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# Morphological and Morphometrical Study of Umbilical Cord of Newborn Babies

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## Summary:

*Morphological and morphometric study of umbilical cord on 50 newborn babies were carried out during January to December 1998 at Bangabandhu Sheikh Mujib Medical University, Dhaka to expand the knowledge of gross anatomy of the umbilical cord of Bangladesh. The length of the cords were irrespective of sex ranged from 28 to 93 cm with a mean ( $\pm$ SD) of 55.6 ( $\pm$ 10.78). The length of the umbilical cords of males were significantly longer than female ( $P < 0.001$ ). The diameter of the cords irrespective of sex were varied from 1 to 1.9 cm with a mean ( $\pm$ SD) of  $1.45 \pm 0.31$  cm. The mean circumference length percentage ratio index of umbilical cord was 8.31. Thirty-three (66%) cords were inserted eccentrically, all being paracentral in position. The rest were inserted centrally. False knots were more frequent (47; 94%). Only one (2%) showed a true knot in addition of false knot. In 2(4%) cases cord had not any true or false knot. It is concluded that the gross morphological and morphometrical features of the umbilical cord in Bangladesh appear to be similar to those described in western literature.*

**Key words:** umbilical cord, length, diameter, circumference-length percentage ratio index, knots and insertion

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## Introduction:

Reduced blood flow due to any morphological or pathological changes in the umbilical cord hampers proper fetal development and growth, and may be associated with abnormalities of babies or even death. Among the gross morphological features, length of the umbilical cord shows a wide range of variation, ranging from 15 to 130 cm<sup>1</sup>. Abnormally long and short cords have been claimed to be associated with intrapartum complications as well as congenital abnormalities<sup>2-4</sup>. Diameter of umbilical cord may also be variable. An abnormally large or smaller diameter may be associated with perinatal problems and congenital anomalies and even may lead to fetal death from anoxia<sup>5-9</sup>. The insertion of the cord into the placenta may be central or eccentric. Eccentric cord insertion can be associated with morphological anomalies of placenta as well as clinical problems<sup>5</sup>. With the above background and rationale in mind, the present study was done to expand the body of knowledge of gross anatomy of the umbilical cord Bangladesh with a view to establish a normal standard on which further research can be based in understanding the clinical variations.

## Materials and methods:

The present case control study was carried out on 50 umbilical cords with placenta of Bangladeshi women. The specimens were collected from Department of Obstetrics and Gynaecology, Bangabandhu Sheikh Mujib Medical University Dhaka, Lutfu Nursing Home and Family Health Care, Mirpur Dhaka and Dhaka Medical College Hospital, Dhaka, during January to December 1998. The age of the mothers was ranged from 17 to 36 yrs; height range from 127.6 cm to 138.6 cm, and weight from 45 kg to 76 kg respectively. Out of 50 normal deliveries at 38-40 weeks of gestation, 25 umbilical cords with placenta was taken from male child and 25 from female child. Mothers with blood pressure not exceeding 125/85 mmHg were included. Multiple pregnancy and mothers with history of diabetes were excluded from the study.

The umbilical cords were separated 5 cm away from the newborn and was ligated at the separated ends and taken out after the delivery of the placenta. The length of the umbilical cord was measured by a metallic tape in cm in labor room within half an hour of delivery. The length

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of umbilical cord measured both the segment attached to the fetus and the segment attached to the placenta.

Circumference of the cords was measured at the fetal end, mid-point and at placental end by thread. At each place, two readings were recorded. Then the thread was measured by a metallic tape. Finally, the mean circumference of the umbilical cord was taken from these measurements. Circumference was then converted into diameter.

Circumference length percentage ratio index, was made by dividing the circumference of the cord by its length and multiplying the result by 100. Thus, this index would be directly proportional to the cord diameter and inversely proportional to the cord length. No index was available from normal mother but with overt diabetic mother<sup>10</sup>. When there was a visible swelling in a cord without a knot it was recorded as false knot. Number of true or false knots present in the cords were counted. When the cord was inserted at the center or within 2 cm of the center of placenta, it was recorded as central insertion. When the cord was attached at or within 2 cm of the placental margin, it was recorded as marginal or peripheral insertion. And when inserted in between, it was recorded as paracentral attachment. These measurements had been done with little modification of others<sup>5,12,13</sup>. Paracentral and marginal insertion are together known as eccentric insertion<sup>14</sup>.

### Results:

All of 50 umbilical cords had two umbilical arteries and one umbilical vein. False knots were present in 47(94%) cases. In one cord (2% cases) a true knot and a nuchal cord (the cord was placed round the neck of the baby) was present along with false knot. In 2(4%) cases cord had not any knots (false or true knot). Two-third of the cords 33(66%) were eccentrically inserted to the placenta while the rest 17(34%) were centrally inserted. All eccentric insertions were "paracentral". No marginal insertion was present.

The length of the umbilical cord varied widely, ranging from 28 to 93 cm with a mean of 55.6( $\pm$ SD 10.78) cm irrespective of sex (Table-1). Table II shows that in half of the cases, the length was between 51 and 60 cm. In 90% cases the length was between 41 and 70 cm. In two (4%) cases length was below 40 cm. These were cords of female child. In three (6%) cases the length of the cord were above 80 cm and these were from male child. The mean length of the male babies was significantly longer ( $P < 0.01$ ) than that of the female (Table1).

**Table-I**

Length of the umbilical cord in relation to sex (n=50)

Group	Rang	Mean $\pm$ SE(cm)
Female	28-69	51.48 $\pm$ 7.72
Male	45-93	59.11 $\pm$ 11.93**

\*\*  $P < 0.05$ .

