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Morphological Variations of Placenta in South Coastal Andhra Pradesh

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Abstract: ***Introduction: Placenta is the most important endocrine organ with intimate relation to foetus. It is the functional center of the maternal-foetal system and is responsible for respiratory, nutritional, excretory, endocrine, and immunological functions. Aim: To determine the morphometry of placenta and its variations. Materials And Methods: The present study consists of 100 Placentae with Umbilical Cords attached were collected from the GGH, Department of Obstetrics and Gynaecology. Before the study the permission was taken from the Institutional Ethical Committee and Head of Obstetrics and Gynaecology. Exclusion criteria HIV +ve, HbS Ag +ve cases were excluded. In the Inclusion criteria all the Placentae of full term delivered who has attended to GGH, Labour room. Results: Parameters like Weight, Shape, diameter, thickness, Number of Cotyledons, Length, and Contents of the Umbilical Cord along with blood vessels supply to Umbilical Cord were measured for 100 placentae. Conclusion: The higher incidence of normal weight of placenta is 513gms with the range of 350gms to 850gms. The incidence of shape of placenta is 83% round, 17% oval. The thickness of the placenta is 7.3 inches. The average numbers of maternal cotyledons are 19.5 (mean) with the range of 11-36. The length of umbilical cord ranges from 40 - 70cms. 39% cords are in the range of 30-61cms because of the irregular cutting of the umbilical cord at the baby end, so length of the umbilical cord will be altered.***

Keywords: Placentae, Umbilical Cords, Number of Cotyledons and Umblical artery

1. Introduction

Placenta is the most important endocrine organ with intimate relation to foetus. It is the functional center of the maternal-foetal system and is responsible for respiratory, nutritional, excretory, endocrine, and immunological functions [1].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. The examination of the placenta in utero as well as postpartum, gives valuable information about the state of the foetal well-being [2].It is a vital organ for maintaining pregnancy and promoting normal foetal development. Proper vascular development in the placenta is fundamental to ensuring a healthy foetus and successful pregnancy [3]. Placenta is actually a window providing insight vision for understanding maternal dysfunction and its impacts on foetal well-being [4, 5, 6]. It depicts accurate record of prenatal experience of an infant, along with it undergoes different changes in weight, volume, structure, shape and function continuously throughout the gestation to support the prenatal life[7]. At term 4/5th of placenta is of foetal orgin and 1/5th is of maternal origin. The foetal surface is covered by smooth and glistening amnion with the umbilical cord attached at the center. Branches of the umbilical vessels are visible beneath amnion, as they radiate from the insertion of the cord. Margins of the placenta are limited by the fused basal and chorionic plates and are continuous with the chorion and amnion. The principal component is foetal, which develops from chorion frondosum and the maternal component consists of decidua basalis. The placenta at term is a circular disc with a diameter component of 185mm and thickness of about 2.5cm at its center feels spongy and weight about 500gms. The proportion of the weight of the baby roughly 1:6 at term and occupies about 30% of uterine wall[8]. The maternal surface is finely granular mapped into 15-30 convex polygonal areas called lobes or grooves by series of fissures are called cotyledons. The maternal blood gives a dull red colour, numerous small grayish spots are seen due to deposition of calcium in the degenerated area and of no clinical importance [9]. Information on placental size, shape, consistency, completeness of the placenta, presence of accessory lobes, placental infarcts, haemorrhage, and tumors may be important to the care of both mother and infant the placenta is a complex multifunctional organ of mainly foetal origin with pleiotropic roles during foetal growth. It has a portion derived from the developing embryo and a maternal portion formed by the modification of the uterine lining of the mother. The placenta comprises a large number of functional units called villi which contains branched terminals of the foetal circulation allowing transfer of metabolic products[10]. At term the normal umbilical cord is about 55-65 cm in length with a diameter of 2.0 - 2.5 cm which normally insert centrally or eccentrically on the foetal side of the placenta[11]. It provides the means by which oxygen, carbon dioxide, steroids and other products are carried to and from the foetus, and it also allows free movement of the foetus within the uterus and protects the umbilical blood vessels from mechanical injury[12].

