronary artery disease and hypertension during adult life. With this context, it is vital to give attention about the patterns of body proportion of IUGR babies. The aim of this study was to determine the proportion of asymmetric distribution IUGR in contrast to symmetric distribution among babies with low birth weight (LBW).*

Methods: *This cross-sectional study was conducted in the Department of Pediatrics, Sher-e-Bangla Medical College, Barisal,from January 2012 to June 2012, with a total 114 babies with LBW. All singleton newborns, within 24 hours of birth, having birth weight < 2.5 kg was were included. Weight was plotted in weight for gestation age centile chart. Then Ponderal index (PI) was calculated to determine asymmetric and symmetric IUGR by using the formula. Convenient sampling was used. Data were analyzed with SPSS. P value <0.05 was considered as significant.*

Results: *Out of 114 LBW babies, 79 were IUGR babies. Among 79 IUGR babies, 45.6% were male and 54.4% were female. The mean age of the mothers of the IUGR babies was 24.2 ± 5.6 years. Most of the mothers were in the age group of 16 to 25 years. In this study, most of the IUGR was asymmetric (68.4%) and a majority of the asymmetric IUGR babies were from rural areas. The PI of the asymmetric IUGR was significantly (p =<0.001) lower than the symmetric IUGR.*

Conclusion: *This study highlights that, among the LBW babies most of them were IUGR, the large population of IUGR babies were of asymmetric patterns. This group of patients carries immense importance to keep an eye on the risk of fetal origin of adult diseases.*

Key words: *Low birth weight, Ponderal index, intrauterine growth retardation, asymmetric IUGR.*

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INTRODUCTION

Low birth weight (LBW) is a significant public health problem in developing countries like Bangladesh. The World Health Organization (WHO) had defined LBW as weight at birth of less than 2500gm.[1] Certainly,70% of all LBW babies are born in Asia.[2] The incidence of LBW in Bangladesh is 21.6%.[3] LBW may be due to intrauterine growth retardation (IUGR) or because birth is preterm. Most of the LBW in developing countries is due to IUGR.[4]Infants less than the 10th percentile for gestational age are termed as IUGR.[5] IUGR can be further classified as asymmetric or symmetric based on Ponderal index (PI). Asymmetric IUGR infants have a low PI whereas symmetric IUGR babies have a normal PI.[6]

The incidence of diabetes mellitus (DM) and coronary artery disease (CAD) is increasing day by day. One hundred and seventy million people suffer from diabetes worldwide, out of which 2/3rd are in low income

countries.[7]In Bangladesh, the estimated prevalence of diabetes among adults was 9.7% in 2011[8] and the number is projected to be 13.7 million by 2045.[9]One study describes the prevalence of hypertension in Asian countries is 15-35%.[10]According to 'Thrifty phenotype' (foetal origins) hypothesis, persistent malnutrition to thefoetus causing some structural and metabolic changes that leads to subsequent development diabetes and coronary artery disease.[11]Many other studies also have stated an association between LBW-IUGR and subsequent development of diabetes, CAD and hypertension during adult life.[12-14]

Babies who were LBW especially asymmetric IUGR are susceptible to disease in later life through several kinds of processes. Hypertension is developed by the reduced number of glomeruli found in people who were LBW-IUGR.A reduced number leads to increased blood flow through each glomerulus. This hyperfiltration is responsible for the development of glomerulosclerosis which, along with normal ageing, leads to accelerated age-related loss of glomeruli, rising blood pressure and loss of kidney function.[15]

Now, it is considered that asymmetric IUGR infants that may be related to long-term morbidities like DM, CAD, hypertension and chronic kidney disease (CKD) with decreased lifespan and increased healthcare costs. With the context of the high numbers of LBW-IUGR and increasing incidence of DM, CAD and CKD, it is vital to give attention to identify the patternsof LBW babies in our population. This study aimed to determine the proportion of asymmetric versus symmetric IUGR among LBW babies.

