ORIGINAL RESEARCH

Prediction of Pre-Eclampsia by Placental localization by Ultrasonography

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ABSTRACT

Background and objectives: Finding high-risk pregnancies early on is the main problem in modern obstetrics so that the appropriate steps can be taken to lower the prevalence of the condition. This study aimed to investigate the relationship between placental position and pre-eclampsia development. **Method**: 120 pregnant women participated in the study, which involved taking their medical histories, performing a general and obstetric checkup with USG between weeks 18 and 24, and monitoring them until delivery to look for signs of preeclampsia and its correlation with placental position. **Results**: Our study shows that out of 120 women, 37% developed pre-eclampsia between 21–25 years, 22% of pre-eclamptic women delivered at 31–35 weeks of gestation, 63% of pre-eclamptic women weigh between 71–80 kg, 97 (81%) had central placenta, and 23 (19%) had lateral placenta. Pre-eclampsia developed in patients with lateral placentas (33%), and those with central placentas developed pre-eclampsia in 15%, which was statistically significant. **Conclusion**: Though there are many predictors for pre-eclampsia, early detection of placental location by a routine anomaly scanwill definitely be the best predictor in categorizing the woman under the high-risk group so that close fetomaternal surveillance can be done to reduce the maternal and neonatal morbidity as well as mortality.

Keywords: Pre-eclampsia, Ultrasonography, Placental Location, Lateral Placenta.

INTRODUCTION

The primary cause of maternal and newborn morbidity and mortality globally is still pre-eclampsia, a disease of trophoblastic tissue that manifests as a complicated clinical condition involving several organ systems. The placental position determined by ultrasonography at 18 to 24 weeks is one of the most economical, non-invasive, and positively predictive predictors of preeclampsia. Placental position and foetal Doppler investigations are significantly correlated with negative outcomes, such as foetal growth limitation and preeclampsia. The uterine artery near the placenta exhibits less resistance than the one across from it when the placenta is laterally positioned. Therefore, only one side of the uterine artery can supply the blood flow requirements of the uteroplacenta. Pre-eclampsia is therefore more common in women with unilateral placentas than in those with centrally placed placentas.

AIMS

To study the relation between placental location and the development of pre-eclampsia.

OBJECTIVES

1. Incidence of pre-eclampsia with the lateral location of the placenta
2. Incidence of lateral location of placenta in pre-eclampsia.

MATERIALS AND METHODS

This prospective observational study was conducted among 120 pregnant women who attended the antenatal clinic in Coimbatore Medical College Hospital from November 2022 to October 2023. The sample size was 120.
Sampling technique: Simple random sampling
Study period: 1 year

Inclusion Criteria

- All pregnant women attending antenatal clinic, both outpatient and ward admissions at 18 – 24 weeks.
- Determination of placental location by ultrasound
- Singleton pregnancy
- Patients willing for follow-up

Exclusion Criteria

- Chronic hypertension
- Twin gestation
- Uterine anomalies
- Previous cesarean section
- Diabetes
- Renal disease
- H/O smoking

Pregnant women who fulfilled the inclusion and exclusion criteria were selected, and data were collected according to the proforma. A detailed history is taken. A general examination is done, including vital signs, especially blood pressure and weight. A detailed abdominal examination was done.

All 120 of these ladies had their placentas located by ultrasonography between weeks 18 and 24.

Regardless of its anterior, posterior, or fundal placements, the placenta is categorized as central when it is evenly distributed across the right and left sides of the uterus. A placenta is categorized as unilaterally right or left when more than 75% of its mass is on one side of the midline.

According to the American College of Obstetrics and Gynecology's criteria for pre-eclampsia, which include blood pressure of 140/90 mm Hg or higher, new-onset hypertension after 20 weeks of pregnancy, with or without proteinuria or end-organ damage, was the study's end point. If blood pressure was >140/90 mm Hg, antihypertensives were added. Hospitalization and appropriate management were provided for severe cases.

