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Original Article

Obstetrics and Gyanecology /Perinatology Section

Umbilical Coiling Index and Its Relationship with Perinatal Outcomes

SASWATI TRIPATHY

ABSTRACT

Aim: To evaluate any adverse perinatal outcomes associated with abnormal coiling of umbilical cord

Materials and Methods: One hundred two (102) umbilical cords of babies delivered either by vaginally or by lower segment caesarian section were examined. The umbilical coiling index was calculated by dividing the total number of coils by the length of the cord. Subjects with umbilical coiling index below 10th percentile, between 10th and 90th percentile and above 90th percentile were defined as hypocoiled, normocoiled and hypercoiled respectively. Various outcome measures like gestational age at birth, intrauterine growth retardation, birth weight, meconium staining, APGAR scores at 1 and 5 mins were observed. Statistical analysis was done and $p<0.05$ was considered as significant.

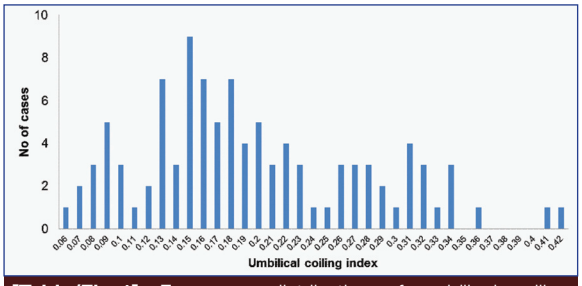
Results:The mean Umbilical coiling index was 0.20 ± 0.08. A significant relationship was found between hypocoiled cords and pregnancy-induced-hypertension (PIH) in mother and meconium staining ($p<0.05$). Hypercoiled cords were associated with PIH in mother, preterm delivery and low birth weight ($p<0.05$). APGAR score at 5min ≤ 6 was seen in hypocoiled cords ($p<0.05$).

Conclusion:Abnormal coiling index is associated with adverse perinatal outcomes.

Keywords: Hypo coiling umbilical cord, Hypercoiling umbilical cord, Umbilical coiling index

INTRODUCTION

The umbilical cord or the "funis" is vital to the development, well-being and survival of the foetus. It is a trivascular conduit which allows the foetal blood to flow in to and from the placenta. A coil is defined as complete 360 degree spiral courses of umbilical vessels around the Wharton's jelly. About 95% of the umbilical cords have coils and the origin of the coiling is unknown. Edmonds HW et al. quantified the umbilical coiling by dividing the total number of coils with umbilical cord length and called it as "The Index of Twist" [1]. The positive and negative scoring was assigned to clockwise and anticlockwise coiling of the umbilical cord. But Strong TH et al. simplified this classification by eliminating these directional scores and renamed it as "The Umbilical Coiling Index" (UCI) [2]. Hypocoiled and hypercoiled cords were defined as coils having UCI less than 10th percentile and more than 90th percentile respectively. Various reports have shown that abnormal coiling index is associated with adverse perinatal outcomes [3-6]. As there are inadequate studies to support this hypothesis in an Indian scenario, this study was undertaken to find out the umbilical coiling index and its relationship with perinatal outcomes.



[Table/Fig-1]: Frequency distribution of umbilical coiling indices

MATERIALS AND METHODS

This prospective study was conducted in Obstetrics and gynaecology department of a tertiary care hospital in Odisha, India which is a referral center for high risk pregnancies. Pregnant ladies of ≥ 28 weeks of gestation having singleton live baby irrespective of parity and the mode of delivery were included in study. The pregnant women with multi foetal gestation and having history of congenital malformed babies were excluded. Base on the selection criteria One hundred and two pregnant women were taken in to the study. After separating the baby from the umbilical cord, the cord was tied and cut closed to the placenta. Without being stretched, the cord was examined initially on the examination table. The entire umbilical cord was measured in centimeter including the

