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Original Article

Obstetrics and Gynaecology Section

Mid-trimester Placental Localisation and Pregnancy Outcomes: A Prospective Cohort Study

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ABSTRACT

Introduction: Placental location significantly influence the placental blood flow and consequently, pregnancy success.

Aim: To determine the pregnancy and neonatal outcomes depending on the second trimester placental location.

Materials and Methods: This prospective cohort study was conducted in the Department of Obstetrics and Gynaecology at PSG Institute of Medical Sciences and Research, Coimbatore, Tamil Nadu, India, from June 2021 to November 2022. A total of 283 pregnant women between 18 and 24 weeks of gestation were included. Details such as maternal age, gravida, placental location in the second-trimester scan, occurrence of gestational diabetes, gestational hypertension, preeclampsia, foetal growth restriction, premature rupture of membranes and preterm premature rupture of membranes were collected. Neonatal details, including APGAR scores at one minute and five minutes, Neonatal Intensive Care Unit (NICU) admissions, intrauterine death, respiratory distress, preterm delivery and low birth weight were also recorded. Data was entered into an MS Excel sheet, and statistical analysis was performed using Statistical Package for the Social Sciences (SPSS) software version 23.0. The Chi-square test and Fisher's exact test were used for comparison of the two groups.

Results: The mean age of the pregnant women was 25.41 years, ranging from 19 to 39 years. Out of the 283 pregnant women, 236 (83.39%) had a centrally located placenta, while 47 (16.61%) had a laterally located placenta. The relationship between placental location and parity was statistically significant (p-value <0.05). Among women with a lateral placenta position, 3 (6.38%) had a Lower Segment Caesarean Section (LSCS), 39 (82.98%) had a vaginal delivery, and 5 (10.64%) had an assisted vaginal delivery. Among women with a central placenta position, 41 (17.37%) had an LSCS, 170 (72.03%) had a vaginal delivery, and 25 (10.59%) had an assisted vaginal delivery. This observation was statistically significant. Statistical analysis revealed significant differences for gestational hypertension, preeclampsia and foetal growth restriction, with p-values of 0.001, 0.004 and 0.049, respectively. NICU admission was required for 18 (38.3%) of those with lateral placentas, compared to 35 (14.8%) with a p-value of 0.001. Low birth weight infants were found in 12 (25.53%) of women with lateral placentas compared to 25 (10.6%) of women with central placentas (p-value of 0.007).

Conclusion: Maternal outcomes such as gestational hypertension and preeclampsia were considerably higher in women with a lateral-position placenta. Furthermore, these pregnancies also exhibited markedly higher rates of foetal growth restriction, NICU admission, preterm birth and low birth weight.

Keywords: Central, Lateral, Maternal complications, Neonatal outcome, Placenta position

INTRODUCTION

The placenta begins to develop gradually from the fourth month of pregnancy, growing in tandem with the size of the uterus. By the time it is fully developed, it resembles a spongy disc approximately 3 centimeters thick and 20 centimeters wide. It is a temporary organ whose genetic makeup is identical to that of the growing child. This fragile organ consists of numerous layers of tissue that must develop appropriately for proper function during pregnancy [1-3]. Cytotrophoblasts penetrate the decidua and myometrium, thus attaching the placenta to the uterus. They also develop a vascular phenotype, enabling foetal cells to enter and line the uterine blood arteries. This process facilitates the channeling of maternal blood to the placenta [4]. Early pregnancy loss, stillbirth and Foetal Growth Restriction (FGR) are a few adverse pregnancy outcomes linked to abnormal placental development [4-6].

Several characteristics of the placenta, such as villous surface area [7], villous vascularity, infarction/thrombosis [8], proliferative and apoptotic events in the trophoblastic area [9], placental phenotype [10], superficial implantation and maternal vascular underperfusion [11], as well as apoptosis in the placenta [12], foetal placental weight ratio [13], altered inflammatory profiles in maternal and foetal surfaces [14], and abnormal placental morphology [15,16], have been recognised as influencing pregnancy outcomes. By identifying the placental position early in pregnancy, antenatal surveillance can be intensified, potentially preventing both neonatal and pregnancy-related complications. The novelty of this study lies in the prospective identification of maternal care, which is beneficial for maternal health. The aim of the study was to determine the pregnancy and neonatal outcomes in mid-trimester placental location.

