ORIGINAL ARTICLE

A STUDY ON MACROSCOPIC ANATOMY OF HUMAN PLACENTA

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HOW TO CITE THIS ARTICLE:
Alpana Hatibaruah. "A Study on Macroscopic Anatomy of Human Placenta". Journal of Evidence based Medicine and Healthcare; Volume 2, Issue 25, June 22, 2015; Page: 3673-3687.

ABSTRACT: It is only the eutherian mammals that have evolved a complex organ - "The Placenta" which not only protect but also gives nutrition to the embryo till its birth. We should see that the placenta is more than just some messy after birth to be discarded and ignored in the excitement and joy over the birth of a beautiful new child. So, this study aims to evaluate the macroscopic study of placenta and to explore the morphological variation of placenta with respect to preterm, term and post term pregnancy. **MATERIALS AND METHOD:** It's a hospital based Prospective Nonrandomized Observational study of 90 placentae, conducted in the Department of Anatomy and the Department of Obstetrics and Gynaecology, FAAMCH, Barpeta. **RESULTS:** The macroscopic study of placenta revealed that most of the placentae were discoidal in shape, only a few oval. The weight of the term and post term placentae were more than preterm placentae. Comparison of weight between preterm and term categories were found to be significant ($p<0.01$) whereas comparison of weight between term and post-term were found to be just significant ($p<0.05$). A difference in diameter between preterm and term cases were seen whereas the difference was less in respect to term and post-term cases, statistically just significant ($p<0.05$). Thickness showed no major difference, the number of cotyledons found were 15–20 and the arrangement of chorionic vessels were similar in all the three categories of placentae. Out of 90 placentae two placentae had marginal attachment and seven had velamentous insertion of cord, rest of them were eccentric in position. **CONCLUSION:** Therefore, it is obvious that the various parameters of placenta are subjected to slight variations in preterm, term and post-term placentae. Direct examination and assessment of placental parameters contribute to the assessment of the neonate; help to explain certain antenatal events and aid in the management of the puerpera.

KEYWORDS: Placenta, Preterm placenta, Term placenta, Post term placenta, Macroscopic anatomy.

INTRODUCTION: Placenta is defined as "haemochorial, chorio-allantoic, discoidal and deciduate" (Standring et al. 2005).[1] There are many scholars devoted to the study of term placenta regarding morphological, histological and biochemical aspects. However, studies to explore any variation with respect to preterm and post term pregnancies are very few. In this region, such studies have not been done previously. So, this study is done in preterm, term and post term placentae with following

AIMS AND OBJECTIVES:

- To carry out the macroscopic study of placenta.
- To explore the morphological variation of placenta with respect to preterm, term and post term pregnancy.

MATERIALS AND METHOD: The study was conducted in the Department of Anatomy and in the Department of Obstetrics and Gynaecology, FAAMCH, Barpeta from 1st April, 2014 to 31st March, 2015.

SELECTION OF CASES:

- Women aged between 20—35 years of age including both primigravida and multigravida up to 4th gravida was taken for collection of placenta.
- Placenta from mother without any medical or obstetric history such as eclampsia, PIH, anaemia of pregnancy, diabetes, etc. were selected for study. Those patients without proper medical history were excluded from this study.

STUDY POPULATION: The placenta were collected from those patients who were admitted in the hospital for delivery. The selected cases were grouped into preterm, term and post term as follows:

- **Preterm:** 28 weeks to 36 weeks.
- **Term:** 37 weeks to 42 weeks.
- **Post Term:** Beyond 42 weeks.

The gestational period as well as the expected date of delivery was calculated from the date of 1st day of last menstrual period by adding nine calendar months and seven days to it (Naegele's formula). The gestational age was recorded in relation to completed weeks.

For example:

- 36 weeks + 0 day = 36 weeks.
- 36 weeks + 2 days = 37 weeks.

All the relevant information of the mother such as age, weight, duration of pregnancy, gravida, etc. were recorded in a proforma. The placentae from such cases were collected live birth only. The placental parameters required for our study such as weight, thickness, diameter, number of cotyledons, attachment of umbilical cord, etc. were plotted in a Proforma No. 2A total of 90 placentae from three categories namely preterm, term and post-term were collected.

METHOD: At first the biodata of the mother was plotted in Proforma No. 1. Then after delivery the placenta was collected in a clean tray. The umbilical cord was cut short to about 2 inches. It was then gently pressed so as to remove as much blood as possible without injuring it. It was then gently washed with water to remove excess blood clots and amniotic debris. With the help of tissue paper, the placenta was soaked dry.

