



UMBILICAL CORD COILING INDEX AND ITS PERINATAL OUTCOME IN VAGINAL DELIVERY

Obstetrics & Gynaecology

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ABSTRACT

The umbilical cord is crucial for the development, well-being, and survival of the foetus. However, it is susceptible to kinking, compression, traction and torsion, which might affect on, perinatal outcome. This was a descriptive observational study conducted from January 2023 to July 2024. About 300 patients of 20-45 years old were enrolled by convenient sampling. Mean age was 24.9 ± 3.4 years. The mean umbilical cord coiling index was 0.38 ± 0.05 . Majority of mothers fall within the 20-24 years. There was a significant association between CTG, Meconium stained liquor (MSL), APGAR score, birth weight of baby, risk of IUGR & NICU admission. The conclusion drawn was UCI > 90th percentile of the umbilical cord coiling index (hypercoiling) is associated with IUGR and the UCI < 10th percentile of the umbilical cord coiling index (hypocoiling) was associated with low Apgar score at 1 min and meconium-staining. Hence, umbilical cord coiling index should be part of antenatal ultrasound screening for better outcomes.

KEYWORDS

Umbilical cord coiling index, perinatal outcome, Vaginal delivery

INTRODUCTION:

The umbilical cord is crucial for the development, well-being, and survival of the foetus. However, it is susceptible to kinking, compression, traction and torsion, which might affect on, perinatal outcome. The vessels are the most susceptible element of the embryonic anatomy. The number of coils in a cord is thought to be determined early in gestation. Coiling occurs throughout the second and third trimesters, most likely due to cord snashes, and changes during pregnancy. The three blood vessels travel down the cord in helical or coiled patterns. The helical fusion of these umbilical vessels is known as spiral course [1, 2].

A coil is defined as having completed a 360-spiral course of umbilical vessel around Wharton's jelly. Coiling property of umbilical cord was described by Berengarius in 1521. In 1954, umbilical coiling was first quantified by Edmonds who divided the total number of coils by umbilical cord length in centimetres and called it "Index of twist". He assigned positive and negative scores to clockwise and anticlockwise coiling, respectively [3]. Later, Strong et al simplified it by eliminating these directional scores and named it "The umbilical cord coiling index" [4]. An abnormal umbilical cord coiling index includes both hypocoiled cords (cords with an umbilical cord coiling index which is < 10th percentile) and hypercoiled cords (cords with an umbilical cord coiling index which is > 90th percentile). An abnormal umbilical coiling index has been reported to be related to adverse perinatal outcomes [4, 5, 6].

John William Ballantyne (1861-1923), a British obstetrician and considered to be the father of prenatal care, said in 1904: "A diseased foetus without its placenta and cord is an imperfect specimen and a description of a foetal malady, unless accompanied by a notice of placental and umbilical cord condition is incomplete". In early 1990s, Dr. Strong and his colleagues observed that children born with non-coiled umbilical vessels are at increased risk for perinatal mortality and morbidity. They then developed the umbilical cord coiling index which is calculated by dividing the total number of complete vascular coils by the umbilical cord length in centimetres. Several studies have addressed the correlations between abnormal cord coiling index and adverse pregnancy outcome. They all show an increase in adverse pregnancy outcome when there is abnormal cord coiling. Present study was conducted to study the umbilical cord coiling index & its perinatal outcomes in vaginal delivery.

Methodology:

This was a descriptive observational study conducted from January 2023 to July 2024. About 300 patients of 20-45 years old who were in active labour with term gestations, irrespective of their parities & presentation, who had singleton pregnancies with live babies who were delivered vaginally were enrolled in this study by convenient sampling. After separating baby from umbilical cord, the cord was tied

and cut as close to baby as possible. The umbilical cord was measured in its entirety, including the length of the placental end of the cord and umbilical stump on the baby. Number of complete coils or spirals were counted from neonatal end towards the placental end of cord, and it was expressed in cm. After this, UCI was calculated by dividing the total number of coils by the total length of cord in cm.

Data will be entered systematically in master chart by using MS excel. The data on categorical variables will be presented as n (% of cases) and the values on continuous variables will be presented as Mean $\pm$ Standard deviation (SD). Chi square test will be used for qualitative data. P-values less than 0.05 will be considered to be statistically significant.

RESULTS:

Total 300 patients enrolled in this study with mean age was 24.9 ± 3.4 years. The mean umbilical cord coiling index was 0.38 ± 0.05 . Majority of mothers fall within the 20-24 years age group (49%) followed by 25-29 years (40%). About 139 (46.3%) were Primis followed by 35% were G2. About 232 (77%) had normo-coiling of umbilical cord. (Table 1)

Table 2 shows, there was a significant association between CTG, Meconium stained liquor (MSL), APGAR score, birth weight of baby, risk of IUGR & NICU admission.

