Original Research Article

Role of uterine artery Doppler in prediction of FGR in high risk pregnancies in 20-24 weeks

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ABSTRACT

Background: Accurate prediction of fetal growth retardation (FGR) is a long-sought goal of perinatology as it contributes significantly to perinatal mortality and morbidity. It generally manifest later in pregnancy, their underlying pathophysiology is largely established early in pregnancy. Early detection will help in decreasing the associated morbidity.
Methods: The study was carried out on 100 pregnant women of 20-24 weeks gestation in the Department of Obstetrics and Gynecology, MGM Medical College and MY Hospital, Indore from March 2015 to February 2016.Presence of diastolic notch in uterine artery waveform was taken as screen positive.
Results: Total Diastolic notch positive cases 20/100 out of which 60% developed FGR and 80/100 Diastolic notch negative cases out of which only 4 cases (5%) will developed FGR. The sensitivity of the test was 75% while the specificity was 90.47%. The positive predictive value was 60% while the negative predictive value was 89.74%. 50% of screen positive belonged to 30-39 year age group and 68.75% FGR was seen in primiparous.
Conclusions: Study of uterine artery flow velocity waveform seems to be a modern technique which can be used for ruling out the probability of FGR. Presences of diastolic notch in uterine vessels in 2nd trimester are of prognostic value for maternal complications and fetal jeopardy and therefore need of further critical assessment and management.

Keywords: Diastolic notch, FGR, Uterine artery doppler

INTRODUCTION

FGR poses an important obstetrical problem in the developing countries on account of high rate of perinatal mortality and morbidity associated with it.

Accurate prediction of adverse pregnancy outcomes, including preeclampsia, fetal growth retardation (FGR), pregnancy loss, and preterm delivery, is a long-sought goal of perinatology. Together, these complications are common and contribute significantly to perinatal mortality and morbidity.[1] Increasing evidence suggests that although they generally manifest later in pregnancy, their underlying pathophysiology is largely established early in pregnancy. This finding has sparked great interest in the search for tests to predicting them early in pregnancy before these complications occur.

Although there is currently no effective prophylactic or therapeutic intervention for many of these adverse outcomes, the ability to accurately predict them early has several advantages. It would identify those women who require more intensive monitoring and permit earlier recognition when these complications develop.[2] It may also permit the use of interventions, such as antenatal corticosteroids, to improve perinatal outcomes if preterm

delivery is indicated. In addition, accurate prediction will permit targeting of potential preventive measures to those at risk and initiate them early, before the underlying pathophysiology is established. By colour Doppler velocimetry in a normal pregnancy uterine artery shows low diastolic Doppler indices during the 1st 10 weeks of pregnancy depicted as early diastolic notch which disappear with significant increase in diastolic flow. During 2nd trimester corresponding to 2nd trophoblastic invasion in presence of high resistance in uteroplacental circulation presence of diastolic notch during 2nd trimester can be studied as a predictor of fetal growth retardation.[3]

Therefore, present study has been done with the objective to predict FGR by screening the antenatal women at risk by uterine doppler, in 2nd trimester 20-24 weeks.

METHODS

The study was carried out in the Department of Obstetrics and Gynecology of MGM Medical College and M.Y. Hospital, Indore. It is a prospective study and study period extended from March 2015 to February 2016. Pregnant women attending the antenatal clinics, screened for possible participation in the present study after explaining the nature of the study and antenatal women between 20-24 weeks of gestation with 3 minor risk factors (essential hypertension, obesity, anaemia, history of PIH, pre-eclampsia, eclampsia in previous pregnancy) were risk factors screened for were enrolled with willingness to deliver at M.Y. Hospital, Indore were selected. Gestational age at the time of color doppler study recorded and duration of pregnancy confirmed by routine ultrasound between 20-24 weeks. Women included in the study were screened by color doppler of both the uterine arteries for, presence/absence of diastolic notch in one or both. Flow pattern in both the arteries were concluded in the form of SD ratio, pulsality index (PI) and resistance index (RI) and average values of such waveform were taken. Those cases with, presence of diastolic notch were taken as screen positive cases. Those pregnancies with diastolic notch positivity in the colour doppler and who developed IUGR in 2nd half of pregnancy were used to calculate sensitivity, specificity, positive predictive and negative predictive value.

