



UMBILICAL CORD MORPHOLOGY AND ITS CLINICAL SIGNIFICANCE

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Abstract-

Background: Umbilical cord is life line of the fetus. Though it is a simple structure of two arteries, one vein & Wharton's jelly, it is of importance for fetal well being. Any change in its morphology may be responsible for adverse pregnancy outcome. So umbilical cord was studied under many parameters and it is co-related with fetal parameters.

Materials and Methods: 74 freshly delivered placenta were obtained from labour room of K.J. Somaiya hospital. They were numbered and kept in 10% formalin. Umbilical cords were studied under parameters of length, thickness, coiling, and attachment of umbilical cord to placenta. Fetal parameters like any IUGR (Intrauterine Growth Retardation), IUD (Intrauterine Death), FD (Fetal Distress) & birth weight was recorded. Cord parameters were co-related with fetal parameters.

Results:

- The mean umbilical cord length was $56.2 + 9.6$ (40-68).
- The mean umbilical cord thickness was $9.7 + 2.4$ (5-15).
- In 15 cords (20%) hyper coiling was observed & in 7(46%) cases out of 15 adverse pregnancy outcome was seen which is significant.
- We found significant p value showing relation between cord thickness & hyper coiling also between cord length and adverse pregnancy outcome.
- In all umbilical cords two umbilical arteries and one vein are seen.

Conclusion: Hyper coiling of umbilical cord is one of the factors responsible for adverse pregnancy outcome. Monitoring of hypercoiling prenatally may indicate adverse pregnancy outcome.

Keywords- Hypercoiling, Hypocoiling, Coiling of cord, Umbilical cord, Furcated artery, Marginal insertion, Adverse pregnancy outcome, Fetal parameters

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Introduction

Umbilical cord is connecting cord from developing fetus to placenta. It is derived from allantois and stalk of yolk sac. It is physiological & genetical part of the fetus which conveys the nutrients to fetus from placenta and carries waste products from fetus to placenta. It contains 2 arteries & 1 vein buried in Wharton's jelly which gives flexibility, mobility & strength to resist compression at the same time allows the fetus to move freely [1]. Umbilical cord plays important role in fetal well being. Several umbilical cord abnormalities are known to cause adverse prenatal outcome. Abnormal cord length, thick or lean umbilical cords, hyper coiling or hypo coiling, marginal or velamentous insertion of cord may be associated with IUGR, IUD or Fetal distress. So umbilical cord parameters were studied & co-related with fetal parameters.

Materials and Methods

The study was carried out to assess any association between umbilical cord parameters & pregnancy outcome. 74 freshly delivered placenta were obtained from labour room of K.J. Somaiya Hospital. The umbilical cord was cut on fetal side by keeping 5cm cord on fetal side. Placenta with umbilical cord kept in 10% formalin was brought to anatomy department within 2hrs. The deliveries between 8 am to 4 pm were included & others after this timing were excluded from study. The tag of details of name of mother, age, gestational week was attached to cord with thread. Mother & baby's history was noted. Placenta was washed under running tap water. Umbilical cord length was measured at fetal end with the help of measuring tape. The cord thickness was measured with divider & measuring scale. Numbers of coils were measured &

umbilical coiling index (UCI) was calculated by dividing number of coils by length of cord. The insertion of cord on the placenta was noted. History of IUGR, FD, IUD was noted. Baby's weight was noted. Umbilical parameters were correlated with fetal parameters.

Statistical Analysis

Statistical analysis was done using the statistical software SPSS version 16.0

Descriptive analysis consisted of mean with standard deviation (SD) and range for various parameters. Frequencies for categorical data expressed in percentage.

Continuous variables were analyzed using unpaired t test whereas chi square test (Fisher's exact test was used to compare categorical variables.

P value < 0.05 was considered as statistically significant.

Results

- 20% of cords show hypercoiling pattern & none of the cords show hypo coiling pattern.
- We found significant relation between cord thickness & hypercoiling of cord and there is an association between hypercoiling and adverse pregnancy outcome.
- Adverse Pregnancy outcome was seen more often with thin and short cords.
- Furcated artery and marginal insertion of cord is not associated with adverse pregnancy outcome.
- No significant relation between coiling & birth weight was noticed.