Statistical Analysis

The data was provided as mean +/- SD or the median, depending on their distribution. Frequencies were expressed as percentages. The unpaired t-test was used to evaluate how the quantitative variables differed between the groups. The non-parametric Mann-Whitney test was used to compare the groups. The factors were evaluated using ANOVA. The groups' differences in the categorical variables were evaluated using the chi-square test. For all statistical tests, a two-tailed test p-value of less than 0.05 was considered significant. A statistical software program called SPSS, version 16.0 for Windows, was used to analyze all of the data.

RESULTS

In our study, out of 120 patients, 38% are in the age group of 26–30 years, 34% are between 21–25 years, and 19% are between 31–35. Only 1% of patients were more than 40 years old.

Out of the 120 patients, 61% were primigravida, and the remaining 39% were multigravida.

90% were spontaneous conception, 6% were IVF conception, 2% by IUI, and 3% conceived by ovulation induction.

Out of 120 patients, 85% delivered between 36–40 weeks of gestation, 13% delivered between 31–35 weeks, and 3% less than 30 weeks of gestation. Out of the 120, 23% (27) had pre-eclampsia.

Out of 27 patients, 10 developed pre-eclampsia between 21-25 years, 8 of them between 26-30 years, and 7 between 31-35 years. The mean age group for the development of pre-eclampsia is 28 years, with the minimum of 22 years and maximum of 42 years. Out of 27 pre-eclampsia patients, 17 were having a weight between 71–80 kg, 5 between 81–90 kg, 4 between 61–70 kg, and 1 with a weight of more than 100 kg.

Placenta	No. of Subjects	%
Lateral	23	19%
central	97	81%
Total	120	100%

Table 1: Prevalence of Placenta

Placenta	Pre-Eclampsia	Normal	Total	%
Lateral	9	14	23	19
Central	18	79	97	81
	27	93	120	

Table 2: Association of Placenta with Pre-Eclampsia

Out of the 23 lateral placenta, 9 developed pre-eclampsia, and the rest of the 97 patients with central placenta, 18 developed pre-eclampsia.

In our study, 48 women delivered by normal vaginal delivery, 50 by LSCS, 21 by vacuum, and 1 by forceps. Out of 27 pre-eclampsia patients, 11 of them have birth weights between 2.5 and 3 kg, 6 of them between 2 and 2.5 kg, and 5 of them between 3 and 3.5 kg.

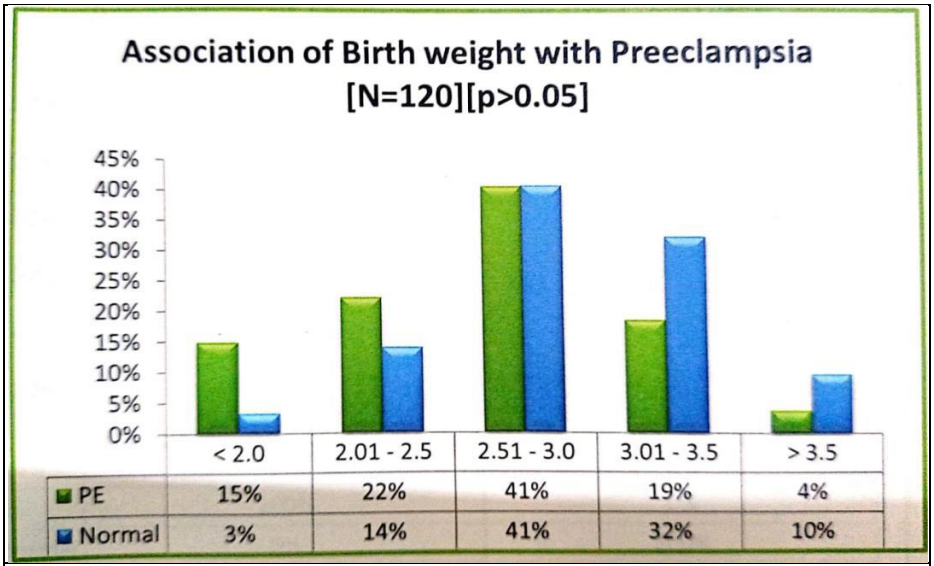

Figure 1: Association of Birth Weight with Pre-Eclampsia

Of the 27 pre-eclamptic women, 24 of them had normal fetal Doppler studies and 3 of them had abnormal studies.