MATERIALS AND METHODS

This was a prospective cohort study conducted in the Department of Obstetrics and Gynaecology at PSG Institute of Medical Science and Research, Coimbatore, Tamil Nadu, India, from June 2021 to November 2022. Institutional Ethical Committee (IEC) approval (IEC

NUMBER- PSG/IHEC/2021/Appr/Exp/095, Project no: 21/129) was obtained.

Inclusion criteria: All pregnant mothers (with or without co-morbidities) between 18-24 weeks with a singleton pregnancy who were willing to follow-up and deliver at the hospital were included in the study.

Exclusion criteria: Patients who refused to participate, with multiple pregnancies, patients planning to go to other hospitals for delivery were excluded from the study.

Sample size: According to the study by Faizi S and Pai MV, considering the prevalence of antepartum haemorrhage in lateral placentas as 19.7%, with a precision of 5% and a 95% confidence interval, the minimum sample size, accounting for a 15% nonresponse rate, amounted to 283 [17].

Study Procedure

Ultrasonography was performed on pregnant women between 18-24 weeks of gestation by a specialist in ultrasonography to identify placental location. The criteria for identifying the placental location were as follows: if the placenta is implanted in the anterior wall of the uterus, it is called an anterior placenta; if it is implanted in the posterior wall of the uterus, it is called a posterior placenta; and if it is implanted in the lower uterine segment, it is called a low-lying placenta. If the placenta is attached to the right or left wall of the uterus, it is called a lateral placental location. The anterior, posterior, and low-lying placentas are also referred to as central placental locations.

Depending on the placental location, the pregnant women were divided into two groups: those with a central placenta and those with a lateral placenta. They were followed-up throughout the pregnancy. Details regarding maternal age, gravida status, placental location in the second-trimester scan, occurrence of gestational diabetes, gestational hypertension, preeclampsia, foetal growth restriction, premature rupture of membranes and preterm premature rupture of membranes were collected. Neonatal details, such as the APGAR score at 1 minute and 5 minutes, NICU admission, intrauterine death, respiratory distress, preterm delivery and low birth weight, were also collected.

STATISTICAL ANALYSIS

Data were entered into an MS Excel sheet, and statistical analysis was conducted using SPSS software version 23.0. For the comparison of the two groups, the Chi-square test and Fisher's exact test were used. Continuous variables are represented by mean, median, and standard deviation. Categorical variables are represented in frequencies and percentages.

RESULTS

The mean age of the pregnant women was 25.41 years, ranging from 19 to 39 years. The mean gestational age (in weeks) was 20.62, ranging from 18 to 28 weeks. Out of the 283 pregnant women, 236 (83.39%) had a centrally located placenta, while 47 (16.61%) had a laterally located placenta. The relationship between placental location and parity was statistically significant (p-value <0.05) [Table/Fig-1].

Among women with a lateral placenta, 3 (6.38%) had a LSCS, 39 (82.98%) had a vaginal delivery, and 5 (10.64%) had an assisted vaginal delivery. Among women with a central placenta, 41 (17.37%) had an LSCS, 170 (72.03%) had a vaginal delivery, and 25 (10.59%) had an assisted vaginal delivery. This observation was statistically significant [Table/Fig-2].

Parity	Placenta position		Total	p-value
	Lateral	Central		
Primi	36 (19.05%)	153 (80.95%)	189 (100%)	0.034
G2	8 (11.59%)	61 (88.41%)	69 (100%)	
G3	2 (14.29%)	12 (85.71%)	14 (100%)	
G4	1 (9.09%)	10 (90.91%)	11 (100%)	
Total	47 (16.61%)	236 (83.39%)	283 (100%)	

[Table/Fig-1]: Comparison of parity with the placenta position.
Fisher's exact test was used

Placenta position	Mode of delivery			Total	p-value
	LSCS	Vaginal	Assisted vaginal		
Lateral	3 (6.38%)	39 (82.98%)	5 (10.64%)	47 (100%)	0.049
Central	41 (17.37%)	170 (72.03%)	25 (10.59%)	236 (100%)	
Total	44 (15.55%)	209 (73.85%)	30 (10.6%)	283 (100%)	

