

Prediction of Pregnancy Outcome by Umbilical Coiling Index

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ABSTRACT

Aberrant umbilical coiling index (UCI) is related to elevated fetal and neonatal adverse incident. It will clarify a portion of the weak perinatal result that is not normally clarified. We however have observed an increase in involvement in females with anomalously coiled umbilical cords related to fetal distress. In our study 12.99% of patients had cord hypocoil and 7.92% had cord hypercoiling, while remainder were normocoiled. It was also found that 12.3% of patients were hypocoiled and 8.9% had hypercoiled issues in this study. The 10th and 90th percentiles in this sample were both 0.21 and 0.59, as well as the median was 0.40 coils / cm. Validation of the results were done through statistical analysis utilizing SPSS and excel software bundles.

Keywords: Umbilical coiling, intraamniotic structure, hypocoiling, hypercoiling, fetal distress, normocoiling

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INTRODUCTION

The fetus umbilicus has been the only clear indication of our intimate bond with our mothers when we are born. It was via the umbilical cord that formed our lives and relates to attachment to our mothers. Is an intra-amniotic configuration attached at one end among placenta as well as fetal cord towards the other end (Mittal et al., 2015). The attention in the cord decreased at the beginning of the 20th century and therefore only intermittent findings did appear from both the periods following on the cord's helix conformation (Najafi et al., 2018). Many of the fetal and neonatal problems associated with the umbilical cord had been found shortly after the births, when the cords were antenatally unavailable (Shobha & Sharanya, 2016; Chholak et al., 2017).

The concept of vesicular twisting in a standard helical structure in the umbilical cord has indeed been identified for a while, but their exact underlying beneficial function as well as supposed human development advantage remains unclear. The focus of the umbilical cord wriggling is connected with a percentage of intra - uterine casualties in pathology as mentioned in various literary works, though it remains unknown about its diagnostic value (Agarwal et al., 2015; Rabiee et al., 2016). A few have proposed concentrating is a result of intrauterine death rather than a trigger, whilst others also claimed that over-winding will lead to a fetal death on its own (Ohno et al., 2016).

It has been possible to study cord disorders prior to birth by using the ultrasonographic methodologies. Moreover, there is a resurgence of interest in this regard, and several reports on cord coiling complications have occurred in recent times (Namli et al., 2019).

RESEARCH OBJECTIVES

The main objectives of the present study were to:

- Evaluate Ultrasound UBI (UUCI) as an indicator of the result of the birth.
- Measure prenatal to 18-23 weeks the indices of umbilical coiling.
- Association of perinatal results of hypocoiling, normal coiling and hypercoiling.

LITERATURE REVIEW

In 1954, Edmonds was the first to characterize the cord coiling procedure. The twisting index is named as the twisting proportion of the cord length, granting the twisting negative or positive values if the curling path varies from left to right, with the sinister twisting dextral counter-balance twisting (Chholak et al., 2017).

In the 2nd trimester of pregnancy, Ohno et al., (2016) made ultrasound measurements of the umbilical coiling index. The UCI was easily evaluated in the 2nd trimester, however these assessments did not clearly represent the UCI in terms of time upon birth. This also contradicts that placental coiling doesn't really change after original coil initiation in the 1st trimester (Jessop et al., 2014).

Laat et al., (2006) demonstrated the embryonic determination of UCI with ultrasound imaging, as well as the association of UCI via an index calculated after conception is well established by ultrasonography 24 hours before conception. The UCI was greater than the PNI (0.44 ± 0.11 vs 0.28 ± 0.08 , $r = .771$, $p < 0.001$), the method associated to the following ante - natal UCI: $0.1775 + 0.9622 \times \text{PNI}$.

Kumar & Chetty (2017), reported that Oligohydramnios was present in 18 (78.3%) women with hypocoiling, when compared to women with hypercoiling (14.3%) and normocoiling cords which was statistically significant, who also showed more incidence of oligohydramnios in patients with abnormal coiling pattern. It could be due to the compression or the torsional operative forces.

