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ASSOCIATION OF UMBLICAL COILING INDEX WITH PREGNANCY OUTCOME: A CLINICAL STUDY.

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ABSTRACT

Background: The umbilicus is the lifeline of a fetus as it supplies water, nutrients and oxygen. Spiral course of its blood vessels makes it unique. An abnormal Umblical Coiling Index(UCI) has been reported to be related to adverse perinatal outcome. **Aims and objectives:** To evaluate association of Normocoiling, Hypocoiling and Hypercoiling of cord to maternal factors and perinatal outcome. **Material and methods:** This prospective observational study carried out in the Department of Obstetrics and Gynaecology for a period of one year(2014-2015) at NSCB Medical College, Jabalpur. Umblical cord of 609 babies were examined and umblical coiling index was calculated.Its association with various maternal and perinatal factors were noted. **Results**: The mean length of the umblical cord was found to be 50.21+12.72cms. Mean number of coils per umblical cord was 12.67+5.23. Mean UCI was 0.25+0.089 per cms. Normocoiling(79.5%) and Sinistral(99%) coiling was predominant. Lower mean difference in gravida was significantly lower in Hypocoiled(p=0.046). Mean number of coil and length of cord found significant in Normocoiled and Hypocoiled(p=<0.0001).Lower fetal weight and Oligohydramnios was also associated with Hypocoiling. Cesarean section deliveries was lesser in Hypocoiling(p=0.009). Preterm labor was significantly associated with Hypercoiled(p=0.011). **Conclusion**: Abnormal UCI is associated with adverse maternal and perinatal outcome.

KEYWODS: Umblical cord, Umblical coiling index, Perinatal factors.

INTRODUCTION

The umbilical cord, a critical life line is vital to the development, well being and survival of the fetus as it supplies water, oxygen and nutrition to the growing fetus. Spiral or helical course of its components i.e. amnion, porous Wharton's jelly, 2 arteries and 1 vein, is the most mysterious and interesting characteristics of umblical cord .This unique arrangement provides protection to umblical cord, yet it is vulnerable to kinking, compression, traction and torsion, thus affecting perinatal outcome.[1]

These vessels wound as cylindrical helices rather than spirals. Origin of umbilical coiling is exactly not known. Hypothesis include fetal movement, active and passive torsion of embryo, differential umbilical vascular growth rates, fetal hemodynamic forces, and the arrangements of muscular fibers in the umbilical arterial wall.[1]

This coiling property of cord vessels was first recorded by Berengarius (1521), quantified by Edmond(1554) who divided total number of coils by length of umbilical cord in cm and called it "The Index of twist". Fabricius(1600) demonstrated right and left twist of umbilical cord. Later on Strong et al simplified by eliminating these directional scores and named it the "Umbilical coiling index".[2,3,4]

Umbilical coiling appears to confer turgor to the umbilical unit, this making the cord strong yet flexible At full term the umbilical cord has an average length of 55 cm [30-100cm].The helical course of umbilical vessels is clearly visible from 7wk post conception in 95% of cases.[4,5]

An umbilical coil is defined as one complete spiral of 360 degree of umbilical vessels around each other. Both sinistral and dextral spirals occur. An umbilical coiling index defined as total number of coils/twist divided by total length of umbilical cord in cm. Total no. of coils on an average is between 0-40. In various studies, abnormal umbilical coiling index has been reported to be related with adverse perinatal outcome.[4,6,7] Hence our study

aims to find out association of UCI with pregnancy outcome.[3,4]

AIMS AND OBJECTIVES

1.To evaluate association of Normocoilng, Hypocoiling and Hypercoiling to maternal factors and perinatal outcome.

MATERIALS AND METHODS

This prospective cross-sectional study was conducted in the Department of Obstetrics and Gynecology NSCB Medical College Hospital Jabalpur for a period of one year(October 2014-September 2015). Approval from Institutional Ethical Board was obtained to proceed with the study. Women admitted in the labor ward, consenting and qualifying the inclusion criteria(singleton, >28 weeks gestation, cephalic presentation, live fetus, vaginal/LSCS delivery) were recruited randomly for the study. Detail history, general, systemic and obstetrical examinations were noted. 600 umblical cords were examined immediately after delivery,clamped and cut at 5 centimeter(cm) from the fetal insertion. After spontaneous separation of placenta rest of the cord(from cut end to the placenta insertion) was measured in cm. without any delay or excessive exertion on the cord. 5cm was then added to length of the measured cord for the entire length.The number of coils were counted from neonatal to placental end. Direction of the spirals were noted as sinistral(left) and dextral(right). Maternal factors and perinatal outcome were studied.

