

MORPHOLOGICAL STUDY OF UMBILICAL CORD AND ITS EMBRYOLOGICAL SIGNIFICANCE

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ABSTRACT

Background: Knowledge about the morphometric measurement of the umbilical cord is important for better perinatal outcome.

Materials and Methods: A total of 50 placentas with umbilical cord were collected from the Department of Obstetrics and Gynaecology in the Government Rajaji Hospital, Madurai. The study was conducted in the Institute of Anatomy, Madurai Medical College, Madurai. The length of the cord, diameter of the cord, cord coiling, presence of knots, vascular pattern and its microscopic structure were studied.

Results: In the present study the total length of the umbilical cord from the fetal end to placental end were measured. The maximum length was 73.4cm and minimum length was 43.4cm. The maximum transverse diameter of the cord at fetal end was 1.4cm and minimum was 0.7cm. The maximum transverse diameter of the cord at placental end was 1.7cm and minimum was 1.2cm. The coiling of the cord was observed. Hypocoiling of the cord was seen in 70%, hypercoiling in 24% and straight in 6%. The coiling manner was also studied. Anticlockwise coiling was seen in 78%, clockwise coiling was seen in 16% and coiling was absent in 6%. In hypocoiling umbilical cord the maximum coiling index was 0.12 and minimum was 0.08. In hypercoiling umbilical cord the maximum coiling index was 0.18 and minimum was 0.14. The false knots were seen in 32%, absence of knots in 68% and true knots were not observed. Three vessel patterns were observed in all 50 umbilical cord specimens. The magistral type of vessel pattern was present in 62% and dispersal type was seen in 38%. Microscopic structure of cord at the fetal end and placental end were coincides with the standard textbook description.

Conclusion: Knowledge about the variation in the morphometric measurements of umbilical cord is important for sonologists, obstetricians and pediatricians for preventing the intrauterine death and various abnormalities.

KEYWORDS: Umbilical cord, Coiling of the cord, Length of the cord, Vascular pattern.

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INTRODUCTION

The umbilical cord is the linkage between the fetus and mother. It initially presents as connecting stalk at the caudal end of embryo

before folding, later shifted to ventral surface of embryo to umbilical ring after folding of the embryo. The umbilical cord is lined by fetal membranes and the main constituents are

extra embryonic mesoderm containing the extra embryonic coelem. The contents of umbilical cord are left umbilical vein, right and left umbilical arteries with differentiation of nerves in the extra embryonic mesoderm. The allantois and vitello- intestinal duct are incorporated at its fetal end. The fetus and the mother are communicated through the umbilical cord and through which the nutrients and all other metabolic exchanges in the fetus occurs. The length of the fully developed umbilical cord is 50cm but the length varies from 20-120cm and the diameter is 1-2cm [1]. In this modern era the complication during delivery of the fetus, any malformation of the fetus, prenatal and postnatal complications in mother are attributed to the umbilical cord abnormalities and its variation.

Any variation in length, vessels pattern may lead to intrauterine death and other abnormalities like renal aplasia, congenital trachea esophageal fistula and chromosomal abnormalities.

MATERIALS AND METHODS

A total of 50 placentas with umbilical cord were collected from the Department of Obstetrics and Gynaecology in the Government Rajaji Hospital, Madurai. The study was conducted in the Institute of Anatomy, Madurai Medical College, Madurai. The length of the cord, diameter of the cord, cord coiling, presence of knots and the vascular pattern were studied. The length of the cord was measured from the cut end of the cord upto its placental attachment and with this reading 10cm was added for the umbilical cord which was uniformly left towards fetal end. The transverse diameter of the cord was measured with the help of thread by taking one reading at the fetal end and another reading at placental end. The presence of cord coiling, presence of true and false knots was also observed. The coiling index was calculated by dividing the total number of coils by the length of umbilical cord. Vascular pattern was studied by Indian Ink injection method. The microscopic structure of cord at the placental and fetal end was studied by routine processing and Haemotoxylin & Eosin staining method.