MACROSCOPIC STUDY: The placenta was then examined macroscopically. Its shape, size, weight, thickness, mode of insertion, number of cotyledons, etc. was plotted in Proforma No. 2. The weight of the placenta was taken on an accurate commercial scale weighing machine. The diameter of the placenta was determined by measuring tape. The tape was placed at first horizontally and then antero-posteriorly and diameter was recorded in centimeters. Thickness at centre was taken by vernier calliper. After completing the Proforma No. 2, a tag was tied to the

placenta according to the serial number as in the proforma. The tag with the serial number on it helped to make sure that the placenta belonged to the mother concerned. Such information was utilized for future study. After macroscopic study, the whole placenta was preserved in 10% formalin for further study.

FIXATIVE USED:

- **Fixative:** 10% formalin was used.

COMPOSITION:

- **Formalin (40% formaldehyde):** 10 ml.
- **Distilled Water:** 90 ml.

DISSECTION: The specimens were then dissected for study. Dissection was done to see the arrangement of chorionic vessels after leaving the umbilical cord.

INSTRUMENTS AND MATERIALS USED:

1. Scissors.
2. Scalpel.
3. Needle (Straight).
4. Surgical Gloves.
5. Dissecting Tray.
6. Dissecting Microscope.
7. Measuring Tape.
8. Measuring Scale.
9. Jar with fixative (10% Formalin).
10. Weighing Machine.
11. Vernier Calliper.
12. Fabric Paint (Red & Blue).
13. Painting Brush (No. 5 and 6).
14. Needle and Thread.

RESULTS OF MACROSOPIC STUDY OF PLACENTA: The shape of placenta were almost found to be discoid in all the three categories, namely – preterm, term and post-term placentae. The weight, diameter and thickness were found to be as follows:

Serial No.	Weight (gm)	Diameter (cm)	Thickness (cm)
1	420	17.0	2.1
2	295	15.5	1.6
3	300	16.2	1.6
4	385	17.0	1.7
5	285	15.0	1.6

6	305	16.3	1.6
7	290	15.0	1.6
8	425	17.5	2.3
9	300	15.0	1.9
10	320	16.3	1.7
11	295	15.2	1.7
12	315	15.8	1.8
13	300	16.0	1.7
14	325	15.5	1.7
15	400	16.5	2.1
16	300	15.5	1.7
17	295	14.8	1.6
18	350	15.4	2.0
19	320	16.0	1.6
20	400	15.0	2.0
21	350	14.5	1.7
22	295	14.5	1.6
23	265	14.5	1.6
24	310	16.5	1.6
25	400	16.0	1.9
MEAN	329.80	15.70	1.76
S.D.	47.20	0.83	0.20

Table 1: Showing average placental weight, diameter and thickness in preterm cases

Serial No.	Weight (gm)	Diameter (cm)	Thickness (cm)
1	500	19.0	2.7
2	410	15.5	2.1
3	510	17.5	2.4
4	500	15.0	2.0
5	400	16.0	1.9
6	450	18.0	2.1
7	400	16.0	2.1
8	415	16.5	1.9
9	400	17.0	2.2
10	430	17.4	2.5
11	410	17.8	1.8

12	400	17.0	2.1
13	350	16.5	1.8
14	350	16.0	1.9
15	425	17.0	2.1
16	410	16.0	2.1
17	360	16.0	2.0
18	500	17.5	2.3
19	450	17.0	2.2
20	420	16.5	2.4
21	400	16.0	1.9
22	400	16.0	2.0
23	410	16.0	2.0
24	300	15.0	1.6
25	350	16.5	1.7
26	410	17.5	2.1
27	360	18.0	1.8
28	455	18.0	2.0
29	400	17.0	2.4
30	450	16.0	2.6
31	525	19.0	2.6
32	500	17.8	2.3
33	435	18.0	2.1
34	350	17.5	2.0
35	460	18.5	1.9
36	400	18.0	1.9
37	500	20.5	2.2
MEAN	421.49	17.04	2.10
S.D.	±53.19	±1.18	±0.26

Table 2: Showing average placental weight, diameter and thickness in term cases

Serial No.	Weight (gm)	Diameter (cm)	Thickness (cm)
1	500	19	2.6
2	410	17.5	1.7
3	500	19	2.6
4	500	19	2.5
5	420	17.6	2.1
6	400	17	1.8
7	420	17.5	2.1
8	595	20.5	3.0

