

SCREENING FOR PREECLAMPSIA AND FOETAL GROWTH RESTRICTION BY UTERINE ARTERY DOPPLER AT 11-14 WEEKS OF GESTATION

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ABSTRACT

BACKGROUND

Preeclampsia which is one of the five hypertensive disorders of pregnancy is common with an incidence of 6-8% and form one of the deadly triad, along with haemorrhage and infection, that contribute greatly to maternal morbidity and mortality. Foetal growth restriction is estimated to occur in 3-10% of the infants. The perinatal morbidity and mortality are significantly increased among these growth restricted infants. Diseases that may be causes of perinatal mortality and morbidity such as preeclampsia, intrauterine growth retardation (IUGR) are often seen in the third month or even just before the time of birth but the pathophysiologic mechanisms are believed to originate at the earlier times in pregnancy. During the period of a normal pregnancy beginning from the first three months till the 24th week, becoming more evident as time goes by, there is an increase in the diastolic blood flow of the uterine vessels. The above said diseases are associated with increased impedance to blood flow. This can be detected by uterine artery Doppler velocimetry as early as the beginning of second trimester. Doppler Ultrasound has been demonstrated to be a reliable non-invasive method of examining utero-placental perfusion. Thus, Uterine artery Doppler studies are common for both preeclampsia and adverse foetal outcome as a screening test because the impairment of placental perfusion is common in both. This study is designed to test the efficacy of uterine artery Doppler study done between 11-14 weeks as a single stage screening test for early prediction of preeclampsia and foetal growth restriction.

MATERIALS AND METHODS

Prospective observational study. 330 pregnant women who attended the antenatal care for measuring nuchal translucency at 11-14 weeks at the Sri Ramachandra Medical College & Research Institute, were recruited into the study. of which 320 patients could be followed up to term were included in the study.

RESULTS

The mean Pulsatility index was calculated and the 95th centile was ascertained as 2.98 and did not change significantly with foetal CRL. Of the total 320 cases, the mean PI was more than 95th centile in 16 (5%) cases and for 304 cases (95%) it was less than 2.98. The lowest PI observed was 0.8 and the highest being 3.75. In the study, the mean age for the 16 cases with mean PI >2.98 is 27.5 years and the mean age for the 304 cases with mean PI <2.98 is 26.8 years. Of the total 182 number of primigravida, 11 were having the mean PI >95th centile (6.8%) when compared to the 138 multigravida those who have the mean PI >95th centile are only 5 (3.3%).

CONCLUSION

In the future, uterine artery screening will probably be combined with biochemical markers of platelet activation or endothelial damage to further improve the screening results. Further studies are still necessary to determine how information from uterine artery Doppler studies should modify current practice in high risk women.

KEYWORDS

Pre-Eclampsia, Pulsatility Index & Nuchal Translucency.

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BACKGROUND

Screening interventions are designed to identify disease in a community early, thus enabling earlier intervention and management in the hope to reduce mortality and suffering from a disease. It is a logical extension of the role of preventive medicine. It should increase the predictive value and the prophylactic measure must be effective.^{1,2,3,4}

Preeclampsia which is one of the five hypertensive disorders of pregnancy is common with an incidence of 6-8% and form one of the deadly triad, along with



haemorrhage and infection, that contribute greatly to maternal morbidity and mortality. Foetal growth restriction is estimated to occur in 3-10% of the infants. The perinatal morbidity and mortality are significantly increased among these growth restricted infants.^{5,6,7,8,9,10}

Although the precise aetiology of these conditions remains poorly understood there is substantial evidence that failure of trophoblastic invasion of the maternal spiral arteries is a common underlying cause.^{5,6}

Diseases that may be causes of perinatal mortality and morbidity such as preeclampsia, intrauterine growth retardation (IUGR) are often seen in the third month or even just before the time of birth but the pathophysiologic mechanisms are believed to originate at the earlier times in pregnancy. During the period of a normal pregnancy beginning from the first three months till the 24th week, becoming more evident as time goes by, there is an increase in the diastolic blood flow of the uterine vessels. The above said diseases are associated with increased impedance to blood flow. This can be detected by uterine artery Doppler velocimetry as early as the beginning of second trimester.^{11,12,1}

Doppler Ultrasound has been demonstrated to be a reliable non-invasive method of examining utero-placental perfusion.⁷ Thus Uterine artery Doppler studies are common for both preeclampsia and adverse foetal outcome as a screening test because the impairment of placental perfusion is common in both. This study is designed to test the efficacy of uterine artery Doppler study done between 11-14 weeks as a single stage screening test for early prediction of preeclampsia and foetal growth restriction.

