International Journal of Current Medical and Pharmaceutical Research

IJCMPR

ISSN: 2395-6429

Available Online at http://www.journalcmpr.com

DOI: http://dx.doi.org/10.24327/23956429.ijcmpr20170227

RESEARCH ARTICLE

ASSOCIATION OF CLINICO-SONOGRAPHIC FACTORS WITH NEONATAL OUTCOME OF IUGR BABIES

Kashif abbas., Fatima Asif., Syed Muhammad Jameel Ashraf., Samina Shamim., Sana Shabbir and Aqibullah

Department of Pediatrics, Liaquat National Hospital, Karachi

ARTICLE INFO

Article History:

Received 22nd June, 2017
Received in revised form 3rd July, 2017
Accepted 18th August, 2017
Published online 28th September, 2017

Key words:

IUGR, Placental Insufficiency, Mortality, Morbidities.

ABSTRACT

Objectives: To identify clinico-sonographic factors associated with outcome of IUGR neonates.
Study design: cross-sectional study
Place and Duration of study: Neonatal intensive care (NICU) at Liaquat National Hospital, Karachi. January 2015 to December 2015.
Methodology: After Ethical committee approval was obtained. A total of 70 IUGR babies were enrolled in the study. Data analysis was done using SPPS version 22. All data with significant p-values (<0.05) were then analyzed with Odd ratio (OR). Pearson chi-square test was applied for sonographic markers associated with mortality.
Results: The mean weight at birth was 1.27 ± 0.30 kg while the mean height and FOC was found to be 37.5 ± 3.91cm and 28.4 ±2.85 cm respectively. Neonates were classified according to gestational age, type of IUGR, birth weight and antenatal ultrasound findings. The most common morbidity found was metabolic derangement followed by RDS, IVH, PPHN and NEC. Risk factor associated IUGR mortality were prematurity [OR 39.42, 95% CI; p= 0.04], symmetrical IUGR [OR 32.5, 95% CI; p= 0.00], weight< 3rd percentile [OR 8.63, 95% CI; p= 0.004] and severe placental insufficiency [OR 39.46, 95% CI; p= 0.00]. There is evidence of strong significant association positive correlation between severe placental insufficiently and mortality (r= 0.750).
Conclusion: IUGR babies with severe placental insufficiency had high mortality and morbidity. Early identification of abnormal placental flow by Doppler study will enable clinicians to initiate surveillance, prompt obstetrical management and to anticipate neonatal outcome.

INTRODUCTION

IUGR (Intrauterine growth restriction) and SGA (small for gestational age) babies are low birth neonates weighing less than 2500 grams. The IUGR commonly refers to those fetuses that have not achieved their growth potential due to underlying genetic or environmental factors.[1] While small for gestational age (SGA) babies are constitutionally small who gain weight in accordance to their growth potential.[2] It is sometimes challenging to differentiate between the two entities, especially in poor socioeconomic setup with limited resources for prenatal observations and diagnostic modalities.

The screening for fetus growth restriction includes serial symphysis-fundal height measurement and a discrepancy greater than 3 cm should lead to further evaluation.[3] The modalities used are fetal biometry and amniotic fluid volumes, Doppler studies and three-dimensional ultrasonography for fetal femur volume.[4] Doppler study for umbilical artery flow is the most commonly used modality as a measure ofgestational age. The abnormalities of systolic to diastolic flow ratio of umbilical artery support the diagnosis of IUGR. This will help clinicians to monitor both fetus and mother, thus by providing timely obstetrical management.[5]

The perinatal mortality rate is 6- 8 times higher for growth-restricted fetuses with serious short or long term consequences.[6] IUGR babies have morbid outcome as exposed to intrauterine stress most of them are born as still - birth. They may also have birth asphyxia, meconium aspiration and persistent pulmonary hypertension. Their metabolic processes are also disturbed making them prone to metabolic disturbances such as hypothermia and hypoglycemia.[7] In long term these infants have increased risk of neurodevelopment, cardiovascular and endocrine morbidities.[8]

We report a one year data of neonatal outcome of IUGR babies with its clinic-sonographic characteristics. The diagnosis of IUGR was established on clinical data and ultrasound findings including Doppler studies. Identifying the IUGR fetuses will help us anticipate the likely consequences. Therefore, initiatives must be taken to reduce the potential complications

in the neonate. Early recognition of IUGR will help us mitigate the possible adverse outcome.

METHODOLOGY

This is a cross-sectional study conducted in NICU of Liaquat National Hospital, Karachi over a period of one year from January to December 2015. Ethical committee approval was obtained. A total of 70 IUGR babies were enrolled in the study.

IUGR was defined as babies with birth weight less than 10th percentile plotted on Fenton[9] growth charts with abnormal umbilical artery Doppler studies. Babies with congenital anomalies and syndrome features were excluded from the study.