9	400	17	1.8
10	480	18	2.1
11	400	17	1.8
12	450	17.7	2
13	480	18.5	2.1
14	500	18.5	2.6
15	500	19.5	2.5
16	400	17	1.8
17	480	18	2.1
18	480	18	2.1
19	395	15	1.4
20	450	17.7	2.1
21	460	18	2.1
22	480	18	2.1
23	410	17.5	2.1
24	420	17.5	2.1
25	480	18	2.4
26	410	17.5	1.8
27	500	19.5	2.5
28	500	19.5	2.5
Mean	457.86	18.02	2.16
S.D.	±48.24	±1.07	±0.35

Table 3: Showing average placental weight, diameter and thickness in postterm cases

ARRANGEMENT OF CHORIONIC VESSELS: The chorionic vessels spread in all directions from the site of attachment of the cord under the amnion. The umbilical cord contained two umbilical arteries and one umbilical vein. The two umbilical vessels were spirally twisted, formed trunks before dividing into terminal branches but never quite reaching the margin of the placenta. The veins were deeper and larger than the arteries.

ATTACHMENT OF UMBILICAL CORD: Most of the placentae had their attachment of cords eccentric in position. Two placentae had marginal (battle-dore) attachment and seven placentae had velamentous insertion.

DISCUSSION:

1) **SHAPE:** The placentae belonging to the three categories were discoidal in shape. Various scholars, viz. Arey (1966),[2] Dutta(2010) et al[3] had described the placenta as a discoid organ.

2) WEIGHT: In the year 2001, Heinonen and his colleagues in their study on "Weights of placentae from small for gestational age infants" found the weight of preterm placentae to range between 400—500 gms. In another study by K. Benirschke (2006)[4] the weight was found to be 320—400 gms. In the present study, the weight of placenta in preterm cases are in the range from 265–420gms. Which correlates with that found by Benirschke (2006).[4]

Term Cases: Placental weight in normal term pregnancy according to various authors along with present study are as follows:

Author	Year	Weight of placenta	Average weight
Adair and Thelander[5]	1925	-	473gms
Hosemann[6]	1946	400-1000gms	-
Wigglesworth[7]	1962	360-570gms	-
Ahern[8]	1966	450-500gms	-
Krishna Menon[9]	1989	350-500gms	-
Standring S et al[1]	2005	-	508gms
A K Dutta[3]	2010	-	500gms
T W Sadler[10]	2014	500-600gms	-
D C Dutta[11]	2015	-	500 gms
Present Study*	**2014-15**	**350-525gms**	**421.49gms**

Table 4

From the above literatures, the present study correlates with the study by Menon, Krishna and Rao (1989).[9] Moreover, the average weight in our study is 421.49gms. This result is slightly less than the average weight of normal term placentae found to be 473gms by Adair and Thelander in 1925.[5]

Post-term Cases: In 1975, Vorherr Helmuth, in his study recorded a weight of 550-600 gms.

In our present study, the findings were 385-595gms. Statistical comparison of weight between term and post-term cases is found to be just significant ($t=2.64$, $p<0.05$), whereas it is significant in case of preterm and term placentae ($t=6.93$, $p<0.01$).

3) DIAMETER:

Preterm Cases: From the present study, it is observed that in preterm cases, placental diameter is between 14.5–17.5 cm and in most of the cases (68%) it ranges from 14.5–15.0 cm. The average being 15.8 cm.

Term Cases: In term cases, the following are some of the studies.

Author	Year	Diameter (cm)	Average (cm)
Hamilton, Boyd and Mossman[12]	1972	15-20 cm	-
Benirschke, Kaufman[4]	2006	200-220 mm	-
A. K. Dutta[3]	2010	15-20 cm	-
T. W. Sadler s[10]	2014	15-25 cm	-
D. C. Dutta[11]	2015	15-20 cm	-
Present Study*	**2014-15**	**15.5-20.5 cm**	**16.6 cm**

Table 5: Diameter of term placenta by various authors along with present study

From the present study, it is seen that the diameter of the placenta varies from 15.5–20.5 cm, the average diameter found to be 16.6 cm. Our study correlates with the studies by Hamilton, Boyd and Mossman (1972),[12] AK Dutta 2010),[3] DC Dutta (2015).[11]

Post term Cases: In our present study, the diameter ranges between 17-20.5 cm, the average being 18.02 cm. Moreover, most of the cases i.e. 67.85% placentae have shown their diameter between 17.1-19.0 cm (Table 3). It is noticed that in majority of cases there is a difference of placental diameter between term and post-term placentae ($t=2.50$, $p<0.05$). But the difference is less in diameter of preterm and term placentae ($t=1.43$, $p>0.05$). The above finding is in accordance to Stieve (1948) and Hamilton & Boyd (1951), they stated that the diameter of placenta in later half of pregnancy doubles the diameter of first half.