**Table-II**

Frequencies of different length of the umbilical cord (n=50).

Length of the Umbilical cord (cm)	Female (n=25)	Male (n=25)
21-30	0	1
31-40	0	1
41-50	4	7
51-60	11	15
61-70	7	1
71-80	0	0
81-90	2	0
91-100	1	0

Mean diameter of umbilical cord was 1.45 $\pm$ 0.31cm irrespective of sex (Table-III). Table IV shows the frequency distribution of diameter of umbilical cord. More than half 62% cases the diameter was between 1.4 and 1.9 cm while 22% had diameter of less than 1.2cm (Table-IV). The mean

diameter of the umbilical cord of male was slightly larger than that of the female (Table-III) but this difference was not significant ( $P>0.05$ ).

**TABLE –III**

Diameter of the umbilical cord in relation to sex  
(n=50)

Group	Rang	Mean±SE(cm)
Female	1.0 –1.8	1.41±0.31
Male	1.0-1.9	1.0±0.32cm ¥

P= 0.929

¥ Not significant,  $P>0.05$ .

**TABLE –IV**

Frequencies of different diameters of the  
umbilical cord (n=50)

Diameter of the Umbilical cord cm	Female n=25	Male n=25
1-1.1	6	5
1.2-1.3	5	3
1.4-1.5	4	5
1.6-1.7	3	3
1.8-1.9	7	9

Circumference length percentage ratio index of the umbilical cord irrespective of sex was 8.31. In female babies, it was 8.67 and in male babies, it was 7.95. As this index was directly proportion to the cord diameter and inversely proportional to the cord length, it was larger in female baby.

### Discussion:

In the present study, the umbilical cord length was found similar to that reported in other studies in Bangladesh and abroad<sup>10,15-22</sup>. Thus racial factor has no influence on the length of the umbilical cord. Some authors have addressed the question as to what factors influences the cord length. Weight of the newborn seems to have an influence on cord length<sup>1,2,16,17</sup>.

Any cord longer than 100cm is considered as a long cord and shorter than 40 cm in length as short cord<sup>4,5</sup>. Long cord may be associated with prolapse of the cord, true knot, and coil round the body. All these

have potentiality of producing fetal distress through compression<sup>2-4</sup>. Short cord may

lead to delay in second stage of labor, rupture of the cord, placental abruption, inversion of uterus, cord herniation, irregular fetal heart tone, breach presentation, twinning, maldevelopment of central nervous system etc<sup>1-4</sup>. It is claimed that the length should be at least 32 cm for normal vaginal delivery<sup>4</sup>. It has also showed that normal gestation and parturition can occur with any cord length between 20 and 100 cm<sup>4</sup>. However, it is difficult to set upper or lower cut off values beyond which problems would ensue. In present study cord length ranged from as low as 28 cm to as high as 93 cm. All the cases were normal vaginal delivery.

The diameter of the umbilical cord in the present study ranged from 1 to 1.9 cm with mean ( $\pm$ SD) of 1.45±0.31cm with no significant difference from the findings of foreign data<sup>5,8,20,23</sup>. A diameter of less than 1cm have been called “Thin cord” and the diameter greater than 4 cm have been called “Megacord”<sup>2,5</sup>. Megacord is associated with persistence of urechus or herniation of the bowel<sup>5</sup>. Thin cord may be associated with perinatal problems and even with fetal death<sup>2</sup>. Peripartum morbidity was greatest in the presence of thin cord<sup>22</sup>. Thin cord occurred due to absence of Wharton’s jelly, stenosis or obliteration of cord vessels and intravascular cord thrombosis<sup>9</sup>. Megacord was found due to infiltration of urine<sup>5</sup>. In present study no cord diameter was below 1cm or above 1.9 cm. This may ensue the normal delivery.

It is assumed that length and circumference may have impacts upon each other. With this view in mind, this circumference length percentage ratio index has been postulated. No literature is however available for comparison of normal circumference length percentage ratio index. But one researcher worked on overt diabetic mother<sup>11</sup>. She found that the circumference length percentage ratio index of overt diabetic

mother was significantly lower than my findings. She also found that the weight of

the fetus and the length of the umbilical cord are larger in diabetic mother. This larger length could have influence on significantly lower circumference length percentage ratio index.

The incidence of the true knots in present study was 2% in contrast 0.5 to 1% described elsewhere<sup>10,20</sup>. True knots if formed in early pregnancy and if tightens during active fetal movement may interfere with fetal circulation leading to abortion or death of fetus<sup>21</sup>. In present study 47 out of 50 cords were false knots, one of the 47 indeed a true knot. It is stated that false knots are developmental variation without clinical importance.<sup>1, 8,20</sup>. In one case of the present study the cord was nuchal (i.e. wind around the neck of the fetus). It did not seem to produce any fetal complication. It is claimed that in one-fifth of all deliveries cord loops around the neck and does not create any fetal risk<sup>20, 21</sup>.

The type of insertion of the umbilical cord was central in 34% and eccentric in 66% cases with no marginal or velamentous insertion and all eccentrics being in paracentral position. These findings were consistent with that of other Bangladeshi workers in their respective studies<sup>10,12,13</sup>. Various international studies stated that central type of insertion occurred in the majority cases<sup>20</sup>. The discrepancy regarding the naming of the different types of insertion dates back to 1968 on account of different criterion for central or eccentric positions<sup>13</sup>. However, some workers accepted that, central and paracentral are normal but marginal and velamentous are abnormal type of insertions<sup>5</sup>. Thus the lack of any significant clinical problems of the patient in the present study supported the above contention.

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