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## MORPHOLOGICAL STUDY OF HUMAN PLACENTA AND ITS CLINICAL SIGNIFICANCE

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### ABSTRACT

**Background-** Placenta is functionally important, temporarily working organ which is responsible for mother and fetus wellbeing. Proper uteroplacental circulation gives rise to normal and healthy baby. Morphology of placenta is associated with pregnancy outcome. Changes in morphology of placenta may put mother or fetus in danger.

**Materials and Methods:** 174 placentae were obtained from labor room of MGM Hospital. History of mother and baby was obtained from labor room. Placenta and umbilical cords were studied under various parameters. All the parameters of placenta and umbilical cord co-related with birth weight.

**Results:** Positive relationship was observed between gestational age and birth weight. Significant co-relation was observed between length and thickness of umbilical cord, placental weight with birth weight.

**Conclusion:** Placenta reflects the status of mother and fetus. Presence of extra lobe, less weight of placenta, abnormal attachment of placenta give rise to adverse pregnancy outcome. During routine sonography detail morphology of placenta should be studied along with the fetus.

**Key words:** Human Placenta, Morphology, Umbilical cord, Insertion of umbilical cord

## INTRODUCTION

Placenta is a fetomaternal organ and functional unit between mother and fetus which maintains wellbeing of fetus by carrying out important functions. It is temporary organ and it is discoid, deciduate, haemochorial, chorioallantoic, endocrine gland which connects developing embryo by umbilical cord to the uterus.<sup>1</sup> It transports oxygen, nutrients and electrolytes from maternal to fetal blood and waste products like urea and carbon dioxide from fetal to maternal blood. It plays great role in the protection of fetus by acting barrier for harmful substances and providing immunity to the fetus by allowing maternal antibodies travel to the fetus. Different factors like morphology of placenta and its capability to carry out functions of transferring nutrients and waste products are responsible for outcome of pregnancy.<sup>2</sup>

The fetal component and maternal component of placenta are developed from two sources. Chorion frondosum forms fetal component and decidua basalis forms maternal component. Placenta has maternal and fetal surface

where on maternal surface, 15-20 cotyledons are present separated by intervillous septae and insertion of umbilical cord is present on fetal surface. Fetal surface is shiny and covered with chorion and amnion. Most of the times placenta is attached to the superior part of body of uterus reaching fundus with anterior and posterior wall of uterus.<sup>1</sup> During first trimester the growth rate of placenta is faster than growth of fetus but during second trimester similarity in the rate of growth of placenta and fetus is observed. At birth weight of placenta is approximately 500 gms, thickness is 3 cm, and diameter is 15 x 20 cm. Ratio of placental weight to fetal weight in first, second and third trimester is 6:1, 1:1 and 1:7 respectively.<sup>3</sup> Many studies mentioned that normal growth and development of placenta will lead to normal outcome of pregnancy. Placental components like weight, volume and umbilical cord components like point of insertion, length and thickness are seen associated with pregnancy outcome.<sup>4</sup>

Placenta and its measurements have been used as an indicator for not only its growth and development but also of the fetus. Any alteration in morphology of placenta will reflect on fetal wellbeing. Careful examination of placenta helps in judging the environment of uterus for development of fetus before delivery.<sup>5</sup> The study was conducted to find out the association between placental, umbilical cord parameters and birth weight of fetus.

## MATERIALS AND METHODS

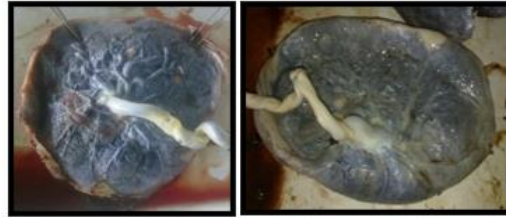
- After ethical and scientific review 174 freshly delivered placenta with umbilical cord were obtained from labor room of MGM Hospital, Kalamboli, Navi Mumbai. The written consent of the patients was taken.
- Details of patient's age, gestational age, haemoglobin were taken. Birth weight was noted.
- The umbilical cord was cut on fetal side by keeping 5cm cord on fetal side. Placenta with umbilical cord kept in 10% formalin was brought to Anatomy department within 2hrs. The deliveries between 8 am to 4 pm were included & others after this timing were excluded from study.
- The tag of details of name of mother, age, gestational week was attached to cord with thread. Placenta was washed under running tap water. Placental parameters like weight of placenta, shape of placenta, calcification of placenta were noted.
- Umbilical cord length was measured with the help of measuring tape.
- The cord thickness was measured with divider & measuring scale.
- The insertion of cord on the placenta was noted.
- Umbilical parameters were correlated with fetal parameters.

