

Morphological Study of Human Umbilical Cord

Ishrat Jahan^{1*} Md. Ashrafuzzaman² Md. Shaikul Islam³ Md Saiful Islam⁴ Md. Habib Khan⁵

ABSTRACT

Background: Umbilical cord is an important organ of the fetus. Morphological variation in the umbilical cord might have effect on the wellbeing of the fetus. Detailed morphological knowledge is essential to provide baseline data on the morphological variation of human umbilical cord.

Materials and methods: Present study was conducted in 60 human umbilical cord specimen collected from the Department of Obstetrics and Gynaecology, Chittagong Medical College Hospital under the Department of Anatomy, Chittagong Medical College from August 2012 to July 2013. All samples were studied morphologically.

Results: All sixty cords had two arteries and one vein without any knot. They showed central mode of insertion in 76.6% (n = 46) cases, intermediate insertion in 16.7% (n= 10) and in 6.7% (n = 4) marginal mode of insertion. The mean longitudinal and transverse diameter were 9.86 mm and 7.88 mm with a range of 5.98-14.60 and 5.00-13.40 mm respectively. The mean diameter was 8.87 mm with a range of 6.20-12.39 mm.

Conclusion: Different morphological features of the human umbilical cord showed similar accord with the other researchers.

Key words: Umbilical cord; Morphology; Placenta; Fetus.

INTRODUCTION

The umbilical cord is a gate way between the developing fetus and the placenta. It is a long cord like structure by which fetus is attached to the uterine wall via placenta which connects umbilicus of a fetus to the center of fetal surface of the placenta. It is covered by glistening amniotic membrane. At full term, one end of this cord is attached to the center of anterior abdominal wall of fetus [Umbilical region] and the

1. Assistant Professor of Anatomy
Rangamati Medical College, Rangamati, Bangladesh.
2. Professor of Anatomy
Chittagong Medical College, Chattogram, Bangladesh.
3. Professor of Anatomy
Marine City Medical College, Chattogram, Bangladesh.
4. Assistant Professor of Pathology
Rangamati Medical College, Rangamati, Bangladesh.
5. Professor of Anatomy
BGC Trust Medical College, Chattogram, Bangladesh.

*Correspondence to:

Dr. Ishrat Jahan

Mobile : +88 01711 12 93 47

Email: drishratjahanurmi@gmail.com

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other end is attached to the center of fetal surface of the placenta. The basic frame work of the cord is formed by the primary mesoderm of the connecting stalk, which is attached to the caudal end of the flattened germ disc containing the allanto enteric diverticulum and umbilical blood vessels.

An umbilical cord measures about 50-55 cm in length and 1-2 cm in breadth. It contain two umbilical arteries, one umbilical vein, Wharton's Jelly, remains of allantoic diverticulum and vitello intestinal duct¹.

Fetus wellbeing depends on this structure. A very short cord accompanied by joint contracture and pulmonary hypoplasia, long cord had been associated with excessive liquor amni and coiling of the cord around fetal parts². Single umbilical artery can occur in association with different clinical condition. A clear conception on the anatomy of umbilical cord is a prerequisite for illuminating certain syndrome. So the study was intended to see if there any morphological variation of umbilical cord among babies of Bangladeshi women in their normal pregnancies.

MATERIALS AND METHODS

A descriptive and cross-sectional study was carried out under the Department of Anatomy, Chittagong Medical College over a period of one year from August 2012 to July 2013.

The umbilical cord was collected from 60 Bangladeshi women who gave birth to a single baby between 36th to 40th weeks of normal pregnancy in the Department of Gynecology & Obstetrics of Chittagong Medical College Hospital.

Each umbilical cord with placenta was collected immediately in the above-mentioned hospital in a labeled plastic container containing 10% formalin. In the Department of Anatomy, Chittagong Medical College, the specimen was kept on flat trays and washed thoroughly in running tap water. The umbilical cord was cut at a distance of 10 cm from its attachment with the placenta. Then the cord was labeled properly with a tag for identification. Then it was kept in a covered plastic bucket containing 10% formalin for 72 hours for the purpose of fixation. After 72 hours of fixation, the umbilical cord with the placenta was examined for some macroscopic features and measurements of the different macroscopic variables were made and recorded as such. Then the umbilical cord was separated from the placenta and preserved in 10% formalin in a covered plastic bucket for further study.

The umbilical cord diameter was measured with the help of a digital slide calipers at the cut surface of the cord at a site 10 cm distal to its attachment with the placenta. Two readings were recorded, one was the maximum diameter as longitudinal and other was at right angle as transverse to that primary reading. Then the mean of these two measurements was considered as the mean diameter of the umbilical cord, expressed in millimeters.

The number of vessels in the umbilical cord was observed from the cut surface of the umbilical cord. The vessels having a thin wall and wide lumen was considered as the umbilical vein and the thick-walled vessel with a narrow lumen was considered as umbilical artery.

