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Original Research Article

Triple Vessel Doppler Study in IUGR with or Without PIH and Relative Perinatal Outcome

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Abstract: This prospective study was carried out in the Department of Obstetrics & Gynaecology, Gauhati Medical College to determine the usefulness of triple vessel Doppler study in IUGR with or without PIH in predicting perinatal outcome. The study group consists of 75 pregnant women between 28 to 40 weeks of gestation with IUGR. It is again divided into group 1a compromised of IUGR cases but without PIH and group 1b compromised of cases with IUGR and PIH. Control group consists of 75 women with normal pregnancy. Cerebro-placental ratio has highest sensitivity (81%) and specificity (95%) in predicting adverse perinatal outcome followed by umbilical artery PI (68%, 83% respectively). Uterine artery PI had minimum sensitivity (50%) and specificity (77%). CPR is best predictor of adverse perinatal outcome in pregnancy with IUGR followed by umbilical artery Doppler among triple vessel Doppler study.
Keywords: Perinatal outcome, IUGR, Triple vessel Doppler, PIH, Doppler in PIH, Cerebro-placental ratio, Doppler study in IUGR

INTRODUCTION

The incidence of IUGR is of significant concern being 11 % worldwide, 12.2 % in Asia and 27.5 % in India[1]. Significant immediate complications of IUGR include increased perinatal mortality, hypothermia, hypoglycaemia, polycythemia, hyper viscosity, hyperbilirubinemia and impaired immune function [2-5]. Long term sequelae in IUGR infant's are- increased risk of neurodevelopmental abnormalities and cognitive impairment. This highlights the importance of early and timely diagnosis of IUGR for proper management. Ultrasonography Doppler is non-invasive and cost-effective method to assess fetal wellbeing at early stage even before physiological changes measured in biophysical profile appears. It is proposed that the alterations in the uteroplacental blood flow which form the main basis for etiopathogenesis of IUGR are thus detected earlier by ultrasound Doppler, even before they translate into the physiologic changes measured in biophysical profile. It can be credited with causing a significant decrease in perinatal mortality and morbidity. The purpose of our study was to evaluate the usefulness of the pulsatility index (PI) of the umbilical artery (UA), middle cerebral artery (MCA), and uterine artery as well as the ratio of the MCA PI to the UA PI in the prediction of adverse perinatal outcome in IUGR pregnancies.

MATERIALS AND METHODS

A Prospective, cohort study was conducted in Department of Obstetrics & Gynecology in collaboration with Department of Microbiology, Gauhati Medical College and Hospital, from 1st June 2012 till 31st May 2013. The study group comprised of women enrolled between 28 to 40 weeks of pregnancy with IUGR with or without PIH attending Antenatal OPD and those admitted as emergency. It is again divided into group 1a compromised of IUGR cases but without PIH and group 1b compromised of cases with IUGR and PIH. Control group consists of 75 women with normal pregnancy.

Inclusion criteria

- Singleton pregnancy with gestational age of 28 to 40 weeks
- Clinically diagnosed intrauterine growth retardation with or without PIH

Exclusion criteria

- Documented major congenital abnormality of fetus

- Multiple gestations
- Pregnant women with medical disorders like diabetes mellitus or thyroid disorders

Patient's particulars and detail history taking and clinical examination were done and noted in a structured proforma.

INVESTIGATIONS

Routine investigations of pregnancy

SPECIAL INVESTIGATIONS:

Ultrasound Doppler using a 2.5-MHz transducer and high pass filter. During the examination, the patient was in a semi recumbent position and in absence of fetal respiration or body movements. The flow velocity waveforms were recorded from the umbilical artery, MCA and uterine artery. After technically satisfactory Doppler waveforms had been recorded, the PI of triple vessel were noted and the ratio of the MCA PI to the UA PI (the C/U ratio) was calculated. The pregnancies were followed-up and the final maternal and perinatal outcome of each case was noted. A pregnancy was considered to have "adverse outcome" when any of the adverse outcomes were present

1) Perinatal death
2) Emergency C/S for fetal distress
3) Admission to NICU

Triple vessel Doppler indices (PI) were considered to be normal if they were within 5^{th} to 95^{th} percentile of normal value as provided in Hurrington's normogram. A single cut-off of 1.08 was used for cerebro-umbilical ratio as described by Gramellini et al and any value below it was considered abnormal. The PI in the IUGR group was compared with that in the normal study group using the chi square test and Fischer's exact test. $P < 0.05$ was considered significant.

RESULTS

As shown in table no-1, a total of 150 women were selected for our study. The study group comprised of 75 women of 28-40 weeks gestation having intrauterine growth restriction with or without PIH. It is subdivided into group 1a, comprised of women with IUGR but without PIH and group 1b, comprised of women with IUGR and PIH. Group 1a has 45 women and group 1b has 30 women. The control group consists of 75 women of 28-40 weeks gestation without IUGR and PIH.

