Original Research Article

Color Doppler study of uterine vasculature in pregnancy induced hypertension

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Abstract

Objectives: 1. To study the blood flow pattern of uterine vessels in pregnancy induced hypertension by Color Doppler.2. To assess the predictive value of Color Doppler Studies of uterine blood flow patterns for perinatal outcome. **Materials and Methods**: The period of our study was for 2 years at a tertiary care hospital in rural area in RMC Loni. 50 cases diagnosed as pregnancy induced hypertension beyond 28 weeks of gestation, i.e, period of viability of fetus were screened by Color Doppler for uterine artery during the above-mentioned period. Outcome of these pregnancies was then collected. It included the gestational age of delivery, mode of delivery, birthweight, APGAR score, still births andlivebirths. **Results**: In this study birth weight in grams in > 36 weeks gestation at delivery showed highly significant difference between the present (1767+209.83) and absent (2289.98+358.96) diastolic notch group indicating that birth weight of the neonate was affected by the presence of diastolic notch. Similarly neonatal mortality was more (45.45%) in case of patients with presence of uterine artery diastolic notch as compared to absence of diastolic notch (0) which was statistically significant. Morbidity was 36.36% in diastolic notch group as compared to diastolic notch absent group (14.28%). **Conclusion:** Doppler is an excellent armamentarium in the hands of obstetrician for non-invasive hemodynamic monitoring of PIH patients to identify the fetuses at risks and predicting perinatal morbidity and mortality. Doppler velocimetry gives us the idea about correct time of intervention so as to get good perinatal outcome thus preventing high fetal mortality and morbidity in hypertensive patients.

Key words: Color Doppler, Pregnancy induced hypertension, Uterine vasculature.

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Introduction

One of the major concerns of obstetrical practice involves evaluation of fetal well-being. However, the relatively inaccessible fetal location and a dearth of appropriate diagnostic techniques have limited ante-partum surveillance to fetal heart rate monitoring and sonographic biophysical assessment. Recent advances in the Doppler ultrasound technology offer a unique opportunity to extend our ability to investigate the fetal hemodynamic state [1]. Doppler ultrasound velocimetry has already been widely used for assessing cardiac structure and function and for determining circulatory insufficiency in peripheral vascular disease. Recently, the technique has been applied extensively to investigate fetal, feto-placental and utero-placental circulation and there is ample evidence associating abnormal Doppler findings with complications of pregnancy and an adverse perinatal outcome [2]. Application of Doppler ultrasound is not new in obstetrical practice; it has been in use for many years for detecting fetal heart activity and counting the fetal heart rate. however, this level of technology generates only Doppler audio output. Doppler ultrasound velocimetry, however requires extraction and further processing, depending upon the type of Doppler ultrasound. A basic understanding of the technology is essential for any meaningful evaluation of its utility and its limitations. Pregnancy induced hypertension (PIH) is defined as blood pressure recording of 140/90 mm of Hg on two occasions more than 6 hours apart after 20 weeks of gestation associated with or without proteinuria and/or edema [3]. Doppler Ultrasound instrumentation provides a noninvasive method of studying the status of various blood vessels which is very useful in cases of PIH. It provides a spectrum analysis of the velocities of moving red blood cells

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thusgiving useful and important information in a variety of gynecologic and obstetric conditions. In obstetrics, "Doppler Velocimetry" of the utero-placental and feto-placental circulation can be used to further investigate complications of pregnancy such as fetal growth retardation, other forms of fetal distress that result from fetal hypoxemia or asphyxia, fetal cardiac anomalies and/or cord malformation[4].

The aim of this study to publish in scientific journal is to vehemently emphasize the great utility of Color Doppler in PIH as the quickest, most reliable, non-invasive and repetitive modality to assess fetal wellbeing and take immediate decision regarding management thus saving precious lives.

Aims and Objectives

1.To study the blood flow pattern of uterine vessels in pregnancy induced hypertension by Color Doppler.

2.To assess the predictive value of Color Doppler Studies of uterine blood flow patterns for perinatal outcome.

Material and Methods

1. The period of our study extended up to 2 years at a tertiary care hospital in rural area in Rural Medical College, Loni, district Ahmednagar, Maharashtra, India.
2. During this period Dopplervelocimetry was performed at our institution.
3. Approval for this work was obtained from the institutional research committee
4. Informed consent was obtained from each woman studied.
5. Equipment: GE LOGIQ 400 PRO-3.5MHz Convex probe with pulsed wave and color Doppler.
6. 50 cases diagnosed as pregnancy induced hypertension beyond 28 weeks of gestation, i.e period of viability of fetus by Color Doppler during the above mentioned period.
7. The patients were followed up antenatally from time of detection till the time of delivery.
8. Outcome of these pregnancies was then collected.It included the gestational age of delivery,mode of delivery, birth weight, APGAR score, still births and live births

