Role of Panvessel Doppler Study in High Risk Pregnancy

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Abstract:
Objective(s): *To evaluate the role of panvessel (umbilical, middle cerebral, uterine artery and ophthalmic artery) color Doppler study in normal and high risk pregnancy in relation to perinatal outcome.*
Method(s): *A prospective study was done including 50 women with high risk pregnancy and 50 normal pregnant women during the year 2012-2014. Doppler examination was done after recording patients' history, clinical examination and ultrasound. Mode of delivery, perinatal outcome including birth weight, perinatal death, Apgar score at 1 and 5 minutes and admission to nursery were compared.*
Result(s): *There was significant difference between the Doppler indices of these vessels in the study and the control group. In women with abnormal Doppler indices, there was high incidence of cesarean section (78%), low birth weight babies, low Apgar score, higher admission rate to nursery (36%) and high incidence of neonatal deaths as compared to that of the control group. The Doppler findings were most abnormal in the group with concomitant PIH and IUGR (seven cases).All the seven (100%) cases had diastolic notch in uterine artery, umbilical artery S/D>3 and abnormal MCA PI.*
Conclusion(s): *Panvessel color Doppler sonography is very useful in high risk pregnancy diagnosis and in predicting perinatal outcome.*
Keywords: *high risk pregnancy, panvessel color Doppler, perinatal outcome.*

I. Introduction

Doppler velocimetry is a rapid noninvasive test that provides valuable information about hemodynamic situation of the fetus and is an efficient diagnostic test of fetal jeopardy which helps in timely intervention and management of high risk pregnancy for better perinatal outcome[1]

The **principle** of Doppler ultrasound was described in 1842 by Johann Christian Doppler. Identification of the pregnancies at risk for preventable perinatal morbidity and mortality is a primary goal of the obstetric care[2].The development of Doppler ultrasound evaluation of uteroplacental and fetoplacental circulation is one of the most important achievements of modern obstetrics. Abnormal Doppler findings are associated with fetal growth restriction and have been used as a screening test for fetal stress. Absent or reversed diastolic flow is a particularly ominous finding indicating extreme downstream resistance, placental dysfunction and fetal compromise.

High Risk Pregnancy Group: There are certain categories of pregnancies where the mother, the fetus or the neonate is in state of increased jeopardy. About 20-30% of the pregnancies belong to this category. To improve the obstetric result, this group must be identified & given extra care. Even with the adequate antenatal & intranatal care, this small group is responsible for 70-80% of perinatal mortality and morbidity.

Material And Method: A prospective study of 100 pregnant women attending to department of obstetrics and gynecology in **Mahatma Gandhi medical college and hospital, Jaipur from June 2012-June 2014.** Group A included 50 control subjects (normal pregnancies) and group B included 50 pregnant women with high risk pregnancies. Their relevant data such as indoor registration number, maternal age, residential area, socioeconomic status, occupation, gestational age confirmed by LMP, parity, clinical examination, routine antenatal investigation like blood group, hemoglobin, HIV, VDRL, HbsAg, any significant medical or obstetric history ultrasound and Doppler waveform of uterine artery, umbilical artery, middle cerebral artery and ophthalmic artery , mode of delivery , fetal weight and fetal outcome.

Table No.1 Categorization Of Cases

Risk Factor	No. of patients	%
APH	5	10
BOH	5	10
Diabetes	3	6
IUGR	9	18
IUGR + Rh-ve	2	4
IUGR+Anemia	2	4
IUGR+BOH	1	2
PIH	11	22