4) THICKNESS:

Preterm Cases: Meagre literature is available on thickness of preterm placenta. In our present study, the thickness ranges between 1.6-2.3 cm, the average being 1.7 cm.

Term Cases:

Author	Year	Thickness	Average
Steive	1940	11-41 mm	23 mm
Crawford[13]	1969	2.5-2.7 cm	–
Boyd and Hamilton[14]	1970	-	23 mm
Stanley and Jacob[15]	1970	-	1 inch

Hamilton, Boyd and Mossman[12]	1972	-	> 3 cm
Chun and Park[16]	1974	-	2.7 cm
Stranding et al[1]	2005	10-40 mm	23 mm
Present Study	**2014-15**	**1.6-2.6**	**2.1 cm**

Table 6: Showing thickness of term placenta by various authors including the present study

Post term Cases: In our study the thickness of post term placenta is between 1.7-2.8 cm, the average being 2.2 cm. It is understood that placental thickness does not increase much from preterm to term as does its weight or its diameter. Strandring et al (2005)[1] stated that, "In the latter half of pregnancy, the placenta further increases its surface area, doubling its diameter, the overall thickness remaining static". In the present study, comparison of thickness between preterm and term placenta has been found to be significant ($t=4.93$, $p<0.01$), while it has got no significance in case of comparison between term and post-term placentae ($t=0.87$, $p>0.05$).

5) **COTYLEDONS:** Regarding the number of cotyledons in preterm, term and post-term cases no significant difference was found. The studies by various authors which correlate with our findings are as showing Table-7.

Author	Year	Number of cotyledons
Clayton[15]	1972	15-20
Fox H[17]	1975	15-20
TW Sadlers[10]	2014	15-20
Present Study*	**2014-15**	**15-20**

Table 7: Studies by various authors which correlates with our findings

No difference was found in the number of cotyledons between preterm and post term placenta. This view is also supported by Fox H (1978).[17]

6) **ARRANGEMENT OF CHORIONIC VESSELS:** Initially the arteries of human placenta was explained as a star like radiation and the vessels are described as falling into primary, secondary and tertiary groups (Bacsich & Smout, 1938).[18] But later on, the vascular pattern is described as of two types-Marginal and Dispersal (Shordania 1929).[19] In the dispersal type, the umbilical vessels undergo successive divisions with gradually diminishing caliber towards periphery, giving it the star pattern. While in the magistral type, the umbilical vessels give small side branches and almost reach the placental margin without marked reduction in caliber, appearing as V pattern. There is no correlation observed between the vascular pattern, placental area supplied and surface anastomosis. So all arteries are considered as end arteries (Franken et al.,1958).[20]

7) ATTACHMENT OF UMBILICAL CORD: The above finding mentioned in results regarding the attachment of umbilical cord has been supported by Hamilton, Boyd and Mossman.[12]

CONCLUSION: Irrespective of preterm, term or preterm placentae, most of the placentae were discoidal in shape.

- It is seen that the weight of placenta in most of the cases (52%) are in the range between 300-399gms followed by 250-299gms (28%) and 400-499gms (20%).
- In term cases, the weight of the placenta varies between 350-525gms, the average weight found to be 421.49gms.
- 62.16% of normal term cases were found to weigh between 400-499gms followed by 300-399gms (18.91%) and 500-599gms (18.91%).
- In post-term cases, the range of placental weight is between 385-595gms; 456.96gms being the average.
- 67.85% of post-term placentae weighted between 400-499gms.
- Comparison of weight between preterm and term categories were found to be significant ($p<0.01$) whereas comparison of weight between term and post-term were found to be just significant ($p<0.05$).
- A difference in diameter between preterm and term cases were seen whereas the difference was less in respect to term and post-term cases, statistically just significant ($p<0.05$).
- Thickness of placentae showed no major difference in placentae from term and post-term cases. Statistically, ($p>0.05$), the difference was not significant whereas in case of preterm and term placentae even though, difference was not very high, statistically was a significant one ($p<0.01$).
- Irrespective of preterm, term, or post-term cases, the number of cotyledons found was in the range between 15–20.
- The arrangement of chorionic vessels was similar in all the three categories of placentae.
- The attachment of the umbilical cord was eccentric in position with respect to preterm, term and post-term placentae. Two placenta had marginal attachment and seven placenta had velamentous insertion of cord. As is perpetually the case in every scientific study, our knowledge is partial even in this aspect. More studies are needed to increase the depth of our understanding. However, we must make the best of the currently available information. Further, the principle aim of the morphologist, to relate structure to function, is still far from being fulfilled and this is a field to which the future efforts of placental biologists should be increasingly directed.

