

# Association between Umbilical Cord Coiling Index and Perinatal Outcome

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## ABSTRACT

**Aim and objective:** To correlate the association between postnatal umbilical cord coiling index (UCI) and perinatal outcome.

**Materials and methods:** This is a cross-sectional study conducted on 220 booked singleton pregnant women with cephalic presentation immediate post-delivery. Both vaginal and cesarean deliveries were included. Umbilical cord coiling index was calculated and the variables assessed were gestational diabetes mellitus (GDM), anemia, hypertensive disorders, oligohydramnios, polyhydramnios, meconium-stained liquor, mode of delivery in the mother and preterm, fetal growth restriction (FGR) and neonatal intensive care unit (NICU) admissions in the fetus.

**Results:** Hypercoiled group or UCI >90th percentile showed a significant increase in cases of FGR ( $p$ -value 0.007), GDM ( $p$ -value 0.001), and polyhydramnios ( $p$ -value 0.0001). Hypocoiled group or umbilical cord coiling index (UCI) <10th percentile showed a significant increase in cases of preterm ( $p$ -value 0.01), hypertensive disorders ( $p$ -value 0.0001), meconium-stained liquor (MSL) (0.0003), and NICU admission ( $p$ -value 0.0001). The study did not reveal any significant changes with regard to mode of delivery, anemia, or oligohydramnios among the three groups (hypercoiled, hypocoiled, and normocoiled).

**Conclusion:** The present study shows that the umbilical cord coiling index is a useful predictor of adverse perinatal outcomes. Cases with abnormal UCI (hypercoiling and hypocoiling) had a higher incidence of complications such as FGR, GDM, polyhydramnios, hypertensive disorders, MSL, and NICU admission. There is a huge arena for research in this field and routine screening of UCI should be considered antenatally.

**Keywords:** Cross-sectional, Perinatal outcome, Umbilical cord coiling index.

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## INTRODUCTION

The umbilical cord is the fetal lifeline. It is a channel connecting the mother, placenta, and fetus during pregnancy. The umbilical cord length is variable. The average cord length is about 50–60 cm.<sup>1</sup> The umbilical cord carries two arteries and a vein along its course. They are guarded by amniotic fluid, Wharton's jelly, and the helical (or) spiral course of the vessel.<sup>2</sup> Coiling safeguards the cord by averting compression of vessels. The sum total of coils of any cord is entrenched in early gestation and the coiling pattern matures in 2nd and 3rd trimester. A coil is defined as a total 360-degree spiral course of umbilical vessels around Wharton's jelly.<sup>3</sup> Umbilical cord coiling index (UCI) is defined as the sum total of the number of coils divided by the complete length of the cord. Based on UCI, cords can be segregated in to three categories:

- Hypocoiled (UCI less than 10th percentile)
- Normocoiled (UCI between 10th and 90th percentile)
- Hypercoiled (UCI more than 90th percentile)

Both hypocoiled and hypercoiled cords have been associated with adverse perinatal outcome.<sup>1,2</sup> The current study was done to assess the perinatal outcome with abnormal UCI.

## MATERIALS AND METHODS

This is a cross-sectional study conducted on 220 booked singleton pregnant women with cephalic presentation immediately post-delivery from Chettinad Hospital and Research Institute, Chennai. Both vaginal and cesarean deliveries were included. Institutional Human Ethics Committee (IHEC) approval was obtained.

After the delivery of the baby, the umbilical cord was cut 5 cm away from the fetal end. The absolute length of the cord was

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calculated by adding 5 cm to the total length of the cord from placental insertion. Umbilical cord coiling index was calculated and variables assessed were gestational diabetes mellitus (GDM), anemia, hypertensive disorders, oligohydramnios, polyhydramnios, meconium-stained liquor, mode of delivery in the mother and preterm, fetal growth restriction (FGR) and NICU admissions in the fetus.