The pulsatility index (PI) in each uterine artery was measured by colour Doppler.¹³ The sensitivity of increased mean PI (> the 95th centile) for subsequent development of Preeclampsia and FGR was calculated.

This study examines the value of uterine artery Doppler at 11–14 weeks of gestation in the identification of women at risk of developing PET and FGR.

Aims and Objectives-

To determine the predictability of Uterine Artery Doppler at 11-14 weeks of gestation in screening preeclampsia and foetal growth restriction by using mean Pulsatility index >95th centile and elucidate its role in stratifying antenatal care.

MATERIALS AND METHODS

330 pregnant women who attended the antenatal care for measuring nuchal translucency at 11-14 weeks at the Sri Ramachandra Medical College & Research Institute, were recruited into the study. Of which 320 patients could be followed up to term were included in the study. It was an Prospective observational study. In all patients, detailed history, followed by complete general and obstetric examination were done. Routine biochemical investigations were done. Ultrasound and Doppler study were done between 11-14 weeks of gestation. All patients were followed with antenatal checkup with specific references to

the variables indicating development of PIH and small for age gestational foetus.

Inclusion Criteria-

Singleton pregnancies irrespective of age and parity.

Exclusion Criteria-

- 1. Multiple gestation
- 2. Maternal chronic hypertension, Maternal renal disease
- 3. Anomalous foetus.

History-

History to elicit the presence of high risk factors in the mother.

RESULTS

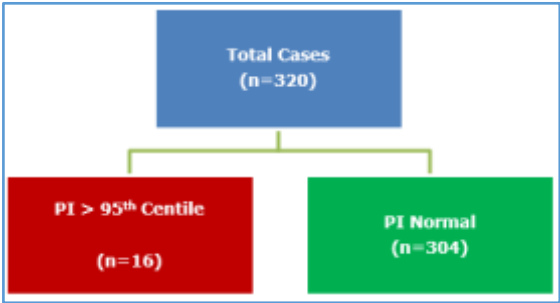


Figure 1. PI>95th Centile and PI Normal Patients Distribution

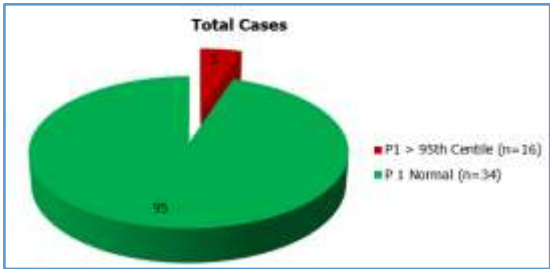


Figure 2. Total Cases

Age	Mean PI >2.98 (n=16)	Mean PI <2.98 (n=304)
< 25 years (n=114)	5 (31.3%)	109 (36.2%)
25–30 years (n=165)	9 (56.3%)	156 (50.8%)
>30 years (n=41)	2 (12.5%)	39 (13%)
Mean Age >2.98 = 27.5 years <2.98 = 26.8 years		

Table 1. Age (n=320)

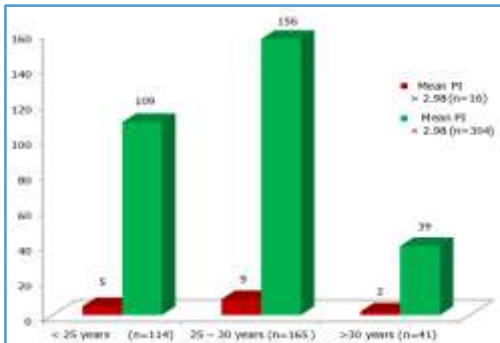


Figure 3. Age Distribution between Mean PI >2.98 Group and PI≤2.98

The mean age for the 16 cases with mean PI >2.98 is 27.5 years and the mean age for the 304 cases with mean PI <2.98 is 26.8 years.

