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ROLE OF FIRST TRIMESTER UTERINE ARTERY DOPPLER PULSATILITY INDEX IN PREDICTION OF FETAL GROWTH RESTRICTION

Obstetrics & Gynaecology

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ABSTRACT

Introduction : Fetal growth restriction is a serious complication of pregnancy associated with high morbidity and mortality .The etiologies include congenital malformations,genetic disorders or infectious diseases but major cause of FGR are Placental abnormalities.Insufficient placental circulation can lead to deficient nutritional supply to the fetus.Uterine artery Doppler can interrogate the uteroplacental circulation and can screen impaired placentation by detecting the alterations in blood flow.Uterine artery Pulsatility Index(PI) indicates the uteroplacental perfusion ,Hence screening by Uterine artery PI in the first trimester helps us to predict fetal outcomes such as FGR .Thus in this study ,Early prediction of FGR by using Uterine Artery Doppler PIas a screening test in the first trimester would be important to identify those fetuses that are at risk and can lead to vigilant monitoring and timely delivery . **Material and methodology : Type of study :**Prospective observational study **Study Area:**Department of obstetrics and Gynaecology,MGM Medical college and Hospital ,Aurangabad. **Study period:** October 2021 to April 2024 **Sample size:** 89 **Inclusion criteria:**All Pregnant women coming for Antenatal checkup in between 11 -13.6weeks of Gestational age **Exclusion criteria**: women with multiple gestation status,with fetal anomaly and known case of chronic diseases. **Results:** High Pulsatility indexi.e,PI>95% (45.5%) as compared to low pulsatility indexi.e,PI<95% (25%)confers a significant risk for Fetal growth restriction . In this study ,the role of uterine artery Doppler in predicting fetal growth restriction had sensitivity and specificity of 43.5% and 70% respectively . Positive predictive value was 51% and negative predictive value was 30%.

KEYWORDS

Pulsatilityindex,Fetal growth restriction,Antenatal care ,Cerebroplacental ratio ,Low birth weight ,Neonatal intensive care unit .

INTRODUCTION :

Fetal Growth Restriction is defined as an estimated fetal weight(EFW) and /or abdominal circumference at one point in time during pregnancy being below 3rd percentile or EFW and/or AC below 10th percentile for gestational age with deranged Doppler parameters[1]
FGR can be divided into two main types[1]

- **Type 1** : symmetrical intrauterine growth restriction
- **Type 2:** asymmetrical intrauterine growth restriction

A new type is also enlisted :Femur sparing intrauterine growth restriction Aetiology[2]

FGR can result from a vast number of causes such as Placental Insufficiency which is the most commonest cause i.e, Abnormalutero placental circulation, Abnormal etoplacental circulation .Maternal conditions such as smoking ,alcohol use, malnutrition, Chronic diseases and Genetic predisposition (ET1,FOXD1,TNFalpha)Fetal factors Such as Genetic abnormalities (T13 ,T17 ,T18),Multiple pregnancies ,Intra uterine infections (TOR Prenatal non detection of FGR has been identified as a major cause of avoidable perinatal death and growth restricted fetuses which are not identified during pregnancy have increased risks of fetal death and perinatal complications . Insufficient placental circulation can lead to deficient nutritional supply to the fetus.Uterine artery Doppler can interrogate the uteroplacental circulation and can screen impaired placentation by detecting the alterations in blood flow.[3]Uterine artery Pulsatility Index(PI) indicates the uteroplacental perfusion ,Hence screening by Uterine artery PI in the first trimester helps us to predict fetal outcomes such as FGR .Thus in this study ,Early prediction of FGR by using Uterine Artery Doppler PI as a screening test in the first trimester would be important to identify those fetuses that are at risk and can lead to vigilant monitoring and timely delivery .

Aim And Objectives:

Aim:
To predict Fetal Growth Restriction using Uterine artery Doppler Pulsatility index at 11-13.6 weeks of gestation

Objective:

- To assess the role of Uterine Artery Doppler pulsatility index in screening Fetal Growth restriction at 11-13.6weeks GA.
- To assess the role of Uterine Artery Doppler pulsatility index in predicting neonatal outcome.

MATERIALS AND METHODOLOGY

A Prospective observational study was done in the Department of Obstetrics and Gynaecology,MGM Medical college and Hospital ,Aurangabadfrom October 2021 to april 2024 with the Sample size of 89.

Inclusion criteria: All Pregnant women coming for Antenatal checkup in between 11 -13.6weeks of Gestational age

Exclusion criteria: Women with multiple gestation status,with fetal anomaly and known case of chronic diseases.

