

## ORIGINAL ARTICLE

**THE ROLE OF COLOUR DOPPLER AND SPECTRAL FLOW ANALYSIS IN PREGNANCY INDUCED HYPERTENSION: A CASE CONTROL STUDY****Hinal Bhagat<sup>1</sup>, Bhavesh R Goyani<sup>2</sup>, Bhagwati V Ukani<sup>3</sup>, Mahesh K. Vadel<sup>4</sup>, Rakesh Sheth<sup>5</sup>****Author's Affiliations:** <sup>1</sup>Assistant Professor; <sup>3</sup>Associate Professor; <sup>4</sup>Professor & Head, Dept. of Radiology, Government Medical College, Surat; <sup>2</sup>Associate Professor, Dept. of Radiology; <sup>5</sup>Associate Professor, Dept. of ENT, GMERS Medical College, Valsad.**Correspondence:** Dr. Bhavesh Goyani, Email: bhaveshgoyani67@gmail.com**ABSTRACT****Background:** The use of Doppler ultrasound to study blood flow in Obstetrics is of major importance because fetal inaccessibility precludes many other methods of study of fetal circulation. This study was undertaken to assess the role of Doppler in management of Pregnancy induced Hypertension.**Methodology:** The present case-control study was conducted in the department of Radiology, Govt. Medical College & New Civil Hospital, Surat. Details of obstetric history, age, last menstrual date and underlying risk factor, Doppler study of umbilical artery, fetal middle cerebral artery, both maternal uterine arteries & Ductus venosus was done. Parameters in form of Resistive index (RI), Pulsatility index (PI) and systolic/diastolic ratio (S/D) of all four arteries were taken.**Results:** It was observed that 55% cases with pregnancy induced hypertension developed IUGR fetuses while 2% of the IUGR fetus was present in control group. There were 41 (54%) cases with IUGR fetuses. Out of which 28 (68%) cases with IUGR had fetoplacental Doppler abnormality. 13 cases had abnormally low PI of MCA with normal umbilical arterial Doppler indices, out of which 12 patients had abnormal fetal outcome.**Conclusion:** By examining the maternal vessels using Doppler ultrasound it is possible to determine, the risk of complication developing in the course of pregnancy long before clinical signs of preeclampsia appear so that therapeutic measures may be undertaken early.**Keywords:** Case control study, Pregnancy induced hypertension, Colour doppler**INTRODUCTION**

The use of Doppler ultrasound to study blood flow in Obstetrics is of major importance because fetal inaccessibility precludes many other methods of study of fetal circulation.<sup>1</sup> The development of Doppler ultrasonographic technology particularly during last 10 years has provided an opportunity to obtain both qualitative and quantitative assessment of maternal and fetal hemodynamic in non-invasive method.<sup>2</sup>

It is suggested that 36% intrauterine death of normally formed singleton fetuses are associated with IUGR co-existing with or without Pregnancy Induced Hypertension (PIH). Doppler ultrasound is relatively new technique which merits investiga-

tions as a screening method for IUGR and PIH as both are associated with placental vascular pathology.<sup>3</sup> In a study, fetal arterial waveform indices have been shown to be superior to single values of abdominal circumference and estimated fetal weight.<sup>4</sup> More recent studies have suggested that ratios of Doppler waveform indices may further improve this prediction.

There are many causes for high risk pregnancies, among them PIH is commonest. The department of Obstetrics and Gynecology, Govt. Medical College & New Civil Hospital, Surat, is the largest referral centre in the South Gujarat. This study was undertaken to assess the role of Doppler in management of Pregnancy induced Hypertension.

