

COMPARATIVE STUDY OF FETOPLACENTAL BLOOD FLOW OF NORMAL AND PREGNANCY INDUCED HYPERTENSIVE MOTHERS BY DOPPLER METHOD, TO PREDICT NEONATAL OUTCOME AND MODE OF DELIVERY

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ABSTRACT

Background and Aim: As placenta is a mirror image of fetal outcome. By Colour Doppler we visualise the fetoplacental blood flow in situ and study the changes in blood flow throughout the pregnancy. Nowadays, Hypertension is a common disorder in pregnancy. With the help of 2D sonography and Doppler study we can examine the placenta, umbilical artery and foetal middle cerebral artery flow to predict neonatal outcome.

Materials and Methods: The purpose of present study was to correlate the foeto placental blood flow in normal and pregnancy induced hypertensive mothers. This study was conducted on total number of 120 patients after 28 weeks of pregnancy attending the Department of Obstetrics and Gynecology and radio diagnosis at Padmashri Dr. D. Y. Patil Hospital, Kolhapur, India. Detailed personal and family history was taken, general examination of the patient was done in normal and pregnancy induced hypertensive mothers. With the help of Doppler the flow of umbilical artery as well as fetal middle cerebral artery was studied. Chi-square test and Unpaired t-test was carried out for statistical analysis.

Result: Fetal outcome is found to be directly related to severity of maternal hypertension. Ischemic results in inadequate transfer of oxygen and nutrients to the fetus resulting in increased incidence of hypoxia, growth retardation and fetal loss. In hypertensive mothers, S/D ratio of fetoplacental flow in fetal Middle Cerebral Artery is reduced as compared to Normal pregnancy.

Conclusion: Thus, we conclude that regular monitoring of placenta in antenatal care and Doppler velocimetry is primary tool for fetomaternal surveillance in hypertensive pregnancies.

KEY WORDS: Colour Doppler, Foeto placental blood flow, foetal Middle cerebral artery, Umbilical artery, PIH.

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INTRODUCTION

The term "Placenta" was used for the first time in 1559. Placenta is a mirror which reflects the

intrauterine status of the fetus. Though it does not become the part of body of neonate, it contributes much for the well-being of the fetus. In utero by its protective nutritional & respiratory

function. It appears at pregnancy & prepares the fetus for extrauterine life [2].

Pregnancy associated problems like intrauterine growth retardation or pre eclampsia are mainly caused by disturbed placental function. Current model suggest that these problems are related to an impaired invasion of fetal trophoblastic cells in the maternal decidua, which will lead to an impended transformation of spiral arteries into vessels of low resistance. This causes reduced blood flow & consequently leads to hypoxic damage of the endothelial vessels initiating a range of disorders including Placental infarction, increased maternal B.P. (PIH) & fetal growth restriction [3].

Doppler sonography has focussed on its ability to identify growth retarded, hypoxic and /or distressed fetus. Abnormal Doppler waveforms are associated with growth retardation and / or fetal distress. Alterations in the fetoplacental circulation and specific fetal vessels reflect important haemodynamic modifications that occur in association with IUGR and fetal hypoxia. The Doppler detectable modifications in the fetal circulation associated with IUGR and fetal hypoxia include increased resistance in the umbilical artery and peripheral vessel in association with decreased resistance in fetal cerebral vessels. This pattern of haemodynamic alteration is believed to reflect " brain sparing phenomenon in which hypoxic fetuses perfuse the brain, heart and adrenals at the expense of integument, viscera, gut and kidney. Currently Doppler velocimetry is probably best used in obstetrics as an adjunctive test in prenatal monitoring [4].

The arterial Resistive Index (R/ I) , developed by Leandre Pourcelot is a measure of pulsatile blood flow that reflects the resistance to blood flow caused by microvasculature bed distal to the site of measurement. In Umbilical artery it should not exceed 0.6 at 30 wks. During pregnancy, Fetal Middle Cerebral Artery show high resistance wave forms i.e. high systolic velocity and low / absent diastolic velocity. S / D ratio is 6. A reduced SD ratio is abnormal i.e. increased diastolic flow in middle cerebral artery – indicator of fetal distress / IUGR. The purpose of the present study is to relate the changes in the fetoplacental blood flow in Normal and Pregnancy

Induced Hypertension (P. I. H.) patients by Doppler method for predicting neonatal outcome [5,6].

MATERIALS AND METHODS

The present prospective comparative study is carried out on a total no. of 120 cases after 28 weeks of pregnancy, attending the department of obstetrics and Gynecology and radio diagnosis at PADM. Dr. D.Y. Patil medical research center, Kolhapur. This hospital is around 500 bedded with well equipments and facilities. Clearance of Institutional Ethical Committee was obtained before starting the work. The present cases are divided into normal and pregnancy induced hypertensive groups according to personal history, general examination of patient & recording of Blood Pressure. A patient with rise of at least 30 mm of Hg & 15 mm of Hg in systolic and diastolic pressure respectively over previous known blood pressure was diagnosed to have PIH. If previous BP was not known, then BP of at least 140/90 mm of Hg was considered abnormal. B. P. > 140 / 90, without proteinuria and oedema is P.I.H. Women attending the antenatal clinic in the Department of Obstetrics & Gynaecology who were referred for routine ultrasonography were selected for the study. After explaining the procedure and obtaining consent, these patients were subjected to ultrasonographic examination.