Methods

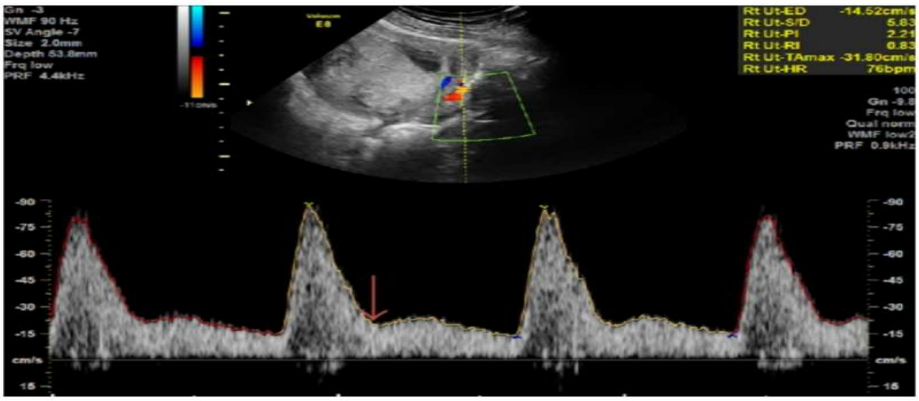
The pregnant women assumed a supine slightly tilted position.A coupling jelly was placed upon the abdomen, and the Doppler probe was placed. The uterine artery was located by B mode real time scanner and then color was displayed. The flow velocity wave forms were examined visually and quantitated by the use of the v-max v- min, systolic/diastolic ratio, pulsatility index, resistance index, diastolic notch and diastolic flow.

Inclusion criteria: regnant women having pregnancy induced hypertension beyond 28 weeks gestation were included in the study with blood pressure>- 140/90 mm Hg with or without proteinuria.

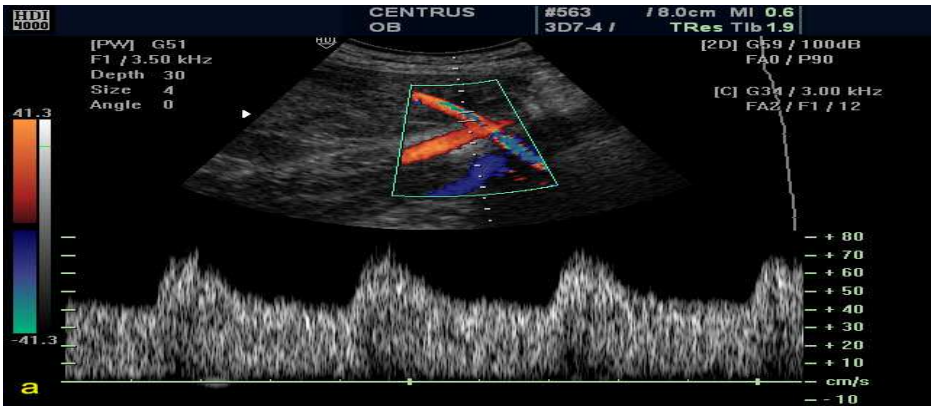
Exclusion criteria

1. Antenatal cases with gestational age<28 weeks.
2. Normal routine antenatal case.
3. Multiple pregnancy.
4. Extra uterine pregnancy.
5. Antenatal cases with intrauterine fetal death.
6. Pregnancy with severe congenital anomaly.

Equipment: GE LOGIQ 400 PRO-3.5MHz Convex probe with pulsed wave and color Doppler



Uterine artery wave form with diastolic notch



Normal uterine artery flow velocity wave form

Observations and Results

Table No-1: Age wise distribution of study population

Age(years)	No of patients%
<20	8
20-24	64
25-29	26
30 & above	2

The above table shows that maximum caseswere in the age group of 20-24 years.

Table No.-2: Gravidity wise distribution of study population

Gravida	No of patients%
Primi	56
Multi	44

56% cases were primigravida as per the above table.

Table No.-3: Severity of pregnancy induced hypertension wise distribution of study population.

Severity of pregnancy induced hypertension	No of patients%
Mild	54
Severe	46

The above table indicates that 54% cases were of mild PIH and 46% severe PIH

Table No.-4: Group with presence of diastolic notch in uterine artery

Gestational age	Mild PIH	Severe PIH	Birth weight	APGAR	IUGR	Fetal Distress	Mode of delivery				peri-natal out come		
							vaginal		Caesarean				
							Spontaneous	induced	elective	Emergency	Mortality	Mobility	Normal
<34 weeks	0	9	1.325	3,5,6	0	2	2	1	1	5	5	3	1
34-36 weeks	3	5	1.893	5,7,8	0	0	2	2	0	4	2	3	3
>36 weeks	2	2	1.766	6,7,8	1	2	1	0	1	3	3	2	0

Group with presence of diastolic notch had 10 cases of perinatal mortality and 8 cases of perinatal morbidity

Table No.-5: Group with absence of diastolic notch in uterine artery.

