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Umbilical Cord Coiling Index as A Predictor of Adverse Perinatal Outcome in Term Pregnancies

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Abstract: It is hypothesized that the abnormal coiling of the umbilical cord, which is measured by the Umbilical Cord Coiling Index (UCCI), interferes with the fetal hemodynamics of the placenta. Although it is linked with the poor outcome in high-risk pregnancies, its prognostic value in terms, ostensibly low-risk pregnancies needs additional confirmation to inform the antenatal surveillance and intrapartum care. This paper identified the purpose of this study, which was to assess the UCCI as a predictor of poor perinatal outcomes in a group of term pregnancies. The cross-sectional study involved 104 women with singleton term pregnancies (37 weeks and above), in which all the data will be collected in different hospitals in Iraq within 12 months of follow-up between January 2024 and January 2025, as well as the UCCI, which was noted after delivery (coils/cm), where the cohorts were divided into hypo coiling (UCCI < 0.10, 10.6%), norm coiling (UCCI 0.10-0.30, 78.8%), and hyper coiling (UCCI > 0.30, 10.6%). We ended up with a composite of the adverse perinatal events (operative births due to fetal distress, 5-minute Apgar below 7, umbilical artery pH below 7.10, or NICU stay longer than 24 h). Comparisons were made on maternal, delivery, and neonatal factors. Hypo coiling and hyper coiling were significantly more linked to composite adverse outcomes (45.5% and 54.5%, respectively) than norm coiling (11.0%). Abnormally coiled groups of neonates were found to have very low 5-minute Apgar scores and umbilical artery pH. Hypo coiling (aOR 5.81, 95% CI 1.42–23.8) and hyper coiling (aOR 8.25, 95% CI 2.01–33.9) were also significant independent predictors after the variables of maternal age, nulliparity, and gestational diabetes were adjusted. A UCCI that was not within the normal range was found to predict the composite outcome with a sensitivity of 68.8, a specificity of 85.7, and a negative predictive value of 92.7. Both hypo coiling and hyper coiling are correlated factors in the negative perinatal outcomes in term pregnancies. The presence of a norm coiled cord is an indicator of a strong, reassuring appearance (high NPV). Routine postnatal screening of UCCI is an excellent risk-stratification instrument because it can define a cohort of term neonates at risk of greater benefit from increased antenatal and intrapartum surveillance despite a low-risk pregnancy.

Keywords: Umbilical cord coiling index (ucci), pregnancy outcomes, and maternal and neonatal characteristics.

INTRODUCTION

The umbilical cord, being the important conduit in fetoplacental exchange, is not inert; the physical properties of the cord have a direct impact on the hemodynamic efficiency [Elsayed, W., & Sinha, A. 2019]. The level of helical coiling, which is measured in terms of the Umbilical Cord Coiling Index (UCCI), has proved to be one of the parameters of much interest. The UCCI defines the cords as Hypocoiled, norm coiled, or hyper coiled, with the normative value usually set in the 10-90 percentile range of a specific population. [Sebire, N. J. 2007]

During gestation, the umbilical cord acts as the lifeline of exchange of nutrients and oxygen between the mother and the fetus [Pergialiotis, V. *et al*., 2020]. Its integrity is, thus, most significant to the best growth and development of the fetus [Subashini, G. *et al*., 2023]. The coiling pattern of the cord is one of the main morphological parameters of the cord, which has been a clinical interest for a long time [Machin, G. A. *et al*., 2000]. The umbilical vessels are generally helical in nature, and this has been measured in terms of the Umbilical Cord Coiling Index (UCCI), which is the number of complete vascular coils per centimeter of cord length. [Nguyen, P. N., & Nguyen, V. T. 2023]

Extreme deformities of normal coiling impair the fetal physiology in different ways. Hypo coiling is linked to the decrease of structural integrity, which predisposes to cord compression and venous stasis, whereas hyper coiling is linked to an increase in vascular resistance and the threat of thromboembolic events in the cord vessels [Lin, H. *et al*., 2025]. As a result, abnormal UCCI has been associated with a continuum of complications,