Discussion

Though variations in shape & other features of umbilical cord are common, some variations can cause adverse pregnancy outcome. Umbilical cord length is one of the major cord morphological features that can't be accurately assessed antenatally via conventional ultrasound [1]. Incidence of all types of complications increases as cord length increases [2] but in the present study mean length of umbilical cord was 58.2 + 9.6 (40-68cm) [Table-1] & it was 59cm [3], (22 to 130cm) & 52.2cm [4]. In the present study significant p value suggests that adverse pregnancy outcome is seen when cord length is less [Table-2]. The mean cord length in IUGR, FD, IUD is 44.7, 47, 42cm which is less than average length [Table-3], [Fig-1], [Fig-2]. The mean length of umbilical cord showing hypercoiling is 50cm. There is no association found between length and hypercoiling of the cord [Table-2].

Table 1- Fetal and maternal parameters with their standard of deviation

Variable	Summary
Age	25.3 + 4.0 (19-37)
Birth weight	2.7 + 0.5 (1.0-3.8)
Cord thickness	9.7 + 2.4 (5-15)
Cord length	56.2 + 9.6 (40-68)
UCI	0.154 + 0.030 (0.000-0.238)
Coiling (Yes/No)	15/59
Pregnancy outcome (FD/IUD/IUGR/N)	6/2/10/56
Furcated artery (Furcated/Normal)	Jul-67

The thickness of umbilical cord in the present study was 9.7 + 2.4 (5-15). Umbilical cord pattern does not correlate with cord thick-

ness [5]. but our study shows there is relation between cord thickness and hypercoiling. Hypercoiling is seen in thick umbilical cords. [Table-4], [Fig-3] The mean thickness of cord is 7.3cm in cases of IUGR which shows that low birth weight is associated with thin cords & same has been observed in our study [Table-5]. Thin cords are seen in IUGR. Thin cords increases risk of having small for gestational babies [1]. Small cord thickness shows significant relation with low birth weight and meconium stain [6] but we did not find relation of cord thickness with fetal distress.

Table 2- Relation between Umbilical Coiling Index, Cord Length and Adverse Pregnancy Outcome

Variable	Adverse pregnancy outcome		P value (Significance)
	Yes (N=18)	No (N=56)	
UCI	0.167 + 0.032	0.149 + 0.028	0.022 (S)
Cord length	49.9 + 9.6	58.2 + 8.7	0.001 (S)

Table 3- Mean cord thickness and length in normal and adverse pregnancy outcome

Mean Cord Thickness in cm				Mean cord length in cm			
IUGR	FD	IUGR	Normal	IUGR	FD	IUGR	Normal
9.5	8.3	7.3	9.7	42	47	44.7	56.2

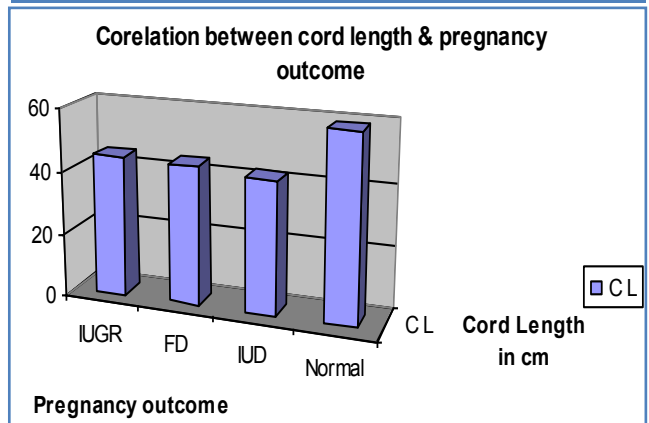


Fig. 1- Correlation between cord length and pregnancy outcome

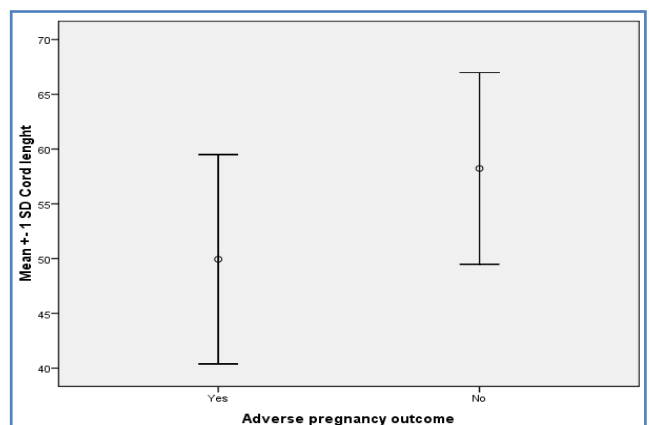


Fig. 2- Correlation between cord length and adverse pregnancy outcome

The blood vessels are seen running through the cord in coiled fashion. A coil was defined as a complete 360 degree spiral course of umbilical vessels around Wharton's jelly [7]. Umbilical coiling

