

## Investigating the Association between Placental Site in the Second Trimester of Pregnancy and Pregnancy Outcomes in Mother and Infant: A Retrospective Study

Zahra Soleimani<sup>1</sup>, Neda Hashemi<sup>2</sup>, Azam Soleimani<sup>3</sup>, \*Mahsa Naemi<sup>4</sup>

<sup>1</sup>Nephrology and Urology Research Center, Baqiyatallah University of Medical Sciences, Tehran, Iran And Fetal Health Research Center, Hope Generation Foundation, Tehran, Iran. <sup>2</sup>Fellowship of Perinatology, Rasoul Akram Hospital, Iran University of Medical Sciences, Tehran, Iran. <sup>3</sup>Cardiac Rehabilitation Research Center, Isfahan Cardiovascular Research Institute, Isfahan University of Medical Sciences, Isfahan, Iran. <sup>4</sup>Assistant Professor, Department of Obstetrics and Gynecology, Shariati Hospital, Tehran University of Medical Sciences, Tehran, Iran.

### Abstract

**Background:** The location of placenta is essential for the proper growth of fetus. This study was conducted to assess the relationship between placental location and perinatal and neonatal outcomes.

**Materials and Methods:** The present retrospective cohort study was carried out on 1000 pregnant women who had delivered in Baqiyatallah Hospital, Tehran, Iran, during 2016-2018. We used a researcher-made questionnaire for collection of clinical and demographic information of patients from their medical records. All women had undergone a detailed ultrasound and Doppler examination at 20–23 weeks. We classified placenta position to four types: Lateral, Posterior, Anterior and Fundal. The data were analyzed using SPSS software version 20.0.

**Results:** Placental site location in 44%, 42.1%, 8.2% and 5.7% of cases were anterior, posterior, lateral and fundal, respectively. The mean birth weight in subjects with lateral and posterior placental site location were  $2999.3 \pm 643.9$ , and  $3269.7 \pm 1776.9$  gr as lowest and highest, respectively ( $P < 0.001$ ). Among the newborns in lateral group, 4.88% of them were pre-term, which was significantly higher than other groups ( $P = 0.035$ ). The rate of IUGR birth in lateral group was 4.88% which was higher than other groups ( $P = 0.023$ ). Also, among perinatal outcomes the rate of twin pregnancy was higher in lateral group, while the percentage of female birth in this group was lower than other groups ( $P < 0.001$ ).

**Conclusion:** Lateral placental locations are associated with a number of adverse pregnancy, delivery and infant outcomes. Placental implantation and location at 14 to 24 weeks can be used in the evaluation of pregnancies. In other words, knowing the placenta location can help obstetricians and gynecologists in the better diagnosis of pregnancies at higher risk of complications.

**Key Words:** Infant, Placental Site, Pregnant women, Outcomes.

\*Please cite this article as: Soleimani Z, Hashemi N, Soleimani A, Naemi M. Investigating the Association between Placental Site in the Second Trimester of Pregnancy and Pregnancy Outcomes in Mother and Infant: A Retrospective Study. Int J Pediatr 2021; 9(3): 13237-242. DOI: **10.22038/IJP.2021.55795.4395**

### \*Corresponding Author:

Mahsa Naemi (MD), Assistant professor, OB-GYN Perinatologist, Department of Obstetrics and Gynecology, Shariati Hospital, Tehran University of Medical Sciences, Tehran, Iran

Email: [naemi.m2018@gmail.com](mailto:naemi.m2018@gmail.com)

Received date: Nov.24, 2020; Accepted date: Feb. 22, 2021

## 1- INTRODUCTION

Function of placenta is important for the normal development of the fetus. Placenta is a place for nutrition and nutrient exchange. Therefore, location of placenta is essential for the proper growth of fetus (1). Placenta is also a link between the mother and the fetus for metabolic exchange, endocrine and other body functions, and is vital for maternal and neonatal health (2, 3). The primary vascular supply of uterus is through uterine artery, a branch of the hypogastric artery. The blood flow in the uterus is not homogeneously distributed. Therefore, the location of placenta within the uterus is important from a clinical point of view (4). In location of lateral placenta, the uterine artery near the placenta has lower resistance compared with the opposite sections. Therefore, needs of the adequate uteroplacental blood flow is achieved through collateral circulation through the surrounding arteries of the uterus, with contribution from other uterine arteries (5).