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such as fetal distress, intrauterine growth restriction, preterm labor, and stillbirth. This heterogeneity obscures the particular prognostic value of UCCI in term pregnancies, which form the majority of the deliveries but are usually considered to be at low risk. [Ghalichi, L. *et al*., 2023]

A straight or under-coiled cord is referred to as hypo coiling, which is subjected to reduced structural integrity, and it is more prone to compression and, therefore, may cause acute or chronic venous blockage [De Laat, M. W. M. *et al*., 2006]. Overcooled, also called hypercoiled, relationships of a cord can increase the vascular resistance, compromise blood flow, and predetermine the vascular thrombosis or stenosis. [Ezimokhai, M. *et al*., 2000]

The clinical utility of UCCI as a predictor tool in normal term pregnancy has not been well-articulated [Predanic, M. *et al*., 2005]. It may lead to the vigor of antenatal monitoring as well as influence intrapartum decision-making, which may avoid the negative effects. [Sharma, B. *et al*., 2012]

METHODOLOGY

This was cross-sectional research carried out in an obstetric center and different hospitals in Iraq to determine the Umbilical Cord Coiling Index (UCCI) as a predictor of bad perinatal outcomes during term pregnancies. The sample was a population of 104 consecutive births within a gestation period of no less than 37 weeks of gestational period in January 2024 and January 2025. The exclusion criteria were used to control the confounding factors and included preterm birth (<37 weeks) and significant congenital anomalies of the fetus, elective cesarean delivery, and a lack of medical or placental examination records. Antenatal and intrapartum data collected during the electronic medical records were systematically obtained as baseline maternal demographics. This was the maternal age, parity, body mass index (BMI), smoking, and the existence of gestational comorbidities, such as preeclampsia and gestational diabetes mellitus (GDM). The UCCI was the key exposure variable, which was assessed through the use of postnatal macroscopic observation of the umbilical cord regarding the umbilical cord within a 24-hour time period after childbirth. The total count of full-length complete vascular coils (360 degrees) was counted over the entire length of the cord, without counting those within 5 cm of the placental and fetal insertion. The cord length was measured in a non-stretched, relaxed position. The UCCI was calculated by division of the total number of coils by the cord length (coils/cm), and the cords were either Hypocoiled (UCCI < 0.10 coils/cm, 90^{th} percentile), norm coiled (UCCI 0.10-0.30 coils/cm), or hyper coiled (UCCI > 0.30 coils/cm).

The main message was a composite adverse perinatal outcome, which was the presence of one or more of the following: (1) operative delivery (emergency cesarean or instrumental vaginal delivery) due to fetal distress, (2) 5-minute Apgar score below 7, (3) umbilical artery (UA) pH below 7.10, or (4) neonatal intensive care unit (NICU) stay longer than 24 hours due to perinatal compromise. The secondary outcome measures were the individual items of the composite, quantitative neonatal variables (birth weight, Apgar scores, UA pH), and mode of delivery. A perinatal pathologist who was not aware of the fate of the neonates examined all the placentas, and the weight of the placenta and the type of cord insertion were recorded.

The SPSS software was employed in data analysis (version 24.0). Frequencies and percentages were used to show categorical variables. The analysis of the strength of association between the categories of UCCI and the composite adverse outcome was conducted at unadjusted and adjusted odds ratios (ORs) with a 95% confidence interval (CI) derived through the logistic regression models, adjusted to potential confounding factors that were identified a priori (maternal age, nulliparity, and GDM). Pearson correlation coefficient (r) was used to determine relationships between continuous values of UCCI and important neonatal variables.

RESULTS

Table 1: Baselines and features of pregnant maternal in this study.

