

# Cross-Sectional Study of Placental Surface Area and Umbilical Cord Attachment on Placenta in Normal and PIH Pregnancy and Its Effects on Foetal Weight

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## ABSTRACT

**Introduction:** Pregnancy-induced hypertension (PIH) is one of the risk factor in pregnancy leading to placental insufficiency which in turn is responsible for maternal and foetal morbidity and mortality. PIH causes morphological changes in placenta. Decreased placental surface area and variation in the attachment of umbilical cord on placenta are more commonly noted in PIH which hampers the uteroplacental perfusion resulting in foetal mortality and morbidity. Hence efforts were made to study the incidence of reduced placental surface area and mode of cord attachment on placenta.

**Materials and methods:** The study was conducted in the Department of Anatomy, Sri Siddhartha medical college and Hospital, Tumakuru, Karnataka. A total of 100 (50 normal and 50 PIH) human placentae were studied. Placental surface area and mode of attachment of umbilical cord in normal and PIH pregnancy were measured and noted. This study was analysed statistically by using Unpaired t-test and Chi-square test.

**Results:** The study revealed significantly decrease in placental surface area and also there is increased incidence of central and marginal attachment of umbilical cord in PIH cases.

**Conclusion:** Study reveals, PIH cause morphological changes in placenta, it decreasing the uteroplacental blood flow which reduces foetal nutrition ultimately decreasing the neonatal weight.

**KEY WORDS:** PIH, uteroplacental blood flow, neonatal weight, placental surface area and Umbilical cord.

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## INTRODUCTION

PIH is one of the common cause of maternal mortality and morbidity. PIH result in placental insufficiency which affect the growth and development of foetus resulting in low birth weight. Placental changes are directly related to severity of PIH. Morphologically, placentae in this condition are lighter in weight, lesser in diameter and thickness with

reduced placental surface area. Placentae are morphologically more affected in PIH than essential hypertension [1]. Normally, umbilical cord is eccentric in position, but in PIH it is found cord attachment is mostly central and marginal [2]. Increased infarcts and abnormal position of cord compromises foetoplacental perfusion affecting neonatal weight [3].

**MATERIALS AND METHODS**

The present work was conducted in Department of Anatomy, Sri Siddhartha medical college and Hospital, Tumakuru, Karnataka. Total 100 intact placentae (50 normal and 50 PIH) were collected immediately after delivery from obstetrics and gynaecology department, washed under running water. Intact placentae with attached umbilical cord, placentae from full term, singleton delivery (normal/caesarean/induced) were included. Placentae from premature delivery, multiple pregnancies, torn placentae and mothers with diabetes, heart ailments severe anaemia were excluded. Placental surface area was measured through digital vernier calliper and noted [4] and site of cord attachment was observed and recorded properly [5]. This study was then statistically analysed by using Unpaired t test and Chi square test respectively.

**RESULTS**

The study shows mean placental surface areas are 248.6±44.4 cm<sup>2</sup> in PIH group and 278±46.8 cm<sup>2</sup> in control group. Mean placental surface area is less in PIH than in normal pregnancy with statistically high significant difference (p<0.01) [Table 1][Fig 1].

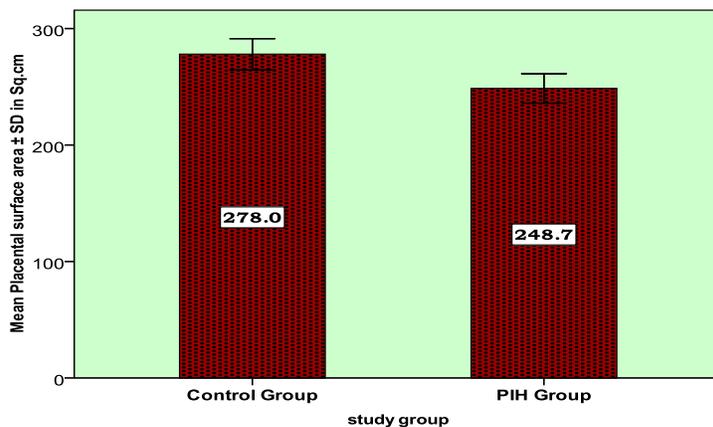
The study shows 32% of placentae of PIH group showed central insertion of umbilical cord while 22% showed central insertion in control group. 22% of the placentae in PIH group showed marginal insertion while only 4% showed marginal insertion in control group. Most common site of insertion in control group is eccentric. Central, marginal and velamentous cord attachment on placenta is more in PIH than in normal pregnancy with statistically high significant difference(p<0.01) [Table 2][Fig 2].

**Table 1:** Comparison of mean placental surface area between two groups.

	Control group (n=50)	PIH group (n=50)	P value*	Statistical significance
Placental surface area Mean± S.D° cm <sup>2</sup>	278±46.8	248.6±44.4	P<0.01	Highly significant

S.D ° - Standard deviation. \* - Unpaired t test

Above table shows, mean placental surface areas are 248.6±44.4 cm<sup>2</sup> in PIH group and 278±46.8 cm<sup>2</sup> in control group.