The Data was collected on predesigned Performa. It included patient case number, sex, age, history, physical examination and laboratory tests. Written informed consent was obtained from parents of study participants.

The sample technique that used was non-probability consecutive sampling. Later on after completion of data of required sample, a data base was developed on SPSS for windows version 22.0 for data analysis.

Mean, median and standard deviation was calculated for continuous variables such as weight, height and FOC. Frequency along with percentages were drawn for qualitative variables like gender, gestational age, type of IUGR presentation (symmetric/asymmetric), spectrum of morbidities, ultra sound Doppler and outcome; while Pearson Chi- square test ($\chi 2$) of all qualitative variables were applied by taking p-value < 0.05 as significant. All data with significant p-values were then analyzed with Odd ratio (OR).Finally association between sonographic markers (umbilical artery Doppler) with IUGR mortality was determined.

RESULTS

There were total 70 neonates enrolled in the study. The mean weight at birth was 1.27 ± 0.30kg.Moreover, the mean height and FOC was found to be 37.5 ± 3.91cm and 28.4 ±2.85cm respectively. (Table-1)

Table 1

(cm)	Mean	Standard Deviation (SD)
Weight	1.27	0.30
Height	37.5	3.9
FOC	28.4	2.85

43 out of 70 neonates were male and 27 were female which constitute about 61.4%and 38.6% respectively. (Figure-1)

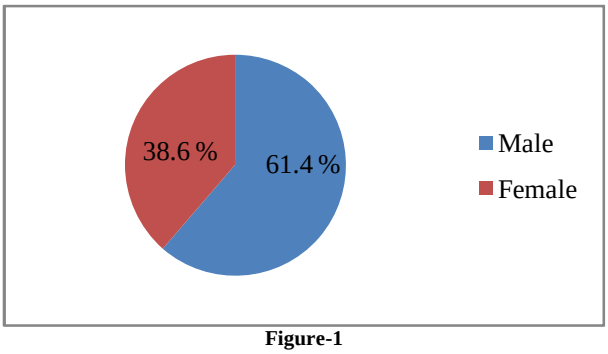

Figure-1

Spectrum of Morbidities shows maximum number of babies that is 42(60%) had metabolic derangements (characterized by hypoglycemia, electrolyte imbalance, hypocalcemia and hypomagnesemia). Moreover 21 (30%) babies were found to have RDS, 3 (4.3%) with IVH and 2(2.9%) with each PPHN and NEC respectively.(Table-2)

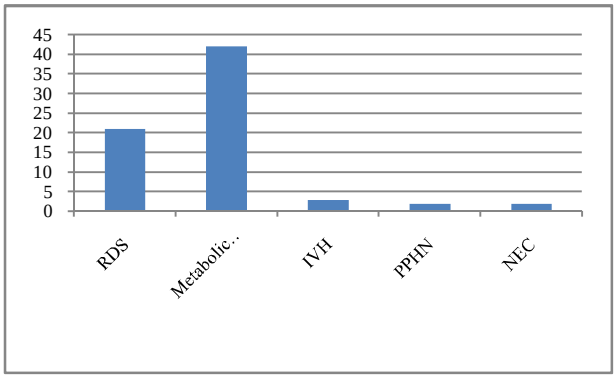

Table 2

In the study, we grouped IUGR babies according to gestational ages into >30 weeks and ≤ 30 weeks. Both groups had equal number of babies which were 35.

Among all 70 babies, 22 (31.4%) were symmetrical IUGR whereas 48 (68.6%) were asymmetrical IUGR.

All neonates had evidence of placental insufficiency on Doppler ultrasound. Of which 22 (31.4%) had mild insufficiency and 35 (50%) had moderate insufficiency. A total 13 number of babies had Severe placental insufficiency with abnormal umbilical artery flow in which 6 (8.6%) had reduced flow and 7 (10%) had absent flow.

Most babies were discharged home successfully constituted as 55(78.6%), LAMA was 5 (7.1%) and the proportion of expired neonates was 10 out of 70 approximates to 14.3%.The major proportion of expired neonates 9 out of 10 were unbooked cases.

Our study identified four independent variables associated with neonatal IUGR mortality. It included prematurity (gestational age less than 30 weeks), symmetric presentation, weight less than 3rdpercentile and severe placental insufficiency (absent or reduced umbilical artery flow). So finally a total of 10 expired neonates were assessed on the basis of above mentioned four factors. (Table-2)

Risk factor associated with IUGR Mortality

Table 2

	Risk Factors	Expiries (Out of 10)	Percentage (%)	Odd Ratio (OR)	P-value
Gestational Age	<30 weeks	8	80	4.88	0.04
Type of IUGR	Symmetry	9	90	32.5	0.00
Weight	< 3 percentile	8	80	8.63	0.004
Doppler Ultrasound (placental flow)	Reduced/Absent Placental flow	9	90	126	0.00

A significant association between severe placental insufficiencies with mortality was found with p-value 0.00 .There is evidence of strong significant co-relation between severe placental insufficiency and mortality[OR 126, 95% CI: 12.61-1258.72]. The odd of IUGR mortality is 39.46 higher

with severe placental insufficiency compared to those with mild to moderate placental insufficiency.