Gestational age	Mild PIH	Severe PIH	Birth weight	APGAR	IUGR	Fetal Distress	Mode of delivery				peri-natal out com		
							vaginal		Caesarean				
							Spontaneous	induced	elective	Emergency	Mortality	Mobility	Normal
<34 weeks	1	2	1.66	6,6,7	0	0	0	3	0	0	0	1	2
34-36 weeks	9	1	2.26	4,7,8	2	3	1	2	1	6	0	2	8
>36 weeks	13	2	2.42	6,7,9	1	1	7	0	1	7	0	1	14

Group with absent diastolic notch had no perinatal mortality whereas 4 cases had perinatal morbidity.

Table No.-6: Comparison of mean birth weight in grams in present and absent uterine artery diastolic notch (DN) group.

Gestational age in weeks at the time of delivery	DN present (n=22) Mean+-SD	DN Absent (n=28) Mean+- S/D	T value	P value	Result
<34	1329.33+-410.43 (n=9)	1415.62+-248.7 (n=3)	0.53	p>0.05	Not significant
34-36	1894.55+-526.44 (n=8)	2104.26+-314.27 (n=10)	0.99	p>0.05	Not significant
>36	1767.7+-209.83 (n=5)	2289.98+-358.96 (n=15)	3.96	P<0.01	Highly significant

Mean birth weight >36 weeks shows significant difference in present and absent uterine artery diastolic notch as per the above table.

Table No.-7 : Uterine artery diastolic notch (DN) and perinatal outcome

Perinatal outcome	Present DN%	Absent DN%	After applying Z test, P value
Morbidity	36.36	14.28	P<0.05
Mortality	45.45	0	P<0.05

Perinatal morbidity and mortality in uterine artery diastolic notch is significantly more in cases with absent diastolic notch.

Table No-8: Uterine artery diastolic notch and its efficacy of prediction of poor perinatal outcome.

Perinatal outcome	Sensitivity %	Specificity %	PPV %	NPV %
Morbidity	66.66	63.15	36.36	85.71
Mortality	100	66.66	45	100

Uterine artery diastolic notch has 100% sensitivity in mortality cases, 100% NPV in mortality cases and 85.71% NPV in morbidity cases.

Discussion

Hypertensive disorders complicating pregnancy are common and form a deadly triad along with hemorrhage and infection that contribute greatly to maternal morbidity and mortality. The incidence of various hypertensive disorders of pregnancy is around 5% to15%. They are the most common cause of fetal growth retardation and preterm delivery and thus contributing to prenatal morbidity and mortality, the percentage being 15 to 20% in developing countries. There is evidence that such pregnancies are commonly associated with reduced utero-placental blood flow. This is thought to be due to the development of certain pathological obstructive lesions at the level of the spiral arteries [3].

The aim of this study was to study uterine vasculature by Color Doppler and to assess its predictive value regarding fetal outcome. A total of 50 cases were studied by Color Doppler who were diagnosed as pregnancy induced hypertension beyond 28 weeks of gestation, i.e; period of viability of fetus out of which 27 were mild PIH and 23 were severe. The target group for Doppler velocimetrystudy is the group with age between 20-24 years and primigravida as evidenced in observation tables 1 and 2. In our study 64% cases were in the age group of 20 to 25 years comparable to the study by WHO (1998) which did a collaborative study of hypertensive disorders of pregnancy and concluded that preeclampsia occurs more commonly during first pregnancy and in very young or older women and when a woman has had preeclampsia in previous pregnancies [6]. In the study by Aharwal S et al 73.1% cases were found in 20-29 years age group [7].

In our study 54% had mild hypertension and 46% had severe hypertension. In the study by Gaikwad P R et al [8] there were 78.3 mild cases and 21.7 severe cases. In this study birth weight in >36 weeks gestation at delivery showed highly significant difference between the present (1767+209.83) and absent (2289.98+358.96) diastolic notch group indicating that birth weight of the neonate was affected by the presence of diastolic notch.

Similarly, neonatal mortality was more (45.45%) in case of patients with presence of uterine artery diastolic notch as compared to absence of diastolic notch which was statistically significant similar to the study carried out by Fleisher et.al [9] and Aharwal S et al. Study by Gaikwad P R et al had perinatal death 8.1%. Morbidity was 36.36% in diastolic notch group as compared to diastolic notch absent group (14.28%). Thus the relationshipbetween abnormal uterine artery Doppler velocimetry and preeclampsia and adverse pregnancy outcome is well established[10]

Conclusion

1.Color Doppler is an excellent armamentarium in the hands of obstetrician for noninvasive hemodynamic monitoring of PIH patients to identify the fetuses at risksand predicting perinatal morbidity and mortality.

2. Dopplervelocimetry gives us the idea about correct time of intervention so as to get good perinatal outcome thus preventing high mortality and morbidity in hypertensive patients.

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