2. Materials and Methods

The study was carried out in Department of Obstetrics and Gynaecology, Guntur medical college over the period of 2012-2015. During this period we collected totally 100

Placentae with Umbilical Cords from the Department of Obstetrics and Gynaecology in GGH. The study protocol was approved by the Institutional Ethical Committee and Head of Obstetrics and Gynaecology before commencement.

- **Exclusion criteria**: HIV +ve, HbS Ag +ve cases were excluded.
- **Inclusion criteria:** All the Placentae of full term delivered who has attended to GGH, Labour room.
- In all cases after separating the baby from Umbilical Cord, the specimens were tagged with number and placed in a container of 10% formalin. Samples were picked up and washed clean of blood and stored again in a solution of 10% formalin for further detailed examination.

In the collected placenta the following parameters were studied on gross examination:

1) **Weight:** Measured using Paediatric weighing machine.
2) **Shape:** The shape of the placenta and the presence of accessory lobes were recorded
3) **Diameter:** The placenta was placed in a flat tray after trimming. Diameter was measured with a metallic scale graduated in centimetres. Then the second maximum diameter was taken at right angles to the first one. The mean of the two measurements is considered to be the diameter of the placenta expressed in centimetres.
4) **Thickness:** Thickness of placenta is measured using the Wernier calipers
5) **Number of Cotyledons:** Each formalin fixed placenta was taken on both the hands.. Then the counting was started from the left side of one end of the placenta going right ward and again turning back to the left in a manner of loop. This counting procedure was repeated until the other end of the placenta was reached. The total numbers of cotyledons were recorded.

Gross examination of the umbilical cords:

- **Umbilical Cord Length:** Umbilical cord length is measured by the help of standard tape measure. A cord of roughly 5 or 6cms of length leaving along the baby and the remaining length of the umbilical cord to the placental end was measured.Cords are grouped into three depending on the basis of cord length. Length less than 40 cm, between 40 and 70 cm and greater than 70 cm as short, normal and longer than normal respectively. All measurements were done in centimetres (cm) using a standard tape measure.
- **Umbilical Cord diameter:** Umbilical cord diameter is measured by the help of standard tape measure. It is usually about 2.5 cm.
- **Insertion of umbilical cord into the placenta:** As Centric, Eccentric or Marginal or Velamentous.
  a) Central Insertion: The Umbilical Cord is attached to the placenta at it center.
  b) Eccentric Insertion: The Umbilical Cord is attached between the center and margin or the Placenta.
  c) Marginal Insertion: The Umbilical Cord is attached to the placenta at its margin.
- **Contents of the Umbilical Cord:** Number of vessels was determined by making a cross-sectional incision at the tip of the foetal end of the cord and counting the vessels from the surface.
- **Arrangement of Blood Vessels on the foetal surface:** Careful dissection on foetal surface was carried out by took at most care to avoid injury to the vessels. The type of arrangement of blood vessels is either disperse or magistral.
  a) Disperse: The Umbilical arteries divide in dichotomous manner and undergo successive reduction in caliber.
  b) Magistral: The Umbilical arteries maintain almost uniform caliber up to the periphery of the placenta and give off a number of smaller side branches.

To find out the weight, shape, Thickness and diameter of the Placenta, number of cotyledons and lobes with reference to the maternal surface as well as find out the site of insertion to umbilical cord with reference to the Foetal Surface. To know the thickness and length and contents of the Umbilical Cord along with know the distribution of blood vessels with reference to the Foetal Surface. Analyze and compare the data with previous studies.

