Radiodiagnosis

COLOR DOPPLER IN EVALUATION OF INTRAUTERINE GROWTH RETARDATION AND FETAL OUTCOME

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ABSTRACT

INTRODUCTION- Intra uterine growth retardation (IUGR) most commonly caused by placental insufficiency is rampant in developing countries like India. With the development of ultrasound along the the Doppler, antenatal diagnosis of IUGR is simplified with early detection of the abnormal waveform and Doppler indices of uterine artery, umbilical artery and middle cerebral artery.

MATERIAL AND METHOD- A total of 35 high risk patients, presenting to the Himalayan Hospital were recruited in the study. Color Doppler indices of Uterine, Umbilical and Middle cerebral arteries were taken using Philips EPIQ 5G/ EPIQ 7G ultrasound machine with 3.5/5 MHz curvilinear transducer with follow up of the pregnant women up to delivery.

RESULT- 35 patients were enrolled in the study with majority (45.7 %) patients was between 26-30 years followed by 34.3 % of women <26 years of age. Most common high risk factor in our study being hypothyroidism. Neonatal death/Still birth as the fetal outcome was seen in 14.3% of pregnancies. There was a significant association between abnormal umbilical and middle cerebral artery Doppler indices with adverse fetal outcome.

CONCLUSION- Abnormal Doppler indices of umbilical and middle cerebral artery was significantly associated with adverse fetal outcome, however no significant association with the uterine artery seen.

INTRODUCTION-

Intra uterine growth retardation (IUGR) due to inadequate fetoplacental blood supply is common in developing countries like India because of absence of wakefulness, antenatal women usually come in third trimester of the pregnancy for their first ultrasound examination (1). In past development of fetus was mainly assessed through size of the uterus and fetus by palpation and can only see the baby at time of delivery and conclude at what had happened in utero, thus increasing the perinatal mortality and morbidity. Today in the age of sophisticated modality of real time ultrasound, antenatal diagnosis of IUGR is simplified, hence diminishing the future catastrophe (2). The occurrence of IUGR in healthy pregnant women is approximately 3-5% while in pregnant women having high blood pressure or has restricted growth of fetus earlier, the incidence rises to 15- 20% (3). As per UNICEF prevalence of IUGR in India is 25-30% (4). IUGR can occur due to many maternal causes and due to fetal infections and chromosomal anomalies (5). Diagnosis IUGR antenataly by ultrasonography has reduces the perinatal complications but with the commencement of Doppler ultrasound uteroplacental and fetoplacental blood flow can be determined hence drastically reducing adverse fetal outcome (6). Umbilical artery Doppler velocimetry being the most extensively used method to access the fetal well-being (6). Middle cerebral artery Doppler indices also have noteworthy association with fetal hypoxia (7). Hence the study was undertaken to affirm the role of Doppler ultrasonography in abnormal perinatal outcome in pregnancies with clinical suspicion of IUGR.

AIMS AND OBJECTIVES-

To estimate color Doppler indices of uterine artery, umbilical artery and middle cerebral artery as predictors of adverse perinatal outcome in clinically suspected IUGR pregnancies.

MATERIAL AND METHOD-

The study was carried out in the department of radiology and department of Obstetrics, HIMS, Swami Ram Nagar, Dehradun, over a period of 12 months. Both Outpatients and Inpatients were included. After taking a proper written informed consent and permission from the ethical committee, complete history and thorough clinical examination was done and the patients were subjected to ultrasound sonography. **Study Design-** Follow up, observational Study. **Sample size:** The study included 35 high risk patients by convenient sampling method. **Inclusion criteria -** All antenatal woman at or over 28 weeks of gestational age having one or more high risk factors (h/o of IUGR, uteroplacental insufficiency, obesity, medical diseases, h/o neonatal death) was studied. **Exclusion criteria-** All subjects with history of rupture of membranes, active labor, multiple pregnancies and fetuses with congenital anomalies. **Study tools-** All the gray scale and color Doppler analysis of the Uterine, Umbilical and Middle cerebral arteries were obtained using Philips EPIQ 5G/ EPIQ 7G ultrasound machine with 3.5/5 MHz curvilinear transducer with follow up of the pregnant women up to delivery. Perinatal outcome variables in high-risk pregnancies included were mode of delivery, metabolic complication, birth weight, Apgar score at 5mins, Fetal distress, admission in NICU, need for artificial intubation, perinatal and neonatal mortality. SGA was defined as fetal weight less than 10 percentile of gestational age.

All data was analyzed with SPSS software version 22.0. Continuous variables were presented as mean±SD and categorical variables were presented as absolute numbers and percentage. Data was checked for normality before statistical analysis. Chi-square test or Fisher's exact test was used for statistical comparison of qualitative variables and for determining the association between different variables.