METHODS

This cross-sectional study was conducted in the neonatal unit of the Department of Pediatrics, Sher-e-Bangla Medical College and Hospital, Barisal, from January to June 2012. Newborns were defined as LBW if their birth weight was <2500 gm. All singleton new-born within 24 hours of birth having birth weight < 2.5 kg were included. The classic definition of IUGR is birth weight below the 10th percentile of sex-specific birth weight in the gestational age reference curve.[16]Small for gestational age (SGA)/IUGR newborns were classified as having an adequate PI representing symmetric growth retardation in both weight and length or a low PI, representing asymmetric growth retardation, i.e., infants more retarded in weight than in length.[17]The newborns were also classified as either SGA/IUGR or appropriate-for-gestational-age (AGA) by using the 10th percentile as the cutoff on a gestational-age-specific and sex-specific birth weight.[18] An infant was classified as having a low PI if the index was less than the 10th percentile on a reference chart of PI for each gestational age category.[16]On admission, the weight and length were taken by trained nurses and gestational age was calculated in weeks using last menstrual period of mother. Trained physicians conducted a postnatal physical examination of every newborn baby. The babies with any congenital anomalies and those presented to the hospital after 24 hours of birth were excluded. The weight of newborns was managed by a digital baby scale (SohnleMultina Plus model 8310) to the nearest 10 g. The length was measured with a length board (Kiddimetre) to the nearest 0.1 cm. All scales were checked frequently with known standard weight. Weight was plotted in weight for gestation age centile chart. Then PI was calculated to determine asymmetric and symmetric IUGR by using the formula. The nature of the study was fully explained to each guardian and written informed consent was taken from at least one parent before their enrollment in the study. The study protocol was approved by the Ethical Review Committee of the Sher-e-Bangla Medical College and Hospital, Barisal. PT is determined by taking a ratio of the weight and length. PI = Weight (GM)/Length (CM)x 100 (Table I).[6]Data were analyzed with Statistical Package for Social Science (SPSS Inc, Chicago, Illinois, USA) software version 18. The means and standard deviations were used to describe continuous data. Tables and graphs were used to express the results. For categorical data, frequencies and percentages were estimated. P value <0.05was considered as significant.

Table I Pattern IUGR using reference value of Ponderal index

	Gestational age	PI value
Disproportionate (asymmetric)IUGR	between 29 and 37weeks	< 2.0
	beyond 37 weeks	<2.25
Proportionate (symmetric)IUGR	29 and 37weeks	> 2.0
	beyond 37 weeks	>2.25

RESULTS

One hundred and fourteen LBW babies were enrolled within 24 hours of birth and 79 were IUGR babies. Among the 79 IUGR babies, 36 (45.6%) were male and 43 (54.4%) were female. The ratio of male and female was 0.84. More than half of the enrolled LBW babies were IUGR. The ratio of IUGR versus preterm LBW was about 2.3:1 (Figure 1).

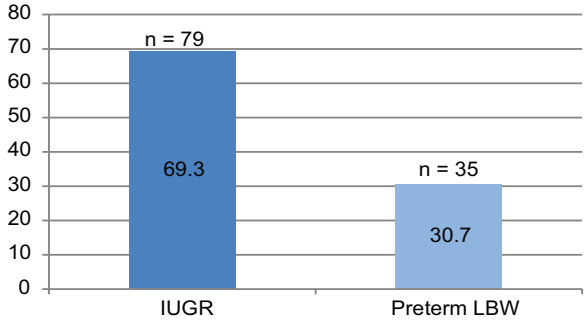

Figure 1 Pattern of low birth weight babies (N =114)

Mean birth weight of asymmetric IUGR and symmetric IUGR babies was 1680.83±1096.57 and 1531.00±381.03 grams respectively. The mean age of the mothers of the IUGR babies was 24.2 ± 5.6 years. Most of the mothers were in the age group 16 to 25 (Table II). In this study, most of the IUGR was asymmetric (68.4%). Table III showed that the majority of the asymmetric IUGR babies were from rural areas. The mean monthly income of the family of IUGR newborn was 8367.0±4403.3 taka (Table IV).Though the babies with asymmetric IUGR were a little heavier (1680.83 gm) than the symmetric IUGR (1531.00 gm) but the difference was not significant(p=0.51). Table Vshowed differentials between the PI by IUGR. The PI of the symmetrical IUGR was significantly higher (p = <0.001) than asymmetric IUGR.

