

DOI: <https://dx.doi.org/10.18203/2320-1770.ijrcog20261624>

Original Research Article

## Association between umbilical cord coiling index and adverse perinatal outcomes: a prospective observational study

Bhagyashree D. Wagaskar<sup>1,2\*</sup>, Sangita Ramteke<sup>1</sup>

<sup>1</sup>Department of Obstetrics and Gynecology, Shree Bhausaheb Hire Government Medical College and Hospital, Dhule, Maharashtra, India

<sup>2</sup>Department of Obstetrics and Gynecology, Indira Gandhi Government Medical College and Hospital, Nagpur, Maharashtra, India

**Received:** 14 April 2026

**Accepted:** 16 May 2026

**\*Correspondence:**

Dr. Bhagyashree D. Wagaskar,

E-mail: [wagaskarbhagyashree65@gmail.com](mailto:wagaskarbhagyashree65@gmail.com)

**Copyright:** © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

### ABSTRACT

**Background:** The umbilical cord coiling index (UCI) has been proposed as a valuable parameter in predicting adverse perinatal outcomes. Abnormal coiling patterns, including hypocoiling and hypercoiling, are thought to reflect aberrant vascular development, potentially resulting in compromised fetal well-being. Objectives were to determine the association between UCI patterns (normocoiling, hypocoiling, and hypercoiling) and maternal and neonatal outcomes in singleton pregnancies.

**Methods:** A prospective observational study was conducted from November 2023 to November 2024 at a tertiary care center. A total of 250 pregnant women with singleton pregnancies beyond 28 weeks of gestation were enrolled. Postnatally, UCI was calculated by dividing the number of complete vascular coils by the total cord length in centimeters. Values below the 10<sup>th</sup> percentile were labeled hypocoiled (<0.07), and above the 90<sup>th</sup> percentile were labeled hypercoiled (>0.4). Outcomes, including mode of delivery, birth weight, meconium-stained liquor, APGAR scores, NICU admissions, and maternal risk factors, were analyzed.

**Results:** Out of 250 cases, 199 (79.6%) showed normocoiling, 26 (10.4%) had hypocoiling, and 25 (10%) exhibited hypercoiling. Hypercoiled cords were significantly associated with preterm delivery 11 (44%), very low birth weight 10 (40%), NICU admission 15 (60%), and low APGAR scores at 1 and 5 minutes is 20 (80%) and 13 (52%) respectively. Hypocoiled cords showed a strong association with meconium-stained liquor 15 (57.7%) and high cesarean delivery rates 22 (84.6%). Maternal comorbidities did not show statistically significant differences among the groups.

**Conclusions:** Both hypocoiled and hypercoiled umbilical cords are significantly associated with adverse perinatal outcomes. UCI serves as a useful postnatal marker and has potential as a prenatal predictive tool for identifying fetuses at risk.

**Keywords:** Hypercoiling, Hypocoiling, Meconium-stained liquor, Perinatal outcome, Umbilical cord coiling index

### INTRODUCTION

The fetal cardiovascular system is directly continued by the umbilical cord, commonly known as “the birth cord”. In contrast to the placenta, which is fixed to the uterine wall, this structure, which serves as an anatomical bridge between the placenta and the developing fetus, is crucial to human development because it allows the fetus to move.

In addition to allowing the fetus to grow in an almost unrestricted manner, aquatic environment, the umbilical cord ensures a flexible delivery system of oxygen and nutrients while simultaneously removing carbon dioxide and other waste components/elements towards the placenta and away from the tethered fetus, facilitating pulmonary and joint extension/flexion development. The umbilical cord is a straightforward structure made up of

two arteries and one vein encased in Wharton's jelly, despite its immense significance. The placenta receives one end of the umbilical cord, while the fetal abdomen receives the other. The umbilical cord develops additional coils as gestational age increases. Coiling is a method to protect the vessels in the cord from being crushed.<sup>1</sup>