[Table/Fig-2]: Comparison of mode of delivery with the placenta position.
Fisher's exact test was used

Upon analysing maternal complications, 6 (12.8%) of women with a lateral placenta had gestational hypertension, whereas only 3 (1.3%) of women with a central placenta experienced this condition. Preeclampsia was observed in 7 (14.9%) of those with a lateral placenta and in 8 (3.4%) of those with a central placenta. foetal growth restriction was seen in 8 (17%) of women with a lateral placenta, compared to 21 (8.9%) of women with a central placenta. Statistical analysis revealed significant differences for gestational hypertension, preeclampsia, and foetal growth restriction, with p-values of 0.001, 0.004, and 0.049, respectively [Table/Fig-3].

Maternal complications	Placenta position		p-value
	Lateral	Central	
Gestational diabetes	8 (17%)	43 (18.2%)	0.164
Gestational hypertension	6 (12.8%)	3 (1.3%)	0.001
Premature rupture of membranes	2 (4.3%)	26 (11%)	0.087
Preterm premature rupture of membranes	2 (4.3%)	6 (2.5%)	0.263
Foetal growth restriction	8 (17%)	21 (8.9%)	0.049
Preeclampsia	7 (14.9%)	8 (3.4%)	0.004
Large for gestational age	0	2 (0.8%)	0.695

[Table/Fig-3]: Maternal complications with placenta position.
Chi-square test was used

NICU admission was required for 18 (38.3%) of those with lateral placentas, compared to 35 (14.8%) with central placentas (p-value=0.001). Preterm birth rates were significantly higher among those with lateral placentas compared to those with central placentas (p-value of 0.049) [Table/Fig-4].

DISCUSSION

The right and left uterine arteries are the primary vascular supplies to the uterus. Blood flow in the uterus is not evenly distributed; hence, identifying the location of the placenta during pregnancy is very important. In present study, 236 (83.39%) of women had a central placenta position, while 47 (16.61%) had a lateral placental position. The results were similar to those of a study conducted

Neonatal outcome	Placenta position		p-value
	Lateral	Central	
Intra uterine death	0	5 (2.1%)	0.400
NICU admission	18 (38.3%)	35 (14.8%)	0.001
APGAR at 1 min	5 (10.6%)	16 (6.8%)	0.149
APGAR at 5 min	2 (4.3%)	4 (1.7%)	0.206
Respiratory distress	2 (4.3%)	12 (5.1%)	0.288
Preterm	3 (6.4%)	3 (1.3%)	0.049
Meconium stained liquor	2 (4.3%)	5 (2.21%)	0.240
Low birth weight	12 (25.5%)	25 (10.6%)	0.007

[Table/Fig-4]: Neonatal outcomes with placental position.
Chi-square test was used

by Patil A, which found that out of 200 women, 166 (82.8%) had central placentation, 32 (16.2%) had lateral placentation, and 2 (1%) had placenta previa [18]. Another study by Nair VV et al., showed that 377 placentas (or 83.8%) were central, whereas 73 (16.2%) were lateral [19]. Fung TY et al., reported that 89.89% had central placentas, 2.5% had fundal placentas, and 3.87% had a lateral position of the placenta [20]. The distribution of placenta locations varies among different studies due to differences in study criteria and settings. Dhingra S et al., reported that among their study population, 84 (42%) had fundal placentation, 60 (30%) were anterior, 36 (18%) were lateral, 16 (8%) were posterior, and 4 (2%) were low-lying [21]. Faizi S and Pai MV, indicated that at 28 weeks, 44% of placentas were anterior, 27.2% were posterior, 15.8% were fundal, 9.8% were lateral, and 2.9% were placenta previa [17].

In present study, among the maternal complications, gestational hypertension and preeclampsia showed a significant relationship with the placental location. This is because, in a centrally located placenta, the blood flow to the placenta is contributed equally by both uterine arteries, resulting in low resistance. However, if the placenta is laterally located, it receives blood supply primarily from the ipsilateral side of the uterine artery, which has low resistance, while the contralateral uterine artery has high resistance. Consequently, the blood supply to the placenta will be greater from the ipsilateral artery and less from the contralateral artery due to poor collateral formation. This deficient development can lead to improper trophoblastic invasion and the release of cytokines and other inflammatory mediators, resulting in the subsequent development of hypertension and preeclampsia [22]. Racher ML et al., demonstrated that central and fundal locations compared to all lateral placentas had a decreased incidence of pregnancy-related hypertension [23]. Dhingra S et al., found that gestational hypertension was present in 22%, 13%, and 12% of cases with lateral, anterior, and posterior placentas, respectively. Preeclampsia was detected in 22% of women with a lateral placenta [21].