Patients were scanned using Mindray DC – 7 real time USG machine with a sector array 3.5 MHz frequency transducers. Patients were asked to maintain a full bladder, for obtaining a better window for USG examination.

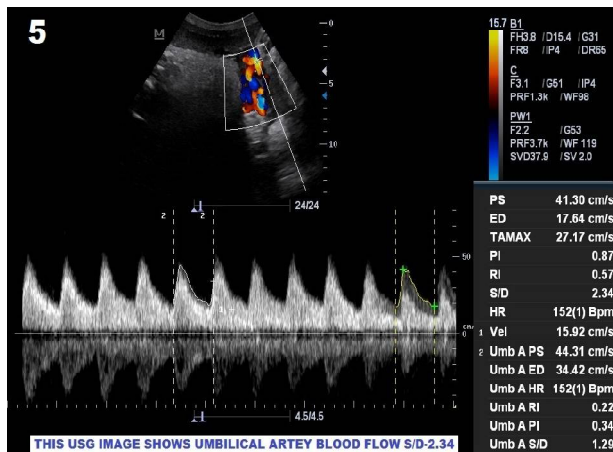
Inclusion criteria:

- 1 .Age group 20 to 35 yrs.
- 2 . Third trimester above 28 wks of pregnancy.
3. Pregnant women having normal blood pressure & Pregnancy Induced Hypertension.

Exclusion criteria:

- 1.Pregnancies with congenital anomalies
2. Pregnancy with hypertension with proteinuria & oedema
3. Twin pregnancy.

Fig. 1: Showing the umbilical artery blood flow (Ultra sound findings).



OBSERVATION TABLES AND RESULTS

Table 1: Age distribution (yrs).

Age distribution	No. Of Patients	Percentage (%)
20 to 25	60	50
26 to 30	50	41.67
>30	10	8.33
Total	120	100

The above table shows 50% patients are in the age group 20-25 yrs and 8.33% patients are above the age 30 yrs.

Table 2: Gestational Age distribution (wks).

Gestational Age	No. Of Patients	Percentage (%)
26 to 31	75	62.5
32 to 37	45	37.5
Total	120	100

The above table shows 26 to 31 wks pregnancy found 62.5% of total no. of cases and 37.5% in between 32 to 37 wks. of gestational age.

Table 3: Mode of delivery in P.I.H. & Normal mothers.

Pregnancy	Mode of Delivery				Total	Test	P value	Stat. Sig
	Normal		Elective Cesarean					
	(n)	(%)	(n)	(%)				
P.I.H.	24	39.3	37	60.7	61	Chi-square	0	Yes
Normal	59	100	0	0	59			

Above table shows that in normal mothers, 100

% deliveries were normal, while in P.I.H., 39.3 % cases delivered normally.

60.7 % cases of P.I.H. required Caesarian Section. It is statistically significant

Table 4: Pregnancy outcome in P.I.H. & Normal mothers.

Pregnancy	Pregnancy outcome							Total	Test	P value	Stat. Sig		
	Live Birth		IUGR		Severe IUGR		Death						
	n	(%)	n	(%)	n	(%)	n					(%)	
P.I.H.	1	1.6	40	65.6	18	29.5	2	3.3	61	100	Chi-square	0	Yes
Normal	59	100	0	0	0	0	0	59	100				

The above table shows 100% Live birth in Normal mothers. In P.I.H., 1.6 % LIVE BIRTHS are NORMAL, 65.6% are I.U.G.R. and 29.5% Severe I.U.G.R. Death rate of fetus in P.I.H. is 3.3 %. This may be correlated with early placental maturation (Grade III) in P.I.H. mothers. p value is 0.000 , which is Statistically Significant.

Table 5: Fetoplacental flow in Umbilical Artery.

Variables	Normal (59)		P.I.H. (61)		Test	P value	t value	Stat. Sig
	Mean	Standard Deviation	Mean	Standard Deviation				
R/I	0.6247	0.05059	0.6541	0.12879	Unpaired t-Test	0.105	1.633	No
S/D	2.7125	0.38578	2.8425	1.03165		0.366	0.908	No

From the above table ,it is seen that there is no much variation in Resistive Index (R / I) and Systolic - Diastolic ratio (S / D) of fetoplacental flow in umbilical artery of normal and P. I. H. mothers. It is also stastically not significant.

Table 6: Fetoplacental flow in Middle Cerebral Artery.