The umbilical cord's vessels are arranged in a helical configuration. The umbilical cord's coiling gives it strength and flexibility to withstand stress that could impair blood flow through its capillaries.<sup>2</sup> Many theories have been presented to explain how coiling occurs, but the mechanism of cord coiling remains poorly understood. One theory is that the fetus rotates around the axis of its umbilical cord. Additional possibilities include the distinct muscle fibre arrangement in the umbilical artery wall and the variation in the growth rate of umbilical blood vessels.<sup>3</sup> To standardize the description of cord coiling, Strong et al introduced the term "umbilical coiling index" (UCI) in 1994.<sup>4</sup> It is defined as the number of coils in the cord divided by the total cord length in centimeters. UCI typically ranges from 0.2 to 0.24 coils/cm, or one coil per five centimetres.<sup>5</sup>

Umbilical cords were classified as hypocoiled (UCI < 10<sup>th</sup> percentile), normocoiled (UCI between 10<sup>th</sup> and 90<sup>th</sup> percentile), and hypercoiled (UCI > 90<sup>th</sup> percentile) according to Rana et al frequency distribution of the umbilical cord coiling index (UCI).<sup>6</sup>

Undercoiled cords may be more prone to acute kinking, which would result in an abrupt and noticeable cessation of blood flow; in the case of hypercoiled cords, flow dynamic principles and research indicate that flow through a coiled tube should be associated with greater resistance to flow than through a straight tube.<sup>7</sup>

The goal of the current study was to measure the umbilical cord coiling index (UCI) after birth and ascertain whether normocoiling, hypocoiling, and hypercoiling are associated with perinatal outcomes.

## METHODS

### *Study design and setting*

A prospective observational study was conducted over 12 months (November 2023 - November 2024) in the department of obstetrics and gynecology at Indira Gandhi Government Medical College and Hospital, Nagpur, a tertiary care teaching hospital affiliated with the Maharashtra University of Health Sciences (MUHS), Nashik.

The study was approved by the institute ethics committee, Board of Research Studies, Indira Gandhi Government Medical College and Hospital, which issued approval IGGMC/Pharm/BORS/1366-67/2023. Written informed consent was taken from all the participants in their preferred vernacular language (Hindi/Marathi).

### *Inclusion criteria*

Singleton pregnancy, cephalic presentation, gestational age  $\geq 28$  weeks

### *Exclusion criteria*

Multiple gestations, intrauterine fetal demise, malpresentations, history of smoking, drug abuse, or maternal fever  $\geq 37.8^\circ\text{C}$ .

### *Sample size*

Using the formula  $N = (Z_{\alpha/2})^2 \times P(1-P) / E^2$

Where, N = Sample size,  $Z_{\alpha/2}$  = Z value at 5% error (1.96), P = 20% Prevalence of abnormal UCI, E = Absolute error (taken as 5%) with 95% confidence and 5% margin of error, and assuming a prevalence (P) of 20% for abnormal UCI, the sample size was calculated as 246. A total of 250 women were recruited consecutively.

### *Data collection*

Data was collected using a pre-made semi-structured study proforma (Appendices: case report form). In addition to a general, physical, systemic, and obstetric examination, each patient's full menstrual, obstetric, and medical history was collected. Based on clinical findings, pertinent investigations were carried out. A trustworthy ultrasound examination of the first trimester or last menstrual cycle, or both, was used to determine gestational age.

### *UCI measurement*

The appearance of the umbilical cord was assessed after birth. The number of complete vascular coils was counted after the baby was separated from the umbilical cord, and the cord was tied and cut as close to the baby as feasible. The cord was measured from the placental insertion to the baby's neonatal clamp site or to the baby's belly (an additional 5 cm is required). Following the calculation of the umbilical cord coiling index using the following formula,

UCI = Number of coils / total length of cord (in cm)

Normocoiling: UCI 0.07-0.4

Hypocoiling: UCI < 0.07

Hypercoiling: UCI > 0.4.

### *Outcome measures*

Primary neonatal outcomes include birth weight, APGAR scores, NICU admission, meconium-stained liquor, preterm birth. Maternal parameters such as age, parity,

pregnancy-induced hypertension (PIH), diabetes mellitus, polyhydramnios/oligohydramnios.

### Statistical Analysis

Patients were profiled using various clinical, laboratory, and demographic parameters as part of the analysis. Means and standard deviations were used in the descriptive analysis of quantitative parameters. Absolute numbers and percentages were used to express ordinal data. Cross-tables were created, associations were tested using the chi-square test, and quantitative parameters were compared

using the student t-test. A p value of less than 0.05 was regarded as statistically significant. SPSS software, version 24.0, was used for all analyses.