## Statistical Analysis

- Statistical analysis was done using the statistical software SPSS version 16.0
- Descriptive analysis consisted of mean with standard deviation (SD) and range for various parameters. Frequencies for categorical data expressed in percentage.
- Continuous variables were analyzed using Pearson Correlation
- Co-relation was considered statistically significant at  $p < 0.05$  (\*) and  $p < 0.01$  (\*\*.)

## RESULTS AND DISCUSSION

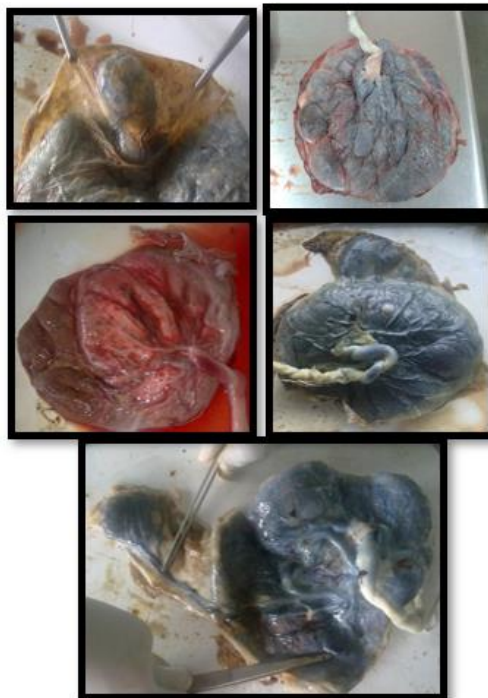
1. Out of 174 placentae, 74 were circular, 54 were oval, 26 triangular, 1 was irregular. In 5 cases placenta succenturiate was found and in 14 placenta extra lobes were found.
2. All placentae showed central and peripheral calcification (photo-1,2)
3. Thickness of umbilical cord ranged from 0.9 cm to 2.2 cm and length of umbilical cord ranged from 40 cm to 68 cm
4. Out of 174 placenta and umbilical cord, in 54 placenta umbilical cord was inserted centrally, in 84 it was in between central and marginal position and in 37 placenta umbilical cord was inserted at margin. (photo5)
5. Out of 174 placenta and umbilical cord, furcate arteries were observed in 18 umbilical cords and remaining 156 placenta showed normal type of insertion of umbilical cord (photo 4)
6. Significant association was observed between gestational age, placental weight, umbilical cord length, umbilical cord thickness and birth weight.



a b  
Photograph 1: shows circular placenta (a) oval placenta (b)



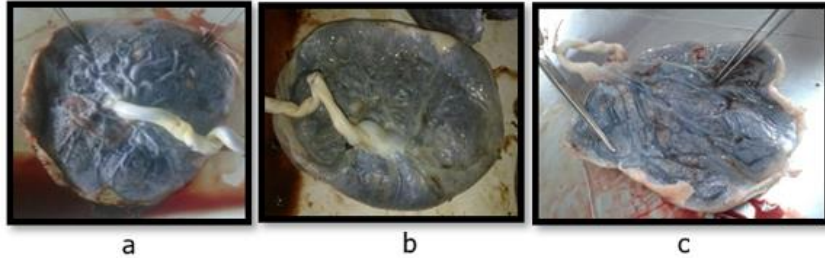
a b c  
Photograph 2: shows trilobed placenta a, multilobed b, triangular c



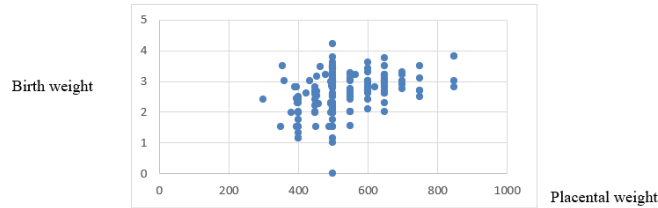
Photograph 3: shows 5 placenta succenturiata