Sebire (2007), found that hypo-coiled umbilical cords are predominantly related to mortality, fetal abnormalities including anomalous insertion; hence, these are presumed to be indicators of potential irregular endogenous growth and so could be correlated with elevated risk of reduced blood circulation because of kinking.

MATERIALS AND METHOD

Study Design

Prospective study was conducted within 2 years span, in the Department of Radio-diagnosis, KIMS, Karad, Maharashtra.

Sample size

Umbilical cord coiling of 210 antenatal women was evaluated between 18 and 23 weeks of gestation. Out of a total of 210 antenatal women that were recruited for the study 21 were lost for follow up and 12 had not delivered as of August 30, 2014, hence their out-come variables could not be studied and were excluded from further analysis.

Equipment

All sonographic examinations were performed using ACUSON X300 SIEMENS Ltd with transabdominal convex transducer (2-5 MHz). Dynamic colour flow imaging was

used to improve visualization of the umbilical coils. The same person performed ultrasound scans to avoid inter-observer variation.

Method

The pitch of one complete vascular coil was measured by ultrasonography in a midsection of the umbilical cord. Longitudinal views of umbilical cord were obtained and the distance from the inner edge of an arterial wall to the outer edge of the next was measured as demonstrated in Figure 1.

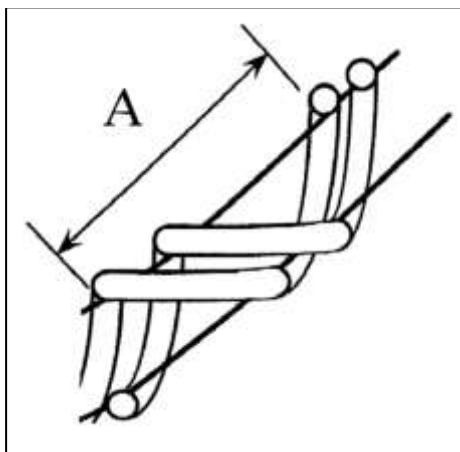


Figure 1: Distance measurements

The Ultrasonographic Umbilical Coiling Index (UUCI) was calculated as follows:

$$\frac{1}{\text{Distance between a pair of coils (A in cms)}}$$



Figure 2: Measurement of UCI with Doppler imaging

Frequency distribution of UUCI was determined and based on centile values following categories were made:

Table 1: Distribution of UUCI

Hypocoiled	<10 th percentile
Hypercoiled	> 90 th percentile

Normocoiled between 10 th and 90 th

Following outcome variables were studied:

- Pre-mature rupture of membrane (PROM)
- Preterm delivery
- Oligohydramnios
- Meconium stained amniotic fluids (MSAF)
- Fetal distress
- Interventional delivery for fetal distress
- Intrauterine fetal Demise (IUFD)
- Birth weight

The following data were collected: gestational age at delivery, parity, maternal age, sex and birth weight of the baby and instrumental delivery for non-reassuring fetal status, PROM, preterm delivery, oligohydramnios, meconium staining of the amniotic fluid.

Statistical analysis

The excel and SPSS version 14 software packages were used

for data entry and analysis. The comparison of outcome among the three study groups was done by Chi-square test and one way Anova test wherever applicable. A p value of <0.05 was considered statistically significant.

Out of a total of 210 antenatal women that were recruited for the study 21 were lost for follow up and 12 had not delivered in the said duration, hence their out-come variables could not be studied and were excluded from further analysis.

RESULTS

Out of the 177 patients who were analyzed the incidence of PROM, Preterm delivery, oligohydramnios, non-reassuring FHR, meconium stained amniotic fluid, interventional delivery and intrauterine fetal demise were 13.6%, 14.1%, 22.5%, 11.2%, 15.8 %, 38.4% and 1.7% respectively (Table 2, Figure 3).