### RESULTS

A total of 250 subjects were included in the final analysis. It was found that for our study sample, the 10<sup>th</sup> percentile for UCI was 0.07 and the 90<sup>th</sup> percentile for UCI was 0.4. Of the sample, 199 (79.6%) had normocoiling, 26 (10.4%) had hypocoiling, and 25 (10%) had hypercoiling.

**Table 1: Sociodemographic distribution of study participants (n=250).**

Characteristics	Age groups	Normocoiling (%)	Hypocoiling (%)	Hypercoiling (%)	Total (%)
Age groups (years)	20 to 25	67 (33.70)	7 (26.90)	10 (40.00)	84 (33.60)
	26 to 30	91 (45.70)	11 (42.30)	10 (40.00)	112 (44.80)
	31 to 35	32 (16.10)	4 (15.40)	5 (20.00)	41 (16.40)
	36 to 40	9 (4.50)	4 (15.40)	0 (0.00)	13 (5.20)
	Total	199 (100.00)	26 (100.00)	25 (100.00)	250 (100.00)
Obstetric score	Primigravida	71 (35.68)	12 (46.15)	9 (63.00)	92 (36.80)
	Multigravida	128 (64.32)	14 (53.85)	16 (64.00)	158 (63.20)
	Total	199 (100.00)	26 (100.00)	25 (100.00)	250 (100.00)

**Table 2: Description of mean umbilical cord length, number of coils, and UCI.**

Umbilical cord	Mean	Std. deviation	Minimum	Maximum	
Length (cm)	Normocoiling (UCI 0.07 to 0.4)	68.8	13.1	35	120
	Hypocoiling (UCI<0.07)	82.4	10.7	51	95
	Hypercoiling (UCI>0.4)	55.6	5.9	42	68
	Total	68.9	13.8	35	120
No of coils	Normocoiling (UCI 0.07 to 0.4)	14.9	6.8	4	67
	Hypocoiling (UCI<0.07)	4.3	0.8	3	6
	Hypercoiling (UCI>0.4)	29.0	5.2	18	36
	Total	15.2	8.4	3	67
UCI	Normocoiling (UCI 0.07 to 0.4)	0.2	0.1	0.07	0.4
	Hypocoiling (UCI<0.07)	0.04	0.01	0.03	0.06
	Hypercoiling (UCI>0.4)	0.5	0.1	0.41	0.6
	Total	0.2	0.1	0.03	0.6

Table 1 depicts the basic sociodemographic data of the study participants. Mean age of patients in hyper-, hypo-, and normocoiling group cases was 26.2±4.2, 28.6±4.9, and 27.4±4.1 years, with no significant difference between them (p value =0.11). Overall, in our study sample, 26 to 30 years was the most common age group. Study showed that 158 (63.20%) were multigravida and 92 (36.80%) were primigravida.

Table 2 depicts mean overall umbilical cord length was 68.9cm, the mean number of coils was 15.2, and the mean UCI was 0.2.

Table 3 summarizes the association of maternal high risk factor with abnormal UCI. Among cases with hypocoiled cord 5 (19.23%) were oligohydramnios, while among

hypercoiled cords, 2 (8%) were oligohydramnios, 2 (8%) polyhydramnios, 2 (8%) were premature rupture of membranes.

Table 4 summarizes in these out of the total 250 cases, 127 (50.80%) were lower segment caesarean section (LSCS) and 123 (49.20%) were vaginal delivery. The incidence of LSCS was maximum in cases with hypocoiling 22 (84.6%) as compared to those with hypercoiling 17 (68%), and normocoiling 88 (44.2%), with p value <0.01, which was statistically significant.

Table 5 summarizes the relation of neonatal outcome with abnormal UCI. A statistically significant association was observed between abnormal UCI and adverse neonatal outcomes (p<0.01).