## RESULTS

A total of 220 singleton pregnant women were studied. Among them 40 had hypocoiling, 24 had hypercoiling and the rest 156 had normocoiling umbilical cord coiling index. Hypercoiled group or UCI >90th percentile showed a significant increase in cases of FGR ( $p$ -value 0.007), GDM ( $p$ -value 0.001), and polyhydramnios ( $p$ -value 0.0001). Hypocoiled group or UCI <10th percentile showed a significant increase in cases of preterm ( $p$ -value 0.01), hypertensive disorders ( $p$ -value 0.0001), MSL (0.0003), and NICU admission

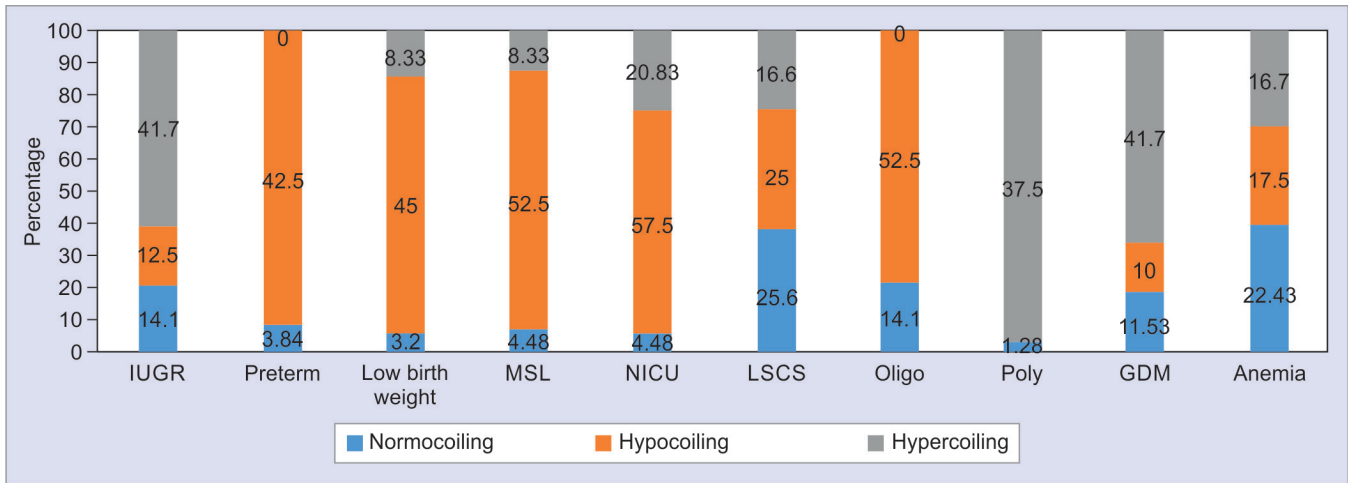


Fig. 1: Pictorial representation of 220 singleton pregnant women preliminary studies

Table 1: Report of 220 singleton pregnant women preliminary studies

Variables	Normocoiling		Hypocoiling		Hypercoiling		Chi-square	p
	N = 156	%	N = 40	%	N = 24	%		
IUGR	22	14.10	5	12.5	10	41.67	7.34	0.007
Preterm	134	85.90	35	87.5	14	58.33	6.42	0.01
Hypertensive disorder	6	3.85	17	42.5	0	0.00	14.12	0.0001
MSL	150	96.15	23	57.5	24	100.00	12.95	0.0003
NICU	5	3.21	18	45	2	8.33	26.65	0.0001
LSCS	151	96.79	22	55	22	91.67	0.69	0.4
Oligo	8	5.13	21	52.5	2	8.33	0.9	0.3
Poly	148	94.87	19	47.5	24	100.00	38.45	0.0001
GDM	7	4.49	23	57.5	5	20.83	9.97	0.001
Anemia	149	95.51	17	42.5	19	79.17	0.69	0.4
	40	25.64	10	25	4	16.67		
	116	74.36	30	75	20	83.33		
	22	14.10	21	52.5	0	0.00		
	134	85.90	19	47.5	24	100.00		
	2	1.28	0	0	9	37.50		
	154	98.72	40	100	15	62.50		
	18	11.54	4	10	10	41.67		
	138	88.46	36	90	14	58.33		
	35	22.44	7	17.5	4	16.67		
	121	77.56	33	82.5	20	83.33		

(p-value 0.0001). The study did not reveal any significant changes with regard to mode of delivery, anemia, or oligohydramnios among the three groups (hypercoiled, hypocoiled, and normocoiled) (Fig. 1 and Table 1).