Umblical coiling index was calculated by dividing the total number of complete coils by the total.

length of cord in cm. UCI= $\frac{\text{No. of complete coils}}{\text{Total length of cord in cm}}$

The centile values for UCI was calculated and grouped into Hypocoiling (<10thpercentile), Normocoiling (10th-90th percentile) and Hypercoiling (>90th percentile). All the datas were analysed and the three groups were evaluated by establishing correlation between the UCI and maternal and perinatal factors. Statistical analysis was done by regression analysis.

RESULTS

The mean length of the umblical cord was found to be 50.21+12.72 cms. Mean number of coils per umblical cord was 12.67+5.23. Mean UCI was 0.25+0.089 per cms(Table 2). Normocoiling(79.5%) and Sinistral(99%) coiling was predominant(Table 3). Lower mean difference in gravida was significantly lower in Hypocoiled(p=0.046).Furthur, mean number of coil and length of cord was significant in Normocoiled and Hypocoiled(p=<0.0001).Lower fetal weight and Oligohydramnios was also associated with Hypocoiling(p=0.01 and p=0.01respectively) (Table4, Fig. 3). Cesarean section deliveries was lesser in Hypocoiling(p=0.009) (Fig.1). Preterm labor was significantly associated with Hypercoiled(p=0.01) (Fig. 2).

Table 1: Maternal and Perinatal factors.

Maternal	Perinatal
Age , Parity , Gestational age	APGAR score
Mode of delivery	Fetal weight
Abruption , GDM ,IUGR , MSL , Postdate	NICU admission
Poly/Oligo H , Prematurity , Severe Anemia	

GDM Gestational diabetes mellitus, IUGR intrauterine growth retardation, MSL muconium stained liquor, H hydramnios, NICU neonatal intensive care unit.

Table 2: Key Indicators of UCI.

Characteristics		N	Mean	Std. Deviation	Minimum	Maximum
No. Of coils		609	12.67	5.213	3	41
Length of cord		609	50.21	12.729	24	74
Direction of coils	Sinistral(left)	604	.2544	.08977	.08	.65
	Dextral(right)	5	.2780	.02168	.25	.31
UCI		609	.2546	.08944	.08	.65

Table 3: Distribution of the cases according to UCI.

UCI	No. of cases N=609	Percentage %
Hypocoiled (<0.14)	71	11.7%
Normocoiled (0.14-0.37)	484	79.5%
Hypercoiled (>0.37)	54	8.9%
Total	609	100%

Table 4: Regression analysis of factors associated with Umbilical Coiling Index (UCI was coded in three ordinal groups before analysis)

Factors	UCI	Beta Coefficient	SE	t	p value
Age	Hypercoiled (UCI>0.37)	Reference			
	Normocoiled (UCI0.14-0.37)	0.199	0.408	0.49	0.627
	Hypocoiled(<0.14)	- 0.249	0.536	0.46	0.642
Gravida	Hypercoiled (UCI>0.37)	Reference			
	Normocoiled (UCI0.14-0.37)	- 0.171	0.111	1.54	0.125
	Hypocoiled(<0.14)	- 0.291	0.146	2.00	0.046*
No. of coils	Hypercoiled (UCI>0.37)	Reference			
	Normocoiled (UCI0.14-0.37)	- 4.432	0.672	6.59	<0.0001*
	Hypocoiled(<0.14)	- 10.483	0.884	11.86	<0.0001*
Length of cord	Hypercoiled (UCI>0.37)	Reference			
	Normocoiled (UCI0.14-0.37)	13.673	1.725	7.93	<0.0001
	Hypocoiled(<0.14)	18.041	2.667	7.96	<0.0001*
Fetal weight	Hypercoiled (UCI>0.37)	Reference			
	Normocoiled (UCI0.14-0.37)	- 0.001	0.042	0.02	0.980
	Hypocoiled(<0.14)	- 0.142	0.055	2.58	0.010*
APGAR 1	Hypercoiled (UCI>0.37)	Reference			
	Normocoiled (UCI0.14-0.37)	0.016	0.082	0.19	0.847
	Hypocoiled(<0.14)	- 0.024	0.108	0.22	0.823
APGAR 5	Hypercoiled (UCI>0.37)	Reference			
	Normocoiled (UCI0.14-0.37)	0.029	0.064	0.45	0.655
	Hypocoiled(<0.14)	0.020	0.084	0.24	0.808

* Statistically significant

Table 5: Ordered logistic regression analysis of UCI with other categorical factors.