Study Procedure:
An informed consent was taken from all the women who were willing to participate. After enrolling Demographic data,obstetric data and current pregnancy details were taken .A transabdominal ultrasound was used for doppler assessment of uterine circulation for uterine artery and mean PI was obtained.Colour Doppler was done in the third trimester to monitor fetal growth parameters.The women were then followed uptil the delivery to observe that whether there was development of fetal complications like fetal growth restriction , low birth weight ,need of NICU admission .The data obtained were coded and entered into Microsoft excel worksheet and the data were analysed using SPSS statistical software .

RESULTS

Table 01:Demographic data wise distribution .

Demographic data	Uterine artery PI >95%	Uterine artery PI <95%
Age		
<19yrs	0 (0%)	5(8.9%)
19-29yrs	26(78.8%)	44(78.6%)
>30 yrs	07(21.2%)	07(12.5%)
Parity		
Primigravida	22(66.7%)	27(48.2%)
Multigravida	11(33.3%)	29(51.8%)
Region		
Urban	8(24.2%)	0(0%)
Rural	25(75.8%)	56(100%)

The most common age group with raised PI(78.8%) and normal PI(78.6%) was in between 19-29 years .66.7% of patients with raised

PI were primigravida and 75.4% of cases with raised PI belonged to urban region .

Table 02 :Association between Uterine artery PI >/=95% and Fetal growth restriction.

Fetal growth Restriction	Uterine artery PI>/=95%
Present	15 (45.5%)
Absent	18 (54.5%)
Total (n)	33 (100%)

P value : 0.047 significant

In this study 45.5% of the pregnant women with uterine artery PI >/=95% had fetal growth Restriction which is significant suggesting that raised PI could also a predictor of FGR .

Table 03: Association between Uterine artery PI <95% and Fetal growth restriction

Fetal Growth Restriction	Uterine artery PI <95%
Present	14 (25.0%)
Absent	42 (75.0%)
Total (n)	56 (100%)

In this study, only 25% of the cases with normal PI had developed fetal growth restriction

Table no.04 :Corelation between uterine artery PI and Cerebro placental ratio.

CPR ratio	Doppler Velocitimetry			
	Uterine PI ≥ 95%		Uterine PI < 95%	
	Count	%	Count	%
<1 (Abnormal)	5	15.2%	13	23.2%
>/=1 (Normal)	28	84.8%	43	76.8%
Total	33	100.0%	56	100.0%

P value:0.360

In this study 84.8% pregnant women with raised PI had normal CPR. 23.2% of the cases with normal PI had abnormal CPR.

Table no:05:Distribution according to mode of delivery

Mode of delivery	Uterine artery PI >95th centile	Uterine artery Pi <95th centile
Vaginal delivery	23(69.69%)	48(85.71)
Instrumental delivery	00	00
Caesarean section	10 (30.30)	08(14.28)
Total (n)	33 (100.0%)	56(100.0%)

In my study 30.3% of the cases with raised PI underwent caesarean section . 85.7% of cases with normal PI underwent vaginal delivery . There were no cases of instrumental delivery .

Table no 06 :Association between uterine artery PI >/=95% and Birthweight

Birthweight	Uterine artery PI>/=95% (n)
<2.5 kgs	15 (45.5%)
>2.5 kgs	18 (54.5%)
Total (n)	33(100.0%)

P value : 0.010 significant

In this study 45.5% of women with uterine artery PI >/= 95% delivered babies whose weight was less than 2.5 kgs .My study showed a positive corelation between raised PI value and low birth weight babies .

Table no 07 : Association between uterine artery PI <95% and Birthweight.

Birth weight	Uterine artery PI <95%. (n)
<2.5kgs	11 (19.6%)
>2.5 kgs	45 (80.4%)
Total	56 (100.0%)

In this study 80.4 % of women with uterine artery PI vaLue<95% had normal weight babies .My study showed a positive co relation between normal uterine artery PI and normal weight

Table no:08:Distribution according to mode of delivery

Mode of delivery	Uterine artery PI >95th centile	Uterine artery Pi <95th centile
Vaginal delivery	23(69.69%)	48(85.71)
Instrumental delivery	00	00
Caesarean section	10 (30.30)	08(14.28)
Total (n)	33 (100.0%)	56(100.0%)

In this study 30.3% of the cases with raised PI underwent caesarean section . 85.7% of cases with normal PI underwent vaginal delivery . There were no cases of instrumental delivery .

Table no 09 : Association of uterine artery PI value with Admission of baby in NICU

Admission To NICU	Doppler Velocitimetry			
	Uterine PI ≥ 95%		Uterine PI < 95%	
	Count	%	Count	%
Present	17	51.5%	12	21.4%
Absent	16	48.5%	44	78.6%
Total	33	100.0%	56	100.0%

P value:0.003 significant

In this study, babies born to 51.5% of the women with raised PI were admitted in NICU whereas 78.6% of the women with normal PI had babies who were not advised admission .This shows significant association between raised Pi value and NICU admission as raised PI was also associated with FGR and LBW in my study .

