A STUDY OF MORPHOLOGY AND GROSS ANOMALIES IN FULL-TERM PLACENTAE

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Abstract
Background: Placenta is an important connecting organ between the mother and fetus. It provides nutrition, gas exchange, waste removal, immune support, and endocrine functions. Since variations of the placenta result in effects on fetal development and neonatal survival it is the area of interest to be studied by anatomists, pathologists, and obstetricians. We in the current studied the placental morphology, variations, and abnormalities of the human placenta.

Methods: The samples comprised of a collection of placentae in the Department of Anatomy of Prathima Institute of Medical Sciences, Karimnagar. Samples were collected after delivery, placentae were mopped to remove any clotted blood, and then weighed with 10 cm of the umbilical cord. The specimen is fixed in 10% formalin immediately over 24-48 hours and then subjected to thorough gross examination.

Results: Out of n=60 placentae studied the mean weight of the placenta was found to be highest at 38 weeks of gestation with a mean surface area of 964.46 cm² and mean weight of 463.75 Kgs. N=49(81.67%) were normal maternal conditions and history of abortions and pre-eclampsia was in n=2 cases each and oligohydramnios in n=3 cases. Among the fetal abnormalities Anencephaly, Macrostomia, MS/TS/Cerebellar hypoplasia, and holoprosencephaly with single nostril was found in n=1(1.67%) cases each.

Conclusion: Examination of the placenta performed in the delivery room provides information that may be important to the care of both mother and infant. The findings of this assessment should be documented in the delivery records. The placenta should be submitted for pathologic evaluation if an abnormality is detected.

Keywords: Placenta, Morphological Variations, Anencephaly, oligohydramnios, Macrostomia.

Introduction

The placenta is coined from a Latin word that means "cake", and in Greek, it is called "Plakon" which means "flat, slab-like". In pre-Roman languages of tribal cultures, the placenta is often referred to as the "little mother" or "grandmother". The placenta is the connecting channel formed by both maternal and fetal contributions. It is an essential biological event that shows fetal graft acceptance by the maternal immune system perfectly. Placentae are characteristic of placental mammals but are also found in some non-mammals with varying levels of development. The placenta plays a crucial role during pregnancy. It is a structure where maternal and fetal tissues come in direct contact without rejection, suggesting immunological acceptance of the fetal graft by the mother. This may be due to the production of immune-suppressive cytotoxins and proteins, HLA genes which block the recognition of the conceptus as a foreign body. The placenta is responsible for working as a trading post between the mother’s and the baby’s blood supply. Small blood vessels carrying the fetal blood run through the placenta, which is full of maternal blood. Placental Medicine during postpartum time helps the mother to recover faster from childbirth. The human placenta allows the passage of IgG antibodies, thereby protecting the fetus in utero. In humans, cell proliferation, differentiation, and death are the driving forces behind the process of placentation, determining the fate of trophoblast cells. Abnormality at any stage of this development may lead to improper placental function and subsequent pregnancy-related complications. The maternal surface of the placenta is divided into cotyledons with irregular grooves and the fetal surface is smooth shiny and translucent which is covered with an amniotic membrane. A full-term human expelled placenta appears to be a flattened discoid mass with a circular or oval outline. The average volume is 500 ml (range 200-950 ml) the average thickness is about 23 mm and the average surface area is about 30000 mm². The placenta also provides a reservoir of blood for the fetus, delivering blood to it in case of hypotension and vice versa, comparable to a capacitor. Many scientists studied the placenta in many angles macroscopically and microscopically, as it has an influence on the growing fetus and pregnant mother and used it in therapeutics like treating post-natal, chronic infections, and supplementation of hormones in infertility and other conditions. This study is taken up to compare the morphological features of the placenta with the gestational age and weight of the fetus.
Material and Methods

This cross-sectional study was done with the samples comprised of a collection of placentae in the Department of Anatomy, from the Department of Obstetrics and Gynaecology of, Prathima Institute of Medical Sciences, Karimnagar. District Civil Hospital, Karimnagar. Institutional Ethical committee permission was obtained for the study.

