

## Role of Placenta Location and Uterine Artery Doppler Assessment at 18 To 24 Weeks as Predictors of Pre-Eclampsia

Navkiran Kaur<sup>1</sup>, Piyush Singh<sup>2</sup>, Parneet Kaur<sup>3</sup>

<sup>1</sup>Professor and Head Deptt. of Radiodiagnosis, Govt. Medical College, Rajindra Hospital, Patiala, <sup>2</sup>Resident, Deptt. of Radiodiagnosis, Govt. Medical College, Rajindra Hospital, Patiala, <sup>3</sup>Professor, Dept. of Obst & Gynae, Govt. Medical College, Rajindra Hospital, Patiala.

### Abstract

**Background:** Preeclampsia, a pregnancy disorder, is defined as a systemic syndrome characterized by new-onset of hypertension and proteinuria after 20 weeks of gestational age in pregnant women, which resolves before the end of 6th week postpartum. Hence; under the light of above mentioned data, we planned the present study to establish the role of placenta location and uterine artery doppler assessment at 18 to 24 weeks as predictors of pre-eclampsia. **Subjects and Methods:** First 100 patients were scanned at 18-24 weeks and were followed up till delivery. The location of the placenta and uterine artery Doppler was determined by ultrasound using Phillips HD11 XE ultrasound machine with a 3.5-MHz curvilinear transducer at 18-24 weeks in all the cases at the time of scan. The end point of the study was the development of preeclampsia. The study group included 100 patients reporting to ultrasound section. Grey scale ultrasound and colour doppler was performed. Any co-relation of radiological findings with clinical and surgical findings were documented and analysed. **Results:** Significant results were obtained while assessing distribution of patients in relation to lateral placenta location, Doppler study and occurrence of pre-eclampsia. 87 percent of the patients had central located placenta while in the remaining 13 percent of the patients had lateral located placenta. While assessing the 100 patients, we observed that Pre-Eclampsia was found to be present in 12 percent of the patient. **Conclusion:** By identifying the high risk patients & anticipating preeclampsia patients can be monitored more closely to reduce the morbidity and improve the outcome of pregnancy.

**Keywords:** Doppler, Preeclampsia

**Corresponding Author:** Dr. Piyush Singh, Deptt. of Radiodiagnosis, Govt. Medical College, Rajindra Hospital, Patiala

**Received:** January 2020

**Accepted:** January 2020

### Introduction

In normal pregnancy, placental trophoblast cells invade the inner third of the myometrium and migrate the entire length of the maternal spiral arteries what optimizes delivery of oxygen and nutrients to the fetus.<sup>[1]</sup>

Preeclampsia, a pregnancy disorder, is defined as a systemic syndrome characterized by new-onset of hypertension (blood pressure – systolic > 140 mm Hg, diastolic > 90 mm Hg on two occasions at least 4 h apart, or in severe cases systolic blood pressure >160 mm Hg and diastolic blood pressure > 110 mm Hg) and proteinuria (protein [mg]/creatinine [mg] ratio of > 0.3 or protein > 5 g in a 24 h urine sample, or > 3 g in two samples taken 6 h apart from a patient on bed rest) after 20 weeks of gestational age in pregnant women, which resolves before the end of 6th week postpartum. In the absence of proteinuria, preeclampsia presents with hypertension associated with any features of end organ damage. Eclampsia is characterized by onset of seizures in pregnant women with preeclampsia.<sup>[2-5]</sup>

Abnormal uterine artery Doppler studies in both the first and second trimesters have been shown to be associated with subsequent perinatal complications. For women with

abnormal testing in the first trimester, the likelihood ratio (LR) for the development of preeclampsia is approximately 5, while those with normal Doppler flow studies have an LR of 0.5. Similarly, an abnormal test carries an LR of 2 for fetal growth restriction, with an LR of 0.9 after a normal test result. Though this relationship persists with testing in the second trimester, the sensitivity may be lower.<sup>[6,7]</sup>

Hence; under the light of above mentioned data, we planned the present study to establish the role of role of placenta location and uterine artery doppler assessment at 18 to 24 weeks as predictors of pre-eclampsia.

