

A study on the Morphology and the Morphometry of the Human Placenta and its Clinical Relevance in a population in Tamilnadu

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ABSTRACT

Context (Background): The placenta is a dynamic organ which is unique in its development and functions. It is the only organ in the body which is derived from two separate individuals, the mother and the foetus. The placenta is responsible for the respiratory, nutritional, excretory, endocrinal and the immunological functions of the foetus. The anomalies of the placenta are usually associated with placental insufficiency, which could lead to complications in the foetus. Hence, a thorough examination of the placenta in-utero, as well as post-partum, gives valuable information about the state of the foetal well being.

Aims: To study the morphology and the morphometric analysis of the placenta and to clinically correlate it with the foetal parameters, in order to help in the assessment of the state of the well being of the foetus.

Methods and Material: A total of 101 placentae were freshly collected (76 from uncomplicated deliveries and 25 from various factors which complicated the pregnancy). The placental parameters and their respective maternal and foetal details were collected, analysed and clinically correlated.

Results: Out of 101 placentae which were collected (91 full term babies and 10 preterm babies), 94 were circular in shape and 7 were oval in shape. In this study, the average diameter of the placenta was 17.4cm, the average thickness 2.1cm and the average weight of the placenta was 528.55gm. This study showed a placental coefficient of 0.19. The parameters of the placentae which were collected from babies whose mothers had factors

which complicated their pregnancy, correlated well with their foetal parameters. A subchorionic placental cyst with clear serous fluid was observed in one case. The amniotic membrane was translucent in 93% of the cases. The placental cotyledons on an average were 18 in number. This study revealed the presence of placental calcification in 20% of the cases, retro-placental clots in three cases and the presence of placenta succenturiata in three cases.

Conclusion: An adequate knowledge of the morphometry of the placenta and its clinical relevance can prove to be valuable in the early assessment of the foetal well being, especially in a community like ours, where antenatal mothers still come unbooked to the labour room, with no prior investigations done.

KEY MESSAGES

1. "Placenta" or the "After birth" begins to meet the demands of the embryo, as early as from the third week of the intrauterine life, even before the mother is aware of her pregnancy.
2. The placenta is the accurate record of the infant's prenatal experiences.
3. The anomalies of placenta which are detected by ultrasound may indicate the presence of complications in the foetus.
4. The foeto-placental ratio and the placental coefficient can help to assess the severity of the toxemia of pregnancy.
5. In unbooked cases, a thorough examination of the placenta postpartum indicates the state of the foetal well-being.

Key Words: Placenta, Morphometry, Foeto-Placental Ratio, Placental Coefficient, Placental Infarction, Cotyledon, Amniotic Band, Placental Cyst, Placenta Succenturiata

INTRODUCTION

The placenta is a unique characteristic of higher mammals which is attached to the uterus and is connected to the foetus through the umbilical cord. Researchers have, for a long time, emphasized the benefits which are associated with the anatomical examination of the placenta, an organ that is often disposed soon after parturition, without adequate examination. The examination of the placenta in utero as well as postpartum, gives valuable information about the state of the foetal well being [1]. Hence, this study was done to correlate the morphological parameters of the placenta with the foetal parameters in a population in Tamilnadu.

MATERIALS AND METHODS

A total number of 101 freshly delivered placentae were collected from the government hospital for women and children in Egmore, Chennai. The placentae were collected soon after their expulsion, both from normal deliveries and caesarean sections. The collected placentae were washed under running tap water and the mem-

branes were thoroughly examined and trimmed. The umbilical cord was cut, leaving a length of 5cms from its placental site of insertion. The specimens were then transported to the Department of Anatomy in formalin (10%) filled plastic containers. All the specimens were tagged with number discs before the commencement of the study, for the purpose of identity.