Readings	Normal (59)		P.I.H. (61)		Test	P value	t value	Stat. Sig
	Mean	Standard Deviation	Mean	Standard Deviation				
R/I	0.7886	0.11105	0.7515	0.21106	Unpaired t-Test	0.232	-1.201	No
S/D	4.386	1.0176	2.482	1.7818		0	-7.158	Yes

The above table shows Fetoplacental flow in Middle Cerebral Artery. There is not much difference in Mean Resistive Index (R / I) of Middle Cerebral Artery of foetus in Normal and P. I. H. pregnancy. Resistive index (R/I) of MCA in Normal and P.I.H. mothers is not statically significant.

Mean Systolic-Diastolic ratio of Middle Cerebral Artery in Normal pregnancy is 4..386 ,while in P.I.H. it is 2.482 and it is statistically significant.

Decreased S /D ratio is an indicator of fetal distress / IUGR.

DISCUSSION

Hypertensive disorders of pregnancy is the one of leading causes of maternal mortality, morbidity and perinatal mortality and morbidity.

Mode of Delivery: In the present study, in Normal pregnancy, 100% cases delivered normally. While 60.7 % cases of P. I. H. required Caeserian Section. There is no comparable findings to this parameter.

Neonatal Outcome: In the present study, in P.I.H. out of 97 % Live births, 65.6 % babies have IUGR (Intra Uterine Growth Retardation) and 29.5 % babies have severe IUGR. Death rate in these patients seen is 3.3%

Many workers have shown correlation between P. I. H. and IUGR. Our findings confirm the relation between high blood pressure and IUGR due to placental insufficiency.

Foetoplacental flow in Umbilical artery: Umbilical artery flow velocity waveforms reflect placental impedance to blood flow and that changes of flow patterns may be caused by alteration of the fetoplacental vessels tree (vasoconstriction and villous infraction), therefore it could be anticipated that fetus with an elevated systolic diastolic ratio is more likely to have perinatal problems than a fetus with normal flow pattern.

Kotini et al. in 2005, studied the correlation between biomagnetic and Doppler findings of umbilical artery in IUGR and concluded that values of umbilical artery is proved to be helpful for the evaluation of fetal well-being especially in pregnancies complicated with preeclampsia and growth restriction. Most of those authors concluded that an umbilical blood flow study by Doppler in 3rd trimester is very useful in predicting fetal outcome [7].

Most studies concluded that umbilical artery Doppler is more significant and accurate in predicting the pregnancy out-come than the uterine artery Doppler. However the uterine artery Doppler is unique in its ability to predict only severe adverse pregnancy outcome, namely placental abruption, fetal death, and pre-term delivery, so that it can be used as a continuous

screening variable so as to make risk prediction specific to an individual patient [8,9].

As shown by Fleischer et al about 40% of hypertensive pregnancies have increased resistance in the umbilical artery which is significantly associated with IUGR & perinatal mortality and morbidity. On the other hand it has been mentioned number of tertiary stem villi & arterial channels, fetoplacental compartment develops & the impedance in the umbilical artery decreases. From 15 weeks of gestation umbilical artery resistance declines & the diastolic component appears in the waveform during early second trimester [10-12].

S/D ratio of less than or equal to 3 is considered normal. In the present study, mean S / D of umbilical artery in normal pregnancy was 2.7125 while in P. I. H. patients it was 2.8425. In present study there is no statistical difference seen in S/D ratio of Umbilical artery in Normal & P.I.H. patients. Fetal Middle Cerebral Artery: In normal fetus, there is little diastolic flow in MCA & S/D ratio is greater than 4 . In asymmetric IUGR there is increased diastolic flow, a pattern believed to reflect brain sparing phenomena described in experimental models of fetal hypoxia.

In our study in pregnancy induced hypertensive mothers 'P' value of S/D ratio in Umbilical artery is 0.366 , it means it is not significant while 'P' value of S/D ratio in Middle cerebral artery flow is 0.00 , it means it is statistical significant.

Reduced S/D ratio in MCA is associated with IUGR and perinatal mortality and morbidity. In the present study out of 61 cases 40 babies show IUGR, 18 babies have severe IUGR and 2 babies succumbed to death.

Table 7: Association of PIH with USG Findings. (Test of significance- Unpaired 't' test)

Readings	Normal (59)		P.I.H. (61)		Test	P value	t value	Stat. Sig
	Mean	Standard Deviation	Mean	Standard Deviation	Unpaired t-Test			
R/I	0.7886	0.11105	0.7515	0.21106		0.232	-1.201	No
S/D	4.386	1.0176	2.482	1.7818		0	-7.158	Yes

The etiopathogenesis of hypertensive disorders of pregnancy still remains a subject of controversy. The classical view in this regard focuses

on the placenta and the utero placental circulation.

CONCLUSION

Thus, we conclude that regular monitoring of placenta in antenatal care and doppler velocimetry is primary tool for fetomaternal surveillance in hypertensive pregnancies, because the changes in umbilical & uterine circulation strongly correlates with pregnancy outcome. It helps us to take timely action, plan the treatment & also counsel the patients in their future pregnancies.

Conflicts of Interests: None

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