**Table 3: Comparison of maternal risk factors between normocoiling, hypocoiling, and hypercoiling cases.**

Maternal factor	Normocoiling (%)	Hypocoiling (%)	Hypercoiling (%)	Total (%)	P value
Oligohydramnios	25 (12.56)	5 (19.23)	2 (8.00)	32 (12.80)	0.47
Polyhydramnios	3 (1.51)	0 (0.00)	2 (8.00)	5 (2.00)	0.06
Pre-eclampsia	9 (4.52)	1 (3.85)	1 (4.00)	11 (4.40)	0.98
Gestational hypertension	17 (8.54)	2 (7.69)	0 (0.00)	19 (7.60)	0.31
Intra-uterine growth retardation	15 (7.54)	2 (7.69)	1 (4.00)	18 (7.20)	0.81
Premature rupture of membranes	10 (5.03)	0 (0.00)	2 (8.00)	12 (4.80)	0.38
Gestational diabetes mellitus	1 (0.50)	1 (3.85)	1 (4.00)	3 (1.20)	0.13
Anemia	2 (1.01)	0 (0.00)	0 (0.00)	2 (0.80)	0.77
Other	17 (8.54)	1 (3.85)	2 (8.00)	20 (8.00)	0.71
<b>Total</b>	199 (100)	26 (100)	25 (100)	250 (100)	

**Table 4: Comparison of mode of delivery with UCI.**

Mode of delivery	Normocoiling (%)	Hypocoiling (%)	Hypercoiling (%)	Total (%)
Lower segment cesarean section (LSCS)	88 (44.20)	22 (84.60)	17 (68.00)	127 (50.80)
Vaginal delivery	111 (55.80)	4 (15.40)	8 (32.00)	123 (49.20)
<b>Total</b>	199 (100.00)	26 (100.00)	25 (100.00)	250 (100.00)

P value\* &lt;0.01

**Table 5: Comparison of perinatal outcome with abnormal UCI.**

Birth weight	Normocoiling (%)	Hypocoiling (%)	Hypercoiling (%)	Total (%)
Low birth weight (<2.5 kg)	46 (23.10)	7 (26.90)	9 (36.00)	62 (24.80)
Very low birth weight (<1.5 kg)	9 (4.50)	3 (11.50)	10 (40.00)	22 (8.80)
<b>Preterm</b>				
Yes	31 (15.6)	1 (3.80)	11 (44.00)	43 (17.20)
No	168 (84.40)	25 (96.20)	14 (56.00)	207 (82.80)
<b>Meconium-stained liquor</b>				
Yes	38 (19.10)	15 (57.70)	1 (4.00)	54 (21.60)
No	161 (80.90)	11 (42.30)	24 (96.00)	196 (78.40)
<b>APGAR &lt;7</b>				
At 1 minute	62 (31.20)	17 (65.40)	20 (80.00)	99 (39.60)
At 5 minutes	20 (10.10)	6 (23.10)	13 (52.00)	39 (15.60)
<b>NICU admission</b>				
Yes	23(11.60)	5(19.20)	15(60.00)	43(17.20)
No	176(88.40)	21(80.80)	10(40.00)	207(82.80)

P value\* &lt;0.01.

In these, the mean birth weight was low in cases with hypercoiling (1.8 kg), as compared to those with hypocoiling (2.5 kg) and normocoiling (2.5 kg), which was statistically significant, p value <0.01, and was analyzed using one-way ANOVA. Among cases with hypercoiling, 9 (36%) were LBW and 10 (40%) VLBW, which is statistically significant, while among hypocoiling cases, 7 (26.9%) were born LBW, 13 (1.5%) VLBW, p value <0.01, which was statistically significant.

The incidence of preterm was 11 (44%) among hypercoiling cases, which was significantly higher

compared to hypocoiling 1 (3.8%) and normocoiling 31 (15.6%), p value <0.01.

The incidence of MSL was 15 (57.7%) among hypocoiling cases, which was significantly higher than hypercoiling 1 (4%) and normocoiling 38 (19.1%), p value <0.01.

Comparison of APGAR scores at 1 and 5 minutes showed that at 1 min 20 (80.00%) of the neonates of hypercoiling cases had APGAR score <7, which was significantly higher than hypocoiling 17 (65.40%) and normocoiling 62 (31.2%), p value <0.01. At 5 minutes, 13 (52%) of the neonates of hypercoiling cases had an APGAR score <7,

which was significantly higher than hypocoiling 6(23.1%) and normocoiling 20 (10.1%), p value <0.01.

