International Journal of Reproduction, Contraception, Obstetrics and Gynecology
Singh A et al. Int J Reprod Contracept Obstet Gynecol. 2017 Dec;6(12):5568-5571
www.ijrcog.org

pISSN 2320-1770 | eISSN 2320-1789

DOI: http://dx.doi.org/10.18203/2320-1770.ijrcog20175283

Original Research Article

Are preeclampsia and small for gestational age baby could be predicted by placental location?

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Received: 11 October 2017
Accepted: 04 November 2017

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ABSTRACT

Objective: Preeclampsia is one of the major cause of maternal and perinatal mortality and morbidity. The pathophysiology is complex and involves multiple organs. The purpose of this study was to find out whether the placental laterality as a predictor of preeclampsia and small for gestational age baby.
Methods: This was prospective observational study conducted from February 2015 to December 2015, in a tertiary care hospital of Delhi. 347 antenatal patients attending obstetrics OPD without high risk factors were enrolled. After enrolment 50 patients were lost to follow up and 27 not delivered in our hospital. Ultrasonography for placental localization was done at 18-24 weeks of pregnancy. Patients were followed till delivery for pregnancy outcomes such as preeclampsia, small for gestation age (SGA) baby and mode of delivery. Placenta locations were divided into lateral (either right or left) and central (anterior, posterior or fundal).
Results: Out of 347, a total of 270 patients were analysed, 39 (14.4%) had lateral placenta and among them 17 (43.5%) developed preeclampsia and 24 (61.5%) had small for gestational age baby ($p<0.001$). 231 (85.5%) had central placenta and among them 49 (21.2%) developed preeclampsia and 63 (27.2%) had small for gestational age baby ($p <0.001$).
Conclusions: Laterally located placenta had significant association with preeclampsia and small for gestational age babies.

Keywords: Lateral placenta, Preeclampsia, Small for gestational age baby, Ultrasonography

INTRODUCTION

Preeclampsia is one of the major cause of maternal and perinatal mortality and morbidity. The pathophysiology is complex and involves multiple organs. Various tests have been proposed to identify women at risk of developing preeclampsia such as the cold pressor test, the isometric hand grip exercise, and the roll over test which depends on the presence of some pathophysiological changes which occur in preeclampsia. Other tests such as the measurement of urinary calcium or plasma fibronectin are based on the presence of biochemical alterations peculiar to this disease.[1] Preeclampsia occurs only in the presence of placenta.[2] The placental location by ultrasound at 18-24 weeks is non-invasive, cost effective, and has a good positive predictive value among the various predictors for preeclampsia.[3] Blood supply of uterus is not uniformly distributed. The site of implantation and location of the placenta within the uterus are likely important determinants of placental blood flow and pregnancy outcomes like intrauterine growth restriction and preeclampsia.[4] Both uterine arteries demonstrate similar resistance in the women with centrally located placenta. When the placenta is laterally located, the uterine artery close to the placenta has lower resistance than the one opposite from it. In lateral

placenta, the uteroplacental blood flow needs are to be met primarily by one of the uterine arteries with some contribution by the other uterine artery via collateral circulation.[3,5] The degree of collateral contribution may not be the same in all women, and deficient contribution facilitates the development of preeclampsia, IUGR, or both.

METHODS

This prospective observational study was carried out in the Department of Obstetrics and Gynecology of a tertiary care hospital of Delhi from February 2015 to December 2015.

Definition of lateral and central placenta

The placenta was classified as lateral (either right or left) and central (anterior, posterior, or fundal position) according to position of attachment with uterus.

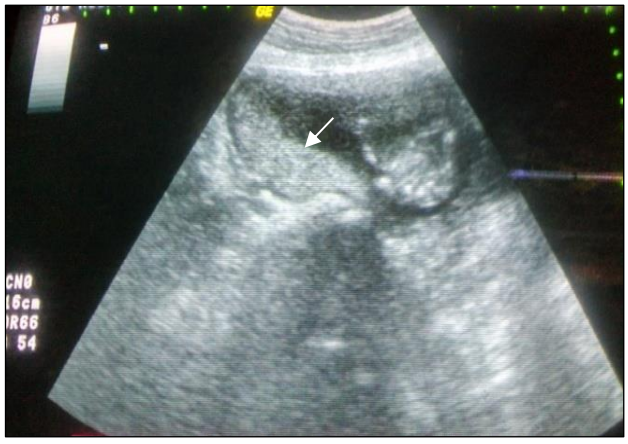

Figure 1: Lateral placenta (arrow).