BMI	Mean PI >2.98 (n=16)	Mean PI <2.98 (n=304)
<18.5	-	-
18.6 – 25 (n=65)	2 (12.5%)	63 (20.7%)
25.1 – 30 (n=222)	7 (43.8%)	215 (70.7%)
30.1 – 35 (n=33) n=320	7 (43.8%)	26 (8.6%)
Mean BMI > 2.98 = 28.73 < 2.98 = 27.18		

Table 2. Body Mass Index with P.I. Correlation (n – 320)

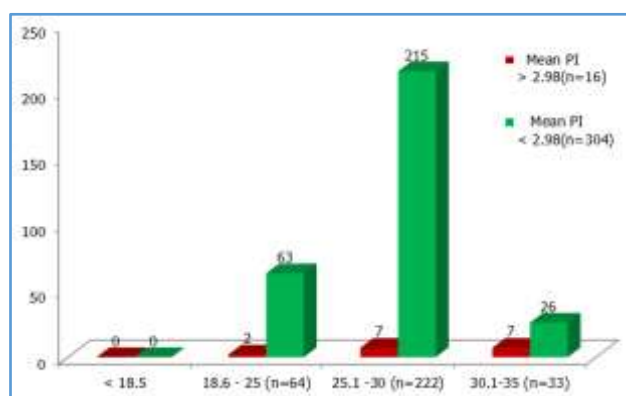


Figure 4. Body Mass Index with P.I. Correlation (n = 320)

Those who have BMI more than 30 to have higher percentage of cases with mean PI >95th centile. Of the total 33 cases with BMI >30, 7 cases (43.8%) are more than 2.98.

	Mean PI >2.98 (n=16)	Mean PI <2.98 (n=304)
Gestational HT	3	20
Pre-Eclampsia	4	12
Foetal Growth Restriction	2	12
PE + FGR	1	5
No complications	6	255

Table 3. Mean PI & Complications

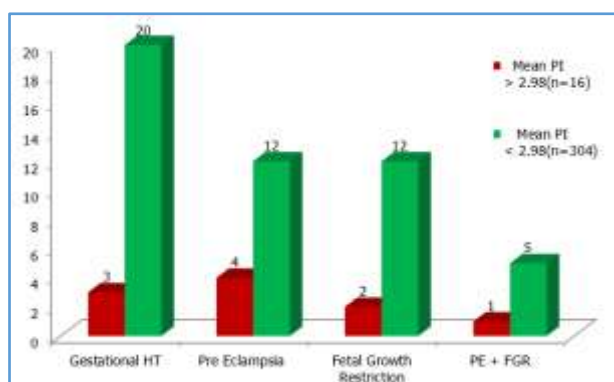


Figure 5. Mean PI & complications

Of the 16 cases with mean PI >95th centile, 3 cases had GHT, 4 developed Preeclampsia and 2 had FGR and a single case with both PE and FGR accounting for a total 9 cases (56.25%). 7 cases (43.75%) with mean PI >95th centile developed neither PE nor FGR.

Gestational Hypertension	Mean PI >2.98 (n=16)	Mean PI <2.98 (n=304)
Present	3 (18.8%)	20 (6.6%)
Absent	13 (81.3%)	284 (93.4%)
P Value is 0.066 - insignificant		

Table 4. Mean PI and Gestational Hypertension

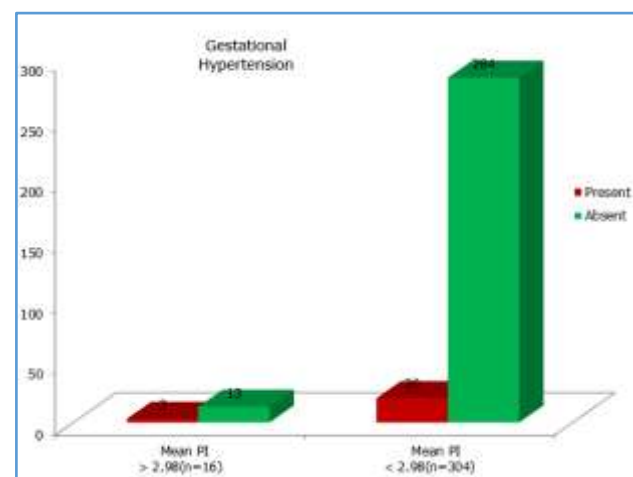


Figure 6. Mean PI and Gestational Hypertension

In the study out of 16 cases of mean PI >95th centile, 18.8% developed gestational hypertension.

FGR	Mean PI >2.98 (n=16)	Mean PI <2.98 (n=304)
Present	2 (12.5%)	12 (3.9%)
Absent	14 (87.5%)	292 (96.1%)
P Value is 0.10 is insignificant		