### Subjects and Methods

The prospective observational study was conducted at Rajindra Hospital, Government Medical College, Patiala, Punjab (Department of radiodiagnosis) for a period of 24 months from November 2017 to November 2019. First 100 patients were scanned at 18-24 weeks and were followed up till delivery. The location of the placenta and uterine artery Doppler was determined by ultrasound using Phillips HD11 XE ultrasound machine using a 3.5-MHz curvilinear transducer at 18-24 weeks in all the cases at the time of

## Kaur et al; Role of Placenta Location and Uterine Artery Doppler Assessment at 18 To 24 Weeks as Predictors of Pre-Eclampsia

scan. The end point of the study was the development of preeclampsia. The study group included 100 patients reporting to ultrasound section of Department of Radiodiagnosis, Rajindra Hospital, Patiala, with gestation period of 18 to 24 weeks. Grey scale ultrasound and colour doppler was performed. Any co-relation of radiological findings with clinical and surgical findings will be documented and analysed.

### Inclusion Criteria

- Normotensive, Primigravida, Singleton pregnant women of 18 to 24 weeks gestation.

### Exclusion Criteria

- Previous history of diabetes, hypertension, renal disease, collagen vascular disorders or history of smoking.
- Multipara and multiple gestations.

All the data were entered in Microsoft excel sheet. Statistical analysis was done using diagnostic tests such as sensitivity, specificity and predictive values. Chi- square test was used for assessment of level of significance. P-value of less than 0.05 was taken as significant.

## Results

A total of 100 patients were analysed. In 16 percent of the patients each, gestational age was found to be 19 weeks, 21 weeks and 23 weeks. Mean gestation age of the patients of the present study was 20.88 weeks. Among the 87 patients with central placenta position, normal Doppler findings were found to be present in 79 patients while abnormal Doppler findings were found to be present in 8 patients. Significant results were obtained while assessing the distribution of patients in relation to Central placenta location, Doppler study and occurrence of pre-eclampsia. Among the 13 patients with lateral placenta position, normal Doppler findings were found to be present in 1 patient while abnormal Doppler findings were found to be present in 12 patients. Significant results were obtained while assessing distribution of patients in relation to lateral placenta location, Doppler study and occurrence of pre-eclampsia. 87 percent of the patients had central located placenta while in the remaining 13 percent of the patients had lateral located placenta. In the present study, while assessing the 100 patients, we observed that Pre-Eclampsia was found to be present in 12 percent of the patient.

**Table 1: Distribution of cases according to gestational age**

| Gestational age (weeks) | Number of cases | % of cases |
|-------------------------|-----------------|------------|
| 18                      | 15              | 15         |
| 19                      | 16              | 16         |
| 20                      | 13              | 13         |
| 21                      | 16              | 16         |
| 22                      | 13              | 13         |
| 23                      | 16              | 16         |
| 24                      | 11              | 11         |
| Total                   | 100             | 100        |

**Table 2: Distribution of cases according to placental location**

| Location of placenta | Number of cases | Percentage of cases |
|----------------------|-----------------|---------------------|
| Central              | 87              | 87                  |
| Lateral              | 13              | 13                  |
| Total                | 100             | 100                 |

**Table 3: Incidence of Pre-eclampsia**

| Pre-eclampsia | Number of patients | % of patients |
|---------------|--------------------|---------------|
| Present       | 12                 | 12            |
| Absent        | 88                 | 88            |
| Total         | 100                | 100           |

**Table 4: Distribution of patients in relation to Central placenta location, Doppler study and occurrence of pre-eclampsia**

| Pre-eclampsia     | Central Placenta        |                           | Total |
|-------------------|-------------------------|---------------------------|-------|
|                   | Doppler Normal findings | Doppler abnormal findings |       |
| Negative          | 74                      | 5                         | 79    |
| Positive          | 5                       | 3                         | 8     |
| Total             | 79                      | 8                         | 87    |
| Chi- square value | 58.12                   |                           |       |
| p- value          | 0.00                    |                           |       |

**Table 5: Distribution of patients in relation to Lateral placenta location, Doppler study and occurrence of pre-eclampsia**

| Pre-eclampsia     | Lateral Placenta        |                           | Total |
|-------------------|-------------------------|---------------------------|-------|
|                   | Doppler Normal findings | Doppler abnormal findings |       |
| Negative          | 1                       | 8                         | 9     |
| Positive          | 0                       | 4                         | 4     |
| Total             | 1                       | 12                        | 13    |
| Chi- square value | 49.25                   |                           |       |
| p- value          | 0.00                    |                           |       |