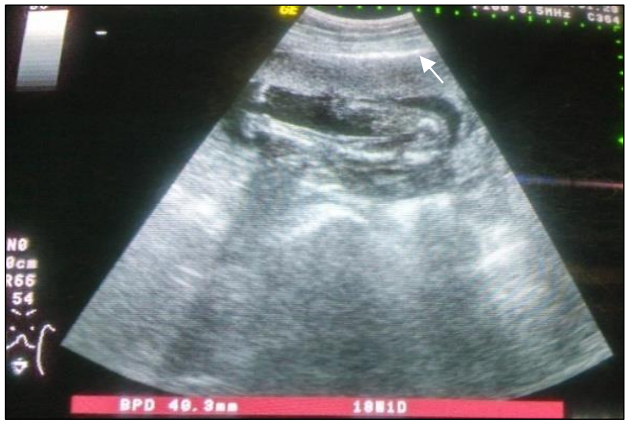

Figure 2: Central placenta (arrow).

Inclusion criteria

All pregnant women at 18-24 weeks of gestation without any high-risk factors, attending the antenatal clinic were included in this study.

Exclusion criteria

Pregnant women were excluded from the study if they were having risk factors like diabetes mellitus, chronic hypertension, thyrotoxicosis, renal disease, severe anemia, connective tissue disorder, positive lupus anticoagulant and anticardiolipin antibodies, RH incompatibility, twin pregnancy, low lying placenta and accreta and positive VDRL test.

All the cases were subjected to history, general physical, and systemic as well as obstetrical examination at the time of their antenatal visit and at the time of admission. The location of placenta was determined by ultrasound at 18-24 weeks in all the selected women and they were followed till delivery for the development of preeclampsia, baby birth weight and mode of delivery.

Preeclampsia was diagnosed on the basis of the American Congress of Obstetricians and Gynecologist criteria for preeclampsia and is defined as new-onset hypertension (BP is ≥140 mmHg systolic and/or ≥90 mmHg diastolic) occurring in a pregnant woman after 20 weeks gestation, with proteinuria (defined as urinary excretion of >0.3 g protein in 24 hour). Patients who developed preeclampsia in follow up period were managed as per institutional protocol.

SGA babies were diagnosed as per definition - if baby birth weight <10th percentile for that gestational age.[6]

RESULTS

A total of 270 patients were analysed, out of them 39 (14.4%) had lateral placenta and 231 (85.5%) had central placenta with a mean age 24.36 years and 24.81 years respectively. Among lateral and central placenta groups, the mean BMI was 22.38 kg/m^2 and 22.35 kg/m^2 respectively. Hence age and BMI of both the groups were matched (Figure 3).

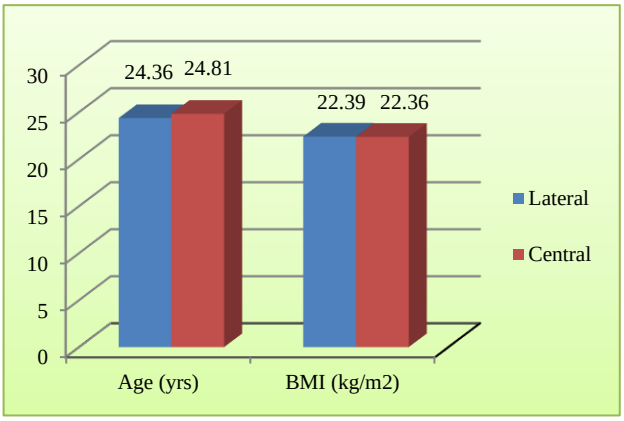

Figure 3: Mean age and BMI in both the groups.

Among lateral placenta (n=39), 17 (43.5%) developed preeclampsia with 9 (23%) had non-severe and 8 (20.5%)

have severe preeclampsia. Among central placenta (n=231), 49 (21.2%) developed preeclampsia with 43 (18.6%) have non-severe and 6 (0.025%) had severe preeclampsia (p<0.001) with 2.87 odds ratio (95% confidence interval = 1.415 - 5.821) (Table 1). The odds of developing preeclampsia in patients with lateral placenta was 2.87 times as compared to patients with central placenta.

Table 1: Relationship between placental location and preeclampsia.

Placental location	No.	With preeclampsia	Without preeclampsia	Non-severe preeclampsia	Severe preeclampsia
Lateral	39	17	221	9	8
Central	231	49	182	43	6
Total	270	66	204	52	14

x^2=23.210, p<0.001

Birth weight of babies were compared, in laterally situated placental group 61.5% (24/39) patients developed small for gestation age (SGA) with mean birth weight was 2.3 kg (Table 2). In central placenta group (n=231), mean baby birth weight was 2.71 kg, 63 (27.2%) patients have SGA babies (p<0.001) with the odds ratio 4.26 (95% confidence interval = 2.10 - 8.65) (Table 2). SGA babies developed 4.26-fold among laterally situated placenta.