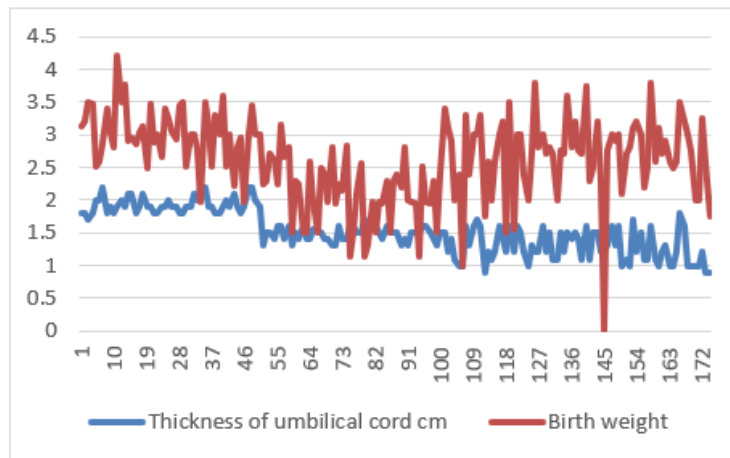
Photograph no 4- Shows furcate umbilical cord insertion



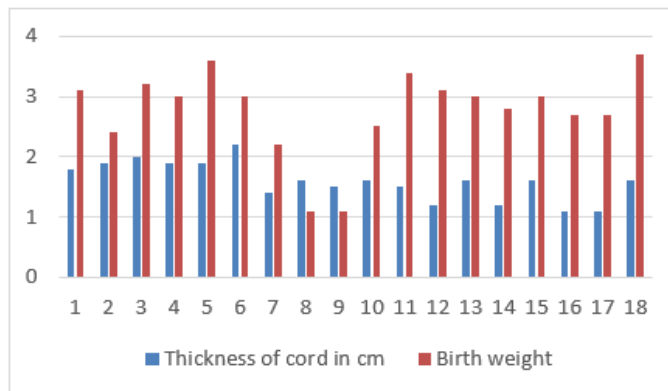
Photograph no 5: Shows insertion of umbilical cord at central (a), eccentric (b), marginal (c) position



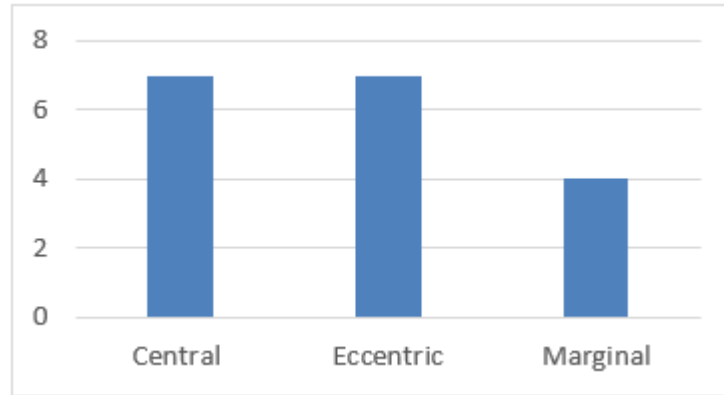
Graph no 1: shows association between placental weight and birth weight



Graph no 2: Association between umbilical cord thickness and birth weight



Graph no 3 - Umbilical cord thickness and birth weight in furcate insertion of cord



Graph no 4: Type of insertion in furcate umbilical cord

Statistical analysis

Table 1

|                         |                     | Age    | Gestational Age (Weeks) | Haemoglobin | Placenta (Wieght gms) | Cord (length cm) | Thickness (cm) | Birth Weight kg |
|-------------------------|---------------------|--------|-------------------------|-------------|-----------------------|------------------|----------------|-----------------|
| Age                     | Pearson Correlation | 1      | -.151*                  | .090        | -.191*                | -.038            | -.009          | -.103           |
|                         | Sig. (2-tailed)     |        | .047                    | .238        | .012                  | .615             | .904           | .177            |
|                         | N                   | 174    | 174                     | 173         | 174                   | 174              | 174            | 173             |
| Gestational Age (Weeks) | Pearson Correlation | -.151* | 1                       | -.015       | .379**                | .226**           | .153*          | .558**          |
|                         | Sig. (2-tailed)     | .047   |                         | .848        | .000                  | .003             | .044           | .000            |
|                         | N                   | 174    | 174                     | 173         | 174                   | 174              | 174            | 173             |
| Haemoglobin             | Pearson Correlation | .090   | -.015                   | 1           | -.073                 | .075             | .135           | .053            |
|                         | Sig. (2-tailed)     | .238   | .848                    |             | .340                  | .329             | .078           | .492            |
|                         | N                   | 173    | 173                     | 173         | 173                   | 173              | 173            | 172             |
| Placenta (Wieght gms)   | Pearson Correlation | -.191* | .379**                  | -.073       | 1                     | .474**           | -.229**        | .396**          |
|                         | Sig. (2-tailed)     | .012   | .000                    | .340        |                       | .000             | .002           | .000            |
|                         | N                   | 174    | 174                     | 173         | 174                   | 174              | 174            | 173             |
| Cord (length cm)        | Pearson Correlation | -.038  | .226**                  | .075        | .474**                | 1                | -.032          | .363**          |
|                         | Sig. (2-tailed)     | .615   | .003                    | .329        | .000                  |                  | .676           | .000            |
|                         | N                   | 174    | 174                     | 173         | 174                   | 174              | 174            | 173             |
| Thickness (cm)          | Pearson Correlation | -.009  | .153*                   | .135        | -.229**               | -.032            | 1              | .366**          |
|                         | Sig. (2-tailed)     | .904   | .044                    | .078        | .002                  | .676             |                | .000            |
|                         | N                   | 174    | 174                     | 173         | 174                   | 174              | 174            | 173             |
| Birth Weight kg         | Pearson Correlation | -.103  | .558**                  | .053        | .396**                | .363**           | .366**         | 1               |
|                         | Sig. (2-tailed)     | .177   | .000                    | .492        | .000                  | .000             | .000           |                 |