Characteristic	Findings
Maternal Age (years)	28.5 ± 4.2
Gestational Age at Delivery (weeks)	39.2 ± 1.1
Nulliparity	44 (42.3%)
Body Mass Index (kg/m²)	26.1 ± 3.8

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Smoking during pregnancy	9 (8.7%)
Preeclampsia	7 (6.7%)
Gestational Diabetes Mellitus	12 (11.5%)

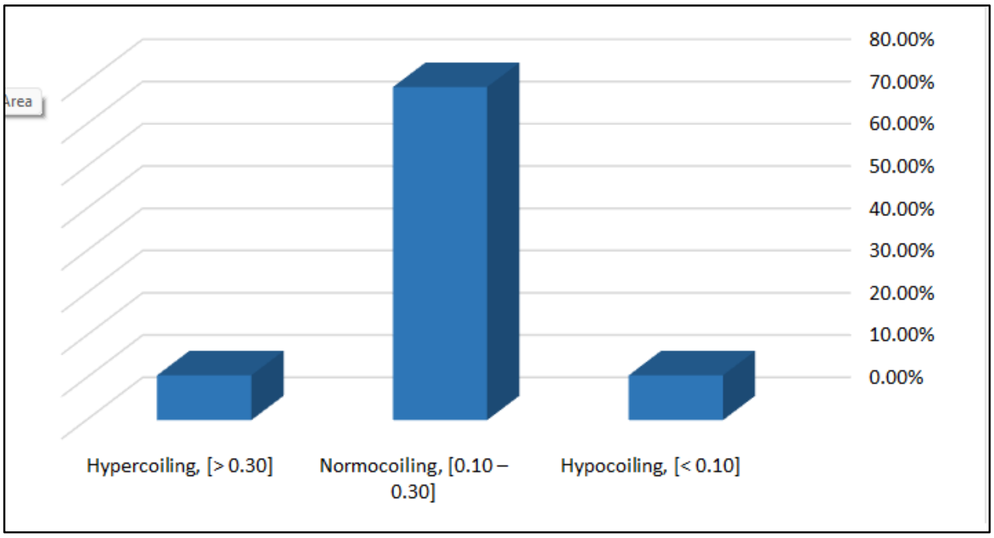

Figure 1: Categorizing the prevalence of patients based on the umbilical cord coiling index (UCCI).

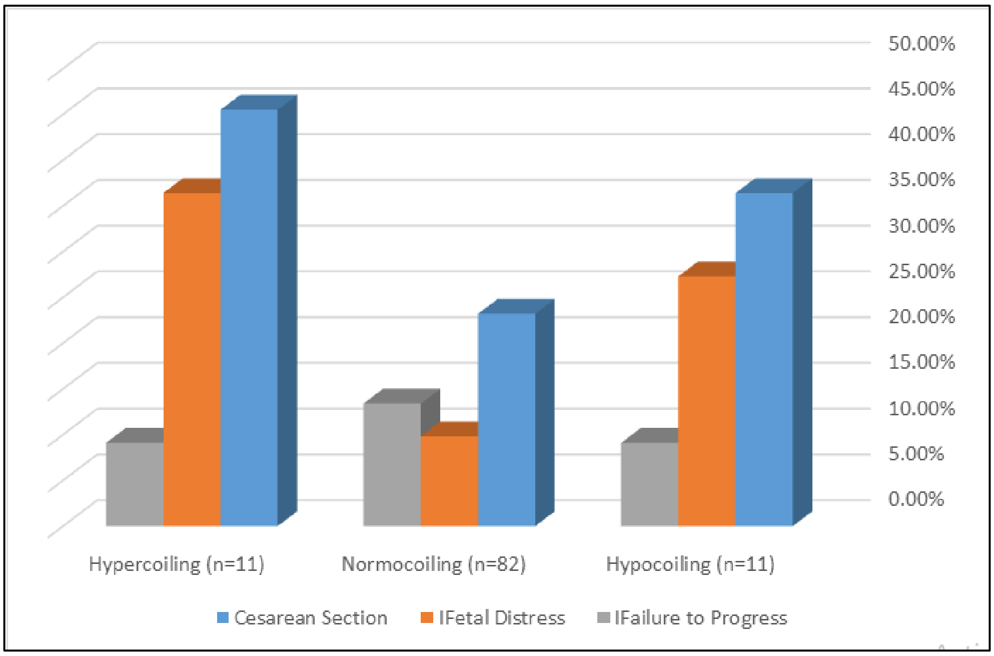

Figure 2: Determining delivery outcomes through UCCI categorizing.

Table 2: Identifying clinical outcomes of neonatal throughout UCCI classifications.

