

## **Research Article**

# **Umbilical Cord Coiling Index and Perinatal Outcome in Normal and Abnormal Pregnancies**

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**Abstract:** The purpose of the study was to compare umbilical coiling index and perinatal outcome in normal and abnormal pregnancies. The umbilical cords of the babies born to 500 women, who delivered either vaginally or by lower segment caesarean section, were examined and umbilical coiling index was calculated. UCI was determined by dividing the total number of coils by the total umbilical cord length in centimeters. The statistical tests were the Chi-square test and assessed with SPSS version 17.0 software. *P* value of less than 0.05 was regarded as statistically significant. The mean umbilical coiling index was found to be  $0.34 \pm 0.18$ . Hypocoiling ( $<0.05$ ) was found to be significantly associated with low apgar score, meconium staining & NICU admissions. Hypercoiling ( $>0.48$ ) was found to be associated with low birth weight & IUGR. Umbilical coiling index in the antenatal period should be studied using color Doppler as that would further categorize antenatal cases into Normal, Hypocoiling, Hypercoiling. This will help in prediction of maternal & neonatal outcome and suitable management.

**Keywords:** Umbilical coiling index, Intrauterine growth restriction, Apgar score.

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## **INTRODUCTION**

The umbilical cord is the life line of the foetus as it supplies water, nutrients and oxygen. Protection of these blood vessels is needed and provided by Wharton's jelly, amniotic fluid and the helical pattern, or coiling of the umbilical cord vessels. Umbilical cord develops in close association with amnion. Cord length is influenced positively by both volume of amniotic fluid and foetal mobility. A coil is defined as complete 360° spiral courses of umbilical vessels around the Wharton's jelly. Umbilical coiling index is defined as the number of complete coils per centimetre length of the cord [1]. An abnormal UCI includes both hypocoiled cords (i.e.; cords with UCI  $<10$ th percentile) and hypercoiled cords (i.e.; cords with UCI  $>90$ th percentile) [2]. An abnormal UCI has been reported to be related to adverse perinatal outcome.

## **MATERIAL AND METHODS**

This is a clinical observational descriptive study conducted in the Department of Obstetrics & Gynaecology of Government Medical College Haldwani. 500 singleton live babies with  $>32$  weeks gestation born in labour room of Department of Obstetrics and Gynaecology, Dr. Susheela Tiwari Government Hospital, Haldwani between November 2011 to May 2013 and attended by a single observer were included in the study.

After separating baby from umbilical cord, the cord was tied and cut as close to placenta as possible. The umbilical cord was measured in its entirety, including the length of the placental end of cord and umbilical stump on baby. The numbers of the complete coils or spirals were counted from the neonatal end towards the placental end of cord and direction of coiling was also assessed from neonatal end. A coil is defined as a complete 360 degrees spiral course of umbilical vessels around the Wharton jelly. Umbilical coiling index was calculated by dividing the total number of the complete vascular coiling by the total umbilical cord length in centimetres.

Hypocoiled cords were those with UCI less than 10th percentile and hypercoiled cords were those with UCI more than 90th percentile.

Then the relationship between UCI and perinatal factors like IUGR, meconium staining, birth weight, apgar score at 1min & 5min and NICU admission were evaluated. All patients and baby were followed till discharge

## **RESULTS**

Among 500 women studied, 343 were booked and 157 were unbooked. Multigravidas were 177 and

primigravida were 323. 302 delivered vaginally while 198 women delivered by LSCS, of which 102 had indication of foetal distress. 391 umbilical cords showed normal coiling, 52 hypercoiling and 57 had hypocoiling. 432 babies, weighed >2.5 kg. Meconium staining liquor was present in 105 cases, Apgar score at

1 min <4 was observed in 78 cases and >4 in 422 cases. Apgar score at 5 min was <7 in 70 cases and >7 in 430 cases. 55 were IUGR babies. The twist of the cord was dextral in 192 and sinistral in 308 cases. 230 were female and 270 male babies. 88 babies admitted in NICU and 12 died among them.

**Table 1: Association of Meconium Staining with UCI**

Meconium Staining	Normal	Hypo	P value	Hyper	P value
Yes	43 (11.0%)	57 (100%)	0.000	5 (9.62%)	0.763
No	348 (89.0%)	0 (0%)		47 (90.38%)	
<b>Total</b>	391 (100%)	57 (100%)		52 (100%)	

Out of 500 cases studied, 105 (21%) had meconium stained liquor; out of which 43 had normocoiling, 57 had hypocoiling & 5 had hypercoiling. 395 (79.0%) cases did not have meconium stained liquor out of them

348 had normocoiling, none had hypocoiling and 47 had hypercoiling. Meconium staining was more in hypocoiled group (p<0.05).

**Table 2: Association of IUGR with UCI**

IUGR	Normal	Hypo	P value	Hyper	P value
Yes	13 (3.32%)	0 (0%)	0.162	42 (80.77%)	0.000
No	378 (96.68%)	57 (100%)		10 (19.23%)	
<b>Total</b>	391 (100%)	57 (100%)		52 (100%)	

Out of 500 babies, 55 (11%) had IUGR out of which 13 had normocoiling, none had hypocoiling & 42 had hypercoiling. 445 (89%) babies did not have IUGR

out of which 378 had normocoiling, 57 had hypocoiling and 10 had hypercoiling. Hypercoiled cords had significant association with IUGR (p<0.05).