3. Results

Placenta

1) **Weight of placenta**: The total number of 100 placentae was studied, which ranges from 350 gms to 850 gms with mean± SD of 513g ±94.50 (Figure – 1)
2) **Shape of Placenta**: In the whole series of 100 placentae, 83 had round, 17 had oval (Figure – 2).
3) **Thickness of Placenta**: Out of 100 placentae, this ranges from 1cm to 3.5cm with mean of 1.77cm and SD 0.59. Out of which 46 were in the range of 1.1cm to 1.5cm, 22 were in the 1.6cm to 2cm, 18 were in 2.1cm to 2.5cm, 10 were 2.6cm to 3cm, 4 were in the 3.1cm to 3.5cm ± 0.59. (Figure– 3).
4) **Diameter of Placenta**: In the whole series of 100 placentae, which ranges from 5.5 inches to 9 inches with a mean± SD (7.30 ± 0.76) (Figure – 4).
5) **Number of Maternal Cotyledons**: Out of 100 placentae, which ranges from 11 to 36, with mean ± SD (19.50 ±4.71) (Figure – 5).
6) **Number of Lobes**: Total numbers of 100 placentae, the No of Lobes are 1% i.e placenta succenturiata. (Figure – 6)
7) **Umbilical Cord :** Length of Umbilical Cord: The total No 100 Placentae with attached umbilical cord was studied which ranges from 7 cms to 61 cms and mean ± SD of (27.70 ± 10.66) (Figure – 7)
8) **Diameter of Umbilical Cord**: In whole series of 100 placentae, this ranges from 0.5 cms to 2 cms with mean ± SD(0.93± 0.28) (Figure– 8)
9) **Attachment of Umbilical Cord**: Out of 100 Placentae, of which 36 attached to central, 55 are ecentric, 9 are marginal, and no velamentous attachment. (Figure – 9)
10) **Contents of Umbilical Cord**: In the whole series of 100 placentae with attached umbilical cord examined, 2 placentae contain single umbilical artery and single umbilical vein. The remaining 98 placentae contain two umbilical arteries and single umbilical vein. (Figure – 10)
11) **Arrangement of blood vessels**: The total number of 100 placentae with attached umbilical cord examined, the foetal surface show 70% disperse pattern and 30% show magistral pattern (Figure – 11)