Method of Collection of Specimens: The placental specimens are studied in the Department of Anatomy. After delivery, the placenta is mopped to remove any clotted blood and then weighed with 10 cm of the umbilical cord. The specimen was fixed in 10% formalin immediately over 24-48 hours and then subjected to thorough gross examination. The shape, size, and diameter of the placenta, site of attachment of umbilical cord, and gross variations are noted in all specimens. The gestational age and fetal weight were obtained from clinical case sheets. All the available data was uploaded on an MS Excel spreadsheet and analyzed by SPSS version 21 on windows format for descriptive statistics.

Results

During the study, a total of n=60 placenta samples were obtained and included in the study. The thickness of placenta was < 2 cms in n=6(10%) and between 2 – 3 cms in n=50 (83.33%) cases, and > 3 cms in n=4 (6.67%) cases. The description of the shape of the placenta and the distribution is depicted in table 1.

| Shape       | Frequency | Percentage |
|-------------|-----------|------------|
| Discoid     | 41        | 68.33      |
| Oval        | 18        | 30.00      |
| Bilobed     | 1         | 1.67       |
| Total       | 60        | 100        |

The measurement of diameter of n=60 cases found diameter of <15 cms in n=18(30%) cases, and between 16 -20 cms in n=37(61.67%) cases and >20 cms in n=5(8.33%) cases respectively. The measurement of the circumference of the placenta and the distribution is depicted in table 2. The comparison of surface area and net weight of placenta along with gestational age distribution is given in table 3.

| Circumference (cms) | Frequency | Percentage |
|---------------------|-----------|------------|
| 21-30               | 9         | 15.00      |
| 31-40               | 24        | 40.00      |
| 41-50               | 25        | 41.67      |
| 51-60               | 2         | 3.33       |
| Total               | 60        | 100        |
Table 3: The comparison of surface area and net weight of placenta to the gestational age of the mother

| Gestational age (Weeks) | Mean Surface Area (cm²) | Mean net weight of the placenta (g) |
|-------------------------|-------------------------|-------------------------------------|
| 37                      | 968.83                  | 445.55                              |
| 38                      | 964.46                  | 463.75                              |
| 39                      | 917.03                  | 473.00                              |
| 40                      | 677.01                  | 425.00                              |
| 41                      | 480.66                  | 355.00                              |

The attachment of the umbilical cord was studied, and it was found the cord was attached in the center in n=37(61.67%) of cases, Battledore attachment was found in n=15(25%) cases, the velamentous attachment was found in n=7(11.67%) cases, and double umbilical cords were found in n=1(1.67%) case. The measurement of the weight of the placenta in grams revealed n=13(21.67%) cases were weighted below 400 gms. N=40(66.67%) cases were having weights between 401 to 500 gms. N=5(8.33%) cases were with weight 501 – 600 gms and more than 600 gms weight was found in n=2(3.33%) cases. The maternal conditions associated with placentae have been shown in table 4.

Table 4: Showing Associated Abnormal Maternal Conditions

| Associated Abnormal Maternal Conditions | Frequency | Percentage |
|----------------------------------------|-----------|------------|
| Normal                                 | 49        | 81.67      |
| H/O Abortions                          | 2         | 3.33       |
| Oligo Hydramnios                       | 3         | 5.00       |
| Pre-Eclampsia                          | 2         | 3.33       |
| Type 2 DM                              | 4         | 6.67       |
| Total                                  | 60        | 100        |

Graph 1: Showing gestational age of the mother

The study of vascular pattern of placenta revealed disperses pattern in 83.33% cases and magistral pattern in 16.67% of cases. The number of cotyledons was less than 15 in n=6(10%) cases and between 15 to 30 in 54(90%) cases. The abnormalities of the placentae are depicted in table 5.

Table 5: Showing Abnormalities of Placentae

| Abnormalities of placenta               | Frequency | Percentage |
|----------------------------------------|-----------|------------|
| Nil                                    | 49        | 81.67      |
| Blood clots innmembranes               | 5         | 8.33       |
| Cotyledons decreased                   | 3         | 5.00       |
| Cotyledons not differentiated           | 3         | 5.00       |
| Total                                  | 60        | 100        |

The various abnormalities of fetuses were studied we found n=56(93.33%) cases were without any abnormalities. Anencephaly, Macrostomia, MS/TS/Cerebellar hypoplasia, and holoprosencephaly with single nostril were found in n=1(1.67%) cases each. The weight of the fetus was less than
3 Kgs in n=9(15%) cases and between 3-4 Kgs in (81.67%) cases and more than 4 Kgs in n=2(3.33%) cases.