NICU admission rate was 15 (60%) among neonates of hypercoiling cases, which was significantly higher compared to hypocoiling 5 (19.2%) and normocoiling 23 (11.6%), p value <0.01.

## DISCUSSION

The relationship between the umbilical coiling index (UCI) and perinatal outcomes has been the subject of numerous prior studies. UCI was compared with a number of parameters in the current study. The mean age of patients in the hyper-, hypo-, and normocoiling group cases was 26.2±4.2, 28.6±4.9, and 27.4±4.1 years, respectively, when compared with age and parity; there was no significant difference between them (p value =0.11). Overall, in our study sample, 26 to 30 years was the most common age group. Additionally, there was no significant correlation found between abnormal UCI and parity. Parity was not substantially linked to abnormal UCI in the study by Singh et al, Makde et al.<sup>8,9</sup> In the present study, hypocoiled cords were significantly associated with lower segment cesarean section. In the study by Singh et al, found that caesarean section was more common in the hypocoiling group.<sup>8</sup> Meconium staining was found to be significantly correlated with Hypocoiling in the current study (p value <0.01). Meconium staining was found to be significantly associated with the hypocoiled group in Gupta et al study of 107 umbilical cords.<sup>10</sup> Meconium-stained amniotic fluid was found to be significantly associated with Hypocoiling in another study by Makde et al and observed that meconium-stained amniotic fluid was significantly associated with hypocoiling.<sup>9</sup> Meconium-stained liquor was linked to hypocoiled cords in a study by Jain et al that calculated the umbilical cord coiling index and compared its association with perinatal outcome in normal and complicated pregnancies.<sup>11</sup>

In the present study, among cases with hypercoiling, the most common risk factors were oligohydramnios, polyhydramnios, and premature rupture of membranes. Among cases with hypocoiling, the most common maternal risk factor was oligohydramnios. Other risk factors were gestational hypertension, intrauterine growth retardation, pre-eclampsia, and gestational diabetes mellitus. The study by Reddy et al demonstrated that hypercoiling was significantly associated with GDM and polyhydramnios.<sup>12</sup> In the study by Jain et al, showed that PIH, GDM, and oligohydramnios were significantly associated with hypocoiled cords, and polyhydramnios was significantly associated with hypercoiling.<sup>11</sup> Studies by Chitra et al revealed a huge relationship between diabetes and hypercoiled cords.<sup>13</sup>

In the present study, APGAR score at 1 min and APGAR score at 5 min of <7 was found with a UCI >10<sup>th</sup> percentile (p value <0.01). In the study by Boyama et al, low Apgar scores were present in 13.3 % of normocoiled cases, 30%

hypocoiled cases, and 33.3% in hypercoiled cases. In hypercoiled groups, a significant correlation was found.<sup>14</sup> Makde et al found a significant correlation between hypercoiling and low birth weight (LBW), NICU admissions, and a low Apgar score at one minute.<sup>9</sup> In the present study Mean birth weight was found to be significantly low in cases with hypercoiling. Among cases with hypercoiling, 9 (36%) were born LBW (<2.5 kg) and 10 (40%) were born VLBW (<1.5 kg). The hypercoiled group had a significantly higher incidence of preterm and NICU admission rates. Khan et al study found that Hypercoiling was linked to PIH, FGR, LBW, low APGAR score, and NICU admissions.<sup>15</sup>

In the Jain et al study, low ponderal index demonstrated moderate statistical significance with the hypercoiled group, while hypocoiling was significantly associated with low Apgar score, and hypercoiling was associated with LBW (<2.7 kg).<sup>11</sup> According to a study by Devi et al, neonates with hypercoiled cords had considerably higher perinatal morbidity in terms of meconium-stained liquor, fetal distress, lower Apgar scores at birth, and the need for NICU admissions when compared to those with normocoiled cords.<sup>16</sup>

This study confirms that both extremes of the UCI spectrum, hypocoiling and hypercoiling, are associated with adverse perinatal outcomes. The pathophysiological basis likely includes vascular compromise, increased resistance in hypercoiling, and kinking risk in hypocoiling.