Table 1: Distribution Of Patients According To Demographic Data

Study Parameter	Frequency	Percentage
Age Group	20-24	147
	25-29	120
	30-35	16
	36-39	10
	>40	7
Gravida	Primi	139
	G2	105
	G3	51
	G4	5
Umbilical cord coiling index	Hypo-coiling	35
	Normo-coiling	232
	Hyper-coiling	33

Table 2 : Association Between Umbilical Cord Coiling Index And Perinatal Outcome

Perinatal Outcome	Hypo-coiling	Normo-coiling	Hyper-coiling	p Value
Gravida	Primi	15	105	19
	G2	12	82	11
	G3	8	40	3

	G4	0	5	0	
CTG	Abnormal	6	11	12	<0.05
	Normal	29	221	21	
MSL	No	29	215	18	<0.05
	Yes	6	17	15	
Gender	Male	24	126	19	>0.05
	Female	11	106	14	
APGAR Score	<7	6	14	6	<0.05
	>7	29	218	27	
Birth weight	LBW	8	7	3	<0.05
	Normal	27	225	30	
IUGR	No	34	221	26	<0.05
	Yes	1	11	7	
NICU Admission	Yes	16	24	16	<0.01
	No	19	208	17	

DISCUSSION:

The umbilical cord and its vital blood vessels are the most vulnerable part of the foetal anatomy. The total number of coils for any particular cord is believed to be established early in the gestation. The pattern of coiling develops during the second and third trimesters, presumably due to scars in the cord and this coiling changes as the pregnancy advances. Despite the belief that umbilical vascular coiling occurs early in gestation it is not yet known whether this coiling is a genetic or acquired event. Many theories have been proposed to explain the umbilical cord twist including those that intercept the twist as inherent to the cord itself, and those that explain the twist as a result of active or passive rotation of the fetus. Regardless of its origin, umbilical cord coiling appears to confer turgor to the umbilical unit, producing a cord that is strong flexible. Measuring the umbilical cord coiling index is not always easy, especially in cords with a very irregular coiling pattern and especially when blood has been drained from the cord. It seemed to be predominantly due to disagreement on cases with an umbilical cord coiling index just under or above the 10th percentile.

In this study, mean umbilical cord coiling index was 0.38 ± 0.05 . Our study results were comparable with UCI 0.20 ± 0.1 by Ereal et al, 0.13 ± 0.08 by Shalu Gupta et al, UCI 0.21 ± 0.07 by Strong et al and 0.19 ± 0.1 by Rana et al. [1,2,4,6]. In this study 169 were male babies and 131 were female babies. We couldn't find any association between umbilical cord coiling index and umbilical vein blood flow to gender of the baby.

The average birth weight of the babies in the hypocoiled group was 2.2 kg, hypercoiled group was 2.4 kg and the normocoiled group was 2.9 kg. The incidence of small for gestation babies in the hypercoiled could be due to the thrombosis of the vessels. under- and overcoiling of the umbilical cord, it may be argued that there is a window of optimal coiling. According to Reynolds, umbilical cord coiling contributes to the venous return to the fetus. The pulse pressure of the two umbilical arteries in coiled cords has been shown to generate a pumping mechanism within the umbilical vein, enhancing venous blood flow. With more coils this pumping mechanism is probably more efficient, and consequently venous flow will increase. It may be hypothesized that when overcoiling occurs other mechanisms such as compression of the vein and increased turbulence in the arteries, may become important and cause both venous and arterial flow to decrease [7].

There was statistically significant association between UCI categories and APGAR scores at 1 minute. Gupta S et al. [1], studied 107 umbilical cords and found that in hypocoiled cords, low Apgar scores were present. In present study, umbilical cord coiling index (UCI) has a significant impact on the presence of meconium-stained liquor (MSL). Gupta S et al [1], studied 107 umbilical cords and found that in hypocoiled group, meconium staining was significantly higher than in those with normocoiled group. In another study which was done by Padmanabhan LD et al. [8], 130 cases were studied, where they found that meconium staining was significant in hypercoiled group. In present study, we found significant association among low-birth-weight babies & abnormal umbilical cord coiling index. The incidence of small for gestation babies in the hypercoiled could be due to the thrombosis of the vessels due to increased turbulence leading to stasis of blood flow and low birth weight babies in the hypocoiled might be due to increased incidence of preterm labour. Similar result was showed by Rana et al [2], Raio et al and de Laat [9] et al found low birth weight babies to be significantly associated with abnormal cord coiling index. Many authors have shown significant association between hypercoiling and intrauterine growth restriction. In the present study, it

was observed that IUGR was significantly associated with UCI. In a similar study which was done by Monique WM [10] et al. Among the babies of the study group, 56 were admitted in newborn intensive care unit for various reasons. 16 babies of the hypocoiled group, 16 babies of the hypercoiled group and 24 of the babies of the normocoiled group had NICU admission. Thus, admission of babies to newborn unit was more frequent in both hypocoiled and hypercoiled group and there was significant association. These results were similar to observations made by Gupta et al [1] and Chitra et al [8] in their studies.

CONCLUSION:

Abnormal cord coiling index is an indicator of adverse perinatal outcome like hypocoiling and Hypercoiling are associated with low APGAR score, meconium staining, IUGR and NICU admission. If the umbilical cord coiling index can be measured reliably in utero by ultrasound, then it might be a promising prognostic marker for adverse pregnancy outcome. The conclusion drawn was UCI > 90th percentile of the umbilical cord coiling index (hypercoiling) is associated with IUGR, and the UCI < 10th percentile of the umbilical cord coiling index (hypocoiling) was associated with low Apgar score at 1 min and meconium-staining. Hence, umbilical cord coiling index should be part of antenatal ultrasound screening for better outcomes.

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