## DISCUSSION

A few preliminary studies in the past have connected the relation between the umbilical cord coiling index and perinatal outcome. In the current study, UCI was correlated with numerous parameters. On comparing UCI with meconium-stained liquor (MSL) it was seen that MSL was noticed in hypocoiled group. In a study by Gupta S et al., conducted on 107 patients it was ascertained that meconium staining was higher in the hypocoiled group compared to that of

the hypercoiled and norm-coiled group.<sup>3</sup> The mechanism by which this could occur incorporates the likelihood that a hypocoiled cord might be more prone to intense kinking and consequently sudden cessation of blood flow.

The current study demonstrated the relation between women with GDM and hypercoiled umbilical cords, with a significant p-value (0.001). Studies by Chitra et al.<sup>4</sup> and Mustafa and Said,<sup>5</sup> revealed a huge relationship between diabetes and hypercoiled cords. Ezimokhai et al.<sup>6</sup> found a connection between gestational diabetes and both extremes of the coiling pattern. In the present study, polyhydramnios has a significant association with the hypercoiled group (p = 0.0001).

This can be clarified by Edmond's hypothesis which expresses those twists of the umbilical cord are an after-effect of the revolving

movement by the embryo, and thus, the more the amniotic fluid, the more is the revolving movement of the embryo resulting in hypercoiling.<sup>7</sup> The opposite will be valid for oligohydramnios. All though in our study, there was no significant association of oligohydramnios with UCI. The present study could demonstrate an association between preterm labor and the hypocoiled group ( $p$ -value = 0.01), which is in line with the results of Strong et al.<sup>8</sup> de Laat et al.<sup>9</sup> observed that both extremes (hypercoiling and hypocoiling) were associated with preterm births. This study did not infer a reliable explanation for the same. In our current study, neonates admitted to NICU were essentially connected with UCI which was <10th percentile (hypocoiled). Monique WM et al.<sup>10</sup> inferred that hypocoiling of the cord was related to NICU admission. Solid TH et al., concluded that the frequency of fetal demise in non-coiled group was fundamentally more prominent, with a  $p$ -value of <0.05.<sup>8</sup> In our study hypercoiling is connected with FGR ( $p$ -value <0.007). Ezimokhai M et al.<sup>6</sup> and Chholak D et al.<sup>11</sup> got comparative results as per our studies. Hypertensive disorders were significantly associated with the hypocoiled group ( $p = 0.0001$ ). The same was inferred by Ezimokhai et al.<sup>6</sup> and Gupta et al.<sup>3</sup> An adequately coiled cord had an elastic properties by which, it can oppose outside forces that may compromise the umbilical bloodstream. A coiled cord is more impervious to torsion, stretch, and compression than a hypocoiled cord.<sup>3,12</sup> The study did not reveal any significant changes with regard to the mode of delivery, anemia, or oligohydramnios among the three groups (hypercoiled, hypocoiled, and normocoiled).

## CONCLUSION

- The present study showed that cases with abnormal cord coiling index (hypo or hypercoiling index) were associated with complications such as FGR, low birth weight, and meconium-stained liquor warranting NICU admissions.
- Therefore, estimation of the antenatal umbilical cord coiling index could help in identifying women who are at high risk for adverse perinatal outcomes.
- These women can be managed at tertiary care setup for better neonatal outcomes.

## Limitations

- Study was done postnatally.
- Placental pathology was not considered.

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