There are some restrictions on the study. The results of this single-center, hospital-based study might not apply to a wide range of populations with different socioeconomic or geographic backgrounds. Although the sample size was adequate, a larger multicentric cohort could have improved statistical power and validity. UCI was assessed postnatally, limiting its ability to evaluate prenatal prediction potential and excluding antenatal ultrasonographic measurement variability. Confounding factors such as maternal nutrition and umbilical cord insertion anomalies were not extensively analyzed and might have impacted outcomes. Additionally, inter-observer variability in measurement techniques could not be eliminated.

This study has several notable strengths. It was conducted as a prospective observational study, enabling systematic and real-time data collection with minimal recall bias. The sample size of 250 participants strengthens the reliability of the results. Clear categorization of UCI values using standardized percentile cut-offs allowed accurate classification of normocoiling, hypocoiling, and hypercoiling patterns. Additionally, a comprehensive assessment of important maternal and neonatal outcomes enhanced the clinical relevance of the findings. As the study was performed at a tertiary care center, standardized obstetric and neonatal management protocols helped ensure uniformity of clinical practices.

## CONCLUSION

The umbilical cord coiling index is a simple, objective tool that correlates well with several important perinatal outcomes. Both hypocoiled and hypercoiled cords deserve clinical attention and may necessitate closer fetal monitoring and individualized delivery planning. A promising noninvasive method for identifying high-risk pregnancies and evaluating fetal health is the antenatal measurement of UCI. By ensuring a healthy pregnancy, increased surveillance during pregnancy will improve perinatal outcomes and enhance the well-being of both the mother and the fetus.

## ACKNOWLEDGEMENTS

Authors would like to sincerely extend gratitude to all the faculty and staff of the department of obstetrics and gynecology, Indira Gandhi Government Medical College and Hospital, Nagpur, Maharashtra, India.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: The study was approved by the Institutional Ethics Committee Indira Gandhi Government Medical College and Hospital issued approval IGGMC/Pharm/BORS/1366-67/2023*

## REFERENCES

1. Oyelese, Y. Placenta, umbilical cord, and amniotic fluid: the not-less-important accessories. *Clin Obstet Gynecol.* 2012;55:307-23.
2. de Laat MW, van Alderen ED, Franx A, Visser GH, Bots ML, Nikkels PG. The umbilical coiling index in complicated pregnancy. *Eur J Obstet Gynecol Reprod Biol.* 2007;130(1):66-72.
3. de Laat MWM, Nikkels PGJ, Franx A, Visser GHA. The roach muscle bundle and umbilical cord coiling. *Early Hum Dev.* 2007;83:571-4.
4. Strong TH, Jarles DL, Vega JS, Feldman DB. The umbilical coiling index. *Am J Obstet Gynecol.* 1994;170:29-32.
5. Predanic M, Perni SC, Chasen ST, Baergen RN, Chervenak FA. Assessment of umbilical cord coiling during the routine fetal sonographic anatomic survey in the second trimester. *J Ultrasound Med.* 2005;24(2):185-91.
6. Rana J, Ebert GA, Kappy KA. Adverse perinatal outcome in patients with an abnormal umbilical coiling index. *Obstet Gynecol.* 1995;85:573-7.
7. Kaplan AD, Jaffa AJ, Timor IE, Elad D. Hemodynamic analysis of arterial blood flow in the coiled umbilical cord. *Reprod Sci.* 2010;17(3):258-68.
8. Singh S, Pai S, Sahu B. Study of umbilical coiling index and perinatal outcome. *Int J Reprod Contracept Obstet Gynecol.* 2020;9:3977.
9. Predanic M, Perni SC, Chasen ST, Baergen RN, Chervenak FA. Assessment of umbilical cord coiling during the routine fetal sonographic anatomic survey in the second trimester. *J Ultrasound Med.* 2005;24(2):185-91.
10. ShaluGupta M, Krishnan J. Umbilical coiling index. *J Obstet Gynecol India.* 2006;56(4):315-9.
11. Jain P, Aggarwal M, Ahuja M, Gupta S. Umbilical cord coiling index as a marker of perinatal outcome. *Indian J Obstet Gynecol Res.* 2021;8(3):349-53.
12. Reddy DN, Anuradha CR. Association between umbilical cord coiling index and perinatal outcome. *J South Asian Feder Obstet Gynaecol.* 2024;16(1):17-9.
13. Chitra T, Sushanth YS, Raghavan S. Umbilical coiling index as a marker of perinatal outcome: an analytical study. *Obstet Gynecol Int.* 2012;2012(1):213689.
14. Boyama BA, Yilmaz EZ. The association between umbilical cord coiling index and adverse perinatal outcomes at term pregnancies. *Eur Res J.* 2023;9:963-9.
15. Khan T, Thakur R. Association of postnatal umbilical coiling index with maternal and perinatal outcome. *Int J Clin Obstet Gynaecol.* 2019;3:144-9.
16. Asha DE, Ramesh S, Hamsalekha NA, Huchegowda S. Umbilical coiling index and its relation to perinatal outcome. *J Clin Obstet Gynecol.* 2021;31(1):6-13.