Factors	UCI	Beta Coefficient	SE	z	p value
Sex					
	Female	Reference			
	Male	- 0.392	0.211	1.86	0.064
Booked					
	Un booked	Reference			
	Booked	- 0.365	0.213	1.71	0.086
NICU admission					
	No	Reference			
	Yes	- 0.057	0.296	0.19	0.847
Abruption					
	No	Reference			
	Yes	1.252	1.080	1.16	0.247
GDM					
	No	Reference			

	Yes	- 0.049	1.223	0.04	0.968
IUGR					
	No	Reference			
	Yes	1.020	1.003	1.02	0.309
MSL					
	No	Reference			
	Yes	- 0.052	0.410	0.13	0.898
Polyhydramnios					
	No	Reference			
	Yes	0.049	1.00	0.05	0.961
PIH					
	No	Reference			
	Yes	0.599	0.371	1.62	0.106
Postdate					
	No	Reference			
	Yes	0.483	0.680	0.71	0.478
Severe Anemia					
	No	Reference			
	Yes	0.568	0.799	0.71	0.477

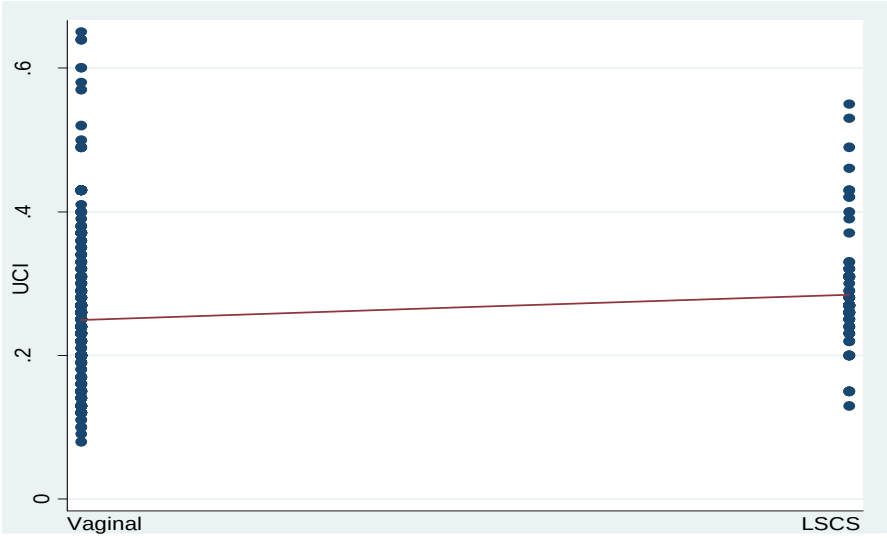

Fig 1: Ordered logistic Regression analysis of UCI withVaginal and Cesarean delivery.