Variables	Hypo coiling (n=11)	Norm coiling (n=82)	Hyper coiling (n=11)	p-value
Birth Weight (g)	3280 ± 420	3380 ± 350	3120 ± 480	0.08
Apgar Score at 1 min	7.1 ± 1.5	8.4 ± 0.8	7.3 ± 1.4	0.01
Apgar Score at 5 min	8.5 ± 0.9	9.2 ± 0.5	8.6 ± 0.8	<0.01
Umbilical Artery pH	7.22 ± 0.06	7.28 ± 0.04	7.21 ± 0.07	<0.01

Table 3: Determining the adverse outcomes of perinatal using UCCI categories.

Variables	Hypo coiling (n=11)	Norm coiling (n=82)	Hyper coiling (n=11)	p-value
Operative delivery for fetal distress	3 (27.3%)	8 (9.8%)	4 (36.4%)	0.03
5-min Apgar <7	1 (9.1%)	0 (0%)	2 (18.2%)	<0.01

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UA pH <7.10	2 (18.2%)	1 (1.2%)	3 (27.3%)	<0.001
NICU admission >24h	3 (27.3%)	2 (2.4%)	3 (27.3%)	<0.001

Table 4: Odd rates indicators of adverse outcomes in perinatal.

UCCI Category	Unadjusted OR (95% CI)	p-value	Adjusted OR* (95% CI)	p-value
Norm coiling	1.00 (Reference)	-	1.00 (Reference)	-
Hypo coiling	6.94 (1.82 – 26.5)	0.005	5.81 (1.42 – 23.8)	0.014
Hyper coiling	9.67 (2.52 – 37.1)	0.001	8.25 (2.01 – 33.9)	0.003

Table 5:- Enroll placental outcomes through UCCI classifications.

Characteristic	Hypo coiling (n=11)	Norm coiling (n=82)	Hyper coiling (n=11)
Placental Weight (g)	480 ± 75	510 ± 65	465 ± 80
Incidence of Marginal Cord Insertion	3 (27.3%)	5 (6.1%)	2 (18.2%)

Table 6: Pearson's r correlation findings for UCCI patients.

Variable	UCCI (coils/cm)	Birth Weight	UA pH	Apgar 5-min
UCCI (coils/cm)	1.000	-0.185	-0.312	-0.278
Birth Weight (g)	-0.185	1.000	0.105	0.210
UA pH	-0.312	0.105	1.000	0.450
Apgar 5-min	-0.278	0.210	0.450	1.000

Table 7: Identifying the Hypo/Hyper coiling accuracy in the prediction of adverse outcome.

Parameters	Value (%)	95% CI
Sensitivity	68.8%	(50.0 – 83.9)
Specificity	85.7%	(76.4 – 92.4)
Positive Predictive Value (PPV)	50.0%	(34.9 – 65.1)
Negative Predictive Value (NPV)	92.7%	(85.6 – 97.0)
Accuracy	81.7%	(73.0 – 88.6)

DISCUSSION

This paper demonstrated the high level of correlation between abnormal coiling of the umbilical cord measured by the Umbilical Cord Coiling Index (UCCI) and poor perinatal outcomes in term pregnancies. We have shown that hypo coring (UCCI < 0.10 coils/cm) and hyperforin (UCCI > 0.30 coils/cm) are powerful risk factors of impaired neonatal health, as per and beyond the collection of literature of previous studies. [Mittal, A. *et al*., 2015; De Laat, M. *et al*., 2005; Predanic, M. *et al*., 2006]

The UCCI baseline in our cohort showed that norm coiling was the dominant prevalence, with 78.8% cases with hypo- and hyper coiling constituting 10.6% and 10.6%, respectively. This two-mode distribution of pathology is congruent with other existing research in the USA [Chitra, T. *et al*., 2012], and which had similar ratios of abnormal coiling, and both extremes of the normal data are pathologic and not normal anatomical variations. The mean UCCI of 0.20 ± 0.08 coils/cm.