In all the collected placentae, the following parameters were studied:

1. Weight
2. Shape
3. The foeto-placental ratio
4. The placental coefficient
5. The number of cotyledons
6. The colour of the placental membranes
7. The presence of subchorionic fibrosis

The presence of the following abnormal placental characteristics

were also looked for:

1. Placental calcification
2. Amniotic bands
3. Retro-placental clots
4. Accessory placental lobes
5. Placental cysts on the membranes

The placentae were collected from:

1. Normal uncomplicated primigravid and multigravid cases
2. Pathological factors which complicated pregnancy, which included:

1. Pregnancy induced hypertension (PIH)
2. Diabetes mellitus
3. Anaemia which complicates pregnancy
4. Rh-isoimmunisation
5. Prematurity
6. Post-maturity
7. Abruptio-placenta
8. Intra-uterine death (IUD)
9. Twin pregnancy

The babies whose placentae were utilized in this study were also examined for the following factors:

1. Sex of the baby
2. Weight of the baby
3. Maturity of the baby
4. Visible anomalies in the baby

In each case, a preliminary history was elicited from the mother regarding her age, parity, the period of amenorrhoea, the history of bleeding per vaginum and her previous obstetric history with regard to PIH and diabetes mellitus.

Babies whose placentae showed the presence of abnormal findings were subjected to thorough clinical investigations to rule out the presence of foetal anomalies.

All the parameters which were studied were tabulated and analysed. [Table/Fig 1]

Parity		Maturity		Mode of labour		Factors complicating pregnancy	
Type	Cases	Type	Cases	Type	Cases	Type	Cases
Primi	48	Full term	91	Vaginal	64	PIH	05
Multi	53	Preterm	06	Caesarean	36	Diabetes mellitus	03
		Post term	04	Hysterotomy	01	Anaemia	02
						Rh-isoimmunisation	01
						Prematurity	03
						Post-maturity	04
						Abruptio-placenta	03
						IUD	03
						Twins	01

[Table/Fig 1]: Table shows the number of placentae collected, based on various categories of pregnancy

RESULTS

Shape

Out of the 101 cases, 94 were circular in shape and 7 were oval in shape. [Table/Fig 2]



[Table/Fig 2]: Figure shows a commonly occurring circular placenta

Weight of the placenta

In this study, the placental weight ranged from 80gm to 800gm, with an average of 528.55gm. [Table/Fig 3]

Sex of baby	Range of weight of placenta	Average weight of placenta
Both sexes together	80 gm – 800 gm	528.55 gm
Male baby	300 gm – 750 gm	519 gm
Female baby	80 gm – 800 gm	526.6 gm

[Table/Fig 3]: Table shows the range and average weight of placenta in normal pregnancies

The correlation of the weight of the placenta with the weight of the baby

The ratio of the foetal weight to the placental weight is known as the foeto-placental ratio, which is normally 6:1. (the weight of the foetus : the placental weight)

1. In the present study, this ratio was 5.35:1(both sexes considered together)
2. In male babies, it was 5.4:1
3. In female babies, it was 5.3:1

There is yet another method to correlate the weight of the baby and the placenta, which is by assessing the placental coefficient.

Placental weight in grams ÷ Birth weight in grams = placental coefficient

The present study showed a placental coefficient of 0.19. [Table/Fig 4]

Sex of baby	Average birth weight	Average placental weight
Male	2.8kg (Range 0.7kg - 3.75kg)	519gms (Range 300gm – 750gm)
Female	2.8kg (Range 0.45kg - 4kg)	538.3gms (Range 80gm–800gm)

[Table/Fig 4]: Table shows the correlation of the weight of the placenta with the birth weight in normal pregnancies

The placental characteristics in the factors which complicate pregnancy

In PIH, the average foeto-placental ratio was 6.03:1 and the average placental coefficient was 0.165, which showed that the weight of the placenta decreases with the severity of the toxemia of pregnancy. Out of the five cases of PIH, three of them showed the presence of placental infarction.

Diabetes mellitus showed a foeto-placental ratio of 5.22:1, with an increase in the birth weight and an increase in the placental weight.

Severe cases of anaemia below 7 gm% haemoglobin, showed a significant reduction in the placental weight, a foeto-placental ratio of 5:1 and an increase in the number of ill-defined cotyledons.