RESULTS

In our study, out of the total screen positive cases, 50% belonged to age group 33-39 years of age. More number of screen positive cases in 33-39 years of age is because of minor risk factor of age elderly gravida age >35 year. Also the incidence of FGR in primipara was 68.75%. The association of diastolic notch in 20-24 weeks is more with the patients with h/o preeclampsia in previous pregnancy. Study shows that 20% cases showed abnormal waveform in colour Doppler, out of which 4% developed FGR, while 80% cases were with normal waveform out of which only 12% developed FGR.

Table 1: Distribution of screen positive cases according to age group.

Age (years)	No. of cases (n=100)		Screen positive cases (n=20)	
	No.	%	No.	%
18-25	50	50%	05	25%
26-32	30	30%	05	25%
33-39	20	20%	10	50%

Table 2: Distribution according to parity.

Parity	No. of cases (n=100)		No. of cases develop FGR (n=16)	
	No.	%	No.	%
Primi	64	64	11	68.75
Second Gravida	28	28	03	18.75
Third Gravida	08	08	02	12.50

Out of the total 16 cases which developed IUGR, 12 (75%) screened positive by showing abnormal waveform in their 2nd trimester. Total Diastolic notch positive cases 20/100 out of which 60% developed FGR and 80/100 Diastolic notch negative cases out of which only 4 cases (5%) will developed FGR. The sensitivity of the test was 75% while the specificity was 90.47%. The positive predictive value was 60% while the negative predictive value was 89.74%.

Table 3: Distribution of screen positive cases according to risk factors.

Risk Factors	No. of cases (n=100)		Screen positive cases (n=20)	
	No.	%	No.	%
Mild PIH	24	24	04	20
Elderly primi >35	14	14	04	20
Anemia	14	14	02	10
BMI > 30	22	22	01	05
BMI < 20	06	06	01	05
Pregnancy interval <6 months	06	06	02	10
H/o Preeclampsia	14	14	06	30

DISCUSSION

The objective of the study is to investigate both the uterine arteries between 20-24 weeks of gestation for presence/persistence of diastolic notch for prediction of FGR in later half of the pregnancy; it is predictor of maternal and perinatal outcome.

In present study, Out of 100 cases 20 cases were between age group of 33-39 years of age in which 50% cases were screen positive (Table 1). Out of this 50% screen positive cases 62.5% cases were develop fetal growth retardation (Table 2). Elderly gravida age >35 years were included in

this group (33-39 years of age) which is minor risk factor for fetal growth retardation. As per the study by Kozuki et al, Nulliparous, age <18 year women, compared with women who were parity 1-2 and age 18 <35 years had the highest odds of SGA (pooled adjusted OR: 1.80), preterm (pooled aOR: 1.52), neonatal mortality (pooled aOR: 2.07), and infant mortality (pooled aOR: 1.49).[1]

Parity

68.75% of FGR were seen in primi parous woman. Similar study done by Shrivastava et al found that highest incidence of FGR (60%) occur in primi women.[2] In study done by Martinez JM study all subject were primigravidae considering primigravidity to be an individual risk factor because PIH is also common in those women and PIH is a risk factor for development of FGR.[3]

Risk factors

Out of the 100 cases, maximum 24 affected cases (24%) with history of PIH, BMI >30 (22%), Pregnancy Interval <6 months (6%) and history of preeclampsia (14%) (Table 3). Out of the above risk factors history of preeclampsia in previous pregnancy cases 14 (14%) out of which 6 (30%) were screen positive. It shows that association of diastolic notch in 20-24 weeks is more with the patients with h/o preeclampsia in previous pregnancy. Poon L found 100% and 94% diastolic notch positivity in low and high risk pregnancies.[4]

Table 4: Distribution of case according to perinatal outcome.