We have offered strong physiological support to the clinical risks of abnormal coiling in our analysis of neonatal outcomes. Apgar was found to be significantly lower in neonates in the hypo- and hyper-coiled groups at 1 and 5 minutes. Also, lower levels of umbilical artery pH were observed in the norm-coiled group. These quantitative measures are direct proxies of fetal acid-base status and immediate postnatal adaptation, and it is thought that aberrant coiling could be disrupting fetoplacental circulation, resulting in poor gas exchange and intermittent cord compression, with a significantly greater rate of operative delivery of fetal distress in these groups indicated. These relationships are supported by the correlation matrix, with statistically significant negative correlations between UCCI and UA pH and 5-minute Apgar score, indicating that the more coiling is out of the norm, the higher the chances of acidosis and depressed vitality. [Kashanian, M. *et al*., 2006; Jo, Y. S. *et al*., 2011; Patil, N. S. *et al*., 2013]

The most noticeable result was the increased dramatically risk of a composite adverse perinatal outcome, which was dramatic according to abnormal coiling. Adjusted odds ratios of hypo coiling and hyper coiling were 5.81 and 8.25, respectively, after the adjustment of potential

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confounders such as maternal age and gestational diabetes, where abnormal UCCI is no incident but a major predictor of morbidity [Ndolo, J. M. *et al*., 2017; Reddy, D. N., & Anuradha, C. R. 2024]. Moreover, the need to perform operative delivery because of fetal distress, low 5-minute Apgar, substantial acidosis (UA pH <7.10), and long NICU stay, all create the image of the rising intrapartum physiological stress and neonatal compromise.

Although the diagnostic accuracy analysis has a high specificity (85.7%) and negative predictive value (92.7%), it has a moderate sensitivity (68.8%) and positive predictive value (50.0%). The fact that norm coiling had occurred was of great reassurance; the mere fact of abnormal coiling is not entirely predictive of bad things. UCCI is a great contributing and identifying factor [Najafi, L. *et al*., 2018; Najafi, L. *et al*., 2022], yet it acts on a larger pathophysiological basis. In addition, the tendency of placental characteristics, including slightly low placental weight in the abnormal coiling groups, suggests the possible common etiologies in placental development. [Lv, L. J. *et al*., 2019]

CONCLUSION

This paper definitively proves the Umbilical Cord Coiling Index (UCCI) as a vital and independent predictor of negative perinatal outcomes in term pregnancies. The findings indicate that there is a strong clinical gradient; both Hypocoiled and hypercoiled cord neonates had lower Apgar scores, reduced umbilical artery pH, and increased probability of operative delivery due to fetal distress than the normocoiled group. Importantly, the multivariate analysis established that abnormal coiling is quite risky, with odds ratios of 5.81 and 8.25, and adjusted odds ratios of 5.81 of hypo coiling and 8.25 of hyper coiling, respectively. Although the specificity (85.7) and negative predictive value (92.7) are high, showing that a norm coiling result is very reassuring, the moderate positive predictive value (50.0) makes abnormal UCCI a crucial risk-stratification measure.

REFERENCES

1. Elsayed, W., & Sinha, A. "Umbilical cord abnormalities and pregnancy outcome." *Journal of Fetal Medicine* 6.04 (2019): 183-189.
2. Sebire, N. J. "Pathophysiological significance of abnormal umbilical cord coiling index." *Ultrasound in Obstetrics and Gynecology: The Official Journal of the International Society of Ultrasound in Obstetrics and Gynecology* 30.6 (2007): 804-806.
3. Pergialiotis, V., Kotrogianni, P., Koutaki, D., Christopoulos-Timogiannakis, E., Papantoniou, N., & Daskalakis, G. "Umbilical cord coiling index for the prediction of adverse pregnancy outcomes: a meta-analysis and sequential analysis." *The Journal of Maternal-Fetal & Neonatal Medicine* 33.23 (2020): 4022-4029.
4. Subashini, G., Anitha, C., Gopinath, G., Ramyathangam, K., & Ganesan, G. "A longitudinal analytical study on umbilical cord coiling index as a predictor of pregnancy outcome." *Cureus* 15.3 (2023).
5. Machin, G. A., Ackerman, J., & Gilbert-Barness, E. "Abnormal umbilical cord coiling is associated with adverse perinatal outcomes." *Pediatric and Developmental Pathology* 3.5 (2000): 462-471.
6. Nguyen, P. N., & Nguyen, V. T. "Additional value of Doppler ultrasound to B-mode ultrasound in assessing for uterine intracavitary pathologies among perimenopausal and postmenopausal bleeding women: a multicentre prospective observational study in Vietnam." *Journal of Ultrasound* 26.2 (2023): 459-469.
7. Lin, H., Shen, M., Li, D., Sun, Q., & Lan, L. "The Correlation Between Fetal Wellbeing and Umbilical Doppler Parameters in Pregnant Women with Gestational Hypertension." *International Journal of Women's Health* (2025): 1009-1018.
8. Ghalichi, L., Ghadikolaei, O. A., Hosseinkhan, N., Abedini, A., Ahmadi, S., & Najafi, L. "Prediction of postnatal abnormal umbilical cord coiling by antenatal evaluation in pregnant women: Diagnostic accuracy study; a systematic review." *Journal of Obstetrics and Gynaecology Research* 49.11 (2023): 2692-2699.
9. De Laat, M. W. M., Franx, A., Nikkels, P. G. J., & Visser, G. H. A. "Prenatal ultrasonographic prediction of the umbilical coiling index at birth and adverse pregnancy outcome." *Ultrasound in Obstetrics and Gynecology: The Official Journal of the International Society of Ultrasound in Obstetrics and Gynecology* 28.5 (2006): 704-709.