Table 2: Distribution of variability of different presentation of delivery (n= 177)

Variable	N	Percent%
PROM	24	13.6
Preterm delivery	25	14.1
Oligohydramnios	40	22.5
Nonreassuring FHR	20	11.2
MSAF	28	15.8
Operative delivery	68	38.4
IUFD	03	1.7

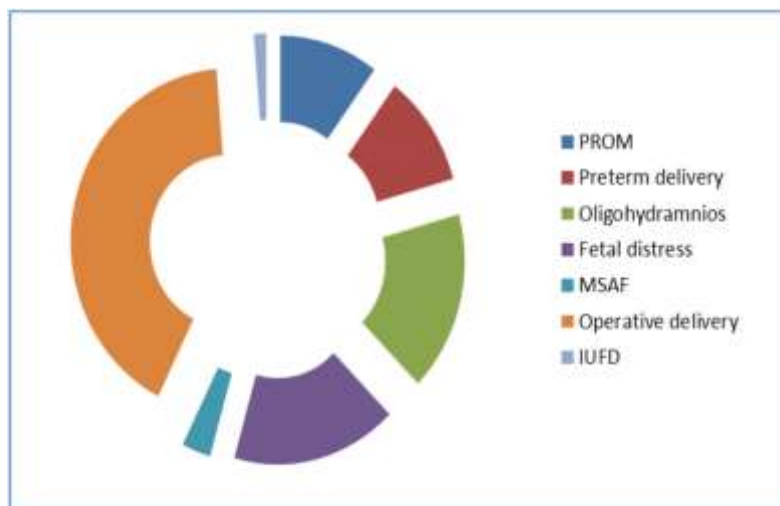


Figure 3: Distribution of variability of different presentation of delivery (n= 177)

Table 3: Umbilical cord coiling index (n=177)

	Minimum	Maximum	Mean
UUCI (NORMAL)	0.21`	0.59	0.4

Hence, cases with UUCI < 0.21 were categorized as hypo-coiled and those with UUCI >0.59 were categorized as hypercoiled. Those between 0.21 and 0.59 were categorized as normocoiled.

Hypo-coiled <0.21

Hypercoiled 0.21-0.59

Normocoiled >0.59

Figure 4 below represent the UCI categories wherein there were a total of 23 (12.99%) cases in the Hypo-coiled, 14 (7.92%) in the hypercoiled group and 140(79.09%) in the

normocoiled group (Figure 4).

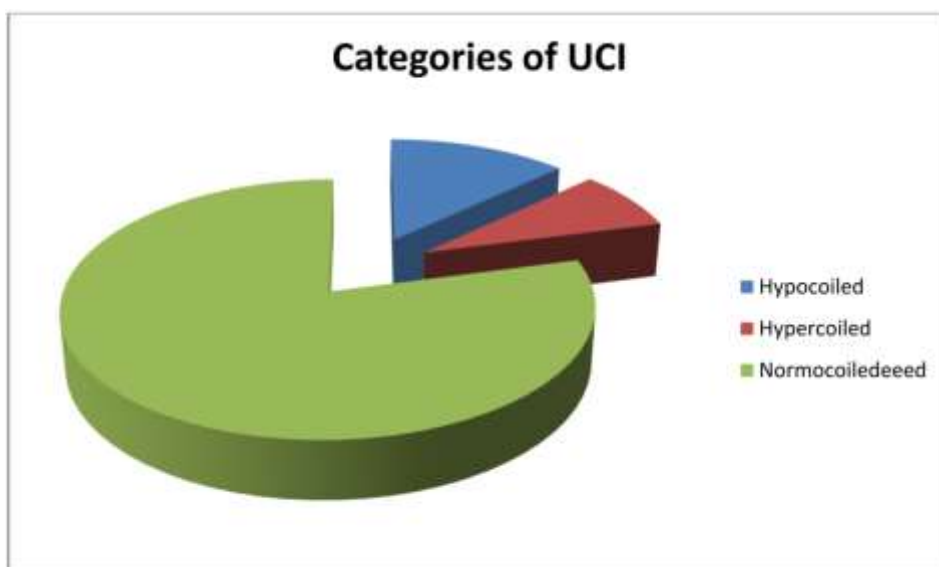


Figure 4: Categories of UCI

Premature rupture of membranes was noticed in 5 (21.7%) of women with hypocoiled cords when compared to Hypercoiled (7.1%) and normocoiled (12.9%). However, these differences were statistically not significant (Table 4).