The association between placental location and uterine artery resistance has led to adverse outcomes including preeclampsia, fetal distress (FT), preterm labor, fetal malpresentation, low Apgar score, stillbirth and intrauterine growth retardation (IUGR) (5-7). Some studies have shown that the lateral placenta leads to low birth weight (LBW). This can be due to difference of the blood supply between the anterior and posterior parts of the uterus leading to lower birth weight (6). Lateral placental location has been reported in relation to increased rate of preeclampsia and IUGR.

Additionally, posterior placental location was found to be related to preterm labor and stillbirth (8). A result of the Granfors et al.'s study has reported that there was no significant correlation in the rate of hypertensive disorders of pregnancy between the patients with central and lateral placentas (9). However, few studies

about the association between placental location and perinatal and neonatal outcomes and the predictability of placental location on adverse perinatal and maternal outcomes in large studies have been undertaken. Therefore, considering the above clinical data, the aim of our study was to assess the association between placental location and perinatal and neonatal outcomes.

## 2- MATERIALS AND METHODS

### 2-1. Study design and population

This retrospective cohort study was carried out on 1000 pregnant women who had delivered in Baqiyatallah Hospital (Tehran, I.R. Iran) during 2016-2018. The eligible cases were included into the study through non-probability convenience sampling method.

### 2-2. Inclusion and exclusion criteria

The inclusion criteria were women having singleton pregnancy who underwent a mid-trimester ultrasound examination between 14±0 and 23±6 weeks of gestation. The exclusion criteria included fetal death, existence of congenital anomalies, systemic diseases as well as subjects with placental abnormality.

### 2-3. Measuring tools

We used a researcher-made questionnaire and collected pregnant women's age, gravidity, parity, abortion history, and gestational age, premature rupture of membranes (PROM) history, diabetes and hypertension for mothers. We also collected obstetric outcomes including: birth weight, fetal sex, delivery type, neonatal intensive care unit (NICU) admission, and being IUGER or preterm for all subjects from their medical records.

### 2-4. Methods

All women had undergone a detailed ultrasound and Doppler examination at 20–23 weeks. We classified placenta position to four types: Lateral, Posterior,

Anterior and Fundal. Lateral placenta was defined when the placenta was found to be located predominantly on the lateral uterine wall (10). Placental location at the latest scan before 24 completed weeks of gestation was used in those women who underwent more than one mid-trimester scan.

## 2-5 Ethical consideration

Ethics approval for the study was obtained from the institutional review board of the Baqiyatallah University of Medical Sciences. The declaration of Helsinki was followed throughout the study (No. IR. BMSU. REC, 1394.270).

## 2-6. Data Analyses

The software package SPSS software version 20.0 was used to perform the statistical analysis. Data were presented as mean  $\pm$  standard deviation for continuous variables and frequency/percentage for categorical variables. The one way ANOVA and Chi-square tests were used to analyze the relationships between variables

with placental site location. P-value  $< 0.05$  was considered as statistically significant.

## 3- RESULTS

Overall, 1000 pregnancies with ascertained placental location and perinatal and neonatal outcomes were assessed. The maternal demographic characteristics, risk factors, medical complications and complications of pregnancy according to the placental site location are shown in **Table.1**. Placental site location in 44%, 42.1%, 8.2% and 5.7% of cases were anterior, posterior, lateral and fundal, respectively. Patients with fundal placental site location had significantly lower maternal age at delivery ( $P=0.04$ ), and patients with lateral placental site location had significantly lower gestational age ( $P=0.001$ ). The number of 28 (34.15%) cases with lateral placental site location had history of PROM, while others did not experience PROM. There was no significant difference between groups with regard to diabetes and hypertension morbidity ( $P>0.05$ ).

**Table-1:** The association between socio-demographic characteristics, risk factors and medical complications with the placental site location, n=1000.

Variables		Lateral (n=82)	Anterior (n=440)	Posterior (n=421)	Fundal (n=57)	P-value
Gravidity	1	29 (35.37%)	153 (34.77%)	162 (38.48%)	25 (43.86%)	0.12*
	2	29 (35.37%)	175 (39.77%)	155 (36.82%)	27 (47.37%)	
	$\geq 3$	24 (29.27%)	112 (25.45%)	104 (24.7%)	5 (8.77%)	
Abortion history	0	68 (82.93%)	357 (81.14%)	361 (85.75%)	44 (77.19%)	0.11*
	1	12 (14.63%)	66 (15.0%)	53 (12.59%)	13 (22.81%)	
	$\geq 3$	2 (2.44%)	17 (3.66%)	7 (1.66%)	0	
Maternal age at delivery (year)		30.32 $\pm$ 5.47	30.07 $\pm$ 4.53	29.75 $\pm$ 5.09	27.92 $\pm$ 4.79	0.04**
Gestational age (week)		37.76 $\pm$ 2.72	38.5 $\pm$ 1.64	38.53 $\pm$ 1.78	38.2 $\pm$ 1.49	<0.001**
PROM history		28 (34.15%)	0	0	0	-
History of hypertension		3 (3.66%)	25 (5.68%)	15 (3.56%)	3 (5.26%)	0.49***
Diabetes		3 (3.66%)	18 (4.09%)	19 (4.51%)	2 (3.51%)	0.97***

PROM: Premature rupture of membranes, \* Chi square test, \*\* One-way ANOVA, \*\*\* Exact fisher test.