The cases of Rh-isoimmunisation and prematurity showed a significant decrease in the placental weight. The foeto-placental ratios in these cases were 6:1 and 4.5:1 respectively.

The post-maturity cases showed a foeto-placental ratio of 6.2:1 and an increased incidence of calcification, subchorionic fibrosis, infarction and meconium stained membranes.

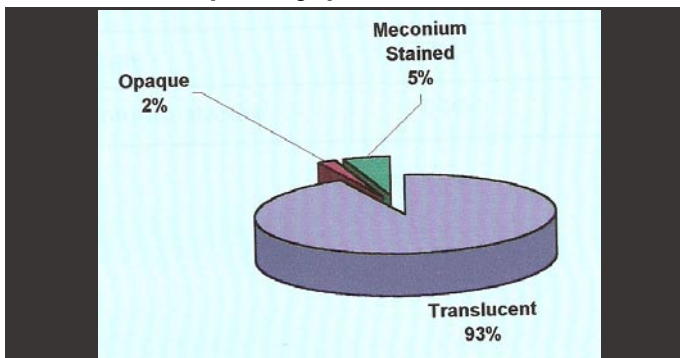
The twin pregnancy which was observed in this study showed a foeto-placental ratio of 5.4:1.

The average number of placental cotyledons was 18 and this study revealed a paucity of cotyledons in cases of PIH, low birth weight and prematurity. [Table/Fig 5]

Factor complicating pregnancy	Average birth weight	Average placental weight	Foeto-placental ratio	Placental coefficient
PIH (5 cases out of 101 placentae)	2.4kg (Range 1.8kg-2.6kg)	398gm (Range 36gm-400gm)	6.03:1	0.165
Diabetes mellitus (3 cases out of 101 placentae)	3kg (Range 2.8kg-3.3kg)	575gm (Range 530gm-635gm)	5.22:1	0.19
Anaemia(2 cases out of 101 placentae)	2kg (Range 1.8kg-2.2kg)	400gm (Range 375gm-425gm)	5:1	0.2
Rh isoimmunisation (1case out of 101 placentae)	2.4kg	400gm	6:1	0.17
Prematurity(3 cases out of 101 placentae)	1.8kg (Range 1.6kg-2.2kg)	400gm (Range 360gm-420gm)	4.5:1	0.22
Post maturity(4 cases out of 101 placentae)	3.2kg (Range 3.1kg-3.3kg)	512.5gm (Range 503gm-522gm)	6.24:1	0.16
Twins (2 placentae out of 101 placentae)	1.9kg (Range 1.85kg-1.92kg)	325gm (Range 320gm-330gm)	5.40:1	0.17

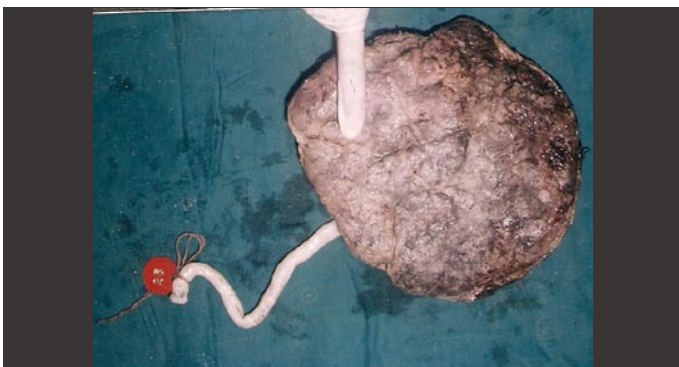
[Table/Fig 5]: Table shows the correlation of weight of the placenta with the birth weight, in factors complicating pregnancy

Foetal membranes - In the cases of placentae with opaque membranes, the babies had a cord around the neck three times and they were mildly asphyxiated. They were resuscitated immediately. Five of the meconium stained membranes were associated with foetal distress. [Table/Fig 6]



[Table/Fig 6]: Figure shows the percentage of distribution of various types of foetal membranes

Subchorionic fibrosis was present in all the term placentae. Calcification of placenta was observed in 20% of the cases in this study and these cases were associated with post-maturity and foetal distress. [Table/Fig 7]



[Table/Fig 7]: Figure shows a case of placental calcification

The amniotic band was not observed in this study.