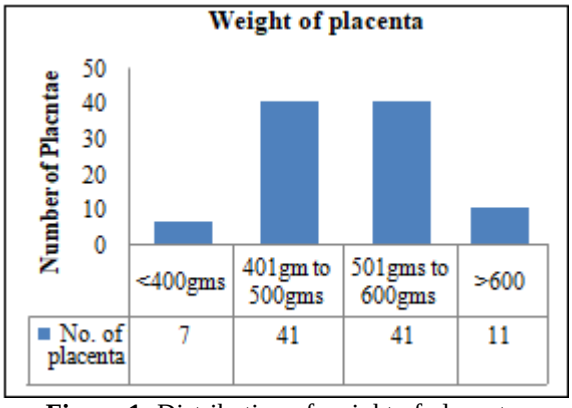

Figure 1: Distribution of weight of placenta

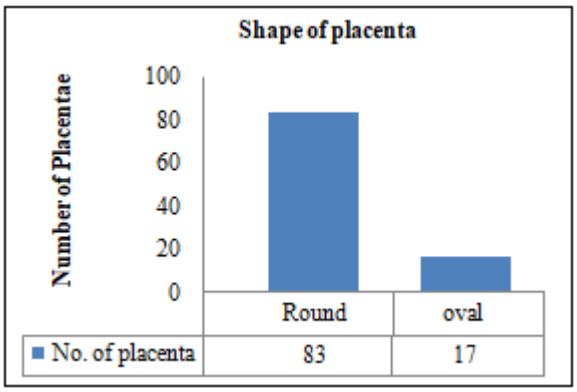

Figure 2: Distribution of shape of Placentae

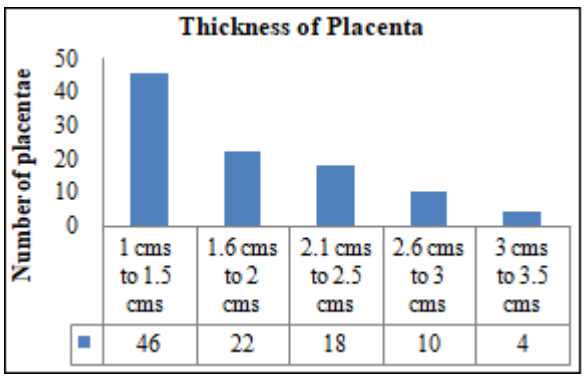

Figure 3: Percentage distribution of thickness of placentae

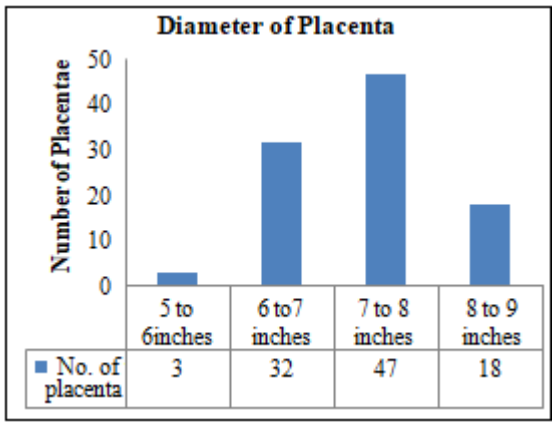

Figure 4: Percentage distribution of diameter of placentae

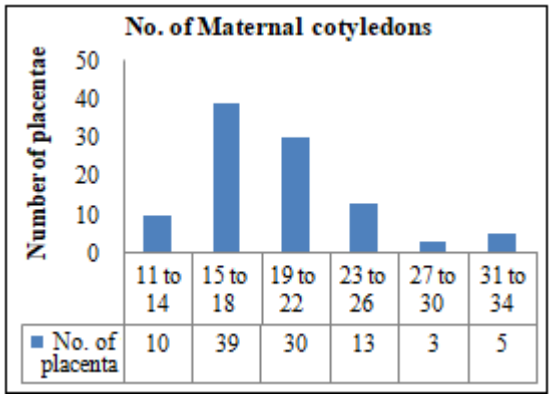

Figure 5: Percentage distribution of No of maternal cotyledons in the placentae

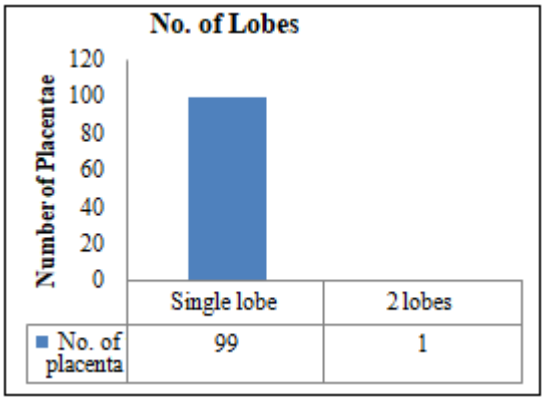

Figure 6: Percsentage distribution of No of lobes in the placentae

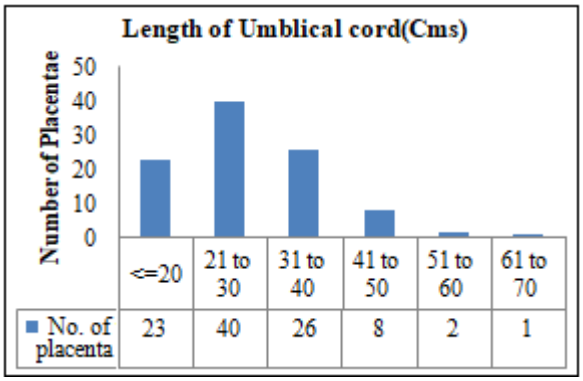

Figure 7: Distribution of Umbilical cord length

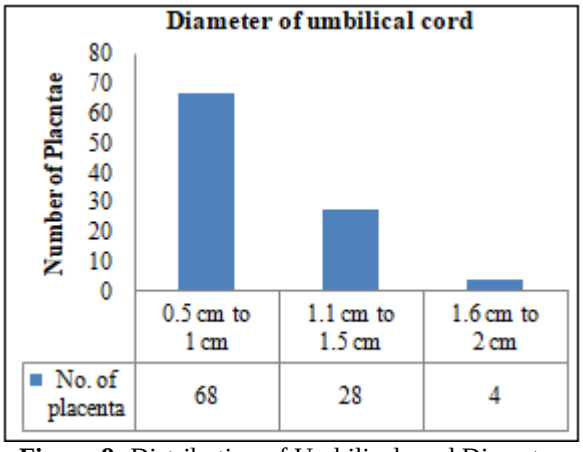

Figure 8: Distribution of Umbilical cord Diameter

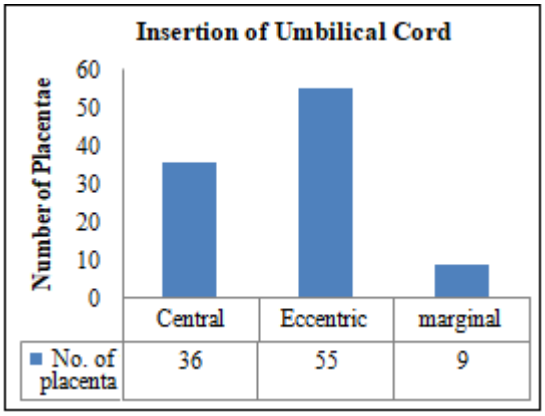

Figure 9: Distribution of Insertion of umbilical cord

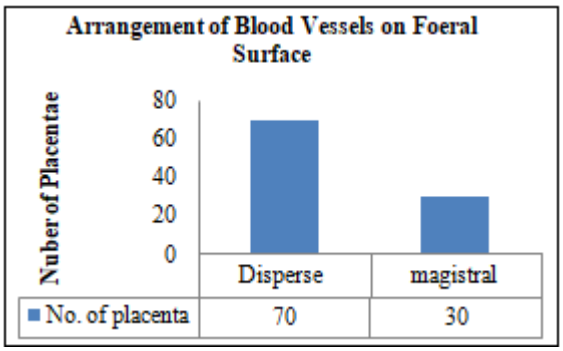

Figure 11: Distribution of No. of umbilical arteries & Vein

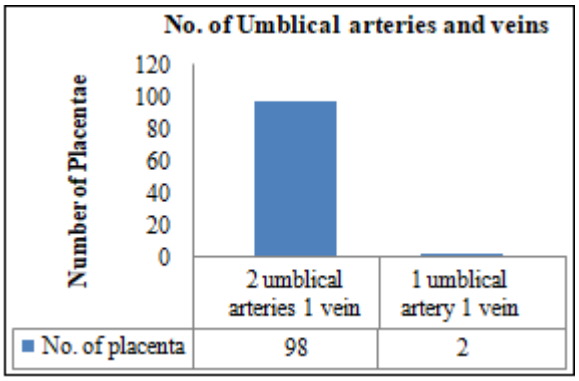

Figure 10: Distribution of Umbilical arteries and veins

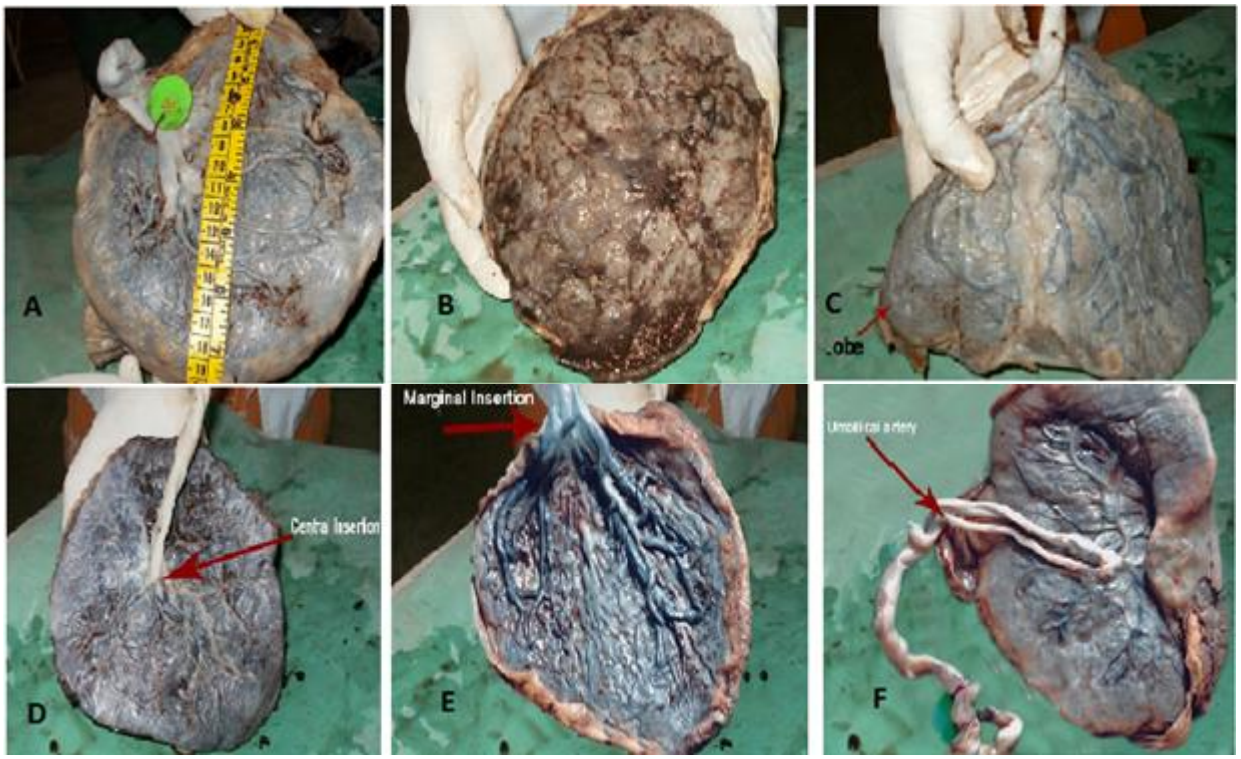

Figure 12: Morphological findings in the placentae (a) Measuring the diameter with the help of tape, (b) Maternal cotyledons in the placentae, (c) Placenta Succenturiata (d) Central Insertion of Umbilical cord in placentae (e) Marginal Insertion of Umbilical cord in placentae (f) Presence of single umbilical artery

4. Discussion