**Table 3: Association of NICU admission of baby with UCI**

NICU admission	Normal	Hypo	P value	Hyper	P value
Yes	48 (12.28%)	25 (43.86%)	0.000	15 (28.85%)	0.002
No	343 (87.72%)	32 (56.14%)		37 (71.15%)	
<b>Total</b>	391 (100%)	57 (100%)		52 (100%)	

Out of 88 (17.5%) NICU admissions, 48 had normocoiling, 25 had hypocoiling & 15 had hypercoiling. 412 babies (82.5%) were not admitted to NICU out of which 343 had normocoiling, 32 had

hypocoiling & 52 had hypercoiling. There was increase incidence of NICU admission in babies with hypocoiling (p<0.05).

**Table 4: Association of Apgar score at 1 minute of baby with UCI**

Apgar score	Normal	Hypo	P value	Hyper	P value
<4.0	58 (14.83%)	18 (31.58%)	0.002	2 (3.85%)	0.027
>4.0	333 (85.17%)	39 (68.42%)		50 (96.15%)	
<b>Total</b>	391 (100%)	57 (100%)		52 (100%)	

78 (15.5%) babies had apgar at 1 min < 4, out of them 58 had normocoiling, 18 had hypocoiling & 2 had hypercoiling. 422 (84.5%) babies had apgar at 1 min > 4, out of them 333 had normocoiling, 39 had

hypocoiling & 50 had hypercoiling. Thus hypocoiling pattern had significant association with apgar at 1 min <4 (p<0.05).

**Table 5: Association of Apgar score at 5 minute of baby with UCI**

Apgar score	Normal	Hypo	P value	Hyper	P value
<7.0	48 (12.28%)	17 (29.82%)	0.000	5 (9.62%)	0.579
>7.0	343 (87.72%)	40 (70.18%)		47 (90.38%)	
<b>Total</b>	391 (100%)	57 (100%)		52 (100%)	

70 (14%) babies had apgar at 5 min < 7, out of them 48 had normocoiling, 17 had hypocoiling & 5 had hypercoiling. 430 (86%) babies had apgar at 5 min > 7,

out of them 343 had normocoiling, 40 had hypocoiling, 47 had hypercoiling. Hypocoiling had significant association with apgar at 5 min <7 (p<0.05).

**Table 6: Association of Birth weight of baby with UCI**

	Normal	Hypo	P value	Hyper	P value
<2.5	25 (6.39)	0 (0)	0.125	43 (82.69)	0.000
2.5-3.5	341(87.22)	52 (91.23)		9 (17.31)	
>3.5	25 (6.39)	5 (8.77)		0 (0)	
<b>Total</b>	391 (100)	57 (100)		52(100)	

UCI was associated with birth weight, 68 (13.6%) babies had birth weight less than 2.5 Kg out of which 25 had normocoiling, none had hypocoiling and 43 had hypercoiling. 402 (80.4%) babies had birth weight between 2.5-3.5 Kg, 341 had normocoiling, 52 had hypocoiling and 9 had hypercoiling. 30 (6%) babies weighed more than 3.5 Kg out of which 25 had normocoiling, 5 had hypocoiling and none had hypercoiling. Low birth weight had significant association with hypercoiling (p value<0.05).

## DISCUSSION

The umbilical coiling index has been found to be an effective indicator of perinatal outcome. The aim of this study was to find the relationship between UCI and perinatal factors. The mean UCI in our study was 0.34 + 0.18.

When the birth weight of babies were compared with UCI, it was found that LBW (birth weight <2.5 kg) was significantly associated with hypercoiling (P =0.001). Literature has found a consistent association between hypercoiling and LBW babies, as shown by Rana *et al.* [2] and de Laat *et al.* [3], however the authors were unable to give a satisfactory explanation for this casual association.

In present study it was observed that meconium staining was significantly associated with UCI <10th percentile. In the study by Gupta S *et al.* [4], they studied 107 umbilical cords and found that in hypocoiled group, meconium staining was significantly higher than in those with normocoiled group. In another study by Strong TH *et al.* [5], 100 cases were studied and they found that meconium staining was associated with UCI values less than 10th percentile with p value of 0.03 which is highly significant. Padmanabhan LD *et al.* [6] also studied 130 cases, where they found that meconium staining was significant among hypocoiled group.

Our study demonstrated a significant association between IUGR babies and hypercoiling (P = 0.000). Ezimokhai *et al.* [7] and de Laat *et al.* [3] obtained a similar result in their studies. However Strong *et al.* [5] and Machin *et al.* [8] found IUGR to be associated with hypocoiling. They summarized that since adequate coiling prevents compression of the cord, hypocoiling in the long run results in reduced fetoplacental circulation, thus resulting in growth restriction. Monique *et al.* [9] also found that hypocoiling was associated with small for gestational age infants.

In the present study babies admitted to NICU were 17.6% and babies with hypocoiled cords had more NICU admission. A similar study was conducted by Monique WM *et al.* [9], 885 cases were studied and it was concluded that under coiling of the cord was associated with fetal death. Strong TH *et al.* [5], found that incidence of fetal death in non coiled group was significantly greater with p value <.05.

In present study, Apgar score at 1 min <4 was found with UCI <10th percentile. Gupta *et al.* and Padmanabhan *et al.* [6] also found that hypocoiled group was associated with Apgar score at 1 min <4. In present study, Apgar score at 5 min <7 in relation to UCI was seen with <10th percentile. Monique *et al.* [9] also observed that hypocoiling was associated with low Apgar <7 at 5 min.

## CONCLUSION

The umbilical coiling index is associated with adverse perinatal outcome. Hypercoiling is associated with IUGR and low birth weight babies. Hypocoiling is associated with meconium staining, low apgar score at 1 min and 5 min & NICU admissions. Umbilical coiling index in the antenatal period should be studied using color Doppler as that would further categorize antenatal cases into Normal, Hypocoiling, Hypercoiling. This will help in prediction of maternal & neonatal outcome and suitable management.

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