Table 4: Correlation between PROM and UCI (n = 177)

UUCI	No PROM	PROM	Total	P value
Hypocoiled	18 (78.3%)	5 (21.7%)	23	0.2
Hypercoiled	13 (92.9%)	1 (7.1%)	14	0.4
Normocoiled	122(87.1%)	18 (12.9%)	140	0.8
Total	153 (86.4%)	24 (13.6%)	177	

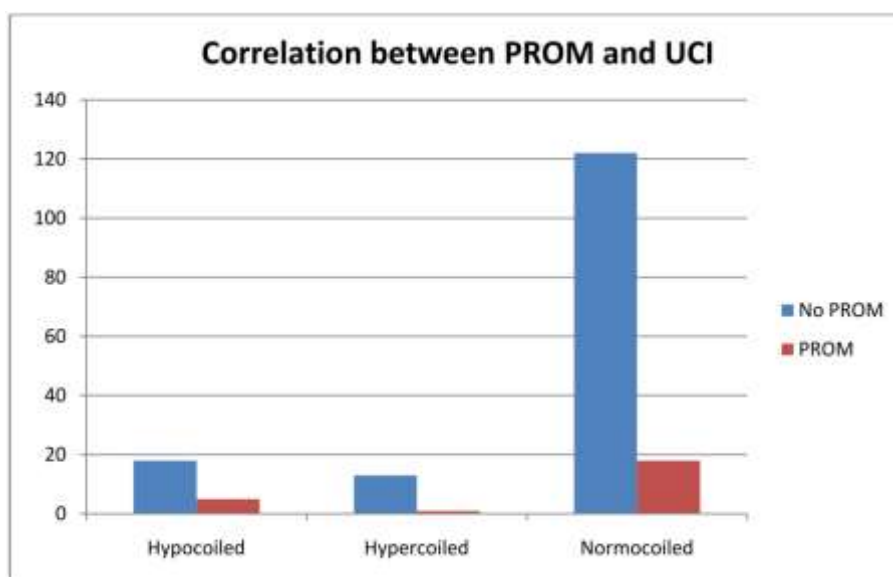


Figure 5: Correlation between PROM and UCI (n = 177)

Incidence of preterm delivery was more (21.4%) women with hypercoiling of the cords when compared to hypo (17.4%) and normocoiled (12.9%) cords but these differences were statistically not significant (see Table 5).

Table 5: Correlation between preterm delivery and UCI (n = 177)

UUCI	No PRETERM	PRETERM	Total	P value
Hypocoiled	19 (82.6%)	04 (17.4%)	23	0.6
Hypercoiled	11 (78.6%)	03 (21.4%)	14	0.4
Normocoiled	122 (87.1%)	18 (12.9%)	140	0.6

Total	152 (85.9%)	25 (14.1%)	177
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A statistically significant association was observed between oligohydramnios and hypocoiling (Table 6). Oligohydramnios was present in 18 (78.3%) women with hypocoiling, when compared to women with hypercoiling (14.3%) and normocoiling cords (14.3%).

Table 6: Correlation between oligohydramnios and UCI (n = 177)

UUCI	Normal liquor	Oligohydramnios	Total	P value
Hypocoiled	5 (21.7%)	18 (78.3%)	23	0.01
Hypercoiled	12 (85.7%)	2 (14.3%)	14	0.4
Normocoiled	120 (85.7%)	20 (14.3%)	140	1.2
Total	137 (77.4%)	40 (22.6%)	177	

In our study non-reassuring fetal heart pattern was observed in 28.5 % of the patients with hypercoiling of the umbilical cord and 26.08 % in hypocoiling which was more as compared to 9.02 % in normocoiling of cords. These findings were statistically significant (Table 7).