PIH + IUGR	7		14
PIH+ IUGR+ BOH	1		2
Rh-ve	4		8
Grand total	**50**		**100**

Table no. 2 Doppler in different categories of cases

S. No.	Categories (High risk)	No. of Cases	Diastolic Notch in Uterine Artery	Umbilical Artery S/D>3	Abnormal MCA PI	Low Apgar (<7)	LBW Babies (<2500gm)	Nursery Admission	Neonatal deaths
1.	PIH	11	8	8	8	6	1	5	0
2.	IUGR	9	6	8	9	6	8	4	0
3.	PIH+ IUGR	7	7	7	7	5	7	6	2
4.	Diabetes	3	0	3	0	2	1	2	0
5.	IUGR+Rh Negative	2	2	2	1	0	0	0	0
6.	PIH+ IUGR+BOH	1	1	1	1	1	1	1	0
7.	IUGR+BOH	1	1	1	0	0	0	0	0
8.	IUGR+Anemia	2	2	2	1	2	2	1	0
9.	BOH	5	0	3	1	1	0	0	0
10.11.	Rh Negative	4	0	3	0	1	1	1	0
	APH	5	0	5	0	4	5	2	1

Table no.3 Comparison Of Umbilical Artery Doppler Indices

UMBILICAL ARTERY	STUDY GROUP	CONTROL GROUP	P value
PI	1.70 ±0.39	0.84±0.22	< 0.001
RI	0.74 ±0.16	0.56±0.07	<0.001
S/D	3.84±0.88	2.15±0.28	<0.001

Table no. 4 Comparison Of Uterine Artery Doppler Indices

UTERINE ARTERY	STUDY GROUP	CONTROL GROUP	P value
PI	0.97±0.38	0.59±0.12	>0.05
RI	0.58±0.17	0.43±0.06	>0.05
S/D	1.82±0.59	1.55±0.26	<0.001

Table no. 5 Comparison Of Middle Cerebral Artery Doppler Indices

MIDDLE CEREBRAL ARTERY	STUDY GROUP	CONTROL GROUP	P value
PI	1.08±0.26	1.28±0.23	<0.001
RI	0.66±0.07	0.74±0.19	< 0.001
S/D	3.03±1.03	3.93±0.94	<0.001

Table no.6 Ophthalmic Artery Index

OPHTHALMIC ARTERY	STUDY GROUP	CONTROL GROUP	P value
PI	1.31±0.33	1.76±0.36	<0.001

Table no.7 Mode Of Delivery In Control And Study Group

Mode of delivery	Control (n=50)	%	Study group (n=50)	%
NVD	42	84	9	18
LSCS	8	16	35	70
PTVD	-	-	6	12
TOTAL	**50**	**100**	**50**	**100**

Table no.8 Comparison of birth weight, Apgar score at 1 & 5 minutes and amniotic fluid index in study & control groups

Variable	Control group	Study group	P value
Birth weight	2.93±0.30	2.30 ±0.48	<0.001
Apgar score at 1 min	6.8 ± 0.66	7.32 ± 0.58	<0.001
Apgar score at 5 min	7.54 ± 0.61	7.94 ± 0.37	<0.001
Amniotic fluid index	12.48±2.02	7.8 ±2.6	<0.001

II. Results

The most common high risk group in the study group was PIH (38%) ,either alone (22%) or in combination with other risk factor like IUGR and BOH (16%).

The second most common high risk group was IUGR either alone (18%) or in combination with PIH , BOH, Anaemia and Rh negative pregnancy (26%).

The other high risk group include BOH (10%) alone and along with other risk factors like IUGR and PIH (4%), Rh negative pregnancy(8%) alone and along with IUGR (4%), APH (10%) and Diabetes (6%).

The Doppler findings were most abnormal in the group with concomitant PIH and IUGR (seven cases).All the seven (100%) cases had diastolic notch in uterine artery, umbilical artery S/D>3 and abnormal MCA PI. Also the perinatal outcome was worst in this group with low Apgar score in five (71%) neonates, LBW babies in all seven (100%) cases and all the seven (100%) neonates were admitted in nursery out of which there was two neonatal death.

In PIH group, Doppler findings were abnormal in eight (73%) cases, with low Apgar score in 6 neonate, 1 case was LBW baby and five neonates were admitted to nursery and no neonatal death. The Doppler findings and the perinatal outcome in other categories are shown in Table 2.