ACKNOWLEDGEMENT: It gives me immense pleasure to acknowledge my deep sense of gratitude and profound indebtedness to Professor & Head, Department of Anatomy, for her valuable suggestions and inspiring guidance with her keen and continued interests all throughout the period of this work.

I express my sincere thanks to Professor & Head, Department of Obstetrics & Gynaecology, for allowing me carry out this study in his department and also to collect the specimen.

I am thankful to Principal–cum–Chief Superintendent, Fakhruddin Ali Ahmed Medical College & Hospital, Barpeta for his kind permission to carry out this work in this institution.

I would not fail to acknowledge my gratitude to my parents Dr. J. Hatibaruah and Dr. (Mrs.) K. Hatibaruah and my mother-in-law Mrs. Urmila Baruah for their unconditional love and blessings.

I am grateful to my husband Dr. Amit Ranjan Baruah, who has been a constant source of encouragement, inspiration and help throughout this study.

I extend my sincere gratitude to all the mothers and newborns without whose existence this piece of work would have ever been possible.

Last but not the least; I thank the 'Almighty God' without whose blessings and help made it possible for me to complete the research work.

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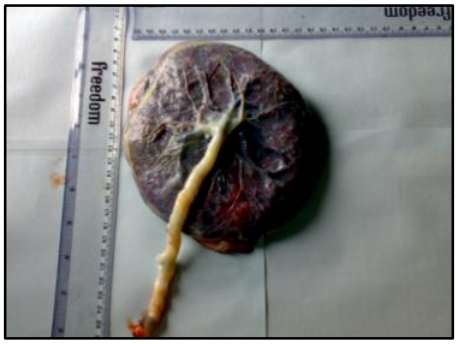
Pre Term:

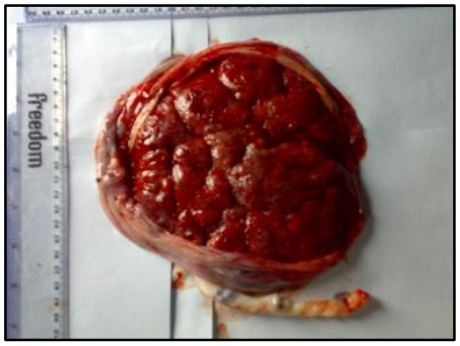
FOETAL SURFACE

MATERNAL SURFACE

TERM:



FOETAL SURFACE



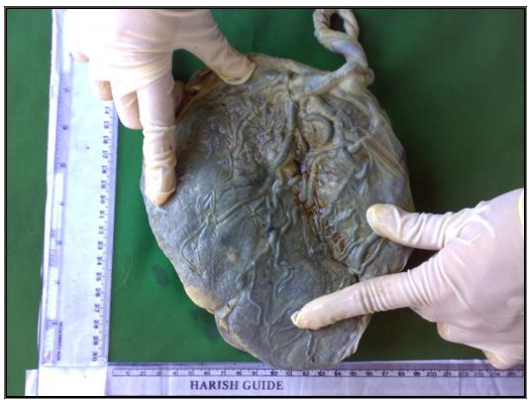
MATERNAL SURFACE

POST-TERM:

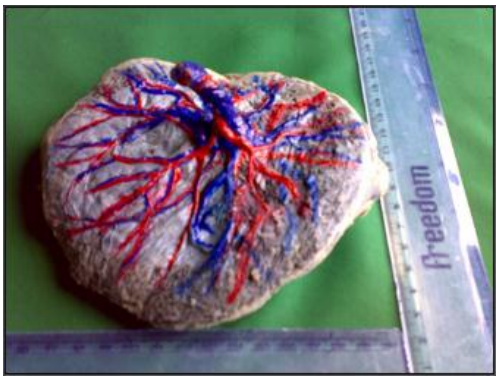
FOETAL SURFACE

MATERNAL SURFACE

SHOWING PRESENCE OF SEPTA



VELAMENTOUS PLACENTA



SHOWING THE ARRANGEMENT OF CHORIONIC VESSELS

SHOWING LOBULES OF PLACENTA

SHOWING THE LOBULES

PLACENTA–MARGINAL (BATTLE-DORE) TYPE

PLACENTA–MARGINAL (B CHORIONIC VESSELS ENDING A FEW MILLIMETER BEFORE REACHING THE MARGIN ATTLE-DORE) TYPE

ORIGINAL ARTICLE

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Date of Submission: 07/06/2015.
Date of Peer Review: 08/06/2015.
Date of Acceptance: 13/06/2015.
Date of Publishing: 18/06/2015.