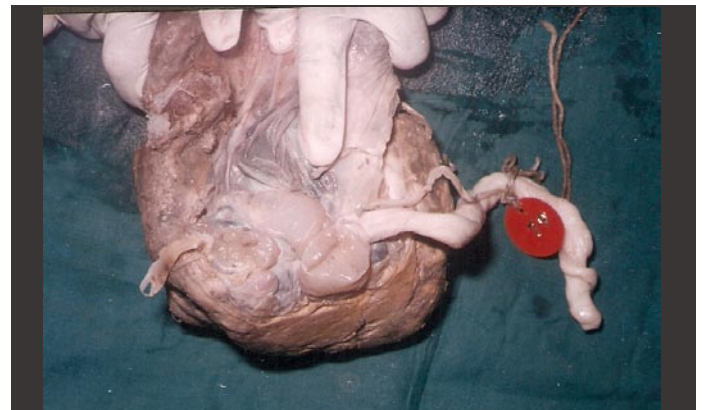
Cases of abruptio-placenta showed the presence of retro-placental clots.

Three cases of placenta succenturiata were observed in this study, where in two of them the succenturiate lobes measured 3cms in diameter and in the other, it measured 8cms x 4.5cms. All the three mothers gave a history of antepartum haemorrhage. [Table/Fig 8]



[Table/Fig 8]: Figure shows a case of placenta succenturiata

A subchorionic placental cyst was observed near the umbilical cord insertion in one case and on aspiration, the cyst was found to contain clear, serous fluid. The baby in this case was associated with foetal growth retardation. [Table/Fig 9]



[Table/Fig 9]: Figure shows a case of subchorionic placental cyst

Discussion

A total number of 101 placentae including those of twins, were studied and their morphological parameters were recorded and clinically correlated with the observations which were made by other researchers on this topic.

Shape of the placenta

94 placentae had a normal circular shape and 7 were oval in shape [2].

Weight of the placenta

Armitage et al. reported the average weight of the placenta to be 508gm [3] and the present study showed an average placental weight of 528.6gms, which could be due to an improvement in the antenatal care, follow up and the nutritional status of the antenatal mother.

The foeto-placental ratio and the placental coefficient in uncomplicated pregnancies

The normal foeto-placental ratio is 6:1 for a western population, whereas in this study, the ratio was 5.4:1 for male babies and 5.3:1

for female babies, in cases of uncomplicated pregnancies.

The normal placental coefficient is 0.12-0.2, the average being 0.15. The present study showed an average placental coefficient of 0.19 in uncomplicated pregnancies, which coincides with the normal value.

Factors which complicate pregnancy

PIH

The foeto-placental unit is adversely affected in PIH. Due to placental insufficiency, the foetal growth is affected. According to previous studies, for the evaluation of foetus, the weight of the placenta is not enough, but the foeto-placental ratio is important [4]. Thomson et al. and Saigal et al. observed that the placental weight and birth weight were below average, but that their ratio was slightly increased in cases of PIH [4], [5].

The present study revealed an average placental weight of 398gm, a birth weight of 2.4kg, a foeto-placental ratio of 6.03:1 and a placental coefficient of 0.165, in cases of PIH.

Zeek and Assali defined placental infarction as a zone of ischaemic necrosis of a group of villi, due to complete interference with their blood supply in the deciduas or by the thrombosis of a spiral arteriole [6]. Fox and Udainia observed placental infarcts in cases of PIH [7], [8]. This study showed placental infarcts of a mild variety in four cases of PIH (80% of the PIH cases in this study) in the form of a few scattered foci of infarcts, during the gross examination of the placentae. It has been further stated that the extent and the incidence of infarction increases with the increasing severity of tox-aemia [7]. [Table/Fig 10]