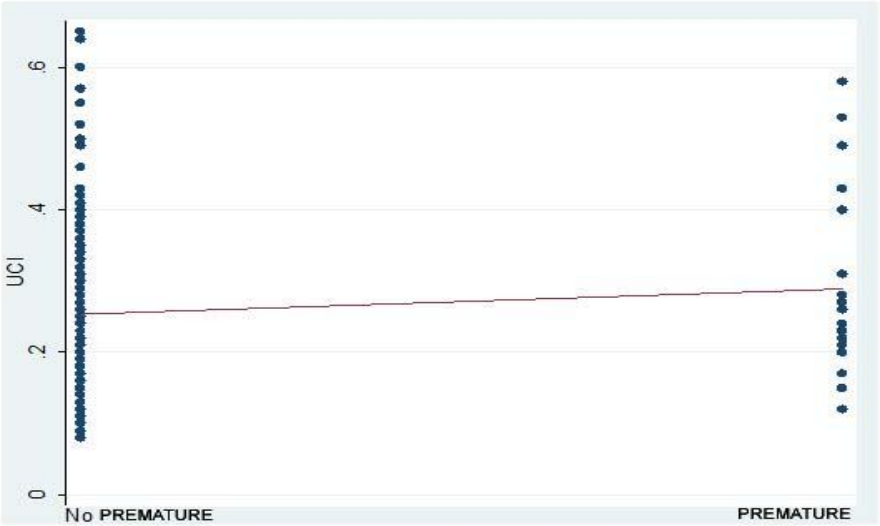

Fig 2: Ordered logistic Regression analysis of UCI and Prematurity

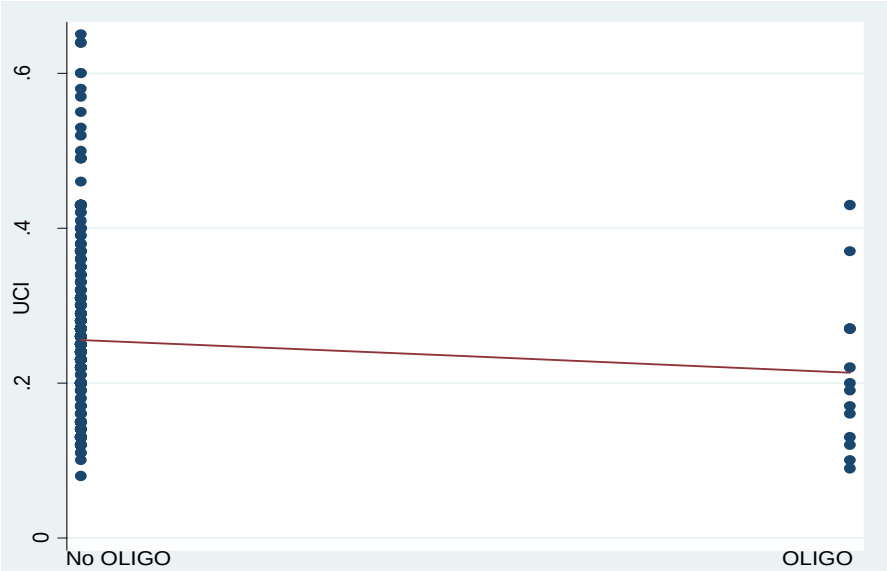

Fig 3: Ordered logistic Regression analysis of UCI with Oligohydramnios.

DISCUSSION

The umblical coiling index has been found to be an effective indicator of maternal and perinatal outcome in our study. The mean length of the umblical cord was 50.21+12.72cms.The mean number of coils per umblical cord was 12.67+5.21.The mean UCI found to be 0.25 +0.08 coils per cms Similar results reported in the studies.[8,9] Mean of sinistral direction of coils was 0.25 and dextral direction was 0.27 which is in agreement with studies.[9] The predominance of sinistral coiling may be due to the forceful paddling with right am of a fetus who has already established handedness. Lacro andshalu. The 10th percentile of UCI was 0.14 and 90th percentile was 0.37.Normocoiled was predominant in our study (79.5%) followed by Hypocoiled(11.7%) and Hypercoiled(8.9%) similar results reported by study.[8]

Analysis revealed that lower mean difference in gravida between UCI groups i.e. Hypercoiled, Normocoiled and Hypocoiled) was significantly lower in Hypocoiled than Hypercoiled (p=0.046). found association between elderly gravida in both Hypocoiled and Hypercoiled. Further, mean number of coil and length of cord was also found significant in Normocoiled and Hypocoiled than Hypercoiled (p<0.0001).Similar results reported in studies.[8] Lower birth weight and Oligohydramnios recorded significantly lower in Hypocoiled than Hypercoiled (p=0.01). The mean values of other factors like age, APGAR 1, APGAR 5, not found significantly different between UCI groups (p>0.05) in our study .However, their association was significant in studies.[8,9,10,11]

The analysis of categorical factors (variables) revealed that chances of Cesarean section(CS) was likely to be lesser in Hypocoiled than Hypercoiled (p=0.009). However CS reported higher in both Hypocoiling and Hypercoinlig by Enas et al. The occurrence of Premature delivery was significantly less in Hypocoiled than Hypercoiled (p=0.011). Furthermore, occurrence of Oligohydramnios was higher in Hypocoiled than Hypercoiled (p=0.05). This can be explained by Edmond hypothesis which states that the twist of the umblical cord is as a result of rotatory movements imparted to the embryo.More the liquor, more is the rotatory movement, so more will be the coiling. The opposite will be true for Oligohydramnios.[3,8] However, we did not find any association of UCI with Polyhydramnios.

Other factors like sex, booked NICU admission, abruption, gestational diabetes mellitus, intrauterine growth retardation, muconium stained liquor, polyhydramnios, pregnancy induced hypertension, postdate pregnancy and severe anemia were not found statistically significant (p>0.05).

In our study we found Hypocoiling to be more associated with adverse pregnancy outcome.The reason could be that Hypocoiled cords may be more susceptible to acute kinking which results in abrupt and marked cessation of blood flow thus jeopardizing fetoplacental flow.Risk factors associated with Hypercoiling can be explained with flow dynamic principles i.e flow through a coiled tube be associated with resistance greater to flow than a straight tube.[12,13] garber and Chandra.

CONCLUSION

There is significant association of abnormal UCI with adverse maternal and perinatal factors. We found Hypocoiling(UCL<0.14) to be more associated with adverse pregnancy outcome. Various studies have reported wide variations in the association. Hence there is need to future research to substantiate the results, which would be a boon to Obstetricians to offer preventive measures and ensure good maternal and fetal outcome there is wide variation association.

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