OBSERVATIONS

In the present study the total length of the

umbilical cord from the fetal end to placental end were measured. The maximum length was 73.4cm (Fig-1) and minimum length was 43.4cm. The maximum transverse diameter of the cord at fetal end was 1.4cm and minimum was 0.7cm. The maximum transverse diameter of the cord at placental end was 1.7cm and minimum was 1.2cm. The coiling of the cord was observed. Hypocoiling of the cord was seen in 70%, hypercoiling in 24% (Fig-2) and straight in 6%. The coiling manner was also studied. Anticlockwise coiling was seen in 78%, clockwise coiling was seen in 16% and coiling was absent in 6%. In hypocoiling umbilical cord the maximum coiling index was 0.12 and minimum was 0.08. In hypercoiling umbilical cord the maximum coiling index was 0.18 and minimum was 0.14. The false knots were seen in 32% (Fig-3), absence of knots in 68% and true knots were not observed. Three vessel patterns were observed in all 50 umbilical cord specimens. The magistral type of vessel pattern was present in 62% and dispersal type was seen in 38% (Fig-4). Microscopic structure of cord at the fetal end and placental end were coincides with the standard textbook description (Fig-5, Fig-6).

Table 1: Length of the umbilical cord.

Umbilical cord length	In cms
Maximum	73.4
Minimum	43.4
Average	54.5

Table 2: Diameter of the umbilical cord.

Diameter of the cord	At Fetal End	At Placental End
Maximum	1.4cm	1.7cm
Minimum	0.7cm	1.2cm
Average	1.1cm	1.5cm

Table 3: Coiling of the umbilical cord.

Coiling of the cord	Number of specimens	Percentage
Hypocoiling	35	70%
Hypercoiling	12	24%
Straight	3	6%

Table 4: Coiling manner of the umbilical cord.

Coiling Manner	Number of specimens	Percentage
Anti clock wise	39	78%
Clock wise	8	16%
Absence	3	6%

Table 5: Cord Coiling Index.

Coiling Index	Hypo-coiled Cord	Hypercoiled Cord
Maximum	0.12	0.18
Minimum	0.08	0.14
Average	0.01	0.014

Table 6: Vessel pattern in the umbilical cord.

Type of vessel pattern	Percentage
Magistral	62%
Dispersal	38%

Fig. 1: Shows long umbilical cord.

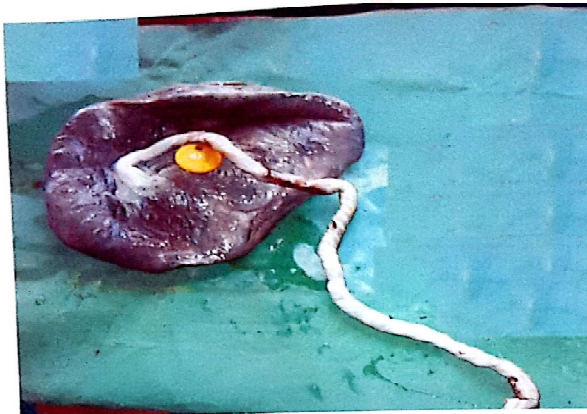


Fig. 2: Shows umbilical cord coiling.

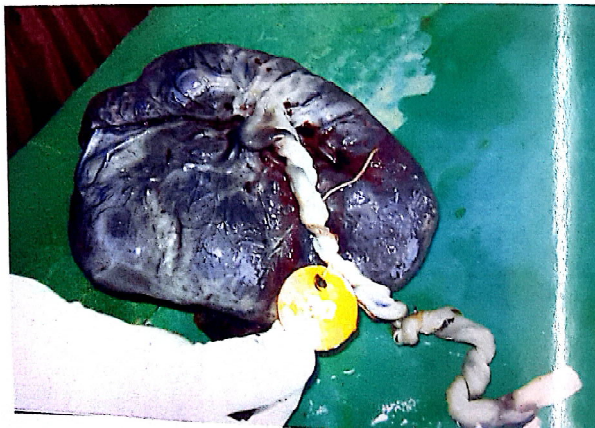


Fig. 3: Shows false knot.



Fig. 4: Shows umbilical vessels.



Fig. 5: Shows the microscopic structure of umbilical cord at the fetal end.