Ultrasound Doppler					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Mild Placental Insufficiency	22	31.4	31.4	31.4
	Moderate Placental Insufficiently	35	50.0	50.0	81.4
	Severe Reduced Placental Insufficiently	6	8.6	8.6	90.0
	Severe Absent Placental Insufficiently	7	10.0	10.0	100.0
	Total	70	100.0	100.0	

Table 4

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Severe_Placental_Insufficency * Expired	70	100.0%	0	0.0%	70	100.0%

Severe_Placental_Insufficency * Expired Crosstabulation

Count

		Expired		Total
		Yes	No	
Severe_Placental_Insufficency	Yes	9	4	13
	No	1	56	57
Total		10	60	70

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	39.361[a]	1	.000		
Continuity Correction[b]	34.044	1	.000		
Likelihood Ratio	31.300	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	38.799	1	.000		
N of Valid Cases	70				

a. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 1.86.

b. Computed only for a 2x2 table

DISCUSSION

Several studies have shown that IUGR babies are associated with increased risk of mortalities and major morbidities.[10] In our experience, the most common complication was metabolic derangement followed by RDS. Study conducted by Hasmasanu reported hypoglycemia and IVH as the most common morbidities among IUGR babies.[11] Hypoglycemia in IUGR is usually transient and could be due to poor body fat and glycogen stores. They also have immature metabolism leading to hypoketotic hyperinsulinism hypoglycemia[12]. In our study factors identified related to mortality of IUGR neonates were prematurity, birth weight less than 3rd percentile, symmetric pattern of growth restriction and Doppler studies showing absent or reverse end diastolic flow. A multicentre study by Garite TJ shows that IUGR infants who are born premature are at several fold increased risk of mortality.[13] Another study by Rivka.H shows similar results comparable to our data in which most expired neonates 80% were less than 30 week gestation and suffered complications.[14] Such neonates are subjected to the risk of prematurity in addition to the risks of IUGR, hence prematurity and IUGR could be a fatal combination.

Our study shows IUGR neonates with birth weight falling at or less than 3rd percentile had grave outcome. Similar results were observed in study done by Donald D Mcintire and colleagues.[15] They concluded that mortality and morbidity are increased among infants whose birth weights are at or below the 3rd percentile for their gestational age.

Depending upon the time of insult that limits fetal growth, IUGR fetuses can be classified as symmetric or asymmetric. Symmetric IUGR is early onset with proportionate reduction in all parameters whereas asymmetric IUGR has relative sparing of head growth. Hugh O' Connor *et al* documented about 12 % morbidity with symmetrical IUGR, but; there was no IUGR mortality observed.[16] Contrary to these findings in our study, there is evidence of increased mortality associated with IUGR. Umbilical artery Doppler waveforms are fundamental for the identification of placental insufficiency.[17] It is performed when fetal growth restriction is noted. Reversal and absent diastolic wave form represent fetal hypoxia and increase risk of death. Absent or reverse end diastolic volume (AREDV) is associated with 30 to 50 % mortality. Absent diastolic volume and AREDV are associated with 4.0 and 10.6 fold increase risk of mortality respectively compared to those with normal Doppler.[18]

A significant correlation was found between placental insufficiency and mortality in our study. The clinical evidence of this progression has been well documented by Mandruzzato *et al*, who reported a remarkable difference in mean birth weight and perinatal mortality for absent end-diastolic velocity (20%) versus reversed end-diastolic velocity (68%).[19]

This suggests that assessment of umbilical artery Doppler may help plan time of delivery. In our cases, mortality was noted in neonates with absent and reverse diastolic flow. Abnormal results, especially absent or reversed end-diastolic flow, can be used to modify frequency of fetal surveillance with other traditional tests (i.e. NST, BPP) with improved perinatal survival.

CONCLUSION

The terms IUGR and SGA are not synonymous. Umbilical artery Doppler is useful tool to identify growth restricted fetus and predict the outcome. Birth of IUGR babies should be planned at a center with a neonatal intensive care unit to reduce morbidity and mortality.

Limitations

1. In our study, the only method to assess placental insufficiency is Doppler ultrasound. However, various studies have shown other modalities such as inferior vena cava (IVC) for significance flow and three-dimensional ultrasonography for fetal femur volume in determining fetal outcome.
2. Secondly, majority of our cases with absent or reverse diastolic flow were unbooked patients, hence affecting the outcome.

Conflict of interest: This is to state that all authors have certified that they have NO affiliations with or involvement in any organization or entity with any financial interest or non-financial interest in the subject matter or materials discussed in this manuscript.

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