

# Comparative Study of Placental Morphometry and Histomorphology in Normal and Pre-eclamptic Pregnancies

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## Abstract

**Background:** Placental examination forms an integral part of prenatal or fetal autopsy and helps in adding important or conclusive information. A glance at the literature reveals that the preeclampsia-eclampsia syndrome exerts its deleterious effects on the placenta.

**Aims and Objectives:** To record and compare the morphometry, histomorphology of normal and pre-eclamptic placentae.

**Materials and Methods:** A total of 200 placentae were examined - 100 pre-eclamptic placentae and 100 normal placentae. The morphometric measurements were taken and histologic features noted.

**Observation and Results:** The pre-eclamptic placentae showed decrease in the morphometry and an increase in histomorphological features such as syncytial knot formation, villous stromal fibrosis, and trophoblastic basement membrane thickening when compared to normal placentae.

**Conclusion:** We conclude that preeclampsia adversely influences the placental morphometry and histomorphology.

**Key words:** Placenta, Placental histomorphology, Placental morphometry, Pre-eclampsia, Syncytial knot.

## INTRODUCTION

Placental pathology has undoubtedly received very little attention by both the obstetricians and pathologist. The various indications for placental examination are essentially any maternal disease or disorders of the infant or any other clinically accepted placental abnormality.<sup>1</sup> Placental examination forms an integral part of prenatal or fetal autopsy and helps in adding important or conclusive information.<sup>2</sup> Toxemia of pregnancy is one of the known leading causes of maternal mortality and stands to be an important factor in terms of fetal wastage as well.<sup>3</sup>

The placenta stays to be the best record of the prenatal experience of every infant. A glance at the literature reveals that the pre-eclampsia-eclampsia syndrome does exert its deleterious effects on the placenta.<sup>3</sup> Grossly, the pre-eclamptic placentae are lesser in weight, diameter, and thickness, with an increase in the incidence of abnormal shape and cord insertion, and diminished fetoplacental ratio. Furthermore, there seems to be a higher incidence of infarction and retroplacental hematoma, in pre-eclamptic placentae. The numerous placental changes bear a direct relation to severity and duration of the disease process. The fetal outcome is adversely influenced by the pathological changes in the placenta. Thus, there is a need for a thorough examination of placenta which may help in revealing the various abnormalities that contribute to the disorder of pregnancy, toxemia, in this study. This study is an attempt to observe and to compare the morphometric and the histomorphological features, in pre-eclamptic and normal placentae.

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### Aims and Objectives

1. To record the data on morphometry, histomorphology of normal and pre-eclamptic placentae, respectively
2. To compare and analyze the placental morphometry and placental histomorphology in normal and hypertensive pregnancies.

### MATERIALS AND METHODS

This prospective study was conducted from April 2015 to September 2015 at Institute of Obstetrics and Gynaecology, Madras Medical College, Chennai. A total of 200 placentae were examined. The study group comprised 100 pre-eclamptic placentae from singleton pregnancies and the control group comprised 100 placentae from normotensive singleton pregnancies. All placentas were collected immediately after delivery and washed in tap water which removed the blood clots. The placenta was examined in fresh state, disc weight obtained after removal of the membranes, cord, and extraneous clot. Measurements of the disc were taken and using standard mathematical formulae, the values for placental surface area and placental volume were derived.

Placental surface area (cm<sup>2</sup>) = ( $\pi \times \text{largest diameter} \times \text{shortest diameter}$ )/4.

Placental volume (cm<sup>3</sup>) = surface area  $\times$  thickness at center.

The placenta along with cord and membranes fixed in 10% formalin, sections were taken and subjected to routine histopathological examination with hematoxylin and eosin staining. All statistical analyses were done with IBM SPSS software version 20.

### RESULTS

The comparison of placental morphometry is shown in Table 1. The mean placental weight is reduced in pre-eclampsia. This is statistically significant. The mean placental surface area is reduced in the pre-eclamptic group and is statistically significant. The mean placental volume is again decreased in the pre-eclamptic group when compared with the control group. This is also statistically very significant.