Insertion of the umbilical cord was recorded as central, intermediate, marginal or velamentous. When the cord was inserted at or within two cm of the centre of the placenta, it was recorded as a central insertion. When the cord was attached peripherally within two cm of the placental margin, it was recorded as a marginal placental insertion. When the cord was inserted at any point between central and marginal points of attachment, it was recorded as an intermediate placental insertion. When the cord was inserted into the chorionic membrane outside the placenta it was regarded as velamentous insertion.

True knots were identified as the parts of the cord formed by the actual passage of cord through a loop, followed by tightening of the loop.

All the data were entered into a software database. All statistical analyses were carried out using the "Statistical Package for Social Sciences (SPSS)" Version 18.0 for Windows.

RESULTS

All sixty cords had two arteries and one vein without any knot. They showed central mode of insertion in 76.6% (46) cases and in rests 16.7% (10) and 6.7% (04) showed intermediate and marginal mode of insertion respectively (Table I). The mean longitudinal and transverse diameter were 9.86 mm and 7.88 mm with a range of 5.98-14.60 and 5.00-13.40 mm respectively. The mean diameter of umbilical cords was 8.87 mm with a range of 6.20-12.39 mm (Table II).

Table I : General morphological characteristics of the umbilical cord (n = 60).

Variables		Number (n)	Percentage (%)
Number of Vessels	Three	60	100.0
Type of Vessels	Two Arteries & One Vein	60	100.0
Mode of Insertion of arteris with placenta	Central	46	76.6
	Intermediate	10	16.7
	Marginal	04	6.7
True Knots	Present	-	-
	Absent	60	100.0

Table II : General morphological measurements of the umbilical cord (n = 60).

	n	Mean	SD	Median	Range
Longitudinal Diameter (mm)	60	9.86	1.89	10.08	5.98 – 14.60
Transverse Diameter (mm)	60	7.88	1.85	7.80	5.00 – 13.40
Mean Diameter (mm)	60	8.87	1.47	8.80	6.20 – 12.39
Radius (mm)	60	4.44	0.73	4.40	3.10 – 6.20

● SD = Standard Deviation

DISCUSSION

In the present study, the mean diameter of the umbilical cord was 8.87 mm and the range was 6.20 to 12.39 mm. The range of umbilical cord diameter was mentioned by Torpin as 1 to 3 cm³. Alam MR et al and Chakrabarty SK et al in their previous two different studies from Bangladesh reported the range of umbilical cord diameter as 7.6 to 14.5 mm with a mean diameter of 11.20 ± 1.77 mm and 8.0 to 13.35 mm with a mean of 11.02 ± 1.37 mm in their control group who had normal pregnancy^{4,5}. Comparing with the both studies the mean diameter of umbilicus in the present study is much lower which is may be due to fact that they calculated the mean from only twenty specimen. The mean diameter of

umbilical cord was reported as 2 to 2.50 cm by multiple studies⁶⁻⁸. Appiah PK found the diameter of umbilical cord was between 1.0 to 1.45 cm in Ghana⁹. Wherer Collins reported the average cord diameter as 1.2 cm and the range was 3.0 to 5.0 cm¹⁰. In the present study the diameter of the umbilical cord found less may because of formalin fixation which causes some shrinkage and other studies were carried out on fresh samples.

In normal situation the umbilical cord contains two arteries and one vein embedded in Wharton's jelly¹. A single umbilical artery is considered as the most commonly reported umbilical cord anomaly and occurs in about one percent of newborns¹¹. In the present study, no umbilical cord was found with single umbilical artery. Similarly, Chakrabarty SK et al and in another study Alam MR all of the samples contained two arteries and one vein. As the sample size was small both the study along with present one found no single umbilical artery^{4,5}.

No true knots were identified from the 60 umbilical cords in this present study. False knots are quite frequent in normal pregnancies and appear to be due to umbilical artery loops within the cord^{7,12}. Chakrabarty SK et al and Alam MR also reported absence of true knots in their study^{4,5}. However large samples would be required to come to any correlate.

In the present study, among the 60 samples of umbilical cord 76.6% was of central, 16.7% was of intermediate or eccentric, and 6.7% was of marginal variety. EL Mowafi found umbilical cord with eccentric insertion in 70% and central insertion in 30% placenta¹³. Lateef RH et al observed in his study from Iraq that in 64.99% of the placenta the attachment of umbilical cord was eccentric¹⁴. Their findings were not in concordance with our findings. On the other hand Appiah PK in Ghana observed in his study that central, eccentric, marginal insertion constituted 60.75%, 21.14% and 18.94% respectively⁹. Yetter found in his study that umbilical cord had central insertion in 60.87% with 20.07% eccentric and 18.06% marginal insertion⁸. These two studies showed near similar to findings of the present study. The differences of mode of insertion in different studies may be due to the smaller sample size.

CONCLUSION

The present study looked for gross morphological features of human umbilical cord. Different morphological features of the human umbilical cord are similar to those of other researchers.

DISCLOSURE

All the authors declared no competing interest.

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