Table 3 shows that the PI, RI and S/D of the umbilical artery were significantly higher in the study group (1.70, 0.74, 3.84) than the control group (0.84, 0.56, 2.15).. Table 4 shows the comparison of uterine artery indices in the study(0.97, 0.58, 1.82) and the control group(0.59,0.43,1.55). Only the S/D ratio was significantly different between the two groups (p<0.001). Table 5 shows that the PI, RI and S/D ratio of MCA in high risk pregnancy group 1.08, 0.66, 3.03 were significantly lower than the control group. Table 6 shows the PI of ophthalmic artery which was significantly lower in study group(1.31) than the control group(1.76).

In the high risk group majority of the patients (70%) had LSCS (lower segment cesarean section) while in the control group most of the patients had vaginal delivery (Table 7). High risk cases had higher admission rate to nursery (44%) as compared to the control group.

The mean amniotic fluid index (AFI) in high risk group was 7.8 cm and in control group was 12.48 cm. Mean birth weight in the study group (2300gm) was significantly lower than in the control group (2930gm).Apgar score at 1 minute and 5 minutes was significantly lower in the high risk group than the control group (Table 8).

III.   Discussion

In the present study, mean age was 25.5 years for the study group and 23.7 years for the control group. Majority of the patients in the study group had PIH (pregnancy induced hypertension) and IUGR. The mean amniotic fluid index was significantly low in high risk group as compared to the control group. In the present study PI, RI and S/D value of the umbilical artery showed significantly higher values in the study group as compared to the control group (p<0.001) indicating increased peripheral resistance and consequently decreased diastolic flow leading to fetal compromise.

The PI, RI and S/D ratios of MCA in high risk pregnancy group were significantly lower than that in the control group, indicating increase in the diastolic flow and cerebral vasodilatation. This suggested the presence of brain sparing effect in the presence of fetal hypoxia due to placental insufficiency.

Sieroszewski et al[3] conducted a study to analyze the usefulness of uterine artery Doppler velocimetry in high risk pregnancy diagnosis. In the present study, among the uterine artery indices, only the S/D ratio was significantly higher in the study group as compared to the control group (p value < 0.001).

In the present study, most of the women in the control group had vaginal delivery while in the high risk group majority of the women had LSCS thus indicating increased operative intervention in the high risk group based on abnormal Doppler velocimetry. The mean birth weight and the Apgar score were lower in the study group as compared to the control group and the difference was highly significant. In the present study, there was higher admission rate to the nursery in the study group as compared to the control group as seen in the study conducted by Seyam[5], where it was found that the average birth weight and gestational age at delivery were significantly lower for fetuses with abnormal Doppler velocimetry than for those in the normal Doppler group. The umbilical and MCA artery indices were abnormal in the group whose babies were admitted in the nursery as compared to those whose babies were not admitted.

This implied poor perinatal outcome in the presence of abnormal indices and hence in the presence of fetal anoxia. When the uterine artery indices were compared in the two groups, it was found that, although the PI, RI, S/D ratio in the high risk group were higher than that in the control group, the difference was not statistically significant. In study group ophthalmic artery PI was lower than control group.In the present study, there were three neonatal deaths in the study group while none of the neonates died in the control group thus indicating poor perinatal outcome in the high risk group associated with abnormal Doppler findings.

Mikovic et al[6], in their study found that in the high risk group with abnormal Doppler indices, the average birth weight was 1327+ 245gm, neonatal mortality 8.6%, while perinatal mortality was 14.3%.

IV.   Conclusion

We conclude that Doppler ultrasound evaluation reflects fetal haemodynamics adequately. The results of our study support the use of Doppler umbilical, middle cerebral, uterine and ophthalmic artery waveform analysis as an important fetal well being investigation, which though not necessarily diagnostic has a lot of

prognostic value. Thus in consultation with obstetrician, neonatologist, the timing and mode of delivery can be decided upon the Doppler studies to improve perinatal outcome in high risk cases.

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