Table 2 shows the comparison of placental histomorphology. In the pre-eclamptic group, there is an increase in the mean number of areas/low power field of syncytial knot formation (Figure 1), cytotrophoblastic cellular proliferation, villous fibrinoid degeneration (Figure 1), and villous stromal fibrosis (Figure 2). This difference is statistically significant.

The comparison of trophoblastic basement thickening is shown in Table 3. The incidence of irregular thickening of trophoblastic basement membrane (TBM) (Figure 3) is increased in the study group. This is statistically significant.

### DISCUSSION

Pre-eclampsia is one of the leading causes of maternal as well as perinatal mortality and morbidity. The etiopathogenesis of pre-eclampsia still remains a subject of controversy. The classical view in this regard focuses on the placenta and uteroplacental circulation. Pregnancy-induced hypertension (PIH) clinically presents with hypertension,

**Table 1: Comparison of placental morphometry**

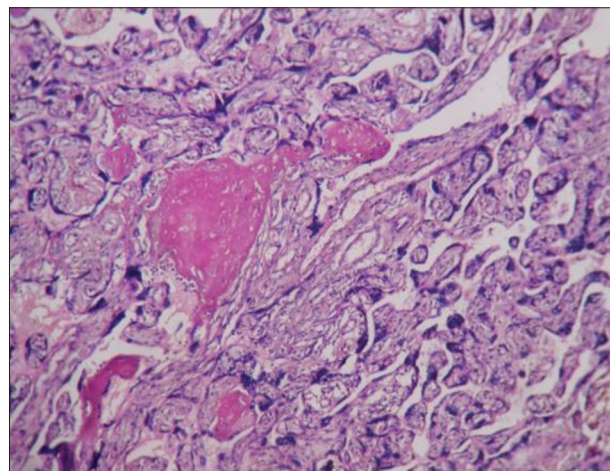
Placental morphometry	Mean $\pm$ SD		P value
	Case	Control	
Placental weight (g)	421.8 $\pm$ 120.09	461.75 $\pm$ 99.08	0.011
Placental surface area (cm <sup>2</sup> )	172.77 $\pm$ 60.82	195.25 $\pm$ 58.82	0.009
Placental volume (cm <sup>3</sup> )	270.8 $\pm$ 132	385.01 $\pm$ 142.66	0.001

SD: Standard deviation

**Table 2: Comparison of placental histomorphology**

Placental histomorphology	Group		P value
	Mean±SD		
	Case	Control	
Mean no of areas of syncytial knot formation/lpf	23.15±4.84	9.75±3.18	<0.001
Mean no of areas of cytotrophoblastic cellular proliferation/lpf	17.72±2.63	5.78±1.31	<0.001
Mean no of areas of villous fibrinoid degeneration/lpf	7.05±2.87	3.04±1.24	<0.001
Mean no of areas of villous stromal fibrosis/lpf	9.22±2.19	2.47±1.01	<0.001

SD: Standard deviation



**Figure 1: Syncytial knot formation and fibrinoid degeneration**

proteinuria, and edema. Typically once the uterus is emptied of the fetus and the placenta, the disease process ceases. In fact immediate postpartum curettage of the placental bed brings down the maternal blood pressure at a faster pace than in places where curettage is not done. The fact that PIH occurs even in the absence of the fetus, for e.g., in hydatidiform moles, shows clearly that PIH is ultimately dependent on the presence of placental tissue. It is difficult to define the normal placental findings and differentiate it from the abnormal, because of the structural complexity and rapid evolution of the placenta.

### Placental Morphometry

Normally, a placenta weighs from 400 to 800 g. In this study, we observed the reduction of placental weight in the pre-eclamptic group. Similar findings were reported by

