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Variation of Diameter of Umbilical Cord in Different Gestational Age Groups of Healthy Pregnant Mother of Bangladesh

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Abstract

Context: The umbilical cord is the lifeline of the fetus, "The baby's life hangs by a cord", as said by Ian Donald. The umbilical cord is an elongated cord like structure enveloped by the glistening amniotic membrane. At full term, it is about 40 cm in length with a usual variation of 30–100 cm. Its diameter is of average 1.5 cm with variation of 1–2.5 cm. Its thickness is not uniform but presents nodes or swelling at places. The umbilical cord is considered both the physical and emotional attachment between mother and fetus. In this article, we investigate the variation of diameter of umbilical cord in different gestational age groups of healthy pregnant mother.

Objective: To identify variations in the diameter of umbilical cord in relation to gestational age.

Study Design: A cross-sectional descriptive type of study.

Place & period of Study: This study was conducted in the Department of Anatomy, Mymensingh Medical College, Mymensingh, from January to December 2018.

Materials and method: For the study, 80 discarded placentae with umbilical cord were collected at random from deliveries (both vaginal and caesarian) conducted at Department of Gynaecology and Obstetrics, Mymensingh Medical College Hospital, Mymensingh. The study was reviewed and approved by the Institutional Review Board (IRB) of Mymensingh Medical College. The collected samples were divided into three gestational age groups. They were Group A (28 to 36 weeks), Group B (37 to 40 weeks) and Group C (above 40 weeks) and examined morphologically by fine dissection method. The Diameter of the umbilical cord was measured with a slide calipers at 5 cm away from the attachment to the placenta. At first the apparently maximum diameter was measured on the external surface of the cord and then another diameter was taken at right angle to the first measurement. Finally the mean of the diameters was calculated and expressed in cm.

Results: The mean (± SD) diameter was 1.12±0.37 cm in group A, 1.62±0.45 cm in group B and 1.99±0.53 cm in group C. The mean diameter of the umbilical cord was maximum in group C and was minimum in group A. It was also observed that the mean diameter of the umbilical cord increased with gestational age. The mean difference of the diameter between groups A and B, and A and C was statistically highly significant ($p < 0.001$) but difference between B and C was statistically significant ($p < 0.05$).

Conclusion: The present study showed that the diameter of umbilical cord was variable, however, maximum number of cases had normal cord diameter. It was observed that the mean length of umbilical cord gradually increased with increase of gestational age.

Key words: Umbilical cord, Diameter, Gestational Age, Healthy pregnant mother

Introduction:

The umbilical cord is the lifeline of the fetus, "The baby's life hangs by a cord", as said by Ian Donald[1]. The umbilical cord is an elongated cord like structure enveloped by the glistening amniotic membrane. At full term, one end of the cord is attached approximately to the center of the anterior abdominal wall of the fetus and the other end is fixed to the center of the fetal surface of the placenta. The basic framework 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 the umbilical blood vessels[2]. It is about 40 cm in length with a usual variation of 30–100 cm. Its diameter is of average 1.5 cm with variation of 1–2.5 cm. Its thickness is not uniform but presents nodes or swelling at places. These swelling (false knots) may be due to kinking of the umbilical vessels or local collection of Wharton's jelly. True knots (1%) are rare. Long cord may loop around the neck (20-30%). It shows a spiral twist from the left to right from as early as 12th week due to spiral turn taken by the vein around the arteries[3]. The umbilical vessels are longer than the cord hence twisting and bending of vessels leads to beaded appearance of the umbilical cord[4]. A sudden umbilical cord compression with a poor layer of Wharton's jelly may strongly reduce the umbilical venous blood flow and cause life threatening risk to the fetus[5]. There is a limitation of published work on variations of the diameter of umbilical cord of Bangladeshi mother. We mainly depend on foreign text and literatures. However, we need our own standard baseline from which we can compare the diameter of umbilical cord of our own population with those of Western and other Asian people. Therefore, this study was done to provide information about the diameter of umbilical cord and umbilical cord diameter related fetal outcome in different gestational age groups of healthy pregnant mother of Bangladesh.