Table 1: Distribution of cases

	Study group		**Control group (pregnant women with neither IUGR nor PIH)**	**Total**
	Group 1a (pregnant women with IUGR)	**Group 1b (pregnant women with IUGR & PIH)**		
Number of cases	45(30%)	30(20%)	75(50%)	150(100%)

Table 2: Age distribution

Age in years	**Study**		**Control**	**P value**
	Group1a	**Group1b**		
18-23	18(40%)	11(37%)	34(45%)	0.5
24-29	23(51%)	15(50%)	38(51%)	
30-35	4(9%)	4(13%)	3(4%)	
Total	100%	100%	100%	
Mean ± SD	24±2.7	23±2.7	24±2.6	

Table 3: Parity distribution

	Primigravida	**Multigravida**	**P Value**
Group 1a	21(47%)	24(53%)	0.5
Group 1b	15(50%)	15(50%)	
Control	41 (55%)	34 (45%)	

Table 4: Mean amniotic fluid index (AFI)

Mean AFI			**P Value**
Group 1a	Group 1b	Control	<0.0001
8.3	7.6	10.7	

Table 5: Gestational age at delivery

Gestational age at delivery	Group 1a	Group 1b	Control	P value
Less than 37 weeks	9(19%)	7(22%)	5(7%)	<0.001
More than 37 weeks	36(81%)	23(78%)	70(93%)	

Table 6: Birth Weight of babies

Birth Weight	Group 1a	Group 1b	Control	P value
1-1.5 Kg	3(7%)	2(7%)	Nil	<0.0001
1.5-2.5 Kg	40(89%)	28(93%)	15 (20%)	
2.5-3 Kg	2(4%)	0	53 (71%)	
Above 3 Kg	0	0	7 (9%)	
Total	45(100%)	30(100%)	75(100%)	
Mean ± SD	2.13±0.36	2±0.3	2.7kg ± 0.22	

From the above tables (table-2 to Table-6), we could conclude that-

1) More than 50% cases in group 1a, 1b and control group are in the range of 24 to 29 years of age.
2) All 3 groups are comparable with respect to parity and p value being 0.5 is statistically not significant.
3) Mean AFI in group 1a, 1b &control groups are 8.3, 7.6 &10.7 respectively. Hence there is maximum reduction in liquor volume in group 1b followed by group 1a.
4) Preterm deliveries in group 1a, 1b and control group are 19%, 22% and 7% respectively. Hence preterm delivery incidence is maximum in group 1b followed by group 1a
5) Mean birth weight in group 1a, 1b & control group are 2.1 kg, 2kg & 2.7 kg respectively. Maximum incidence of LBW & VLBW are seen in group 1b followed by group 1a

Table 7: Perinatal outcome among group 1a, group 1b and control group

Groups	Mode of delivery		NICU admission		Outcome of baby		P value
	LSCS	SVD	YES	NO	Perinatal death	Healthy	
Group 1a(n=45)	10(23%)	35(77%)	10(22%)	35(78%)	3(7%)	42(93%)	<0.0001
Group 1b(n=30)	19(64%)	11(36%)	18(60%)	12(40%)	3(10%)	27(90%)	
Control (n=75)	18(24%)	57(76%)	10(13%)	65(87%)	0(0%)	75(100%)	