## Discussion

Preeclampsia is a major contributor to perinatal mortality and morbidity, as well as the long-term cardiovascular health of the mother and child. Modern antenatal care provision is focused on early identification of risks, thereby allowing early commencement of management strategies to minimize the risk of adverse pregnancy outcomes. Abnormal uterine artery Doppler pulsatility index (PI) assessment in the second trimester might also correlate with suboptimal outcomes, but its role in prediction of later pregnancy complications is controversial.<sup>[7-9]</sup>

In the present study, 87 percent of the patients had central located placenta while in the remaining 13 percent of the patients had lateral located placenta. Variable results have reported in past literature in relation to placenta position. In a study conducted by Chinnappa M K et al, the incidence of lateral placentation was 15% which is comparable to the study done by KarthikaDevarajan et al who had the incidence as 16.5%.<sup>[10, 11]</sup>

In the present study, while assessing the 100 patients, we observed that Pre-Eclampsia was found to be present in 12 percent of the patients. Our results were

in concordance with the results obtained by previous authors who have also reported very low incidence of Pre-Eclampsia in their study populations. Dhakar V et al reported that the prevalence of pre-eclampsia was 5% and Bewley et al, (4.6%) and Jasovic et al (4%). PE is a very significant disease which complicates from 2% to 5% of pregnancies in Europe and America and can reach up to 10% of pregnancies in developing countries, mainly due to the lack of or inadequacy of emergency care.<sup>[12-15]</sup>

Cnossen JS conducted a meta-analysis and evaluated the incidence of pre-eclampsia. The total number of women was 79 547, of whom 2498 were found to have pre-eclampsia. In most of the studies assessed in their meta-analysis, Doppler ultrasonography was performed between 18 and 24 weeks' gestation during a routine prenatal scan; 7 articles reported Doppler results before 16 weeks' gestation. The median rate of pre-eclampsia was 4.9%. Rates of pre-eclampsia varied from 0.4% to 18.7% among patients at low or unspecified risk and from 3.2% to 44.3% among high-risk patients.<sup>[9]</sup>

It has been shown that in humans, both uterine arteries have a significant number of branches and that each supply the corresponding side of the uterus. Although anastomoses between the two uterine arteries exist, there is no proof that they are functional. When the placenta is laterally located, the uterine artery closer to the placenta has lower resistance than the one opposite to it. In women with centrally located placenta, both uterine arteries have similar resistance and the uteroplacental blood flow needs are met by equal contribution from both uterine arteries. However, when the placenta is laterally located, in the majority of the cases, the uteroplacental blood flow needs are met primarily by one of the uterine arteries with some contribution from the other uterine artery via the collateral circulation. The degree of collateral circulation may not be the same in all the women and deficient contribution may facilitate the development of preeclampsia, IUGR, or both. The significance of normal placentation for cytotrophoblastic invasion is high and the cytotrophoblasts fail to adopt a vascular adhesion phenotype in preeclampsia. This may explain the reduced trophoblastic invasion in laterally situated placenta when the uteroplacental blood flow needs are mainly met by one side uterine artery.<sup>[13-16]</sup>

Our results were also in concordance with results obtained by Kofinas et al. who concluded that in women with unilateral placenta, the incidence of preeclampsia was 2.8-fold greater than those with centrally located placenta. Similar results were also reported by Muralidhar et al who reported that a total of 71 women developed preeclampsia of which 74 % had unilaterally located placenta. The relationship was found to be statistically significant  $p < 0.0001$ .<sup>[17,18]</sup>

Preeclampsia is modeled as abnormal trophoblast invasion and development of the uteroplacental

circulation leading to subsequent inflammation with maternal endothelial dysfunction. There is increasing evidence that there may be different phenotypes of preeclampsia and indeed that early or late onset and mild or severe preeclampsia may have differing underlying pathophysiologies. Our data suggests that abnormal development of the uterine vasculature has a stronger involvement in the development of early onset and severe preeclampsia.<sup>[15-18]</sup>

## Conclusion

From the above results, the authors concluded that by identifying the high risk patients & anticipating preeclampsia patients can be monitored more closely to reduce the morbidity and improve the outcome of pregnancy.