DISCUSSION

Fetal growth restriction is most commonly due to uteroplacental insufficiency which effectsthe fetal circulation .[4] Doppler blood flow velocimetry allows non invasive assessment of vascular impendence in the insufficiency and fetal growth restriction Doppler velocimetry uses high frequency sound for investigation of blood flow.The physiology of Fetomaternal unit can be determined by Doppler study ,this provides further approach in pregnancy .Hence ,Doppler studies are needed for timely interventions[5] In my study ,Doppler analysis consisted of looking for raised uterine artery pulsatility index

In this study Fetal growth restriction was present in 45.5% of the cases with uterine artery PI value more than 95thpercentile .Uterine artery Doppler with Pulsatility Index in predicting fetal growth restriction had sensitivity and specificity of 43.5% and 70% respectively. Positive predictive value was 51% and negative predictive value was 30%.

In a study done by **Velautharet et al (2018)**the sensitivity of uterine artery pI value for detection of early onset FGR was 39% and the sensitivity for detection of FGR at any gestational age was 15% .

A study similar to my study was done by **SurbhiHanda et al (2019)** where 25% of the cases with uterine artery PI value more than 95th percentile developed Fetal growth restriction as a complication.[7]

According to a study by **Martinet et al (2020)**a total of 9.5% pregnancies developed fetal growth Restriction whereas pre eclampsia was developed in 21% of the cases with uterine Artery PI value more than 95th centile.

K Sujata et al (2015) conducted a study where 12% cases of uterine artery Doppler more than 95th percentile developed FGR.[8]

E Ferrazzoer et al (2021) Observed in their study that 41% of cases with uterine artery Doppler more than 95th centile developed Fetal growth restriction.[6]

In this study 69.9% of the cases with raised PI underwent vaginal delivery .In this study 45.5% of the women with raised uterine artery PI delivered babies whose weight was less than 2.5 kgs ,showed a positive co relation between raised PI value and low birth weight .

Andres Sarmiento et al 2013 conducted a prospective study of 415 women whose PI was measured between 11 to 13 wks to study the relationship between UtaPI and birthweight .A significant correlation between UtaPI and Birth weight (p=0.013)was observed .[6]

AnshuDhar et al 2017 examined 200 pregnancies to determine the correlation ofUtaPI with fetal outcome and observed that the birth weight in higher mean PI group (2.33+/-0.48kgs) was less than in pregnancies with uterine artery PI < 95th centile (2.86 +/-0.48kgs) pvalue- <001.[6]

In this study babies born to 51.5% of the women with raised PI value were admitted in the NICU.78.6% of the women with normal PI had no history of NICU admission .My study showed a significant association between raised Pi value and NICU admission This could be due to decreased blood supply associated with raised PI value as decreased blood supply can lead to FGR and LBW .

Michelle Jeie et al in the year 2023 did a retrospective cohort study in a teritiary UK hospital to explore the association between abnormal uterine artery doppler and neonatal outcomes. The commonest reasons for NICU admission were prematurity (37.7%),respiratory distress syndrome (24.6%), and suspected sepsis(19.7%),23% were FGR and 14.8% were born to mothers who had developed pre eclampsia .[9]

Veronique Schiffer et al 2018 conducted a retrospective pilot study to evaluate the co relation between abnormal uterine artery dopplerpulsatility index and neonatal outcome .cases with uterine artery PI value 95% had higher rates of pre mature delivery (p=0.007),caesarean section (p value =0.007)and NICU admission (p=0.001). [10]

Because no treatment has been demonstrated to be of benefit for FGR,the assessment of fetal well being and timely delivery remains the main strategy.

CONCLUSION :

Uteroplacental circulation can be assessed non invasively by Doppler studies of uterine arteries .Study of uterine artery Doppler waveform in the first trimester seems to be a modern technique and a good investigating tool to predict the fetal growth restriction.

High Pulsatility index(45.5%) as compared to low pulsatility index(25%) confers a significant risk for Fetal growth restriction .Uterine artery DopplerPulsatility Index in predicting fetal growth restriction had sensitivity and specificity of 43.5% and 70% respectively.Positive predictive value was 51% and negative predictive value was 30%.45.5 % of the cases with raised uterine artery PI developed LBW babies . Babies born to 51.5% of the women with raised PI were admitted in the NICU . Raised uterine artery PI leads to decreased blood supply to the placenta thereby decreasing the blood flow to the fetus leading to fetal growth restriction , low birth weight .

Hence,Doppler analysis of uterine arteries should be included along with routine USG in the first trimester for the early prediction of neonatal outcomes to avoid subsequent perinatal morbidity and mortality .

Raised uterine artery PI which is indicator for Pre eclampsia could also be the indicator for predicting fetal growth restriction ,more studies to be conducted as my sample size is less .

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