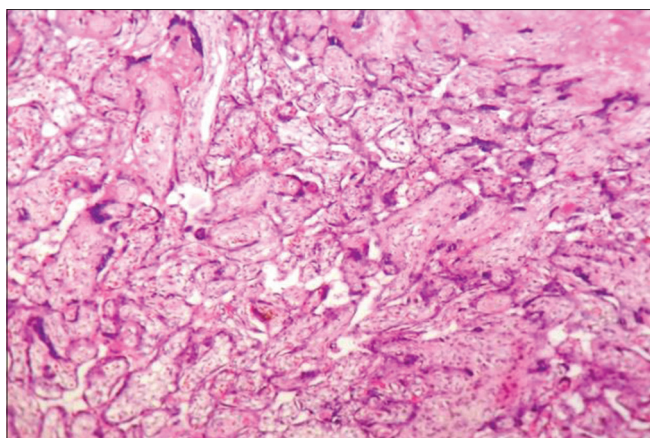


Figure 2: Villous stromal fibrosis

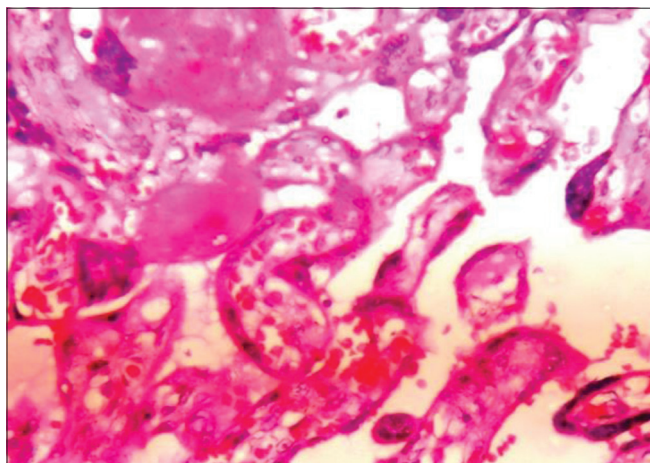


Figure 3: Trophoblastic basement membrane thickening

Table 3: Comparison of TBM thickening

TBM thickening (%)	Case (%)	Control (%)	P value
<3	38.10	61.90	<0.001
>3	70.30	29.70	

TBM: Trophoblastic basement membrane

Das *et al.* (1996), Dutta and Dutta (1989), and Nobis and Das (1991), Londhe and Mane (2011).<sup>4,7</sup> The mean placental volume is decreased in the pre-eclamptic placentae. The mean placental surface area is significantly decreased in pre-eclamptic placentae. This is in concordance with the study of Londhe and Mane and Majumdar and Dasgupta *et al.*<sup>4,8</sup>

### Placental Histomorphology

The histology of placenta from pre-eclamptic pregnancies shows a significant increase in villous cytotrophoblastic proliferation, villous syncytial knot formation, irregular thickening of TBM, patchy villous fibrinoid degeneration, and villous stromal fibrosis, in the study group when compared to the control group. This is very much in accordance with previous studies conducted by Jones and Fox (1980). Genest (1992) reported that stromal fibrosis and excessive syncytial knot formation are seen in generalized form occurring due to overall reduction of fetal perfusion of placenta.<sup>9,10</sup>

Teasdale (1980) and Udainia *et al.* (2004) quoted that localized villous fibrinoid degeneration could be the aftermath of hypertension.<sup>11,12</sup> Tenny and Parker (1940) quoted that the influence of maternal factors is best shown in pre-eclampsia where the decreased intervillous blood flow finally leads to increased syncytial knotting, so-called the Tenny-Parker changes. He emphasized that the increased bridging of placental syncytium producing knots is very much characteristic of pre-eclampsia. Syncytial knots are also seen normally in term and preterm placentae, but their number is much increased in toxemia.<sup>13</sup>

### CONCLUSION

From this study, it can be concluded that although placenta readily adapts to hypoxia due to uteroplacental insufficiency, the compensatory changes are insufficient and result in a primary failure to develop and form an adequate placental mass, thereby adversely influencing the placental morphometry and histomorphology. Although there are various combinations of histologic and gross changes which are characteristic of placenta in pre-eclampsia, the abnormalities are specific to pre-eclamptic placentae.

There are numerous cases where the pre-eclamptic placenta is virtually normal, mainly if the disease was mild and of a shorter duration. In severe pre-eclampsia, the lesions are, however, more prominent and accentuated, and at the same time, the duration of the disease is of importance.

This study greatly emphasizes the importance of placental morphometry and its variation in pre-eclampsia. Currently, with the help of three dimensional ultrasonography and



virtual organ computer-aided analysis, the placental volume can be ascertained in utero and a correlation with the fetal growth can be obtained.

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