**Cite this article as:** Wagaskar BD, Ramteke S. Association between umbilical cord coiling index and adverse perinatal outcomes: a prospective observational study. *Int J Reprod Contracept Obstet Gynecol* 2026;15:2139-45.

**APPENDIX-I**

<b>CASE REPORT FORM: PROFORMA</b>	
NAME:	
AGE(YEARS):	DATE OF ADMISSION:
MRD NO:	
OCCUPATION:	
ADDRESS:	
EDUCATION:	
BOOKED/UNBOOKED CASE:	
CHIEF COMPLAINTS-	
OBSTETRIC HISTORY:-	
Gravida: Parity: Live: Abortions: Dead:	
PRESENT PREGNANCY	
MENSTRUAL HISTORY- LMP:	
EDD: Period of gestation:	
Previous menstrual history: _	
PAST HISTORY: DM/HTN/THYROID/SICKLE CELL DISEASE/EPILEPSY/ASHTMA/TB/JAUNDICE/TB/MAJOR SURGICAL INTERVENTION	
FAMILY HISTORY:	
IMMUNIZATION HISTORY:	
PERSONAL HISTORY:	
<b>GENERAL EXAMINATION:</b>	
General condition:	
Height _____ cm	Weight _____ kg BMI:
Built -	Pallor-
Icterus -	Edema-
Lymphadenopathy-	Clubbing-
Cyanosis-	
Spine-	Thyroid-
Blood pressure _____ (mmhg),	VITALS-
Pulse- _____ /min	
Temperature _____ degree celcius	
Respiratory rate _____ /min	
SYSTEMIC EXAMINATION:	
CARDIOVASCULAR SYSTEM:	
RESPIRATORY SYSTEM :	
CENTRAL NERVOUS SYSTEM :	
PER ABDOMEN:	
Inspection-	
Palpation-	
Fundal height-	
Auscultation:	
PER SPECULUM:	
PER VAGINA:	
Os -dilatation and effacement	
Membrane status- Intact/Clear/Meconium/Blood stained	
<b>DETAILS OF DELIVERY:</b>	
Date and Time:	
Gestational age: Fullterm/Preterm	
Mode of delivery: vaginal/caesarean section(emergency/elective)	
Duration of labor:	
Indication for caesarean section:	
Any blood transfusion:	
<b>DETAILS OF NEONATE-</b>	
Sex: Male/Female, Birth weight (in kg)- Birth order-	
APGAR score at 1 min-	
5 min	
ADMISSION TO NICU: Yes/No	
<b>INDICATION FOR ADMISSION -</b>	
UMBILICAL CORD	
LENGTH(in cm):	
NO OF COILS:	
COILING INDEX:	
Normocoiled:	
Hypocoiled:	
Hypercoiled:	
ASSOCIATED MATERNAL COMPLICATIONS	
INTRAPARTUM MATERNAL COMPLICATIONS	
ABNORMAL FETAL HEART RATE	
MECONIUM STAINED LIQUOR	
<b>INVESTIGATIONS:</b>	
Haemoglobin(gm%)-	
Blood grouping and Rh typing-	
Random blood sugar-	Urine analysis
HIV-	HBSAG
VDRL	OTHERS
<b>OBSTETRIC ULTRASOUND FINDINGS:</b>	