## References

1. Giordano R, Cacciatore A, Romano M, La Rosa B, Fonti I, Vigna R. Uterine artery Doppler flow studies in obstetric practice. *J Prenat Med.* 2010;4(4):59–62.
2. Carty DM, Delles C, Dominiczak AF. Preeclampsia and future maternal health. *J Hypertens.* 2010;28:1349–1355.
3. Malik A, Jee B, Gupta SK. Preeclampsia: Disease biology and burden, its management strategies with reference to India. *Pregnancy Hypertens.* 2019 Jan;15:23-31.
4. Phipps E, Prasanna D, Brima W, Jim B. Preeclampsia: Updates in Pathogenesis, Definitions, and Guidelines. *Clin J Am Soc Nephrol.* 2016;11(6):1102–1113.
5. Sharma D, Shastri S, Sharma P. Intrauterine Growth Restriction: Antenatal and Postnatal Aspects. *Clin Med Insights Pediatr.* 2016;10:67–83.
6. Papageorghiou AT, Yu CK, Nicolaidis KH. The role of uterine artery Doppler in predicting adverse pregnancy outcome. *Best Pract Res. Clin Obstet Gynaecol.* 2004;18:383–96.
7. Spencer K, Yu CK, Cowans NJ, et al. Prediction of pregnancy complications by first trimester maternal serum PAPP-A and free beta-hCG and with second trimester uterine artery Doppler. *Prenat Diagn* 2005;25:949-53.
8. Papageorghiou AT, Yu CKH, Bindra R, et al. Multicentre screening for pre-eclampsia and fetal growth restriction by transvaginal uterine artery Doppler at 23 weeks of gestation. *Ultrasound Obstet Gynecol* 2001;18:441-9.
9. Cnossen JS, Morris RK, terRiet G, et al. Use of uterine artery Doppler ultrasonography to predict pre-eclampsia and intrauterine growth restriction: a systematic review and bivariable meta-analysis. *CMAJ* 2008;178:701-11.
10. Chinnappa M K, Prabha Ganapathy, N Indira, Abhirami, Vasanthi V. Role Of Placental Localization And Uterine Artery Doppler At 18-24 Weeks As Predictors Of Preeclampsia And IUGR. *International journal of medical and applied sciences.* 2015; 4(3): 223- 228.
11. Devarajan K, Kives S, Ray JG. Placental location and Newborn Weight *J Obstet Gynaecol Can.* 2012;34(4) 325- 329
12. Dhakar V, Naz S. Role of uterine and umbilical artery doppler assessment of the uteroplacental circulation in predicting preeclampsia: comparison between different doppler parameters. *Int J Reprod Contracept Obstet Gynecol* 2017;6:4314-7.
13. Bewley S, Copper D, Campbell S. Doppler investigation of uteroplacental blood flow resistance in the second trimester; A screening test for Pre eclampsia and IUGR. *Br J Obstet Gynecol.* 1991;98:871-9.
14. Jasovic-Siveska EI, Jasovic VI. Real time ultra sound in the detection of IUGR in pre-eclampsia. *Bratisl Lek Lisky.* 2008;109(9):405-11.
15. Grill S, Rusterholz C, Zanetti-Dällenbach R. Potential markers of preeclampsia - A review. *Reproductive Biology and Endocrinology.*

*Kaur et al; Role of Placenta Location and Uterine Artery Doppler Assessment at 18 To 24 Weeks as Predictors of Pre-Eclampsia*

- 2009; 7: Article no. 70.
16. Campbell S, Bewbey S, Cohen-overbeek T. Investigation of the uteroplacental circulation by Doppler ultrasound. *SeminPerinatol.* 1987;11:362
17. Kofinas AD, Penry M, Swain M, Hatjis CG. Effect of placental laterality on uterine artery resistance and development of preeclampsia and intrauterine growth retardation. *Am J Obstet Gynecol.* 1989;161:1536-9.
18. PaiMuralidhar V, Pillia J. Placental laterality by ultrasound—a simple yet reliable predictive test for preeclampsia. *J ObstetGynecol India.* 2005;55:431-433.

**Copyright:** © the author(s), publisher. Asian Journal of Medical Radiological Research is an Official Publication of “Society for Health Care & Research Development”. It is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

**How to cite this article:** Kaur N, Singh P, Kaur P. Role of Placenta Location and Uterine Artery Doppler Assessment at 18 To 24 Weeks as Predictors of Pre-Eclampsia. *Asian J. Med. Radiol.Res.* 2019;7(2):188-91.  
DOI: [dx.doi.org/10.21276/ajmrr.2019.7.2.41](https://doi.org/10.21276/ajmrr.2019.7.2.41)

**Source of Support:** Nil, **Conflict of Interest:** None declared.