Table 7: Correlation between Fetal Heart rate and UCI (n = 177)

UUCI	Reassuring CTG	Non reassuring CTG	Total	P value
Hypocoiled	17 (73.9%)	6 (26.08%)	23	0.02
Hypercoiled	10 (71.4%)	4 (28.5%)	14	0.04
Normocoiled	130 (91.0%)	10 (9.02%)	140	0.12
Total	157 (88.7%)	20 (11.2%)	177	

Table 8: Correlation between interventional delivery for fetal distress and UCI (n=177)

UUCI	Vaginal	Caesarean	Instrumental	Total	P value
Hypocoiled	9 (39.1%)	14 (60.9%)	0	23	0.04
Hypercoiled	4 (28.6%)	10 (71.4%)	0	14	0.02
Normocoiled	96 (68.5%)	40 (28.5%)	4 (2.9%)	140	0.16
Total	109 (61.5%)	64 (36.1%)	4 (2.3%)	177	

In our study, the rate of interventional delivery was more with hypocoiled (60.9%) and hypercoiled (71.4%) cords when compared to that in women with normocoiled cords. These differences were statistically significant (see Table 8, Figure 6).

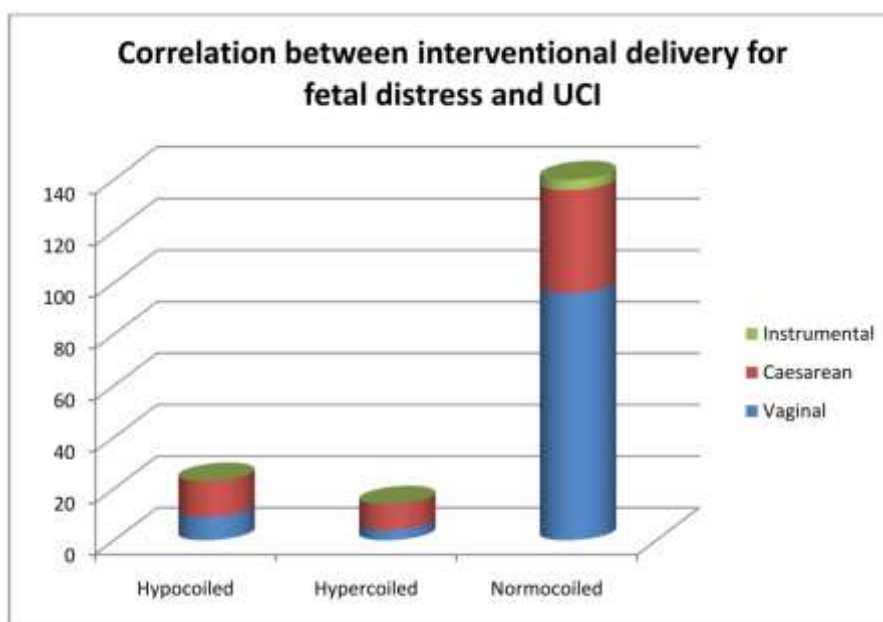


Figure 6: Correlation between interventional delivery for fetal distress and UCI

One-Way Anova test

The mean birth weights in all the three UUCI categories were comparable however and there was no strong association between coiling index and birth weight.

Table 9: Correlation between birth weight and UUCI (n =177)

UUCI	N = 177	Mean birth weight (kg)	Std. deviation
Hypocoiled	23	2.580	0.151
Hypercoiled	14	2.635	0.161
Normocoiled	140	2.822	0.181

CONCLUSION

It was appealing, despite all associations, that certain moms birthed a healthy child after a tangential pregnancy, albeit with hypercoiled and hypocoiled umbilical cords. Since undercoiling and overcoiling are related to serious adverse effects, umbilical coiling index confirmation can be used in antenatal examination as a standard component.

Moreover, hypocoiled cords have been shown to be primarily involved with fetal distresses, amniotic fluid smudged with meconium, intervention, oligohydramnio as well as intra - uterine demise. Consequently, they can be related to an elevated risk of immediate blood flow loss because of kinks and hence a sudden and evident blood termination. Fetal distress, amniotic fluid stained with meconium, interventional deliveries are strongly correlated with hypercoiled cords. It is possible because a coiled tube has a higher resistance in comparison to a straight tube.

CONFLICT OF INTEREST

None

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