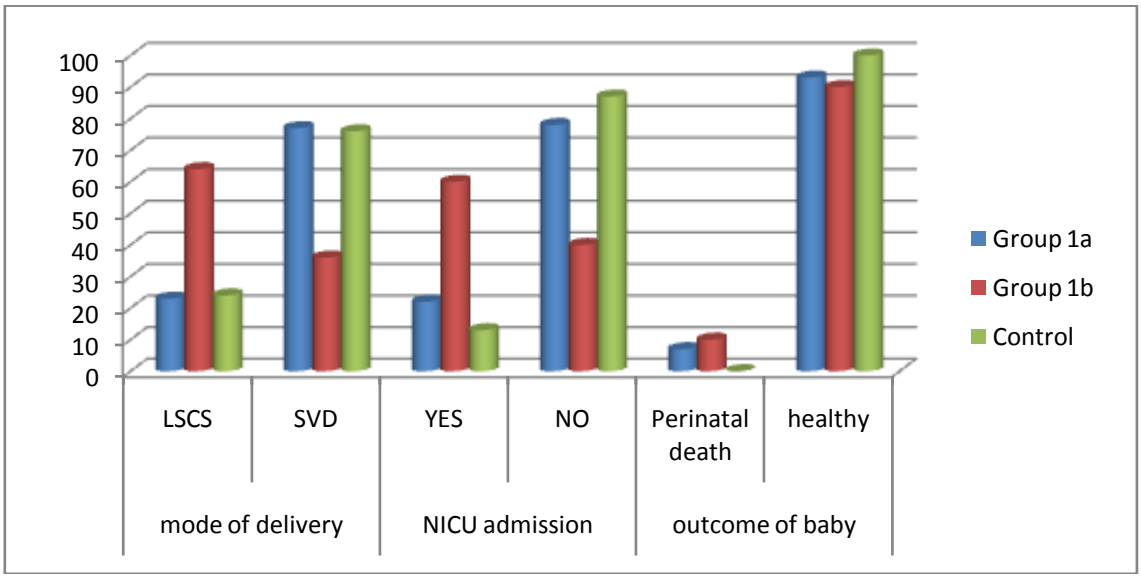

Fig-1: Perinatal outcome among group 1a, group 1b and control group

As shown in Table no-7 & Figure no-1 ,among 3 groups adverse pregnancy outcomes are maximum in group 1b which has 64% LSCS rate, 60% NICU admission rate & 10% perinatal mortality rate. P value being less than 0.0001 is statistically significant.

Table 8: Triple vessel Doppler pulsatality index among group 1a, group 1b and control group

	Mean ± SD			**P value**
	Group 1a	**Group 1b**	**Control**	
Umbilical Artery PI	1.17±0.65	1.3±0.46	0.86 ± 0.13	<0.0001
MCA PI	1.35±0.36	1.16±0.24	1.54 ± 0.34	<0.0001
Cerebroumbilical Ratio	1.3±0.5	0.9±0.4	1.9 ± 0.41	<0.0001
Uterine Artery PI	0.8±0.4	1.12±0.6	0.51 ± 0.2	<0.0001

As shown in Table no-8, group 1b has most abnormal triple vessel Doppler indices. It has maximum mean umbilical artery PI and mean uterine artery PI and minimum mean MCA PI & mean cerebro-placental ratio. However by comparing Table no -7 & Table no-8 it is evident that group 1b which has most abnormal Doppler indices is also associated with worst perinatal outcomes. This is statistically significant as P value in both tables is less than 0.0001.

Table 9: Comparison of triple vessel PI in relation to perinatal outcome

Perinatal outcome	**UA PI**		**MCA PI**		**CPR**		**Uterine artery PI**	
	Normal (n=38)	**abnormal (n=37)**	**Normal (n=45)**	**Abnormal (n=30)**	**Normal (n=45)**	**Abnormal (n=30)**	**Normal (n=49)**	**Abnormal (n=26)**
LSCS	2(5%)	27(72%)	11(24%)	18(60%)	3(7%)	26(86%)	17(34%)	12(46%)
NICU admission	3(8%)	25(67%)	11(24%)	17(57%)	2(5%)	26(86%)	17(34%)	11(42%)
Perinatal mortality	0(0%)	6(16%)	2(4%)	4(13%)	2(4%)	4(13%)	4(8%)	2(8%)
P value	<0.001 <0.001 <0.001		<0.001 <0.001 0.0119		<0.001 <0.001 0.0119		0.05 0.06 0.06	