Perinatal factors	Hypocoiled (n=11)		P Value	Normocoiled (n=81)		P Value	Hypercoiled (n=10)	
	n	%		n	%		n	%
Pre term delivery (< 37 wk.)	2	18.2	NS	9	11.1	S	5	50
Amniotic Fluid Index (AFI) ≤ 06 by USG	4	36.4	NS	15	18.5	NS	2	20
Pregnancy induced hypertension (PIH)	5	45.5	S	14	17.3	S	5	50
Meconium staining	9	81.9	S	34	41.2	NS	2	20
Low birth weight (< 2500 gm.)	6	54.5	NS	35	43.2	S	8	80
Antepartum and intrapartum fetal distress	6	54.5	NS	31	38.2	NS	3	30

[Table/Fig-2]: Umbilical coiling index and perinatal outcomes S – Significant with p<0.05, NS- Not significant

APGAR score at 5 min	Hypocoiled (n=11)	p-value	Normocoiled (n=81)	p-value	Hypercoiled (n=10)
≤ 6	06 (54.5%)	< 0.05	18(22.2%)	NS	03 (30%)
> 6	05 (45.5%)	NS	63 (77.8%)	NS	07 (70%)

[Table/Fig-3]: Relationship between umbilical coiling index and Apgar score at 5 mins S – Significant with p<0.05, NS- Not significant

length of the placental end of the cord and the umbilical stump on the baby. The numbers of complete coils (360 degree spiral course) were counted from the neonatal end towards the placental end of the cord. Then the umbilical coiling index (UCI) was calculated by the formula (the total number of coils / total length of cord in centimeters). The centile values of the umbilical coiling index were calculated. The UCI less than 10th percentile and more than 90th percentile were considered as hypocoiled and hypercoiled respectively. The different perinatal factors like gestational age, intrauterine growth retardation (IUGR), meconium staining, birth weight, APGAR scores were studied. Gestational age was calculated by the first day of the last menstrual period and/or from the first trimester ultrasound report. The Intrauterine growth retardation (IUGR) was assessed by the standard growth curves [7]. APGAR score of less than six at 5 minutes was considered low. The data obtained were analysed using Fisher's exact test and Chi-square test. The p value ≤ 0.05 was considered statistically significant for all the analyses.

RESULT

We observed a total of 102 umbilical cords. The mean umbilical cord length was 53.1 ± 11.1 cm. The mean number of coils was 10.5 ± 4.4. All the umbilical cords had three vessels. The mean umbilical coiling index was 0.20 ± 0.08. The frequency distribution of UCI has been shown in [Table/Fig-1]. Among the study group, 62 subjects were primigravida (60.8%) and 40 subjects were multigravida (39.2%). An equal percentage (11.3%) of primigravida belonged to both hypocoiled and hypercoiled groups. Fifty four women (53%) were in the age group of 19-25 years and 48 (47%) women were above 25 years of age.The entire hypocoiled group (100%) belonged to average socioeconomic status, whereas 50% of the hypercoiled group belonged to low and the rest 50% to average socioeconomic status. When we analysed the data and compared the hypocoiled group (n=11) with the normocoiled group (n=81), the pregnancy induced hypertension (PIH) in mother (p=0.045) and meconium staining (p=0.021) were significantly higher as shown in [Table/Fig-2]. There was no statistically significant difference between hypocoiled group and normocoiled group when preterm delivery, Amniotic Fluid Index (AFI) in ultrasound, low birth weight, antepartum and post-partum foetal distress was considered. Similarly significant differences were seen in perinatal outcomes like preterm delivery, pregnancy induced hypertension (PIH) and low birth weight, when we compared the data of hypercoiled group with the normocoiled group (p<0.05). About 54.5% of the hypocoiled group babies had APGAR score of ≤ 6 at 5 minutes which was significantly different (p<0.05) when compared with the normocoiled group [Table/Fig-3].