Methods:

The specimens containing placenta and umbilical cord were collected just after delivery on different dates from April 2018 to September 2018 from the Department of Obstetrics and Gynaecology of Mymensingh Medical College Hospital, Mymensingh. All the specimens were collected from healthy pregnancy of gestational age at 28 weeks and above. Mothers having the following criteria were excluded from the present study such as below 28 weeks of gestation, ante partum haemorrhage, multiple pregnancies, pre eclamptic toxaemia, eclampsia, Rh-incompatibility, retained placenta, diabetes mellitus, pregnancy induced hypertension. All patients' information regarding the exclusion criteria was collected from the hospital records of MMCH. After the delivery of fetus, cord was clamped at two places and cut in between. The diameter of the umbilical cord was measured with a slide calipers at 5 cm away from the attachment to the placenta. At first the apparently maximum diameter was measured on the external surface of the cord and then another diameter was taken at right angle to the first measurement. Finally the mean of the diameters was calculated and expressed in cm. Each umbilical cord was allotted an identification number tagged with a piece of waxed cloth. The gestational age of the mother was collected from MMCH records and noted in a record book against respective identification number. The collected specimens were divided into 3 groups e.g. A, B, and C according to the gestational age, on the basis of maturation of baby such as group A pre-term 28–36 weeks, group B term 37–40 weeks, group C late term above 40 weeks (Table I) for convenience of differentiating the variation of the diameter of umbilical cord at different gestational age. The diameter of each umbilical cord was recorded in the pre designed data sheet,

analysed by SPSS program & compared with the findings of other national and international studies and standard text books.

Figure 1: Photograph Showing the Placenta with Umbilical Cord

Figure 2: Photograph Showing the Process of Measurement of Diameter of the Umbilical Cord.

Table I: Gestational Age Grouping of Samples for Morphological Study

Group	Gestational age in week	Number of specimen
A	28 – 36	20
B	37 – 40	42
C	Above 40 weeks	18
Total		80

Results:

The maximum diameter of the umbilical cord was 1.9 cm in Group A, 2.8 cm in group B and 2.6 cm in Group C. The minimum diameter of the umbilical cord was 0.7 cm in Group A, 0.9 cm in Group B and 0.75 cm in Group C.

The mean (± SD) diameter was 1.12±0.37 cm in group A, 1.62±0.45 cm in group B and 1.99±0.53 cm in group C. The mean diameter of the umbilical cord was maximum in group C and was minimum in group A. It was also observed that the mean diameter of the umbilical cord increased with gestational age. The mean difference of the diameter between groups A and B, and A and C was statistically highly significant ($p < 0.001$) but difference between B and C was statistically significant ($p < 0.05$). Above findings are shown in the table II and figure 3.

Table II: Diameter of Umbilical Cord in Different Gestational Age Groups

Gestational Age Group	Number of Specimen (n = 80)	Diameter (cm) Mean±SD (Minimum – Maximum)
A (28 to 36 weeks)	18	1.12±0.37 (0.7 – 1.9)
B (37 to 40 weeks)	42	1.62±0.45 (0.9 – 2.8)
C (Above 40 weeks)	20	1.99±0.53 (0.75 – 2.6)

Comparison of diameter of umbilical cord among the gestational age groups

Comparison between gestational	Mean Difference	Standard Error of Difference	t	p	Level of significance

age groups					
A & B	-0.49976	0.11175	-4.472	0	Highly significant
B & C	-0.37357	0.13771	-2.713	0.011	Significant
A & C	0.87333	0.14766	5.917	0	Highly significant