was first quantified in 1954 and the index of twist is calculated by dividing total number of coils by umbilical cord length in centimeter [8]. We counted such complete coils from maternal to fetal end. These are unevenly distributed throughout the cord and are found more on fetal side. Umbilical coiling index was calculated by dividing number of coils by length of umbilical cord. The mean UCI in hypercoiled cords is 0.21 [Table-2] which was close to other results that is 0.20, 0.21 and 0.19 [9-11]. In 15(20%) umbilical cords hypercoiling was observed [Photo-1] & in 7(46%) cases out of 15 adverse pregnancy outcome was seen which is significant [Fig-4], [Fig-5]. Too much coiling must be causing compression on the vessels and so the blood supply must have reduced causing IUGR or FD. In remaining cases of hypercoiling cords pregnancy outcome was normal for which reasoning remained unexplained. We did not observe any cord with hypocoiled pattern.

Table 4- Correlation between cord thickness and birth weight

Cord Thickness	Birth Weight
Pearson Correlation	0.017
P value	0.883
Significant	Not significant
N	74

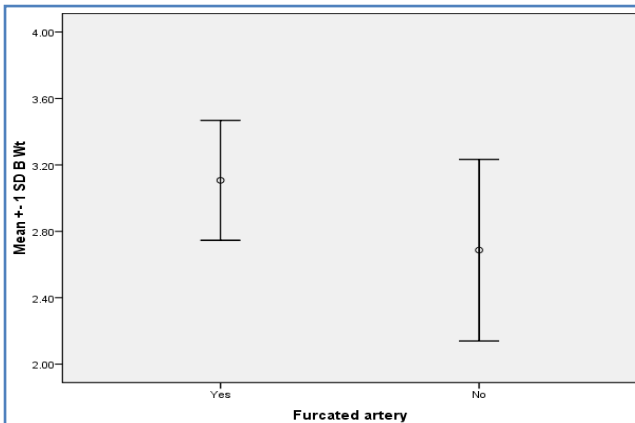


Fig. 3- Relation between furcated artery and birth weight

Table 5- Comparison of hypercoiling with other parameters

Variable	Hypercoiling		P value (Significance)
	Yes (N=15)	No (N=59)	
Cord thickness	10.8 + 2.7	9.4 + 2.3	0.049 (S)*
Birth weight	2.5 + 0.5	2.8 + 0.6	0.139 (NS)*
Pregnancy outcome (FD/IUD/IUGR/Normal)	4/1/3/7	2/1/7/49	0.008 (S)*

(*Unpaired t test / **Chi square test)

Normally umbilical cord inserts on the central part of placenta [12, 13]. If umbilical cord is inserted within 2cms from placental edge it is considered as marginal insertion [14,15]. This is associated with IUGR [16], preterm labour [17]. Another type of insertion is furcated insertion in which umbilical cord branches before its insertion on placenta [18]. Furcated placenta are more prone to early delivery because they are heavier and having more voluminous villi with more trophoblast and syncytial knots than normal [19] & found in 0.5% of all births [20].

The incidence of marginal insertion is 16.3%, 7.2%, 12% [21-23] & in furcated artery is 7.27%, 0.75%, 1% [20-22]. In the present study we found marginal insertion in 9.45% [Photo-2], [Fig-6] and furcat-

ed artery in 8% of cords [Photo-3], both are not related with adverse pregnancy outcome [Table-6], [Fig-7].