Table II Frequency distribution of age of the mother of IUGR babies (n=79)

Age of mother(years)	Frequency	Percentage	Mean ± SD	Minimum - maximum
16-20	26	32.9	24.23 ± 5.63	16-35
21-25	24	30.4		
26-30	15	19.0		
30-35	14	17.7		

Table III Types of IUGR by residence

	Rural	Urban	p value
Asymmetric IUGR n=54	42	12	0.047
Symmetric IUGR n=25	14	11	

Table IV Frequency distribution of IUGR babies by monthly family income

Monthly family Income (BDT)	Frequency	Percent	Mean ± SD	Minimum - maximum
3000-5000	28	35.4	8367.09±4403.31	3000 -20000
5001-10000	33	41.8		
10001-15000	12	15.2		
15001-20000	6	7.6		

BDT=Bangladeshi Taka

Table V Differentials between age of the mother, birth weight of baby and the Ponderal index by types of IUGR

	Asymmetric IUGR(54)	Symmetric IUGR(25)	P value
Age of mother (Mean±SD)	24.85±5.53	22.88±5.73	0.15
Birth weight (gm)(Mean±SD)	1680.83±1096.57	1531.00±381.03	0.51
Ponderal index (Mean±SD)	1.85±0.22	2.40±0.17	<0.001

DISCUSSION

Among the total 114 LBW babies, 79 cases were IUGR that mean IUGR contributed almost 69% of all LBW babies, this finding is consistent with Bangladesh perinatal survey and other study conducted in Bangladesh (IUGR contributes almost 75% and 84% of total LBW respectably).[19]The proportion of IUGR was found to be 54% in India.[20,21]The current study was hospital-based, this result might not represent the population data.

In this study, almost 33% of mothers of IUGR babies were in age less than twenty years. In this study young mother gave birth more IUGR babies, that consistent with the study by Ferdous F et al. in Bangladesh[22] and Jamal et al. in Pakistan.[23] There was no significant difference in the age of mothers having children with asymmetric IUGR (24.85 years) than those with symmetric IUGR (22.88 years).

The PI is a very effective tool for assessing the asymmetrical IUGR. In our study, about 68% of the babies were asymmetric and the ratio of asymmetric versus symmetric IUGR is about 2.6:1. This disproportionate IUGR was nearly consistent with the study done previously by Ahmed et al.[24]They showed asymmetric IUGR babies were 84%. Here, PIis higher in the symmetric IUGR (PI=2.40) than the asymmetric IUGR (PI=1.85). These results are similar to report of Sachdev.[25] Nevertheless, this asymmetric versus symmetric IUGR ratio was not similar to another study where the ratio was 1.2:1.[26]Most of the IUGR babies were hailing from the rural community and belonging to low income group which is consistent with Dey et al.[27]In this study, rural population contributed to more asymmetric IUGR than symmetric IUGR. This finding was similar to a previous study in Pakistan.[23] This high proportion asymmetric IUGR could have implications for long-term co-morbidities, including micro albuminuria, high blood pressure, cardiovascular diseasesandinsulin resistance.[28]

Maternal malnutrition during pregnancy is one of the crucial causes of IUGR babies.[29]

Symmetric intrauterine growth retardation results from undernutrition continuing throughout pregnancy. Asymmetric IUGR is often due to severe malnutrition of the mother in the last trimester of the pregnancy or association with some maternal diseases like pre-eclampsia, chronic hypertension and demonstrates preservation of blood supply to the brain.[30]

This study highlights that the large population of IUGR babies is contributed by an asymmetric pattern of IUGR, observed in our tertiary health care set-up, which is quite alarming.

Limitations

In this study, the records of antenatal check-up were not available. So, the association between IUGR type and maternal weight gain was not possible to determine. For similar reason, documents of intrauterine infection were not available.

Conclusion

In this study, most of the LBW babies were asymmetric IUGR. Despite limitations, this study provides essential information which can be helpful in planning maternal and child health services. So, a holistic effort will be required from significant stakeholders, including both governmental and non-governmental organizations. The prospective studies on low birth weight babies, especially asymmetric IUGR babies, should be conducted to follow the fetal origin of adult diseases.

Authors' contribution: Study concept, acquisition and analysis of data: MOH and AKS. Drafting of manuscript: MOH and MAUA. Critical revision of the manuscript for important intellectual content: KMZ and MP. Study supervision: SZH. All authors read and approved final manuscript for publication.

Conflicts of interest: Nothing to declare.

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