Doppler vs.Study Subjects with Placenta Location						
Placenta				**Pre-Eclampsia**	**Normal**	**Total**
Lateral	Doppler	Normal	n	7	14	21
			%	77.8o%	100%	91.3%
		Abnormal	Count	2	0	2
			%	22.2%	0	8.7%
	Total		Count	9	14	23
			%	100%	100%	100%
Central	Doppler	Normal	Count	17	78	95
			%	94.4%	98.7%	97.9%
		Abnormal	Count	1	1	2
			%	5.6%	1.3%	2.1%
	Total		Count	18	79	97
			%	100%	100%	100%

Table 3: Location of the Placenta and Abnormal Doppler Incidence

DISCUSSION

One of the main causes of intrauterine growth restriction, premature birth, neonatal death, and maternal mortality and morbidity is pre-eclampsia.This multisystem disorder's pathogenesis is typified by an aberrant vascular response to placentation.African ethnicity, age ≥35 years, obesity, kidney illness, diabetes, chronic hypertension, and pregnancy characteristics like twin or molar pregnancy, prior pre-eclampsia, or fetal congenital abnormalities are risk factors. Due to decreased uterine artery blood flow, reduced uterine artery diameter, and increased placental hypoxia, high altitude has also been demonstrated to raise the risk of pre-eclampsia.

During a normal pregnancy, spiral arteries lose their endothelium and the majority of their muscle fibers as the villous cytotrophoblast invades the inner third of the myometrium. Functional changes are linked to these anatomical changes, making spiral arteries low-resistance vessels that are less sensitive—or even insensitive—to vasoconstrictive drugs. The main cause of pre-eclampsia, which has a complicated pathophysiology, is improper placentation. In pre-eclampsia, cytotrophoblast cells exhibit defective invasion of the spiral arteries. Chronic placental ischemia and oxidative stress are caused by increased susceptibility to vasoconstrictors, which is induced by increased uterine vascular resistance. Fetal consequences from this persistent placental ischemia include intrauterine growth retardation and intrauterine mortality. Concurrently, oxidative stress triggers the release of chemicals into the mother's bloodstream, including cytokines, oxidized lipids, free radicals, and serum-soluble vascular endothelial growth factor 1. In order to make up for the decreased flow in the uterine arteries brought on by peripheral vasoconstriction, these anomalies cause endothelial dysfunction with vascular hyperpermeability, thrombophilia, and hypertension.

The primary cause of maternal and newborn morbidity and mortality in India is pre-eclampsia, which affects 8–10% of pregnant women. 7.8% of pregnant women have hypertension problems, and 5.4% have pre-eclampsia. All of the prenatal women in our study who were between 18 and 24 weeks pregnant had their placentas located by ultrasound. They were also monitored until delivery and had their blood pressure, age, parity, and mode of conception noted. Measurements were made of the mother's weight, gestational age, and delivery method at the time of delivery. The development of pre-eclampsia and its relationship to placental location are the study's primary findings.

Age Distribution

Out of 27 patients, 37% developed pre-eclampsia between 21 and 25 years, 30% of them between 26 and 30 years, 26% of them between 31 and 35 years, 4% between 36 and 40 years, and 4% more than 40 years. Nil developed pre-eclampsia less than 20 years ago. Though Shailesh et al.,[1] study shows that extremes of ages developed pre-eclampsia, in our study the age group of 21–25 years showed maximum occurrence of pre-eclampsia, which is the same with Lavanya Kumari et al.[2]

Study Series	Patients	21–25 years
Lavanya Kumara et al.,	150	80 (53.3%)
Our study	120	10 37%)

Mode of Conception

Out of 120 women, pre-eclampsia was observed in 74% of women with spontaneous conception, 15% with IVF (In-Vitro Fertilization), 4% with ovulation induction, and 7% with IUI (Intra-Uterine Insemination) when compared to women without pre-eclampsia, where 95% are by spontaneous conception, 3% by IVF, 2% by ovulation induction, and none by IUI. The above observation shows that IVF conceptions are at high risk of developing pre-eclampsia.

