

## Placental Laterality as a Predictor for Development of Preeclampsia

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### Abstract

**Objective** To find whether placental laterality as determined by ultrasound can be used as predictor for the development of preeclampsia.

**Methods** This prospective study was conducted in the Department of Obstetrics and Gynecology, Govt. Medical College, Jammu from 2006 to 2007. 150 pregnant women attending antenatal clinic both OPD and IPD at 18–24 weeks of gestation without any high risk factor were subjected to ultrasound examination, and placental location was determined. These cases were followed for the development of signs and symptoms of preeclampsia.

**Result** Out of the total 150 women, 84 (56 %) had laterally located placenta and of them, 56 (66.6 %) developed preeclampsia, while the remaining 66 (44 %) had centrally located placenta and of them, 24 (36.3 %) developed preeclampsia. So, the overall risk of developing preeclampsia with laterally located placenta was 5.09 (odds ratio) and 95 % confidence interval (2.40–10.88). The difference was

found to be statistically significant,  $p$  value (0.00002) by  $\chi^2$  test.

**Conclusion** From the above study, we concluded that females with laterally located placenta determined by USG at 18–24 weeks of gestation have five times greater risk of developing preeclampsia.

**Keywords** Placental laterality · Preeclampsia · Central placenta

### Introduction

Preeclampsia occurs only in the presence of placenta [1]. Several tests have been proposed to identify women at risk of developing preeclampsia. Some of these tests such as the cold pressor test, the isometric hand grip exercise, and the roll over test depend on the presence of some pathophysiological changes that 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.

Among the various predictors for preeclampsia, the placental location by ultrasound at 18–24 weeks is very cost effective, noninvasive, and has a good positive predictive value [2]. There is a significant association between placental location and uterine artery resistance and adverse outcomes such as preeclampsia and IUGR. In the women with centrally located placenta, both uterine arteries demonstrate similar resistance. When the placenta is laterally

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located, the uterine artery close to the placenta has lower resistance than the one opposite from it. In laterally located 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, 4]. The degree of collateral contribution may not be the same in all women, and deficient contribution facilitates the development of preeclampsia, IUGR, or both.

## Materials and Methods

The present study is a prospective study. This study was carried out in the Department of Obstetrics and Gynecology, SMGS hospital, Govt. Medical College, Jammu from 2006 to 2007.

### Inclusion Criteria

All pregnant women attending the antenatal clinic, both outpatient and ward admissions, at 18–24 weeks of gestation without any high risk factors were included in this study.

### Exclusion Criteria

Pregnant women were excluded from the study if they were having chronic hypertension or essential hypertension, diabetes mellitus, thyrotoxicosis, renal disease, severe anemia, connective tissue disorder, positive lupus anticoagulant anticardiolipin antibodies, RH incompatibility, twin pregnancy, or positive VDRL test.

All the cases were subjected to detailed 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 followed subsequently for the development of preeclampsia. The placenta was classified as central when it was equally distributed between the right and left side of uterus irrespective of anterior, posterior, or fundal position. When 75 % or more of the placental mass was to one side of the midline, it was classified as unilateral right or left placenta. All women were followed throughout the pregnancy for the development of the signs and symptoms of preeclampsia. Preeclampsia was diagnosed on the basis of the American Congress of Obstetricians and Gynecologists criteria for preeclampsia and is defined as new-onset hypertension (BP is  $\geq 140$  mmHg systolic and/or  $\geq 90$  mmHg diastolic) occurring in a pregnant woman after 20 weeks gestation, with proteinuria (defined as urinary excretion of  $\geq 0.3$  g protein in 24 h). The patients were treated according to the severity of the disease. Mild cases were advised bed rest

and prescribed sedatives and told to come for regular follow-ups, while moderate to severe cases were given anti-hypertensive (labetalol) in addition to the above treatment. Those who showed no response were hospitalized and managed accordingly. In severe cases with persistent hypertension, pregnancy was terminated.

## Results

Out of the total 150 women, 53.3 % (80) were in the age group 21–25 years (Table 1) and 50 % (75) were in the weight group 66–70 kg (Table 2). Eighty-four (56 %) cases had laterally located placenta, while 66 (44 %) cases had centrally located placenta on ultrasound examination done at 18–24 weeks of gestation (Table 3). Out of the 84 women with laterally located placenta, 56 (66.6 %) developed PIH, while 24 women (36.3 %) out of the remaining 66 women with centrally located placenta developed PIH. So, the risk of developing PIH was five times greater in the females with laterally located placenta as compared to those with centrally located placenta. The overall risk of developing PIH with laterally located

**Table 1** Distribution of cases according to the age

Age in years	<i>n</i>	%
$\leq 20$	15	10
21–25	80	53.3
26–30	48	32
31–35	7	4.7

**Table 2** Distribution of cases according to weight

Weight in kg	<i>n</i>	%
$\leq 55$	1	0.6
56–60	20	13.3
61–65	47	31.3
66–70	75	50
71–75	7	4.7

