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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 of 50 newborn babies were carried out during January to December 1998 at Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka to expand the knowledge of gross anatomy of the umbilical cord. The length of the cords 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 cord of male was significantly higher than female ( $P < 0.001$ ). The diameter of the cord irrespective of sex 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 (60%) 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. It was 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, knot insertion.

### 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 or even death. Among the gross morphological features, length of the umbilical cord shows a wide range of variation, ranging from 15 to 150 cm<sup>1</sup>. Abnormally long and short cords have been claimed to be associated with congenital abnormalities and may cause intrapartum complications.<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 may be associated with morphological anomalies of placenta as well as clinical problems.<sup>5</sup> With the above background and rational in mind, the present study was done to expand the knowledge of gross anatomy of the umbilical cord in Bangladeshi newborn 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 study was carried out on 50 umbilical cords with placenta of Bangladeshi women. The specimens were collected from department of Obstetrics and Gynaecology BSMMU, Dhaka, Lutfu Nursing Home and Family Health Care, Mirpur, Dhaka and Dhaka Medical College Hospital from January to December 1998. The age of the mother ranged from 17 to 36 years, height ranged from 127.6 cm to 138.6 cm and weight from 45 kg to 76 kg. Out of 50 normal deliveries at 38-40 weeks of gestation, 25 umbilical cords with placenta were taken from male child and 25 from female child. Mothers with blood pressure not exceeding 125/85 mmHg were included. Mothers with multiple pregnancy and history for 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 measurement included both the segment attached to the fetus and the segment attached to the placenta.

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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 cord were counted. When the cord was inserted at the center or within two cm of the center of placenta, it was recorded as central insertion. When the cord was attached at or within two cm of the placental margin, it was recorded as marginal or peripheral insertion. If the cord was inserted in between, it was recorded as paracentral attachment. These measurement had been done with little modification of others.<sup>5,11,12</sup> Paracentral and marginal insertion are together known as eccentric insertion.<sup>13</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 two (4%) cases cord did not have any knot (false or true knot). Two-thirds 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 of cord was found.

The length of the umbilical cord varied widely, ranging from 28 to 93 cm with a mean  $\pm$  SD of  $55.6 \pm 10.78$  cm irrespective of sex (Table I). Table II showed 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 less than 40cm and 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 cord of male babies was significantly longer ( $P < 0.01$ ) than that of the female (Table I).

**Table-I**  
Length of the umbilical cord in relation to sex  
(n=50)

Group	Range (cm)	Mean $\pm$ SE (cm)
Female	28-69	51.48 $\pm$ 7.72 cm
Male	45-93	59.11 $\pm$ 11.93 cm**
irrespective of sex	28-93	55.6 $\pm$ 10.78 cm

P = 0.005

**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	1	0
31-40	1	0
41-50	7	4
51-60	15	11
61-70	1	7
71-80	0	0
81-90	0	2
91-100	0	1

Mean diameter of umbilical cord was  $1.41 \pm 0.31$  cm irrespective of sex (Table-III). Table IV shows the frequency distribution of diameter of umbilical cord. More than half of the cases (62%) showed that the diameter was between 1.4 and 1.9 cm while 22% had diameter of less than 1.2 cm. The mean diameter of the umbilical cord of male was slightly larger than that of the female (Table III) and this difference was not significant ( $P > 0.05$ ).

**Table-III**  
Diameter of the umbilical cord in relation to sex  
(n=50)

Group	Range (cm)	Mean $\pm$ SE (cm)
Female (N=25)	1.0-1.8	1.41 $\pm$ 0.31 cm
Male (N=25)	1.0-1.9	1.0 $\pm$ 0.32 cm
M + F (n=50)	1.0 - 1.9	1.41 $\pm$ 0.31 cm

P = 0.929

**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 percent ratio index of the umbilical cord irrespective of sex was 8.3 in female babies it was 8.67 and in male babies it was 7.95. As this index was directly proportional to the cord diameter and inversely proportional of 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>14,22</sup> Thus racial factor has no influence on the length of the umbilical cord. Some authors have addressed that the weight of the newborn seems to have an influence on cord length.<sup>1,2,16,17</sup> Any cord longer than 100 cm is considered as a long cord and shorter than 40 cm 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 cord compression.<sup>2-4</sup> Short cord may lead to delay in second stage of labour, rupture of the cord, placental abruption, inversion of uterus, cord herniation, irregular fetal heart rate, breech 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 delivery 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 and all the cases had 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  $1.45 \pm 0.31$  cm with no significant difference from the findings of the western studies.<sup>5,8,20,23</sup> A diameter of less than one cm is called "Thin cord" and the diameter greater than 4 cm was mentioned as "Megacord".<sup>2,5</sup> Megacord

is 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 the present study no cord diameter was below 1 cm or above 1.9 cm.

It is assumed that length and circumference may have impacts upon each other. With this view in mind, this circumference length percentage ration index has been postulated. No literature is however available for comparison of normal circumference length percentage ration index. But one researcher found that the circumference length percentage index of overt diabetic mother was significantly lower than the findings of this study. The same study also found that the weight of the fetus and the length of the umbilical cord were larger in diabetic mother<sup>10</sup>. This larger length could have influence on significantly lower circumference length percentage ration index.

The incidence of the true knot in present study was 2% in contrast 0.5 to 1% described elsewhere.<sup>14,20</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 similar studies in Bangladesh.<sup>12-14</sup> Various international studies stated that central type of insertion occurred in majority of the 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>12</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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