RESULTS-

Table 1: Shows the distribution of high risk in pregnant women according to the risk factors.

Risk factors	Frequency	%
Obesity	20	57.1%
h/o smoking	1	2.9%
h/o alcohol	1	2.9%
h/o chronic hypertension	2	5.7%
h/o previous abruption	2	5.7%
h/o previous neonatal death/still birth	13	37.1%
GDM/ h/o diabetes	9	25.7%
Renal disease/ h/o chronic renal disease	0	0.0%
other medical disease	12	34.3%
Pre eclampsia	6	17.1%
Placenta abruption	1	2.9%
Pregnancy induced hypertension	8	22.9%

The study showed that most common risk factor among high risk women was obesity (57%) followed by previous history of neonatal death/still birth (37.1%) and associated other medical disease (34.3%). Hypothyroidism being the most condition in other medical disease. Multiple risk factors were overlapping in the pregnant women. None of the patient gave history of chronic renal disease.

Table 2: Shows distribution of perinatal outcome in high risk pregnancy.

Perinatal outcome	Frequency	%
Alive	30	85.7%
Neonatal Death	5	14.3%
Total	35	100%

Out of 35 deliveries there were 5 (14.3%) neonatal deaths while 30 (85.7%) were born alive.

Table 3: Shows distribution of fetal outcome with live births and neonatal demise.

fetal outcome		Total cases		Alive		Neonatal Death		P value[*]
apgar 5min <7	N	28	28	93.3%	0	0.0%		<0.001
	Y	7	2	6.7%	5	100.0%		
BW	<2500	17	12	40.0%	5	100.0%	0.019	
	>2500	18	18	60.0%	0	0.0%		
Fetal Distress		10	5	16.7%	5	100.0%	0.001	
INT		10	5	16.7%	5	100.0%	0.001	
NICU		14	9	30.0%	5	100.0%	0.006	
Hypoglycemia		4	3	10.0%	1	20.0%	0.477	
IVH		0	0	0.0%	0	0.0%	-	
Hypocalcemia		0	0	0.0%	0	0.0%	-	
Hyperbilirubinemia		7	3	10.0%	4	80.0%	0.003	

([*] Chi square test)

Out of the 5 neonatal death all were having APGAR <7, birth weight <2500gm, had fetal distress, were intubated at birth, had NICU stay and 4 (80%) were having hyperbilirubinemia. The difference between the values were clinically significant (p<0.05).

Table 4: Shows distribution of uterine artery indices in high risk women.

Normal /abnormal	Frequency	%
ABN	14	40.0%
N	21	60.0%
Total	35	100%

Of the 35 patients 14 (40%) had abnormal uterine artery flow while 21 (60%) patients had normal uterine artery flow.

Table 5: Shows comparison of Uterine artery indices with fetal outcome

Uterine artery	Fetal Outcome				P value*
	Alive		Neonatal Death		
	Frequency	%	Frequency	%	
ABN	11	36.7%	3	60.0%	0.324
N	19	63.3%	2	40.0%	
Total	30	100%	5	100%	

([*] Fisher exact test)

Out of the 30 alive born normal indices were seen in 19 (63.3%), abnormal in 11 (36.7%). While out of 5 neonatal deaths normal indices were seen in 2 (40%), abnormal in 3 (60%). The difference between the values were clinically insignificant (p>0.05).

Table 06: Shows comparison of Umbilical artery waveform with fetal outcome

Umbilical Artery	Fetal Outcome				P value*
	Alive		Neonatal Death		
	Frequency	%	Frequency	%	
N	20	66.7%	1	20.0%	0.033
Decreased EDF	8	26.7%	2	40.0%	
AEDF	2	6.7%	1	20.0%	
REDF	0	0.0%	1	20.0%	

([*] Chi square test)

Out of the 30 alive new born normal indices was seen in 20 (66.7%), decreased end diastolic flow in 8 (26.7%) and AEDF in 2 (6.7%). While out of 5 neonatal deaths normal indices were seen in 1 (20%), decreased end diastolic flow in 2 (40%) , AEDF in 1(20%) and REDF in 1 (20%). The difference between the values were clinically significant (p<0.05)

Table 07: Shows comparison of MCA indices with fetal outcome

MCA	Fetal Outcome				P value[*]
	Alive		Neonatal Death		
	Frequency	%	Frequency	%	
ABN	8	26.7%	4	80.0%	0.020
N	22	73.3%	1	20.0%	
Total	30	100%	5	100%	

([*] Fisher exact test)

Out of the 30 alive born normal indices were seen in 22 (73.3%), abnormal in 08 (26.7%). While out of 5 neonatal deaths normal indices were seen in 1 (20%), abnormal in 4 (80%). The difference between the values were clinically significant (p<0.05).