|  |   |     |     |     |     |     |     |     |
|--|---|-----|-----|-----|-----|-----|-----|-----|
|  | N | 173 | 173 | 172 | 173 | 173 | 173 | 173 |
| *. Correlation is significant at the 0.05 level (2-tailed).  |   |     |     |     |     |     |     |     |
| **. Correlation is significant at the 0.01 level (2-tailed). |   |     |     |     |     |     |     |     |

## DISCUSSION

The placenta (Greek Word “Plakuos” meaning flat cake) is a unique characteristic of the human mammals which plays noteworthy role in immune and endocrine system in developing foetus. It is involved in transportation mechanism which helps in continuing normal pregnancy.<sup>6,7,8,9</sup> During embryogenesis period placenta starts developing and becomes round or oval shaped organ which is involved in serving important functions for foetal well-being. It has attained tremendous importance during antenatal period as examination of placenta is marker of foetal status. Normal placenta is equal to normal pregnancy outcome is an equation seen most of the times but in 2-4% of pregnancies, adverse outcome is noted which is associated with abnormal placenta. Placenta is routinely neglected unknowingly but attracts attention when there is any abnormality. By keeping aim to find out association between placental parameters and birth weight study was conducted on 174 placentas.

Round and oval placenta is considered as common and typical shape in human beings. It is found round in shape in 93% of cases and oval in 7% of cases<sup>10</sup> while in present study round placenta was observed in 74 (42%) cases, oval was in 54 (31%) cases and triangular in 26 (15%) cases. Abnormalities in the shape, weight may become important contributing factors for adverse pregnancy outcome thus achieve clinical significance.

If one lobe is smaller than the other then the placenta is said to have a succenturiate or accessory lobe. Incidence of placenta succenturiate (PS) is 1%,<sup>11</sup> 1.9%,<sup>12</sup> 0.9%,<sup>13</sup> 1.2%,<sup>14</sup> 1%,<sup>15</sup> 0.7%,<sup>16</sup> 0.6%.<sup>17</sup> Placenta succenturiate is observed associated with emergency caesarean section, preterm birth, fetal growth restriction, placental abruption.<sup>15-18</sup> It is seen associated with retaining of placenta and postpartum infection.<sup>19</sup> Placenta succenturiate is rare condition and it is most of the times missed during trans-abdominal ultrasonography.<sup>20</sup> So while doing antenatal ultrasonography and after the delivery through examination of placenta is of importance. Exact mechanism of development of placenta succenturiate is unclear. There can be development of small cotyledon in the membrane at margin where the vasculature of fetal origin can be retained leading to development of small, single lobe called Placenta succenturiate which means “to substitute” (Latin word).<sup>19</sup> In the present study we have observed placenta succenturiate in 5 cases (2.8%) and in none of the cases placental infarction, retention of placental tissue was observed.

Placenta can be bilobed, trilobed or multilobed with incidence of 0.2%,<sup>11</sup> 0.6%,<sup>21</sup> 1.6%.<sup>22</sup> Two lobes, three lobes or multiple lobes are formed which are of equal or unequal size and these are separated by membrane. Insertion of umbilical cord may on any lobe or in the membrane. Formation of lobes are not seen associated with adverse pregnancy outcome.<sup>23</sup> In the present study we have found trilobed placenta in 2 cases (1.1%) and irregular placenta in 1 case which was associated with normal pregnancy outcome.