DISCUSSION

The umbilical cord is a trivascular conduit. It allows the foetal blood to flow to and from the placenta. About 95% of the umbilical cords have coils. The umbilical coiling has been observed as early as eight weeks of gestation [8,9]. The total number of coils in any particular cord is believed to be established early in the gestation [8,9]. The origin of the coiling is unknown. There is lack of consensus regarding the origin of the coiling whether it is genetic or an acquired event. So there are proposed theories to explain umbilical cord twisting. The hypotheses include foetal movements, active or passive torsion of the embryo, differential umbilical vascular growth rates, foetal haemodynamic forces and the arrangement of the muscular fibers in the umbilical arterial wall [1]. Despite the lack of knowledge about the origin of the coiling, umbilical coils appear to reinforce the cord, producing a cord that is strong, yet flexible [10]. While considering the distribution of umbilical coiling index (UCI) among the study group, we observed that the 10th and 90th

percentile were in agreement with the previous studies [5,6,10]. The mean UCI of our study was 0.20 ± 0.08 which is almost similar to the findings of Ercal T et al (0.20 ± 0.1) [5], Strong TH et al (0.21 ± 0.07) [2] and 0.19 ± 0.1 by Rana J et al., [6]. Studies have shown that coiling index is not same in all segments of the umbilical cord. Increased coiling was found at the foetal end compared with the placental and middle segments [11]. In this study we did not find any such difference. Strong TH et al., [10] reported significant higher incidence of fetal death, preterm delivery, intra partum FHR disturbances, operative delivery for foetal distress, meconium staining, anatomical and karyotyping abnormalities in subjects with normocoiled cords when compared with hypocoiled cord. Strong et al., [2] later reported a higher incidence of operative delivery, meconium staining and abnormal karyotyping in hypocoiled group as compared to the normocoiled group. Gupta S et al., [12] studied and observed that incidence of operative delivery, preterm delivery, growth retardation; meconium staining was significantly higher in hypocoiled group than those with normal coiling group. In another study, a high incidence of meconium staining was found in hypocoiled group [13]. A meta-analysis also pointed out that hypo coiling is associated with increased incidence of foetal demise, intra partum foetal heart rate decelerations, operative delivery, foetal distress and chorio- amnionitis [14]. In the present study we observed that the meconium staining and PIH in mother was significantly higher in hypocoiled group which is in agreement with the above studies. In this study a significant relationship was found between pregnancy induced hypertension, preterm delivery, and low birth weight in hypercoiled group. Rana J et al., also noted that premature delivery and low birth weight were associated with hypercoiled cords [6].

In the present study, APGAR score at 5 min of ≤ 6 in relation to UCI was significantly seen with UCI < 10th percentile. Monique WM et al., studied 885 cases and found that hypo coiling was associated with low Apgar scores [15]. Low APGAR score was associated with hypocoiled group in other studies [12,16].

The major highlights of the present study was the lower UCI in new born is associated with PIH in mother, meconium staining and low Apgar score. The vessels of the cord were like hollow cylinders which were prone to torsion, compression, tension and interruption of blood flow. This risk is minimised by their helical disposition. The coiled umbilical cord is able to resist external forces that might compromise the umbilical vascular flow. The umbilical cord is more resistant to torsion, stretch, and compression than the non-coiled cords. This is called as “spontaneous internal ballottement” and linked to the action of concertina. Coiling pattern of the umbilical cord visualised by ultrasonography has a potential value in second trimester screening [17]. Predanic et al found that the sensitivity of ultrasonography to predict the hypo coiling and hypercoiling were 78.9% and 25.4% respectively [18].

CONCLUSION

The present study concludes that abnormal coiling index is associated with adverse perinatal outcomes. Quantification of the degree of abnormal vascular coiling in the antepartum period is important. Antenatal detection of coiling index can identify the foetus at risk and can help in management. But more prospective studies should be done to find the role and mechanism of umbilical coiling and its effect on the new born.

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