Type of pregnancy	Average birth weight	Average placental weight	Average foeto-placental ratio	Average placental coefficient
Uncomplicated pregnancy	2.8kg (Range 0.45kg-4kg)	528.6gms (Range 80gm-800gm)	5.35:1	0.19
PIH	2.4kg (Range 1.8kg-2.6kg)	398gms (Range 36gm-400gm)	6.03:1	0.165

[Table/Fig 10]: Table shows the comparison of foeto-placental ratio and placental coefficient in cases of uncomplicated pregnancies and PIH

Diabetes mellitus

One of the characteristic features of a placenta in maternal diabetes mellitus, is its increase in weight [9]. The present study showed an almost normal foeto-placental ratio of 5.22:1, in cases of diabetes mellitus, due to a good control of blood sugar in the mothers who were utilized in this study.

Other factors which complicate pregnancy

In cases of anaemia, Rh isoimmunisation and prematurity, the average placental weight was low, as these cases were associated with low-birth weight babies.

Postmaturity

These cases were associated with placental calcification, meconium stained membranes and foetal distress. These findings correlated with the study of Burgess and Hutchins whose results support the concept that the meconium passage in-utero may occur as a response to foetal distress [10].

Twins

Ramos-Arroyo et al. reported that dichorionic dizygotic twins were the heaviest and suggested that chorion status is a more important determinant of birth weight than zygosity [11]. One case of a dichorionic dizygotic twin was observed in the present study, with the birth weight of the twins being 1.8kg and 2kg respectively and this

coincided with the results of the former study.

Subchorionic fibrosis

Gray scale ultrasonography can detect the internal lesions of the placenta. Subchorionic fibrosis is caused due to subchorionic fibrin deposits which may be seen in all term placentae and are not of clinical significance, as stated by Spirt et al [12].

This study showed the presence of subchorionic fibrosis in all the term placentae.

Cotyledons

A paucity of cotyledons was observed in this study, in cases of PIH, prematurity and low-birth weight babies, which coincided with the findings of Nordenvall et al [13].

Amniotic band is reported in 1-2% of the malformed foetuses, with a male predominance in less than 32 week old foetuses, perhaps due to the large size and the more vigorous movements of the male foetuses, which may induce an early amnion rupture [14]. The amniotic band was not observed in this study.

Placental cyst

Raga et al. reported that subchorionic placental cysts are ominous findings and that when they are found near the umbilical cord insertion, they may be associated with foetal growth retardation and intrauterine asphyxia due to umbilical cord constriction [15]. One case of subchorionic placental cyst was observed in this study too and it was associated with foetal growth retardation.

Placenta succenturiata

Siegler and Sacks stated that the cases of placenta succenturiata were invariably associated with antepartum haemorrhage [16]. All the three cases of placenta succenturiata which were observed in this study were associated with antepartum haemorrhage.

Conclusion

The placenta is a mirror which reflects the intrauterine status of the foetus [8]. With the advent of advanced investigative technologies such as the Gray scale ultrasound and Colour Doppler Imaging, an adequate knowledge of the morphometric analysis of the placenta with its clinical relevance proves to be useful in the early assessment of placental sufficiency and also the state of the foetal well being. In mothers who have had no previous antenatal check up, a thorough examination of the placenta helps in the early diagnosis of the foetal complications, soon after parturition and thus helps in the early treatment of the baby by neonatologists.

ACKNOWLEDGEMENT

1. I would like to express my sincere and profound gratitude to Dr. T. R. Kalavathy, Retired Director and Professor, Institute of Anatomy, Madras Medical College, Chennai-3, who guided me through this study.
2. My heartfelt thanks also go to Dr. K. Kamakshi, Professor and Head, Department of Anatomy, Satyabama Dental College and Hospital, Chennai, who also helped me in this study.
3. I would also like to thank Dr. P. Saraswathi, Professor and Head, Department of Anatomy, Saveetha Medical College, Than-dalam, Chennai-602105.

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DECLARATION ON COMPETING INTERESTS: No competing Interests

Date of Submission: **Feb 02, 2011**

Peer Review Completion: **Feb 05, 2011**

Date of Acceptance: **Feb 23, 2011**

Date of Publication: **Apr 11, 2011**