**Discussion**

The placenta is the only specialized organ that belongs to two people at the same time. Although the placenta has a tremendous ability to adapt itself to disturbed conditions sometimes these compensatory changes are not sufficient for the nutrition of the fetus and will result in fetal abnormalities such as fetal growth retardation. Small fetuses have smaller placentae with substantial changes in placental morphology. In this study we found out of n=60 placentae studied the placental thick was 2 – 3 cms in 83.33% cases and 68.33% of placentae were discoid shaped. The mean circumference was between 31 – 50 cms in 81.67% of cases. The mean weight of the placenta was found to be highest at 38 weeks of gestation with a mean surface area of 964.46 cm² and a mean weight of 463.75 Kgs. Out of n=60 cases, n=49(81.67%) were normal maternal conditions, and history of abortions and pre-eclampsia was in n=2 cases each, and oligohydramnios in n=3 cases (table 4) were found. Among the fetal abnormalities Anencephaly, Macrostomia, MS/TS/Cerebellar hypoplasia, and holoprosencephaly with single nostril was found in n=1(1.67%) cases each. The mean placental weight was found to be between 400 – 600 gms in other similar studies in this field. [9-13] The mean placental diameter was between 16 - 20 cms in n=37(61.67%) cases of this study. The importance of mean diameter is because it affects the number of nutrients, oxygen, and carbon dioxide that can be exchanged between the mother and fetus. Ohagwu et al., [14] in their study reported the mean placental diameter at term ranged from 15 cms to 25 cms, and Yetter [15] reported a higher mean diameter of 22 cms. M Gediminas [16] in his study of the relationship between insufficient fetal growth and placental thickness, cord insertion, and placental gross abnormalities concluded that placental weight and thickness are associated with intrauterine growth retardation. In most of the cases of the present study n=41(68.33%) discoid-shaped placenta, oval in 18% cases, and bilobed in 1.7%. Nobis et al., [17] in their study of placental morphology found discoid-shaped in 46% oval-shaped in 17%, and bilobed in 5%. Salafi et al., [18] found abnormal shapes are usually associated with reduced placental efficiency. An abnormal placental shape is a marker of maternal uteroplacental and/or fetoplacental vascular pathology which can affect the development of the fetus. Most of the placental weight in the current study was between 401 – 500 gms in 66.67% of cases. There appears to be a significant correlation between placental weight and placental thickness and the birth weight of neonates. The thickness of the placenta has an indirect effect on the weight of the fetus and the fetoplacental ratio. The other factors that impact placental thickness include nutrition, maternal genetics, maternal hemoglobin, and altitude. Placentae with thickness lesser than 2.5 cms are found to be associated with intrauterine growth retardation and those with more thickness of 4 cms may be associated with maternal diabetes, fetal hydrops, and intrauterine fetal infections. [19] Elchalal et al., [20] determined that placental thickness during pregnancy above the 90th percentile was associated with a twofold risk of birth weight less than 2500 g. The thick placenta was also associated with birth weight above 4000 g. The risk for macrosomia in the thick placenta group was higher than in the control group.

**Conclusion**

Examination of the placenta performed in the delivery room provides information that may be important to the care of both mother and infant. The findings of this assessment should be documented in the delivery records. Numerous common and uncommon findings of the placenta, umbilical cord, and membranes are associated with abnormal fetal development and perinatal morbidity. The placenta should be submitted for pathologic evaluation if an abnormality is detected, or certain indications are present. The presence of abnormal creases in the placenta helps the physician to diagnose autism shortly after birth. Such early examination of the placenta can yield information that may be important in the immediate and later management of the infant and mother. This information may also be essential for the attending physician in the event of an adverse maternal or fetal outcome.