Kore SJ et al., showed that among 32 women who had preeclampsia, 19 (59.38%) of them had a unilaterally situated placenta between 20-24 weeks [22]. Seckin KD et al., found that lateral placental placements exhibited a significantly greater rate of preeclampsia compared to central placements (4.5% vs. 1.6%) [24]. Present study also showed similar observations, and the association was statistically significant.

A study conducted by Racher ML et al., found no association between placental location and the occurrence of gestational diabetes, premature rupture of membranes, or placental abruption [23]. In contrast, the study by Zia S found that placental abruption occurred in 3.7% of cases, while gestational diabetes was observed in 6% of participants who had an anterior placenta [25]. The study by Amer MB demonstrated a connection between an anterior placenta and pregnancy-related diabetes, as well as placental abruption. Conversely, preterm labour showed a significant association with a posterior placenta [26]. Dhingra S et al., found that preterm labour and premature rupture of membranes were more common with posterior or lateral placentas [21].

In present study, 17% of women with lateral placentation had foetal growth restriction, while in those with central placentation, it was 8.9%. Incomplete trophoblastic invasion present in lateral placentation and reduced blood supply to the foetus are the causes of foetal growth restriction. A study by Patil A showed a 16% occurrence of foetal growth restriction with lateral placentation [18]. Similarly, a study by Nair VV et al., showed 10.2% of foetal growth restriction associated with the lateral placenta [19]. Kalanithi LEG et al., indicated that foetal growth restriction was approximately four times more likely to occur with lateral placentation than with anterior or posterior placentation [27].

When comparing the mode of delivery, present study revealed that the percentage of vaginal deliveries was higher in those with lateral placentas (82.98%) compared to central placentas (72.03%). The relationship between placental position and mode of delivery cannot be fully explained, as the indication for caesarean section in each woman is individualised. Further studies are needed to better understand and correlate this relationship. This contrasts with a study by Fung TY et al., where the percentage of vaginal deliveries was 78.3% in central placentas and 73.7% in lateral placentas [20].

The placenta plays a crucial role in foetal blood supply, nutrients, and oxygen delivery. In present study, NICU admission was required for 38.3% of those with lateral placentas, while only 14.8% of those with central placentas had NICU admissions. Low birth weight babies were found in 25.5% of cases with a lateral placenta and 10.6% in those with a central placenta. The results are similar to the study conducted by Patil A, which found that preterm birth, NICU admission and intrauterine death were higher with lateral placentas [18]. A study by Nair VV et al., showed that preterm birth occurred in 16.3% of participants, and NICU admission was present in 26% of those with a lateral placenta [19].

The present study did not show any statistically significant differences in APGAR scores at one minute and five minutes, respiratory distress, intrauterine death, or meconium-stained liquor. Magann EF et al., found no association between placental position and low APGAR scores at five minutes. There is an increased incidence of preterm labour, intrauterine foetal death, stillbirth, foetal distress, meconium-stained liquor, and higher rates of caesarean deliveries associated with posterior placentas [28]. This is attributed to the fact that the posterior wall is thicker than the anterior wall, and the blood supply also differs between the two.

Limitation(s)

A notable limitation of present study was that authors did not classify the placenta's position as anterior or posterior. Identifying whether the placenta is anterior or posterior could potentially enhance the understanding of the impacts on both the mother and the foetus.

CONCLUSION(S)

According to the study, maternal outcomes such as gestational hypertension and preeclampsia were considerably higher in women

with a lateral position placenta. Furthermore, these pregnancies exhibited markedly higher rates of foetal growth restriction, NICU admission, preterm birth and low birth weight. The study highlights a strong association between lateral placentation and unsatisfactory pregnancy and newborn outcomes. Therefore, routine localisation of the placenta during second-trimester ultrasound can serve as a non invasive predictor of pregnancy and newborn outcomes.

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