The association between obstetric outcomes with placental site location is shown in **Table.2**. The mean birth weight in cases with lateral and posterior placental site location was 2999.3±643.9 and 3269.7±1776.9 gr as the lowest and highest, respectively (P<0.001). 4.88% of newborns in lateral group were pre-term, which was significantly higher than other groups (P=0.035). The rate of IUGR birth

in lateral group was 4.88% which was higher than other groups (P=0.023). In lateral group, 10.98% of newborns were admitted in NICU, while this rate in posterior group was only 2.38% (P<0.001). Also, the rate of twin pregnancy was higher in lateral group, while the percentage of female births in this group was lower than other groups (P<0.001).

**Table-2:** The association between obstetric outcomes with placental site location.

Variables	Lateral (n=82)	Anterior (n=440)	Posterior (n=421)	Fundal (n=57)	P-value	
Placental abruption	1 (1.22%)	4 (0.91)	3 (0.71)	0	0.86*	
Birth weight (gr)	2999.3±643.9	3210±624.78	3269.7±1776.9	3079.6±735.6	<0.001**	
Pre-term labor	4 (4.88%)	3 (0.68%)	4 (0.95%)	0	0.035*	
IUGR child	4 (4.88%)	5 (1.14%)	3 (0.71%)	1 (1.75%)	0.023*	
NICU admission	9 (10.98%)	11 (2.50%)	10 (2.38%)	5 (8.77%)	<0.001***	
Type of labor	VD	21 (25.61%)	153 (34.77%)	144 (34.20%)	17 (29.82%)	0.38***
	C/S	61 (74.39%)	287 (65.23%)	277 (65.8%)	40 (70.18%)	
Sex of fetus	Boy	44 (53.66%)	236 (53.64%)	219 (52.02%)	32 (56.14%)	<0.001*
	Girl	32 (39.02%)	204 (46.36%)	198 (47.03%)	25 (43.86%)	
	Twin	6 (7.32%)	0	4 (0.95%)	0	

\* Exact fisher test, \*\* One-way ANOVA, \*\*\* Chi square test, IUGR: Intrauterine growth restriction, VD: Vaginal delivery, C/S: Cesarean section.

#### 4- DISCUSSION

This study was conducted to find out the relationship between the site of placenta, as determined by ultrasound between 14 and 22 weeks of gestation, and perinatal and maternal outcomes. The present study showed that placental site location in 44% and 42.1% of cases was anterior and posterior, respectively and the fundal was lowest (5.7%) Only patients with a lateral placenta had history of PROM and this group was at increased risk for IUGR, higher admission in NICU, preterm labor and also twin pregnancy. Evidence shows that the incidence rate of IUGR and need for NICU was higher in lateral placenta position when compared with the central placenta position (7, 9). Moreover in the Granfors et al.'s study,

fundal and lateral placental locations are associated with a number of adverse pregnancy, delivery and infant outcomes including: very preterm birth, small-for-gestational-age birth and manual removal of the placenta in vaginal births. Also, in their study, lateral placental location was associated with preeclampsia and severe postpartum hemorrhage (10). These findings are in line with present study. In a case-control study by Mangann et al. (2007), the incidence of lateral placenta was 4-fold more frequent in IUGR cases when compared with the normal cases (11). Our study also showed that women with lateral placental position were at a significantly increased risk of preterm labor significantly at an increased risk of preterm labor. Furthermore, women with a lateral placenta were at significant

risk of having a spontaneous preterm delivery before 34 weeks of gestation after adjusting for confounder's factor that could lead to preterm labor (7). In the conducted study by Chaksuwat et al., penetration of the placenta was slightly but significantly associated with an increase in rates of preterm birth (12). The risk of low birth weight, spontaneous preterm labor and gestational age in delivery in women with lateral placenta has been reported to be significantly higher compared to the women with central placentae (13).

Our study has found similar results. In lateral placenta, there is lower resistance in the uterine artery near to the placenta than its opposite side. Therefore, the degree of collateral circulation to maintain adequate blood flow may not be the same in all the pregnancies and this may lead to IUGR development (5). Findings of this study showed that placental location by ultrasound imaging can be used as a screening test to predict high risk pregnant women in order to manage prevention of adverse pregnancy outcomes.