Placenta is a complex organ with intimate relation to foetus. It is the functional centre of the maternal-foetal system and is responsible for respiratory, nutritional, excretory, endocrine, and immunological functions. Most of the authors stated that the examination of the placenta in utero as well as postpartum, gives valuable information about the state of the foetal well-being. In the present study the weight of the placenta, in all specimens is coinciding with the

descriptions of authors mentioned below. Number studies were done on weight of placentae and average weight of (485.85 ± 47.31) [13,14,15,16,17], in present studies we found that average weight of 513 gms (mean) and minimum of 350 and maximum weight 850gms, with SD ± 94.50. Weight of Placenta is used in the determination of the foeto-placental ratio. The weight of placenta is gives more about the substances which are exchanged between the mother & foetus. The weight of placenta has a significant correlation with weight of the baby. In our present study is correlate with the above authors and it is nearly coinciding with the above authors [18]around within the range.

Majority of authors Stated that shape of the placenta is disc shaped with circular or oval. In these research studies out of 100, 83 were in round in shape and it was correlated with the authors as well few authors suggested that shape of placente is disc it is also seen in 17[19, 20, 21, 22]. Thickness of the placenta may give indirect information on the foetal-placenta ration. It may give an indication of the amount of nutrients; gases are exchanging between the mother and foetus. Thickness of placenta correlated significantly with the weight of the foetus. However number of studies stated that length of placentae is ranging from 13 to18cm, we found that length of placentae is 1.77± 0.59 by measuring with tape. The positive correlation between the placental thickness and the weight of the baby indicate that the factors which directly affect the weight of the baby will indirectly affect the placental thickness. These factors include nutrition, maternal genetics, maternal haemoglobin concentration gain, altitude. The diameter of the placenta may give an idea about the size of the placenta which may intend give indirect information about the foetal-placental ratio. The diameter of the placenta will affect the amount of nutrients, oxygen and carbon dioxide that will pass from the mother to the child and vice versa. The positive correlation between the placental diameter and the weight of the baby, the head circumference of the baby and the length of the baby indicate that the factors, which directly affect the weight of the placenta will indirectly affect the diameter of the placenta. The difference in placental diameter may be due to nutrition, maternal size, maternal and paternal genetic constitution and altitude. The present study highly correlated with the authors [23, 24,25, 26,] according to author [27] our study is correlated with 4% cases.