**MATERIALS AND METHODS**

The present case-control study was conducted in the department of Radiology, Govt. Medical College & New Civil Hospital, Surat. The study was conducted on 150 antenatal subjects out of which 75 were taken as cases and 75 as controls. Patients were selected from the outpatient department and from admissions in antenatal ward. The cases were selected as subjects with singleton pregnancies and gestational age of 28-40 weeks in the reproductive age group, who were sure of their last menstrual period or had dating scan in first trimester, with pregnancy induced hypertension with or without clinical evidence of an evidence of an small for gestational age of fetus, previous anomaly scan should have been performed to exclude major congenital anomaly. The controls were selected such that they matched the cases for gestational age, parity and maternal age and had no high risk factors. During the follow-up period the controls proceeded as uncomplicated pregnancies. If they developed high risk factors they were excluded from the study.

The patients enrolled for the study were followed up from the point of the recruitment up to the time of delivery. Details of obstetric history, age, last menstrual date and underlying risk factor were noted. All patients were examined on Esaote My-Lab50 colour Doppler machine with 3.5 MHz curvilinear probe and with colour and spectral Doppler. Detailed USG study in form of maturity by biparietal diameter, head circumference, Head circumference, femoral length, abdominal circumference, liquor, expected fetal weight were measured and noted. Doppler study of umbilical artery, fetal middle cerebral artery, both maternal uterine arteries & Ductus venosus was done. Parameters in form of Resistive index (RI), Pulsatility index (PI) and systolic/diastolic ratio (S/D) of all four arteries were taken. In ductus venosus waveform decrease height of 'a' wave, absence or reversal was noted. Follow-up Doppler study was done in required patients at 7 days or 15 days according to the previous Doppler findings. On delivery, the mode of delivery, any complications, the Apgar score, fetal weight of the baby, birth asphyxia and admission in NICU were noted.

**RESULTS**

There were 75 cases and 75 controls in the present study. Maximum cases were in the age group of 21-25 years of age.

It was observed that 55% cases with pregnancy induced hypertension developed IUGR fetuses while 2% of the IUGR fetus was present in control group. It was found that 24 out of 75 cases showed bilateral uterine artery notches, out of this 71% cases were associated with fetal affection in form of IUGR or fetoplacental insufficiency as evident by abnormal umbilical artery Doppler or MCA Doppler. There were 88% of cases with bilateral uterine artery notches showed abnormal fetal outcome in form of low birth weight, preterm delivery, LSCS for fetal distress, birth asphyxia or NICU admission of baby.

There were 41 (54%) cases with IUGR fetuses. Out of which 28 (68%) cases with IUGR had fetoplacental Doppler abnormality. Thus IUGR cases are associated with the abnormal umbilical arterial Doppler indices.

**Table 1: Distribution of subjects (case & controls) by age**

Age group (years)	Cases (n=75)		Controls (n=75)
	Mild PET (n=41)	Severe PET (n=34)	
16-20	10	4	3
21-25	27	23	64
26-30	4	4	8
31-35	0	2	0
36-40	0	1	0

**Table 2: Distribution of subjects according to mean Estimated Fetal Weight on USG & gestational age**

Gestational age	Mean fetal weight (gms) (no of cases)	
	Cases	Controls
26-30	543 (1)	1704 (4)
31-35	1610.2 (34)	1739.4 (38)
36-40	2119.15 (40)	2269.6 (33)

**Table 3: Fetal outcome in cases and controls in relation to Umbilical artery S/D ratio and Umbilical artery Pulsatility Index (PI)**

Variable	Fetal outcome	
	Normal	Abnormal
<b>Umbilical artery S/D ratio</b>		
Cases (n=75)	Normal ( $\leq 3$ ) 36	15(20.5) 21 (28.7)
	Abnormal ( $>3$ )37	3 (4.1) 34 (46.5)
Controls (n=75)	Normal ( $\leq 3$ ) 65	53(70.6) 12 (16)
	Abnormal ( $> 3$ ) 10	5 (6.6) 5 (6.6)
<b>Umbilical artery PI</b>		
Cases (n=75)	Normal ( $\leq 95^{\text{th}}$ centile)	22(29.3) 43 (57.3)
	Abnormal ( $>95^{\text{th}}$ centile)	1 (1.3) 9 (12.0)
Controls (n=75)	Normal ( $\leq 95^{\text{th}}$ centile)	58(77.3) 17 (22.6)
	Abnormal ( $>95^{\text{th}}$ centile)	- -