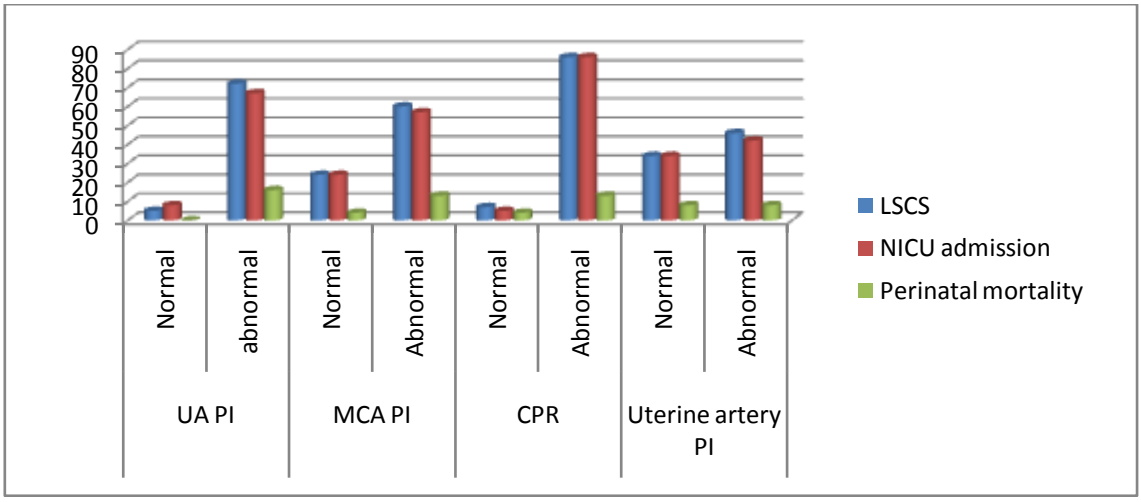

Fig-2: Comparison of triple vessel PI in relation to perinatal outcome

As shown in Table no-9 & Figure no-2 abnormal CPR has maximum LSCS & NICU admission rate of 86% each. However among individual vessel abnormal UA PI had maximum LSCS (72%) & NICU admission rate (67%). Perinatal mortality rate is maximum in abnormal UA PI (16%). Thus among triple vessel Doppler indices abnormal CPR is better predictor of adverse perinatal outcome.

Table 10: Assessment of PI of UA, MCA, uterine artery and CPR with adverse perinatal outcome in study group

	Sensitivity	Specificity	PPV	NPV	Accuracy	P value
UA PI	68%	83%	70%	80%	68%	<0.001
MCA PI	62%	81%	74%	71%	64%	<0.001
CPR	81%	95%	92%	89%	82%	<0.001
Uterine Artery PI	50%	77%	65%	64%	62%	0.31

As shown in Table no-10, abnormal CPR has highest sensitivity (81%) ,specificity (95%) and diagnostic accuracy (82%) and thus it is the best predictor of adverse perinatal outcomes in IUGR pregnancies with or without PIH.

DISCUSSION

In our study, we found that the abnormal CPR is better predictor of adverse perinatal outcome than either the MCA PI or UA PI alone in IUGR pregnancies. This observation is similar to study conducted by Shahina Bano *et al.;* [7] and Gramellini *et al.;* [6]

Table 11: Comparison of triple vessel PI in relation to perinatal outcome

	Present study				Shahina Bano *et al.;* [7]		
	abnormal UA PI	**Abnormal MCA PI**	**Abnormal CPR**	**Abnormal Uterine artery PI**	**abnormal UA PI**	**Abnormal MCA PI**	**Abnormal CPR**
LSCS	72%	60%	86%	46%	66%	75%	85%
NICU admission	67%	57%	86%	42%	44%	75%	75%
Perinatal mortality	16%	13%	13%	8%	8%	25%	25%

Table 12: Comparison of overall diagnostic accuracy of Doppler indices in predicting adverse perinatal outcome in IUGR

	Gramellini *et al.;* [6]	Shahina Bano *et al.;* [7]	Present study
UA PI	**88%**	**88.9%**	**68%**
MCA PI	**66%**	**77.8%**	**64%**
CPR	**90%**	**95.6%**	**82%**
Uterine artery PI	**-**	**-**	**62%**

Table 13: Assessment of uterine artery PI in predicting adverse perinatal outcome

	Sensitivity	specificity	PPV	NPV
Lavanya Rai *et al.;* [8]	86%	81%	93%	68%
Present study	50%	77%	65%	64%

Table 14: Assessment of uterine artery PI in predicting adverse perinatal outcome in group 1b

	Sensitivity	Specificity	PPV	NPV
Lavanya Rai *et al.;* [8]	86%	81%	93%	68%
Group 1b	75%	80%	88%	62%

As shown in Table no-14, in our study uterine artery found to be less sensitive and less specific in comparison to Lavanya Rai *et al.;* [8] in predicting adverse perinatal outcome in IUGR with or without PIH. This is because of differences in the composition of study group among both the studies. In our study 40% of cases had IUGR with PIH whereas in Lavanya Rai *et al.*[8]*;* all cases had pre-eclampsia with IUGR. However uterine artery PI is sensitive (75%) and specific (80%) in predicting adverse perinatal outcome in IUGR with PIH cases (group 1b) and comparable with Lavanya Rai *et al.;* [8] as shown in table no-12.

CONCLUSION

- Cerebro-placental ratio (CPR) has a higher sensitivity of 81% for predicting adverse perinatal outcome than the UA PI, MCA PI or uterine artery PI individually. However among PI of individual vessels UA PI is found to be better predictor of adverse outcome.
- Uterine artery PI has low sensitivity (50%) in predicting adverse perinatal outcome in pregnancies with IUGR but has higher sensitivity (75%) in predicting adverse perinatal outcome in pregnancies with IUGR and PIH.
- Our study recommends use of triple vessel Doppler study in IUGR pregnancies, especially in those with IUGR and PIH. However in pregnancies with IUGR without PIH double vessel Doppler study of UA and MCA is sufficient to predict adverse perinatal outcomes as uterine artery PI has low sensitivity in predicting adverse perinatal outcomes in such pregnancies.

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