A paucity of cotyledons was observed in cases of PIH, prematurity and low birth weight babies'. The present study nearly correlated with the authors [28, 29, 30, 31,] within range. Our study is nearly correlated with the authors, as per author the normal cord length is in the range of 40 to 70 cms, although it is not fully understood what controls cord length, various authors correlate cord length with foetal activity and movement. It is suggested that sufficient space in the amniotic cavity for movement and the tensile force applied to the umbilical cord during foetal movements are two main factors that determine cord length.

In the present study the mean± SD (27.70 ± 10.66cms) we found that the minimum cord length is 7cms and maximum of 61cms. Majority of authors found that length of cord is 32 – 60cms, our results were not correlated authors, only 12% are within the range of 40 – 65cms.It is may be irregular cutting of umbilical cord at the baby end during birth.

According to previous studies on cord diameter ranges of 1 to 3 cms can suggest oedema, tumour or hernia and that, cords with circumference greater than 6 cm should prompt an examination of the umbilical cords and foetuses. The cord diameter correlated positively with birth weight and head circumference but not baby length and gestational age. These study highly correlated with previous studies. Intrapartum hemorrhage, foetal bradycardia, stillbirth, intrauterine growth restriction (retardation), twin-to-twin transfusion syndrome, and preterm labour have all been linked to velamentous and, to a lesser extent, marginal cord insertions. Insertion of umbilical into placntae was found two types, in that majorly Central insertion are found , 9 cases marginal insertion of the umbilical cord is also observed. In these study 98 placentae were had shown two UA is nearly correlated with the reasecher one UA is nearly coinciding with the few studies. Study of vascular pattern of placenta gives information for the distribution of Blood vessels, it helps us to know the foetal status in case of abnormal umbilical artery resistance to blood flow our study is nearly correlated with the authors.

5. Summary and Conclusion

In this study, the higher incidence of normal weight of placenta is 513gms with the range of 350gms to 850gms. The incidence of shape of placenta is 83% round, 17% oval. The thickness of the placenta is 7.3 inches. The average numbers of maternal cotyledons are 19.5 (mean) with the range of 11-36. The length of umbilical cord ranges from 40 – 70cms. 39% cords are in the range of 30-61cms because of the irregular cutting of the umbilical cord at the baby end, so length of the umbilical cord will be altered. Because of this reason, the umbilical cord length parameter will not correlate the normal range. The average diameter of the umbilical cord will be 0.93cms with a range of 0.5 - 2cms. In present study the combined incidence of central/eccentric insertion of placenta is 91%. This shows the umbilical cord is commonly and best positioned central / eccentral.

The incidence of single umbilical cord arteries is 2% that indicates the single umbilical arteries are associated with foetal anomalies than normal cords. 20% infants with single umbilical artery are reported with cardiovascular abnormalities, gastrointestinal tract defect, esophageal atresia and renal defects. The incidence of arrangements of blood vessels are 70% disperse and 30% magistral pattern, study of vascular pattern of placenta will help to know the pathophysiology of twin to twin toxic syndrome (TTTS) & developmental anomalies. The well being of the foetus is highly dependent on the placenta, since it serves as a link between the mother and the developing foetus for nutritional support, excretory functions as well as immunological, hormonal support43. Large placentae provide large surface for the exchange of substances from the mother to the foetus resulting in high foetal weight. The best indicator of foetal weight is related with the placental weight. Detailed examination of the placenta and umbilical cord immediately after delivery should be used to determine the well-being of the baby.

6. Acknowledgment

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