DISCUSSION-
The present study was conducted on 35 singleton pregnancies with various risk factors and their evaluation by doppler velocimetry of bilateral uterine arteries, umbilical artery and middle cerebral artery. Hemodynamic monitoring in pregnancy noninvasively has been done by introduction of Doppler technology. It's an important tool for feto-maternal surveillance in high risk pregnancies (8). In current study it was spotted most of patients in high risk group were in 26- 30 years. None of the patients were < 21 or > 38 yrs. Most of the pregnant women were multigravida (66%).

In cases, considering fetal outcome as live birth or neonatal death. Amongst 30 cases of live birth i.e. 9/30(30%) has abnormal uterine artery flow and 21/30 had normal uterine artery flow. Diastolic notch is present in 7/30 (23.3%) and absent in 23 cases (76.7%). 5/35 cases were of neonatal deaths, out of which 2/5 (40%) had abnormal uterine artery flow and in 3/5 (60%) uterine artery flow was normal. All cases of neonatal deaths showed absent diastolic notch (100%). No significant difference between the Doppler parameters of uterine arteries were seen in relation to perinatal outcome. Similar results was noted by Chien PF et al. in the study done for the analysis of uterine artery Doppler waveform suggesting limited diagnostic accuracy of uterine artery in relation to perinatal outcome (9).

In the present study we concluded that MCA PSV increases and PI decreases with advancing gestational age. In our study (mean ± SD) PI in high risk pregnancies came out to be 1.64±0.44 and S/D ratio 4.39±1.36. In neonatal deaths abnormal MCA indices were observed in 4 cases and only 1 case has normal value. The difference between the values were statistically significant. In our study, in 30 live fetal births fetuses show decreased end diastolic flow in umbilical artery in 26.7% of cases (8/35) and absent end diastolic flow in 6.7% (2/35). No cases with reversal of end diastolic flow was reported. Normal umbilical artery was seen in 66.7% (20/35) cases. In 5 cases of neonatal deaths, normal umbilical was observed on 20% (1/5), decreased end diastolic flow in 2(40%), absent end diastolic flow in 1 (20%) and reversed end diastolic flow was observed in 1(20%) cases. Campbell also reported that initially reduction in diastolic flow of umbilical artery occurs due to increase in the resistance that occurs in arterioles of tertiary villi and small arteries in cases of IUGR. Hence there is increase in S/D ratio; Pl and Rl of umbilical artery. Diastolic flow decreases with worsening of placental insufficiency, then it become absent, and later on it gets reversed. The reduction in diastolic velocity remains constant in some fetuses with advancing gestation and never get reversed or become absent which may be because of a milder form of placental insufficiency (10). The occurrence of perinatal death as the outcome in fetuses with absent or reversed end diastolic flow velocity was stated to be 40% as also seen in our study. Campbell and Schulman also noted that a decrease in diastolic flow or even absent and reversed diastolic flow in uterine and umbilical arteries is seen in pregnancies with abnormal outcome (10).

Apgar score taken at 5 min. of birth was <7 in 7/35 pregnancies, out of which 2 were live births and 5 succumed to death. >7 Apgar score was

seen in 27 fetuses and all of them survived. In our study there were 18/35 fetuses with birth weight >2500 gm, all of which were alive. Whereas there were 17/35 foetuses with birth weight <2500gms out of which 12/35 were alive while 5 cases were of neonatal deaths. Hence we can conclude that all neonatal deaths in our study were having birth weights <2500gms.Fetal distress is seen in 10/35 cases out of which 5 cases   were alive and 5 cases were of neonatal death. Hence we can conclude that all neonatal deaths were having fetal distress (100%).

All the fetuses with distress were intubated (100%). Total number of fetuses shifted to NICU were 14 out of which 9 were alive and 5 died. Hence we can conclude that all the neonatal deaths were in the foetuses that were admitted to the NICU.Hyperbilirubinemia   was seen in 7 cases amongst which 3 fetuses survived and 4 fetuses were succumbed to death. The difference between the values were clinically significant. Difference in specificity and sensitivity with previous studies could be due to earlier intervention in cases of high risk pregnancies due to fear of fetal complications (11).

CONCLUSION-

Abnormal Doppler indices of umbilical and middle cerebral artery was significantly associated with adverse fetal outcome, however no significant association with the uterine artery seen. Abnormal APGAR score with low birth weight was seen in all neonatal demise. Thus abnormal Doppler indices should be taken as acute emergency and early intervention should be done to prevent adverse fetal outcome.

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