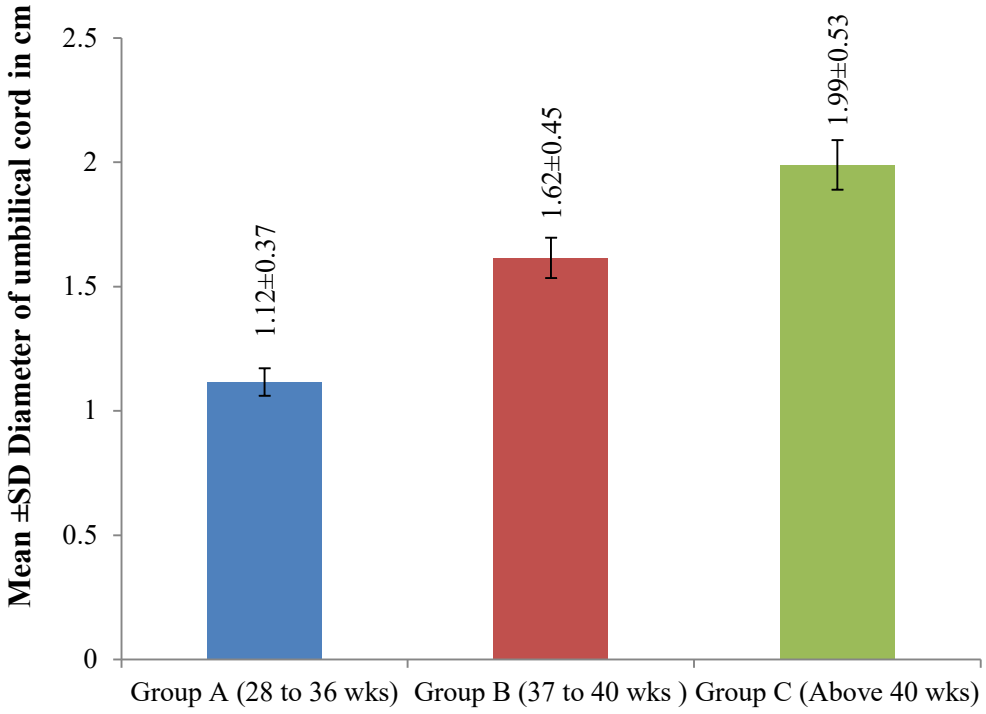

Figure 3: Bar Diagram Showing the Mean Diameter of Umbilical Cord in Different Age Groups

Discussion:

The maximum diameter of the umbilical cord was 1.9 cm in group A, 2.8 cm in group B and 2.6 cm in group C. The minimum diameter of the umbilical cord was 0.7 cm in group A, 0.9 cm in group B and 0.75 cm in group C. The mean (± SD) diameter was 1.12±0.37 mm in group A, 1.62±0.45 mm in group B and 1.99±0.53 cm in group C. The mean diameter of the umbilical cord was maximum in group C (1.99 cm) and was minimum in group A (1.12m). It was also observed that the mean diameter of the umbilical cord increased with age. The mean difference of the umbilical cord diameter between groups A and B and A and C was statistically highly significant ($p < 0.001$) but difference between B and C was statistically significant ($p < 0.05$).

Carr (2016) showed that the umbilical cord diameter in case of control group (n = 12) was 22.9± 0.42 mm, non-fetal growth restricted (n = 10) is 2.9±0.25 mm and in case of fetal growth restricted case was 19.9±0.19 mm[6]. Gunasegaran (2017) described that the average diameter of umbilical cord at term was about 1 to 2 cm[7]. Singh

(2017) stated that the diameter of umbilical cord at term was about 1 to 2 cm[4]. According to the Moore, Persuad & Torchia (2013), the diameter of fully developed umbilical cord was 1 to 2 cm[8]. Datta (2013) showed that the breath of the umbilical cord of full term placenta was 2 cm (20 mm)[2]. Proctor et al. (2013) carried out a 43 sonographic study and reported that the mean umbilical cord diameter was 0.41 cm in pregnancies at < 28 weeks and 0.56 cm in pregnancies at ≥ 28 weeks of gestation. Mean umbilical cord diameter increased with gestational ages[9]. Dutta (2011) stated that average diameter of umbilical cord was 1.5 cm (15 mm) with variation of 1 – 2 cm (1.0 – 2.5 cm)[3]. Begum (2010) made a study on 60 human placentas and revealed that the mean diameter of umbilical cord±SD was 6.79±2.63 mm in between 28 to 32 weeks, 7.03±2 mm in between 33 to 37 weeks and 10.88±2.53 mm in between 38 to above weeks of gestation. It was also observed that mean diameter of umbilical cord increased with age[10]. Decherney et al. (2007) stated that the typical umbilical cord had a fairly uniform diameter of 2.0 to 2.5 cm (20 – 25 cm). Narrow areas may be represent a focal deficiency of Wharton's jelly are associated with torsion and fetal death[11]. Sultana (2005) performed a study on 45 placentas (20 control group and 25 eclamptic mothers) and found the range of diameter of umbilical cord was 0.6 to 1.80 cm with a mean±SD diameter was 1.112±0.270 cm in eclampsia. Whereas in control group the diameter of placenta ranged from 1.00 to 1.80 cm with a mean±SD diameter was 1.260 ± 0.198 cm[12]. Dawn (2004) stated that the average diameter of the umbilical cord was 1.5 cm (1/2″)[13]. Rahman (2003) found in their study that the mean diameter of the umbilical cord near the insertion was 0.98 cm (9.8 mm), 1.06 cm (10.6 mm) normal pregnant mother[14]. Benirschke & Kaufman (2000) stated that the average diameter of the umbilical cord was 0.8 to 2.0 cm[15]. A fully formed umbilical cord was about 1 to 2 cm (0.5 to 1 inch) in diameter and approximately 55 cm (2 ft) long stated by Kent & Kliman (1993)[16]. Finding of the present study was higher than the Dutta (2011) and Begum (2010) and more or less similar in ranges to the findings of all other mentioned authors.

Conclusion:

The present study showed that the diameter of umbilical cord was variable, however, maximum number of cases had normal cord diameter. It was observed that the mean length of umbilical cord gradually increased with increase of gestational age. Due to growing evidence of correlation of morphology of placental and umbilical cord with chronic diseases in later life, we suggest examination of placenta and umbilical cord at the time of birth.

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