Photo 1- Hypercoiling of umbilical cord

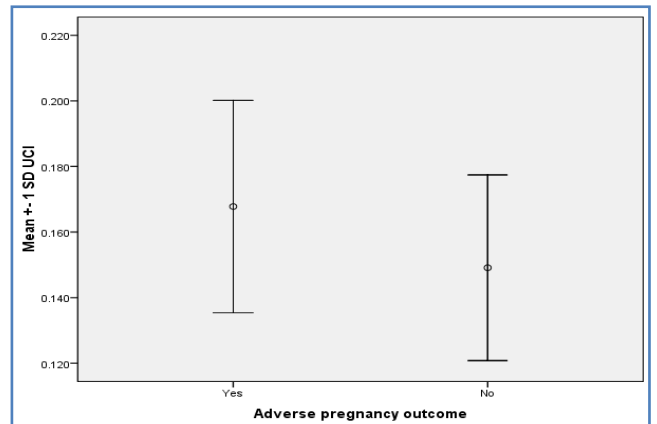


Fig. 4- Relation between coiling index and adverse pregnancy outcome

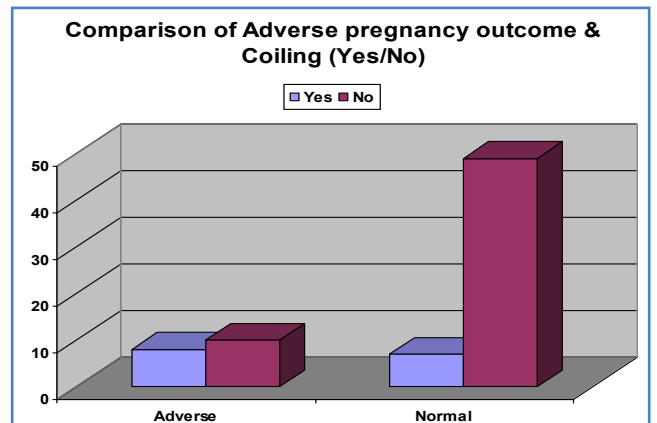


Fig. 5- Comparison of umbilical coiling in normal & adverse pregnancy outcome

Table 6- Relation between Umbilical Coiling Index, Cord Length and Adverse Pregnancy Outcome

Variable	Adverse pregnancy outcome		P value (Significance)
	Yes (N=18)	No (N=56)	
UCI	0.167 + 0.032	0.149 + 0.028	0.022 (S)
Cord length	49.9 + 9.6	58.2 + 8.7	0.001 (S)

(Unpaired t test)



Photo 2- Marginal insertion of umbilical cord

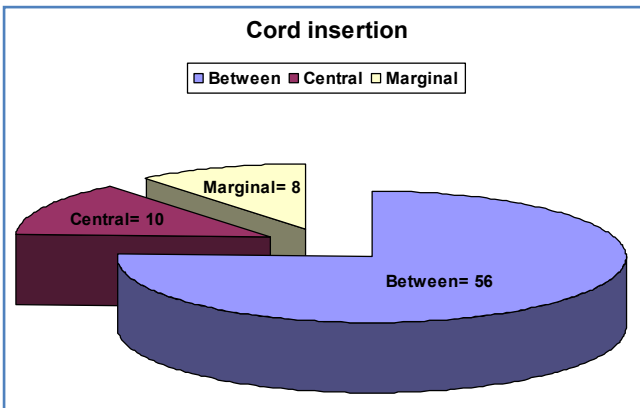


Fig. 6- Different types of insertion of umbilical cord



Photo 3- Furcated artery

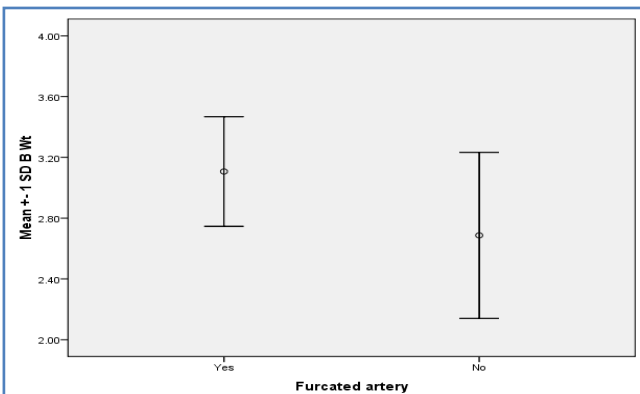


Fig. 7- Relation between cord length and pregnancy outcome

Conclusions

- Hypercoiling is associated with increased thickness and decreased length of umbilical cord.
- Hypercoiling is associated with adverse pregnancy outcome.

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