Outcome of labour	No. of cases (n=100)		Screen positive cases (n=20)	
	No.	%	No.	%
Live Birth	84	84	09	45
Preterm	12	12	09	45
Neonatal death	02	02	01	05
Abortion	01	01	01	05

Martin A in his study found, pre-eclampsia is more common during first pregnancy, 5-10% in twins/triplets, in very young/elder women and multigravidae with history of PIH (7%). Harington found sensitivity of notching for prediction of PIH (76.9%) in primigravidae and (77.76%) in multigravidae.[5] Becker showed prevalence of notch 8.5% in nullipara and 4.7% in multipara. Harrington found sensitivity of bilateral notching for prediction of PIH requiring delivery before 34 weeks was 81.2% and 61.7% in high and low risk pregnancies respectively. Incomplete and inadequate placentation leads to high resistant flow and diastolic notch positivity in colour doppler. Decreased uteroplacental blood flow also leads to SGA babies and development of PIH. Depending on the severity of PIH, pregnancy has to be terminated preterm.

Table 5: Incidence of abnormal waveform in uterine arteries in high risk pregnancies.

Waveform	N	%	No. of cases developed FGR	%
Normal waveform	80	80	04	05
Abnormal waveform	20	20	12	60
Total no. of cases	**100**		**16%**	

Efficiency of test

Present study shows that 20% cases had abnormal waveform in colour Doppler, out of which 4% developed FGR. Total Diastolic notch positive cases 20 out of which 1.Thus our study concludes that uterine artery Doppler at 20-24 weeks for detecting FGR is 75% sensitive and 90% specific. It has a positive predictive value of 60% while negative predictive value of almost 90%. Aquilina found sensitivity 88%, specificity 83% using bilateral uterine artery notches and cut off RI at 20 weeks. He said that it is best screening method if further screening, later in pregnancy is proposed.[6] In a study by Barati M et al, in the case of 'small for gestational age' it had to have a specificity of 96.5%, a sensitivity of 57%, an NPV of 99.2% and a PPV of 23.5%.[7] In a study by Papageorghiou et al, the sensitivity of increased pulsatility index above the 95th centile for pre-eclampsia with fetal growth restriction was 69%, for pre-eclampsia without fetal growth restriction was 24%. The sensitivity of fetal growth restriction defined by the 5th rather than the 10th centile was higher (19% vs. 16%).

Table 6: Statistical indices of the uterine artery doppler in prediction of IUGR.

Diastolic notch	Cases developed FGR	Cases not developed FGR	Total
Positive cases	12	08	20
Negative cases	04	76	80
Total	**16**	**84**	**100**

The sensitivity of bilateral notches in predicting pre-eclampsia and/or fetal growth restriction was similar to that of increased pulsatility index but the screen-positive rate with notches (9.3%) was much higher than that with increased pulsatility index (5.1%).[8] A study done by Singh S et al showed doppler measurement for uterine artery showed higher efficacy as compared to umbilical artery and middle cerebral artery findings. The uterine artery RI was found to be 84.6% sensitive and 82.9% sp0ecific even at 30 weeks. Uterine artery PI too showed a good diagnostic efficacy with an accuracy of 79%, a sensitivity of 76.9%, a specificity of 82.9%.[9] In a similar study done by Coleman et al, 27.5% women developed pre-eclampsia, 26.7% had SGA babies The sensitivity of

any RI of >0.58 for pre-eclampsia and SGA was 91%, 84% respectively.[10]

CONCLUSION

Till date FGR remains a challenge to obstetrician, having ill-defined pathogenesis and therefore no definitive treatment to prevent its progression. Various methods have been acclaimed for identifying pregnant women at risk of development of FGR but none of those predict it. Therefore there has been need of a method, which can predict future development of PIH by mid of pregnancy. Many authors lately studied uterine artery waveform to predict FGR.

This study establishes that study of uterine artery flow velocity waveform seems to be a modern technique which can be used for prediction FGR as early as 16 weeks of pregnancy. High resistance flow and presence of diastolic notch in uterine vessels in 3rd trimester are of prognostic value for rapid progression of maternal complication and fetal jeopardy and therefore need of further critical assessment and immediate management.

We conclude that women with minor risk factor having abnormal uterine artery waveforms between 20-24 weeks of gestation (presence of diastolic notch with/without high resistance) are at higher risk of development of FGR (80%). An important aspect is the high negative predictive value for FGR (89.74%) which helps to detect those patient who will not develop FGR early positive prediction enables, one to take preventive measures early thus improving both maternal and perinatal prognosis.

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