Gestational Age at the Time of Delivery

Our study showed that 22% of pre-eclamptic women delivered at 31–35 weeks, 7% by <30 weeks, and 70% at 36–40 weeks. In Jyothi Jaiswal et al.,[3] study, the mean gestational age of delivery was 38–39 weeks.

Study Series	Gestational Age
Jyothi Jaiswal et al.,	38 – 39
Our study	36

Maternal Weight at the Time of Delivery

In our study, 63% of pre-eclamptic women weighed between 71–80 kg, 19% between 81–90 kg, 15% between 61–70 kg, and 4% over 100 kg, and no pre-eclampsia was observed in <60 kg. It is statistically significant, as the BMI increases, chances of pre-eclampsia increase. The result is the same as shown by Nisa et al.,[4] study, but Jyoti Jaiswal et al.,[3] who observed that normal BMI with lateral placenta has a higher chance of developing pre-eclampsia than women with morbid obesity with central placenta.

Prevalence of Placental Position in Pre-Eclampsia

In our study, out of 120 patients, 97 (81%) had central placenta and 23 (19%) had lateral placenta. Pre-eclampsia with lateral placenta was seen in 33%, and that of central placenta with pre-eclampsia was seen in 15%, which is statistically significant ($p < 0.05$).

Study Series	Lateral Placenta	Central Placenta
Tania et al.	66%	36%
Kanika et al.	66%	36%
Our study	33%	15%

Mode of Delivery

In our study, preeclamptic women who delivered by LSCS were 56%, by normal delivery were 33%, 11% by vacuum and none by forceps delivery. Jyothi Jaiswal et al.,[3] showed that lateral placenta has more chance of caesarean delivery than centrally located placenta, where 45% of patients with lateral placenta underwent cesarean compared to 23.6% in central placenta.

Birth Weight

In our study, 41% of babies born are between 2.5 and 3.0 kg in central and lateral placenta, 22% between 2.01 and 2.5 kg, 19% between 3.01 and 3.5 kg, 15% are <2 kg, and 4% are >3.5 kg. As in Karthika et al.,[5] there was no difference in birth weight between lateral and central placenta.

Association of Fetal Doppler Study with Pre-eclampsia

In our study, pre-eclampsia with abnormal Doppler in the umbilical artery is 11% in laterally located placentas when compared to 1% in centrally located placentas. Teena Nagar et al.,[6] also studied that when both uterine and umbilical artery Doppler are studied, laterally located placenta had an abnormal Doppler study in all patients with pre-eclampsia. Parul et al.,[7] study shows that out of 80 patients with lateral placenta, 26 had raised uterine artery Doppler, out of which 22 developed pre-eclampsia. So lateral placentas with abnormal Doppler studies in pregnant women are at high risk for pre-eclampsia.

Proteinuria

In our study, 22% of women had urine albumin 1+, 5% had 2+, and 11% had 3+. Almost 48% of preeclamptic women had albuminuria compared to none in normal individuals. Shiva Murthy H.M. et al.,[8] study showed a higher level of albumin in fundal placenta than in the central placenta.

CONCLUSION

The present study was to evaluate the incidence of pre-eclampsia in laterally located placentas, and also laterally located placentas are at high risk of pre-eclampsia. Though there are many predictors for pre-eclampsia, early detection by ultrasonography at 18-24 weeks will definitely be the best predictor in categorizing the woman under the high-risk group so that close fetomaternal surveillance can be done to reduce the maternal and neonatal morbidity as well as mortality.

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