Table 2: Relationship between placental location and birth weight.

Placental location (n)	Birth weight		
	Small for gestational age	Average for gestational age	Mean±SD
Lateral (39)	24	15	2.3±0.6830
Central (231)	63	168	2.71±0.4995
Total (270)	93	177	

x^2 =17.94, p<0.001

There was no significant difference in the mode of delivery in both the groups of placenta (p=0.675) (Table 3).

Table 3: Location of placenta and mode of delivery.

Placental location (n)	Mode of delivery	
	Caesarean section	Normal vaginal
Lateral (39)	3 (7.6%)	36 (92.3%)
Central (231)	23 (10%)	208 (90%)
Total (270)	26	244

The sex of babies was approximately equal in both groups; in lateral placental group 19 females and 20 males out of 39 and in central placental group 115 females and 116 males out of 231.

DISCUSSION

Preeclampsia still remains the major cause of maternal and perinatal mortality and morbidity. There is continuous search for an ideal predictive test and preventive measure. It has been shown that in humans, both uterine arteries have a significant number of branches and each supply the corresponding side of the uterus. Although anastomosis between the two uterine arteries exists, there is no evidence 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.[1] 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. Lateral placentation may thus predispose to uteroplacental insufficiency and IUGR in some women. Indeed, data from several computer simulation models of the uteroplacental circulation and studies examining the association between placental location and uterine artery Doppler velocimetry support the hypothesis that the site of placental attachment in the uterus may be an important determinant of placental blood flow.[4] This explanation is consistent with the fact that preeclampsia and IUGR which share the common pathologic mechanism of shallow endovascular trophoblast invasion leading to uteroplacental insufficiency, has been associated with lateral placentation.[4]

Present result is in accordance with Kakkar et al prospective study, in which total 150 patients were taken out of which 84 had lateral placenta and 66 had central placenta.[1] In lateral placenta 66.6% developed pregnancy induced hypertension and the odd ratio was 5.09. Lucy et al studied retrospectively the relationship between intrauterine growth restriction (IUGR) and laterality of placenta, with four-fold increased risk (odd ratio 3.8) of IUGR in lateral placenta.[4] Lateral placentas were significantly more common in the IUGR group than in the non-IUGR group (17.9% [12/67] versus 5.9% [12/205], respectively; P=.047). Seckin et al prospective

study also showed the relationship between lateral placenta and development of preeclampsia (4.5% versus 1.6% in lateral and central placenta respectively) and fetal growth restriction.[7] Gonser et al study (n=148) also showed odd ratio 3.1 in lateral (n=115) versus central (n=33) group for development of preeclampsia.[8] Fung et al also studied prospectively the location of placenta and pregnancy outcome and found the odds ratio of 2.04 for preeclampsia and 1.82 for small for gestational age (SGA) in lateral group.[9] Present results were similar to above studies with odd radio of 2.87 for preeclampsia and 8.89 for SGA in lateral placentas.

Table 4: Review of literature.

Author	Study group (n)	Type of study	Results (PIH)	Results (SGA)
Gonser et al	148 (lateral = 115, central = 33)	Prospective	3.1 (odds ratio)	
Fung et al	16236	Retrospective	2.04 (odds ratio)	1.82 (odds ratio)
Devarajan et al	796	Retrospective	0.62 (odds ratio)	0.81 (odds ratio)
Kakkar et al	150 (lateral = 84, central = 66)	Prospective	5.09 (odds ratio)	
Seckin et al	1052 (lateral = 133, central = 919)	Retrospective	4.5% versus 1.6%	
Present study	270 (lateral = 39, central= 231)	Prospective	2.87	4.26

But the results of Devarajan et al showed that relative to central/fundal location, laterally located placentas had an adjusted OR of 0.81 for SGA and 0.62 for preeclampsia/gestational hypertension and hence no relation between lateral placenta and adverse pregnancy outcomes.[10] Their results were contradictory to current study. We reviewed the literature (Table 4) and found similarity with the present results.

CONCLUSION

Any hypothesis is always proved by the fact either right or wrong; similarly, by the current study we arrived on conclusion that there is a strong association of placental location with obstetric outcome. Laterality of placenta is a good predictor of preeclampsia and small for gestational age babies. We don't need expensive and invasive testing for diagnosis of placental localization as it is routinely done for obstetrics ultrasonography, so it is feasible and easily available tool for prediction of preeclampsia and SGA.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Singh A, Vats G, Sharma T, Shriya R. Are preeclampsia and small for gestational age baby could be predicted by placental location? Int J Reprod Contracept Obstet Gynecol 2017;6:5568-71.