**Table 4: Fetal outcome in cases of abnormal umbilical arterial Doppler in relation to MCA Doppler**

Variable	MCA PI value	Fetal outcome	
		Normal	Abnormal
Abnormal umbilical Doppler (n=37)	Normal 26 (>5 <sup>th</sup> centile) Abnormal 11 (<5 <sup>th</sup> centile)	6 (23)	20 (76.9)
		0	11 (100.0)

MCA- Middle Cerebral artery

**Table 5: Cerebroplacental ratio (CPR) and fetal outcome**

Cerebroplacental ratio	Fetal outcome	
	Normal	Abnormal
Normal (n=53)	26 (49)	27 (51)
Abnormal (n=22)	3 (13)	19 (87)

**Table 6: Fetal and neonatal parameters and Doppler indices in cases group**

Fetal and neonatal parameters	Doppler indices	
	Normal (n=15)	Abnormal (n=60)
Birth weight (gms)	2530	1990
Delivery < 37 weeks	2 (13.3)	24 (40)
Small for gestational age	1 (6.6)	29 (48.3)
LSCS for fetal distress	1 (6.6)	20 (33)
NICU admission	1 (6.6)	40 (66)
Avg. umbilical S/D ratio	2.63	3.41

It was seen from the table 3 that Umbilical S/D ratio less than 3 was present 37 cases out of which 34 cases had abnormal fetal outcome. It was also found that among the cases umbilical artery PI was abnormal in 10 cases out of which 9 cases had abnormal fetal outcome.

13 cases had abnormally low PI of MCA with normal umbilical arterial Doppler indices, out of which 12 patients had abnormal fetal outcome.

Among the cases who had abnormal cerebroplacental ratio, 87% had abnormal fetal outcome (table 5).

## DISCUSSION

Higher number of patients (85%) with PIH was below 25 years of age. This finding is comparable to the study of WHO (1998), which did a collaborative study of hypertensive disorders of pregnancy and concluded that preeclampsia occurs more commonly during first pregnancies and in very young or older women, and when a woman has

had preeclampsia in previous pregnancies.<sup>5</sup> The mean EFW at all the gestational age in case group is lower as compared to the control group. By this we can say that PIH has major effects on the growth of the fetus. The relationship between abnormal uterine artery Doppler velocimetry and preeclampsia, IUGR and adverse pregnancy outcome is well established.<sup>6</sup>

In the present study, case group had 41 out of 75 cases cases with IUGR. A study carried out by Bhatt et al<sup>7</sup> shows that out of 100 cases PIH was present in 50% cases of IUGR. The present study also supports as 55% of PIH cases have IUGR. In the present study there are 41 cases with IUGR out of them 28 (68%) had abnormal umbilical arterial Doppler indices and 13 (32%) had normal Doppler parameters. Trudinger et al studied that out of 53 cases og IUGR 34 cases (60%) had abnormal umbilical artery waveform which is comparable to present study and its suggest that abnormal umbilical artery Doppler study is associated with low birth weight fetuses and abnormal perinatal outcome.<sup>1</sup>

Cool CM, Giles WB and Trudinger concluded that in high risk pregnancy Doppler umbilical velocities studies predict the most compromised fetuses in terms of growth retardation and requirement for neonatal intensive care.<sup>8</sup> Umbilical artery Doppler waveforms provide an estimate of downstream placental vascular resistance and placental blood flow.<sup>9</sup> there is a strong association between reduced and end diastolic umbilical artery blood flow velocity and increased vascular resistance in the umbilicoplacental micro-circulation.<sup>10</sup>

## CONCLUSION

By examining the maternal vessels using Doppler ultrasound it is possible to determine, the risk of complication developing in the course of pregnancy long before clinical signs of preeclampsia appear so that therapeutic measures may be undertaken early, we can also decision regarding any intervention to be done or not in a conditions appearing in the 3<sup>rd</sup> trimester.

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