Table 5. Mean PI and FGR

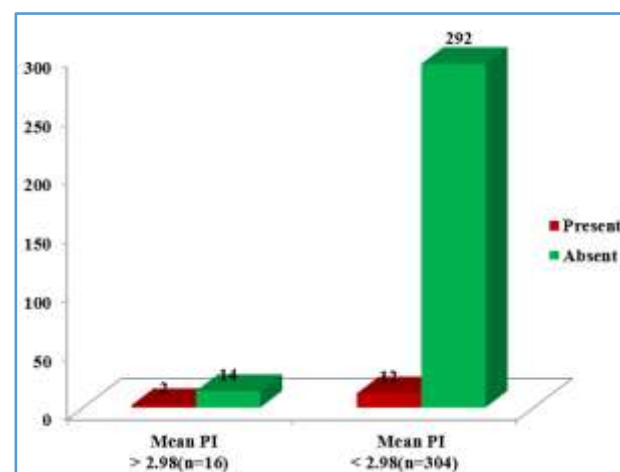


Figure 7. Mean PI and Gestational Hypertension

The total 16 cases with mean PI >95th centile, only 2 (12.5%) cases developed FGR. The obtained P value for correlating FGR 0.10 is insignificant.

DISCUSSION

For the prospective observational study carried out to determine the predictability of Uterine Artery Doppler at 11-14 weeks of gestation in screening preeclampsia and foetal growth restriction by using mean Pulsatility index >95th centile, a total of 330 cases were recruited.

Using colour flow mapping it was possible to visualize both the uterine arteries and satisfactory waveforms were obtained for all. As 10 patients could not be followed up as they did not attend the antenatal clinic and for the reasons of miscarriage, 320 patients were finally available for study.

The mean Pulsatility index was calculated and the 95th centile was ascertained as 2.98 and did not change significantly with foetal CRL. Of the total 320 cases, the mean PI was more than 95th centile in 16 (5%) cases and for 304 cases (95%) it was less than 2.98. The lowest PI observed was 0.8 and the highest being 3.75.

The patients were followed up till delivery for the development pregnancy related complications, PE and FGR. The cases with mean PI >95th centile and the development of complications were correlated to study the significance of the screening in terms of its sensitivity, specificity, positive predictive value and negative predictive value.

In the study, the mean age for the 16 cases with mean PI >2.98 is 27.5 years and the mean age for the 304 cases with mean PI <2.98 is 26.8 years. Of the total 182 number of primigravida, 11 were having the mean PI >95th centile (6.8%) when compared to the 138 multigravida those who have the mean PI >95th percentile are only 5 (3.13%).

It was observed that those who have BMI more than 30 to have higher percentage of cases with mean PI >95th centile. Of the total 33 cases with BMI >30, 7 cases (43.8%) are more than 2.98.

Of the 16 cases with mean PI >95th centile, 3 cases had GHT, 4 developed Preeclampsia and 2 had FGR and a single case with both PE and FGR accounting for a total 9 cases (56.25%). 7 cases (43.75%) with mean PI>95th centile developed neither PE nor FGR.

The significance of mean PI >95th centile with the predictability of the development of preeclampsia is well established with 4 (25%) of the 16 cases with mean PI >95th centile developing it The P value being 0.0005 making it significant.

In the study made at 11-14 weeks, of the total 16 cases with mean PI >95th centile, only 2 (12.5%) cases developed FGR. The obtained P value for correlating FGR 0.10 is insignificant.

Out of 320 cases, the pregnancy was complicated by preeclampsia in 16 cases (5%) and foetal growth restriction in 14 cases (4.3%).

The sensitivity of increased mean PI >95th centile for subsequent development of preeclampsia was 25% and FGR was 14.28%; for pregnancies with these complications requiring delivery before 34 weeks.

In the study, of the 2 cases (12.5%) cases with FGR, one case (50%) was with a birth weight less than the 10th percentile.

	Preeclampsia	FGR	PE+FGR
Sensitivity	25%	14.28%	16.66%
Specificity	96.05%	95.42%	95.22%
Positive PV	25%	12.5%	6.25%
Negative PV	96.05%	96.05%	98.35%

Table 6.

CONCLUSION

1. The uterine artery mean PI >the 95th centile has a sensitivity of 25% for pre-eclampsia and 14.28% for foetal growth restriction.
2. Sensitivity is higher for these complications requiring delivery before 34 weeks.
3. As negative predictive value is high, a normal PI is a better predictor to rule out the development of PE and FGR
4. Pulsatility Index has a low positive predictive value for the prediction of PE and FGR at 11- 14 weeks.

In view of a high negative predictive value, this test would be better in screening a population at high risk. In a multi-speciality institution, where the infrastructures are available, this test would be useful in terms of cost effectiveness and the need for intensive surveillance.

In the future, uterine artery screening will probably be combined with biochemical markers of platelet activation or endothelial damage to further improve the screening results

Further studies are still necessary to determine how information from uterine artery Doppler studies should modify current practice in high risk women.

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