Fetal End

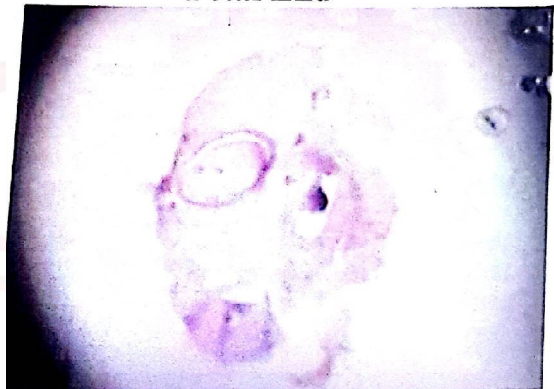
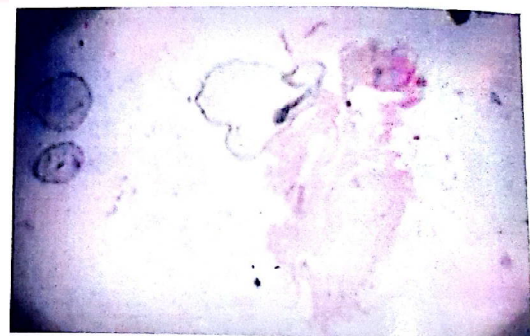


Fig. 6: Shows the microscopic structure of umbilical cord at the placental end.

Placental End



DISCUSSION

According to Standring in Gray's Anatomy 40th edition the mean length of the cord is 50cm. But the length may vary from 20 to 120cm [1]. According to Shunji Suzuki et al, the normal length of the umbilical cord was 45-68cm. the maximum length was greater than 74cm and minimum length was less than 34cm in Japanese singleton deliveries[2]. Baergen et al stated that the mean length of the umbilical cord was 37cm [3].

In the present study the maximum length was 73.4cm, minimum length was 43.4cm and mean length was 54.5cm which was coinciding with the above studies.

According to Standring in Gray's Anatomy 40th edition the diameter of the umbilical cord is 1-2cm [1]. In the present study the maximum diameter of the cord was 1.4cm and minimum length was 0.7cm. At the placental end the maximum diameter was 1.7cm and minimum was 1.2cm coincides with the author's description. Strong et al stated that significant outcome of various fetuses with meconium staining, preterm birth and fetal distress with hypocoiled cords and the non coiled cords were seen in 4 to 5% [4]. According to Machin et al the hypercoiled cords were seen in 21% and hypocoiled cords were seen in 13% [5].

In the present study the hypocoiled cord was seen in 70%, hypercoiled cord in 24% and straight in 6% coincides with above studies.

According to Jones there were 4 true cord knots. In the present study no such true knots were observed [6]. Heifetz stated that single umbilical artery was observed in 1% of cases [7]. According to Benirschke et al the incidence of single umbilical artery was 1% of the twins [8]. Philippe stated that the single umbilical artery was present in 0.2 to 1% in singleton pregnancy and 6 to 11% in multiple pregnancy. In the present study three vessel patterns were observed in both fetal and placental end.

According to Ranjana et al the vascular pattern were studied in 200 placentas and observed that the magistral type was present in 37% and dispersal type was present in 63% [9]. In the present study the magistral type was present in 62% and dispersal in 38%.

According to Shalu Gupta et al, in 107 placental specimens the mean umbilical cord index was 0.13 ± 0.08 . Anticlockwise coils were seen in (76.6%) cases while clockwise coils were seen in (17.8%) cases and no cord coiling in 6% of cases [10]. In the present study the mean coiling index was 0.01 in hypocoiled cord and 0.014 in hypercoiled cord. Anticlockwise coils were seen in 78%, clockwise coils in 16% and absence of coils in 6% which coincides with above studies.

CONCLUSION

Knowledge about the variation in the morphometric measurements of umbilical cord is important for sonologists, obstetricians and pediatricians since any variation in length, vessels pattern may lead to intrauterine death and other abnormalities like renal aplasia, congenital trachea-esophageal fistula and chromosomal abnormalities. Antenatal detection of coiling index is important in identifying the fetus that is at risk during delivery. Since low coiling index is an indicator of adverse perinatal outcome. It can be associated with low apgar score, meconium staining and pregnancy induced hypertension.

Conflicts of Interests: None

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