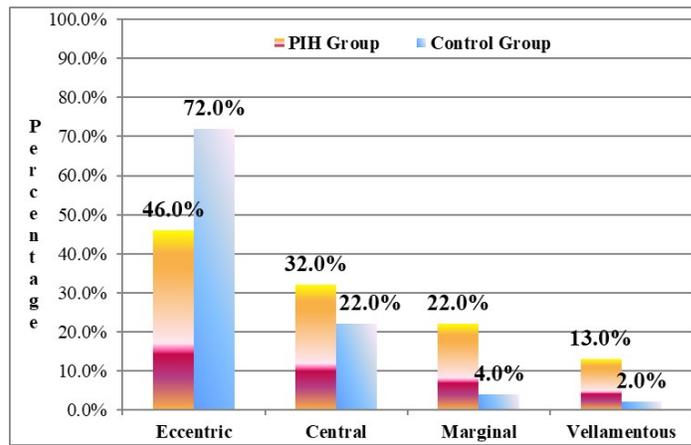


**Fig. 1:** Comparison of mean placental surface area

**Table 2:** Comparison of mode of umbilical cord insertion on placenta between two groups.

	Sample groups		Total	
	Control group	PIH group		
Mode of cord insertion	Eccentric	36 (72%)	23 (46%)	59 (59%)
	Central	11 (22%)	16 (32%)	27 (27%)
	Marginal	2 (4%)	11 (22%)	13 (13%)
	Vellamentous	1 (2%)	0 (0.0%)	1 (1%)
<b>Total</b>	50 (100%)	50 (100%)	100 (100%)	

Chi-square test = 11.02, degree of freedom (df) = 1, P < 0.01, Statistical significance - Highly significant.



**Fig. 2:** Mode of insertion of umbilical cord on placenta

## DISCUSSION

Human placenta plays a central role in regulating foetal growth. The ability of foetus to grow and mature in womb shall be presumed to be related to the ability of placenta to provide nutrition to the foetus [6]. Udaina A et al (2004) [7] studied the relation between placental surface area, infarction and foetal distress in pregnancy induced hypertension with its clinical relevance. 75 cases of PIH and 25 cases of normotensive pregnancy were taken. They found mean surface area was significantly less in severe hypertension (179.14 cm<sup>2</sup>) and in mild hypertension (195.98%) as compared to normal group (242.56%). Thus severity of hypertension adversely affects both foetal and placental outcome. Kajantie E et al (2010) [1] hypothesized that PE would be associated with a small placental surface area. They studied placental size in 6410 deliveries at the Helsinki University Central Hospital. 284 of the pregnancies were complicated with PE. The area of the placental surface was estimated from two diameters, maximum diameters and lesser one at right angle to it. Compared to normotensive pregnancies, the placentae from pregnancies complicated by PE had reduced surface area and surface was more oval. Rath G et al (2000) [2] recorded mean placental surface area in control group as 254.6 cm<sup>2</sup>, 251.7cm<sup>2</sup> in mild PIH, 209.3cm<sup>2</sup> in severe PIH, Udaina et al (2004) [7] found it to be 242 cm<sup>2</sup> in control group, 195.9cm<sup>2</sup> in mild PIH and 179.1cm<sup>2</sup> in severe PIH, Majumdar S et al (2005) [8] recorded it as 265.1±65.2cm<sup>2</sup> in control group and 202.5±58.3 cm<sup>2</sup> in hypertensive group.

In the present study [table 1][Fig1], the mean placental surface area in control group is 278±46.8 cm<sup>2</sup> and in PIH group is 248±44.4 cm<sup>2</sup>, indicating mean placental area is decreased in PIH than control group. This finding is in accordance with the findings of above authors.

Rath G et al (2000) [2] studied 218 placentae which were grouped depending on degree of HTN. Amnion and chorion trimmed. Umbilical cord cut 4cm from site of insertion. Minimum distance between site of insertion and margin were measured (d), surface area measured, and radius taken as (r). Insertion percentage was calculated (d/r X 100). They reported that site of insertion of umbilical cord in HTN was central (75-100%), medial (51-75%) and marginal (0-25%). Narasimha A et al (2011) [9] undertook the study to analyse placental changes in the preeclampsia-eclampsia. They found Central umbilical cord insertion (57%), eccentric (37%) and battledore insertion (6%).

Perceival (1980) had reported that in 73% of cases, the site of insertion of cord is eccentric in position. According to the study of Rath G et al (2000) [2], marginal insertion of cord was seen in 27% of normal pregnancy and 26% of mild PIH, 26% of moderate PIH and 42% of severe PIH. Majumdar S et al (2005) [8] also found marginal insertion of cord is more common in hypertensive pregnancies.

In the present study [table 2][Fig2], the incidence of marginal insertion is seen in 12% of cases in PIH group and only in 4% of cases in control group, while incidence of central insertion is 32% in PIH and 22% in control group. Eccentric insertion is less common in PIH than control group. This shows difference

in the incidence of marginal insertion between PIH and control group is more than that of central insertion between two groups, indicating marginal insertion is more common. This finding is in accordance with the findings of above authors.

Nahar L et al (2015) [10] reported mean surface area in PIH group & control group were 232.29cm<sup>2</sup> and 304.80cm<sup>2</sup> respectively (p<0.001).

Ankit Jain (2017) [11] found that the mean fetal birth weight decreases, as the attachment of umbilical cord in the placenta shifts from central to the periphery. This finding is consistent with those reported by earlier observers. The vessels density is lower in placentae with abnormal cord insertion as compared to those with normal cord insertion, and the fetal stem vessels may be longer in the abnormal cord insertion, which would increase vascular resistance. Therefore, abnormal cord insertion hampers the nutrient transfer to the fetus and may induce fetal growth restriction.

## CONCLUSION

From the above study, it can be concluded that PIH adversely affect placental morphology. It is found that placental surface area is grossly decreased in PIH group. There is increased incidence of marginal attachment of umbilical cord on placenta in PIH group. This abnormal site of cord insertion and decrease surface area causes vascular metabolic inactivity leading to decreased perfusion which in turn hampers the nutrition and growth of the foetus leading to low birth weight in PIH Group.

## Author Contributions & ORCID

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**Conflicts of Interests: None**

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