#### 4-1. Study Limitations

One limitation of this study was that many of the sites had too few pregnancies to analyze and correlate those sites with pregnancy outcomes, therefore we categorized them into 4 sites. Another limitation was that preeclampsia and fetal distress during labor was not determined in this study. Also, further studies are necessary to determine the correlation between central placenta and pregnancy outcomes.

#### 5- CONCLUSION

Placental implantation and location at 14 to 24 weeks can be used in the evaluation of pregnancies to categorize them as being at risk for an adverse pregnancy outcome. We found that lateral placental locations are associated with a

number of adverse pregnancy, delivery and infant outcomes given that the early diagnosis of adverse pregnancy outcome is very important. For the best pregnancy outcomes, the results of sonography, laboratory tests and clinical examinations should be considered.

#### 6- ACKNOWLEDGEMENTS

This study was funded by Baqiyatallah University of Medical Sciences (No; IR. BMSU. REC, 1394.270). We gratefully acknowledge the kind support of the participants for their valuable collaboration in this study as well as the staffs of Baqiyatallah Hospital.

**7- CONFLICT OF INTEREST:** None.

#### 8- REFERENCES

1. Ito Y, Shono H, Shono M, Muro M, Uchiyama A, Sugimori H. Resistance index of uterine artery and placental location in intrauterine growth retardation. *Acta obstetrica et gynecologica Scandinavica*. 1998;77(4):385-90.
2. Singh N, Gupta R, Pandey K, Gupta N, Chandanan A, Singh P, et al. To study second trimester placental location as a predictor of adverse pregnancy outcome. *Int J Reprod Contracept Obstet Gynecol*. 2016;5(5):1414-17.
3. Salama-Bello R, Duncan JR, Howard SL, Song J, Schenone MH. Placental Location and the Development of Hypertensive Disorders of Pregnancy. *Journal of Ultrasound in Medicine*. 2019;38(1):173-8.
4. Kalanithi LE, Illuzzi JL, Nossov VB, Frisbaek Y, Abdel-Razeq S, Copel JA, et al. Intrauterine growth restriction and placental location. *Journal of Ultrasound in Medicine*. 2007;26(11):1481-89.
5. Kakkar T, Singh V, Razdan R, Digra SK, Gupta A, Kakkar M. Placental laterality as a predictor for development of preeclampsia. *The Journal of Obstetrics and Gynecology of India*. 2013;63(1):22-5.

6. Murphy VE, Smith R, Giles WB, Clifton VL. Endocrine regulation of human fetal growth: the role of the mother, placenta, and fetus. *Endocrine reviews*. 2006;27(2):141-69.
7. Magann E, Doherty D, Turner K, Lanneau Jr G, Morrison J, Newnham J. Second trimester placental location as a predictor of an adverse pregnancy outcome. *Journal of perinatology*. 2007;27(1):9.
8. Seckin K, Cakmak B, Karsli M, Yeral M, Gultekin I, Oz M, et al. Is lateral localisation of placenta a risk factor for adverse perinatal outcomes? *Journal of Obstetrics and Gynaecology*.2015;35(7):696-8.
9. Granfors M, Stephansson O. Placental location and pregnancy outcomes in nulliparous women: A population-based cohort study. 2019.
10. Granfors M, Stephansson O, Endler M, Jonsson M, Sandström A, Wikström AK. Placental location and pregnancy outcomes in nulliparous women: A population-based cohort study. *Acta obstetricia et gynecologica Scandinavica*. 2019;98(8):988-96.
11. Fung TY, Sahota DS, Lau TK, Leung TY, Chan LW, Chung TKH. Placental site in the second trimester of pregnancy and its association with subsequent obstetric outcome. *Prenatal diagnosis*. 2011;31(6):548-54.
12. Chaksuwat P, Wanapirak C, Piyamongkol W, Sirichotiyakul S, Tongprasert F, Srisupundit K, et al. A comparison of pregnancy outcomes after second-trimester amniocentesis between cases with penetration of the placenta and nonpenetration. *The Journal of Maternal-Fetal & Neonatal Medicine*. 2020:1-6. <https://doi.org/10.1080/14767058.2019.1702017>.
13. Erdolu MD, Köşüş A, Köşüş N, Dilmen G, Kafali H. Relationship between placental localisation, birth weight, umbilical Doppler parameters, and foetal sex. *Turkish journal of medical sciences*.2014; 44(6): 1114-17.