Weight of placenta is a good predictor and indicator of weight of the fetus. It is directly proportional to weight of the fetus so it is acting as a pillar. Average weight of placenta at term is approximately 500 grams. Many studies showed positive correlation of weight of placenta and birth weight<sup>24, 5, 25</sup>. Increased or decreased placental weight is seen associated with adverse maternal and fetal outcome. Increased placental weight is linked to poor perinatal outcome, respiratory distress syndrome and perinatal death while decreased placental weight is related to maternal complications<sup>5</sup>. Careful and detail examination of placenta in prenatal period gives insight to growth of fetus before delivery. In the present study there is positive relation between placental weight and birth weight was found. The mean placental weight was 529 grams with range from 300-850 grams. These findings are similar to study where average placental weight was 590±82 ranging from 300-890 grams.<sup>5</sup>

Umbilical cord is considered as lifeline of the developing fetus which is composed of two umbilical arteries and one umbilical vein with Wharton’s Jelly all around. It is involved in transportation of nutrients from placenta to developing fetus after inserting on the fetal side of the placenta. Parameters of umbilical cord like umbilical cord length, thickness and insertion is seen associated with birth weight. Visualisation of umbilical cord during antenatal period is technically difficult and challenging but at the birth the parameters of cord can be studied in detail. Average length of umbilical cord is 45-68 cm<sup>26</sup> and thickness is 1.5-3 cm.<sup>27</sup> Long and short umbilical cords are seen associated with adverse pregnancy outcome. Various studies documented long cord as >74 cm and short cord as <38 cm,<sup>26</sup> > 80 cm and < 35 cm,<sup>28</sup> > 70 cm and < 40 cm.<sup>29</sup> The prevalence of long cord is 3.8% and short cord is 4.9%.<sup>29</sup> In the present study the length of umbilical cord ranges from 40 cm to 67 cm with average length 53 cm. Studies documented that long umbilical cords are related to birth weight, respiratory distress.<sup>30</sup> while short umbilical cord is co-related with adverse pregnancy outcome like fetal distress, congenital anomalies and death.<sup>29</sup> It was observed that the average thickness of umbilical cord / umbilical cord diameter is 1.5 cm.<sup>31,32</sup> in male new born it is 1.15 cm and in female new born it is 1.09 cm.<sup>27</sup> Significant co-relation was found between umbilical cord thickness / diameter with birth weight.<sup>27,31,32</sup> In the present study strong and significant positive co-relation was observed in umbilical cord length, thickness and birth weight. More the thickness / diameter of umbilical cord more is the size of vessels which provide optimum amount of blood to developing fetus which gives rise gain in birth weight.<sup>27</sup>



Umbilical cord is inserted on the fetal side of placenta. These insertions can be in the central part of placenta or at margin or in between them (eccentric). Sometimes the insertion of umbilical cord is seen on the membranes where it is called as velamentous type of insertion. The insertion of umbilical cord is dependent on the implantation of the blastocyst.<sup>24</sup> Various studies showed different types of insertions of umbilical cord like central 58 %, eccentric 20%, marginal 20% and velamentous 2%,<sup>33</sup> central 24% eccentric 66%, marginal 8% and velamentous 2%,<sup>34</sup> central 32% eccentric 57%, marginal 8.9% (35) while in the present study central insertion of umbilical cord was found in 31%, eccentric 48 % and marginal was found in 21% of cases. Sometimes separation of umbilical vessels is seen before the insertion of umbilical cord on the placenta. Such rare, asymptomatic and dangerous entity is termed as furcate cord insertion. The incidence is 0.16%,<sup>36</sup> 0.1%.<sup>37</sup> while in present study it is 10%. Because of early separation the umbilical vessels lose the sheath of Wharton's jelly and prone for injury, aneurysmal changes, thrombosis, hemorrhage and rupture of vessels.<sup>38,39</sup> It is also documented that outcome of furcate cord insertion is good but intrauterine death can happen in 1.02% cases.<sup>36</sup> Identification of furcate cord insertion can be done prenatally.<sup>38</sup> and so by taking proper care risk of injury to umbilical vessels can be minimized. In the present study average thickness of umbilical cord is 1.5 cm and average birth weight is 2.5 kg. Furcate cord insertion is seen in central position in 7 cases, eccentric in 7 cases and at marginal in 4 cases. In all the cases furcate cord insertion is not related to adverse pregnancy outcome.

**Conclusion:** Placental and umbilical parameters are of utmost importance and clinically relevant. Any alteration in their dimensions would lead to adverse pregnancy outcome. Meticulous examination, identification and interpretation of altered parameters can reduce or prevent adverse pregnancy outcome.

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