**Table 3** Relationship between placental location and PIH

Placental location	Outcome		Odds ratio	95 % CI
	PIH	No PIH		
Lateral, <i>n</i> = 84	56 (66.6 %)	28 (33.3 %)	5.09	(2.40–10.88)
Central, <i>n</i> = 66	24 (36.3 %)	42 (63.6 %)		

$$\chi^2 = 22.25, p = 0.00002$$

**Table 4** Distribution of cases according to the severity of hypertension

Severity of hypertension based on DBP in (mm of Hg)	Number of cases, <i>n</i> = 80
Mild (90–99)	39
Moderate (100–109)	28
Severe (>110)	13

**Table 5** Distribution of severity of PIH between different placental groups

Severity of Hypertension based on DBP	Centrally located placenta	Laterally located placenta
Mild, <i>n</i> = 39	16	23
Moderate, <i>n</i> = 28	8	20
Severe, <i>n</i> = 13	None	13

placenta was 5.09 (odds ratio) and 95 % confidence interval (CI) 2.40–10.88. The difference was found to be highly significant statistically ( $p = 0.00002$  by  $\chi^2$  test). Out of the total 150 cases, 39 developed mild PIH (D.B.P 90–99 mmHg). Out of these 39 cases, 16 had centrally located placenta and 23 had laterally located placenta (Tables 4, 5).

Twenty-eight women developed moderate PIH (D.B.P 100–109 mmHg). Out of these 28 cases, 8 had centrally located placenta, while 20 women had laterally located placenta (Tables 4, 5). Thirteen women developed severe PIH (D.B.P > 110 mmHg) and all these had laterally located placenta. No case of eclampsia was reported (Tables 4, 5).

## Discussion

Preeclampsia is a complex clinical syndrome involving multiple organ systems and still remains the principal cause of maternal and perinatal mortality and morbidity. The search for an ideal predictive test and preventive measure remains challenging.

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 [3–5] 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.

In the present study, out of 150 women, 84 (56 %) females had laterally located placenta and 66 (44 %) had centrally located placenta. Out of the 84 women with laterally located placenta, 56 (66.6 %) developed PIH as compared to 66 females with centrally located placenta where 24 (36.6 %) developed PIH. So, the risk of developing PIH was five times greater for the females with laterally located placenta as compared to those with centrally located placenta. The overall risk of developing PIH with laterally located placenta was 5.09 (odds ratio) and 95 % CI 2.40–10.88. The difference was found to be highly significant statistically ( $p = 0.00002$ ).

This result is in accordance with Kofinas et al. [6] who concluded that in women with unilateral placenta, the incidence of preeclampsia was 2.8-fold greater than those with centrally located placenta.

The results of the present study were also comparable to those of Muralidhar et al. [7]. In his study, a total of 426 unselected singleton pregnant women were included. Out of 426 women, 324 had centrally located placenta and 102 had unilateral placenta. A total of 71 women developed preeclampsia of which 52 (74 %) had unilaterally located placenta. The relationship was found to be statistically significant  $p < 0.0001$ .

The results of the present study were also comparable to the study done by Lucy et al. [8], the results of which showed that development of PIH and IUGR pregnancies were nearly fourfold more in lateral placentation.

## Conclusions

From the above study, it is concluded that laterally located placenta on ultrasound done at 18–24 weeks is associated with increased risk of development of preeclampsia. Females with laterally located placenta have a five times greater risk of developing PIH, so these pregnancies may require careful obstetric management to achieve a more favorable outcome and decrease the maternal and perinatal morbidity and mortality associated with preeclampsia.

**References**

1. Walker JJ. Current thoughts on the pathophysiology of preeclampsia/eclampsia. In: Studd J, editor. *Progress in obstetrics and gynecology*. Edinburgh: Livingstone-Churchill; 1998. p. 177–88.
2. Cunningham FG, Leveno KJ, Bloom SL, et al. *Williams obstetrics*. 22nd ed. New York: McGraw-Hill; 2005. p. 761–808.
3. Fleischer A, Schulman H, Farmakides G, et al. Uterine artery Doppler velocimetry in pregnant women with hypertension. *Am J Obstet Gynecol*. 1986;154:806–13.
4. Schulman H, Winter D, Farmakides G, et al. Pregnancy surveillance with Doppler velocimetry of uterine and umbilical arteries. *Am J Obstet Gynecol*. 1989;160:192–6.
5. Campbell S, Bewbey S, Cohen-overbeek T. Investigation of the uteroplacental circulation by Doppler ultrasound. *Semin Perinatol*. 1987;11:362.
6. Kofinas AD, Penry M, Swain M, et al. Effect of placental laterality on uterine artery resistance and development of preeclampsia and intrauterine growth retardation. *Am J Obstet Gynecol*. 1989;161:153–69.
7. Pai Muralidhar V, Pillia J. Placental laterality by ultrasound—a simple yet reliable predictive test for preeclampsia. *J Obstet Gynecol India*. 2005;55:431–3.
8. Kalanithi LE, Illuzzi JL, Nossov VB, et al. Intrauterine growth restriction and placental location. *J Ultrasound Med* 2007; 26: 1481–9.