**References**

1. Liddell HG, Scott R. A Greek-English Lexicon revised and augmented throughout by Sir Henry Stuart Jones, with the assistance of Roderick McKenzie Oxford Clarendon Press. 1940.
2. Pough, F. Harvey, Robin M. Andrews, John E. Cadle, Martha L. Crump, Alan H. Savitzky, and Kentwood D. Wells. 2004. Herpetology, Third Edition. New York: Prentice Hall. pp. 712.
3. Davies CJ, Hill JR, Edwards JL, Schrick FN, Fisher PJ, Eldridge JA, Schlafer DH. Major histocompatibility antigen expression on the bovine placenta: itsrelationship to abnormal pregnancies and retained placenta. Anim Reprod Sci. 2004; 82-83:267-80.
4. Wang Y, Zhao S. Vascular Biology of the Placenta. San Rafael (CA): Morgan & Claypool Life Sciences; 2010. Chapter 2, Placental Blood Circulation. Available from: https://www.ncbi.nlm.nih.gov/books/NBK53254/ [Accessed on 13 June 2021]
5. Simister NE, Storycm. Human placental Fc receptors and the transmission of antibodies from mother to fetus. J Reprod Immunol. 1997; 37(1):1-23.
6. Ray J, Jurisicova A, Caniggia I. IFPA Trophoblast Research Award Lecture: The Dynamic Role of Bcl-2 Family Members in Trophoblast Cell Fate. Placenta. 2009; 30 Suppl A: S96-100.
7. Susan Standring, Thomas Ind. Gray’s Anatomy – The Anatomical Basis of Clinical Practice. Implantation, Placentation, Pregnancy and Parturition. 39th Ed,London: Churchill Livingstone 2005; pp. 1341-48.
8. Assad RS, Lee FY, and Hanley FL. Placental compliance during fetal extracorporeal circulation. J Appl Physiol (1985). 2001;90(5):1882-86.

9. Sanin, L. H., Lopez, S. R., Olivares, E. T. N. O., Terrazas, M. C., Silva, M. A. R. and Carrillo, M. L. Relation between birth weight and placenta weight. Neonatology 2001; 80(2): 113-117.

10. Lurie S, Feinstein, M, Mamet, Y. Human Foetal-Placental Weight Ratio in normal Singleton Near-Term Pregnancies, Gynecologic and Obstetric Investigation. 1999; 48:155-157.

11. Barker DJ, Bull AR, Osmond C, Simmonds SJ. Foetal and placental size and risk of hypertension in adult life. British Medical Journal 1990; 301(6746): 259-262.

12. Adinma, J. I. and Agbai, A. O. Foetal birth weight in Africa. Journal of Obstetrics and Gynecology 1995;15(5): 295–297.

13. Lo YF, Jeng MJ, Lee YS, Soong WJ, Hwang B. Placental weight and birth characteristics of healthy singleton newborns. Acta Paediatr Taiwan 2002; 43(1): 21-25.

14. Ohagwu CC, Abu PO, Ezeokeke UO, Ugwu AC. Relationship between Placental Thickness and Growth Parameters in Normal Nigerian Fetuses. African Journal of Biotechnology. 2009; 8(2): 133-138.

15. Yetter JF III. Examination of the Placenta. American family physician, 1998; 57(5): 1045-54.

16. G Meëjus. Influence of placental size and gross abnormalities on intrauterine growth retardation in high-risk pregnancies. Acta Medica Lituanica. 2005; 12(2):14-19.

17. Nobis P, Das U. Placental morphology in hypertensive pregnancy. J Obstet Gynecol. 1991; 41:166–69.

18. Salafia CM, Yampolsky M, Misra DP, Shlakhter O, Haas D, Eucker B, Thorp J. Placental surface shape, function, and effects of maternal and fetal vascular pathology. Placenta. 2010; 31(11):958-62.

19. Malathi, G. and Shanthi, V. Thickness based Characterization of Ultrasound Placenta Images using Regression Analysis. International Journal of Computer Applications, 2010; 3(7): 0975-87.

20. Elchalal U, Ezra Y, Levi Y, Bar-Oz B, Yanai N, Intrator O, Nadari M. Sonographically thick placenta: a marker for increased perinatal risk--a prospective cross-sectional study. Placenta. 2000; 21(2-3):268-72.85.