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10. Ezimokhai, M., Rizk, D. E., & Thomas, L. "Maternal risk factors for abnormal vascular coiling of the umbilical cord." *American journal of perinatology* 17.08 (2000): 441-446.
11. Predanic, M., Perni, S. C., Chasen, S. T., Baergen, R. N., & Chervenak, F. A. "Assessment of umbilical cord coiling during the routine fetal sonographic anatomic survey in the second trimester." *Journal of ultrasound in medicine* 24.2 (2005): 185-191.
12. Sharma, B., Bhardwaj, N., Gupta, S., Gupta, P. K., Verma, A., & Malviya, K. "Association of umbilical coiling index by colour Doppler ultrasonography at 18–22 weeks of gestation and perinatal outcome." *The Journal of Obstetrics and Gynecology of India* 62.6 (2012): 650-654.
13. Mittal, A., Nanda, S., & Sen, J. "Antenatal umbilical coiling index as a predictor of perinatal outcome." *Archives of Gynecology and Obstetrics* 291.4 (2015): 763-768.
14. De Laat, M., Franx, A., van Alderen, E., Nikkels, P., & Visser, G. "The umbilical coiling index, a review of the literature." *The Journal of Maternal-Fetal & Neonatal Medicine* 17.2 (2005): 93-100.
15. Predanic, M., Perni, S. C., & Chervenak, F. A. "Antenatal umbilical coiling index and Doppler flow characteristics." *Ultrasound in Obstetrics and Gynecology: The Official Journal of the International Society of Ultrasound in Obstetrics and Gynecology* 28.5 (2006): 699-703.
16. Chitra, T., Sushanth, Y. S., & Raghavan, S. "Umbilical coiling index as a marker of perinatal outcome: an analytical study." *Obstetrics and gynecology international* 2012.1 (2012): 213689.
17. Kashanian, M., Akbarian, A., & Kouhpayehzadeh, J. "The umbilical coiling index and adverse perinatal outcome." *International Journal of Gynecology & Obstetrics* 95.1 (2006): 8-13.
18. Jo, Y. S., Jang, D. K., & Lee, G. "The sonographic umbilical cord coiling in late second trimester of gestation and perinatal outcomes." *International journal of medical sciences* 8.7 (2011): 594.
19. Patil, N. S., Kulkarni, S. R., & Lohitashwa, R. "Umbilical cord coiling index and perinatal outcome." *Journal of Clinical and Diagnostic Research: JCDR* 7.8 (2013): 1675.
20. Ndolo, J. M., Vinayak, S., Silaba, M. O., & Stones, W. "Antenatal umbilical coiling index and newborn outcomes: cohort study." *Journal of Clinical Imaging Science* 7 (2017): 21.
21. Reddy, D. N., & Anuradha, C. R. "Association between umbilical cord coiling index and perinatal outcome." *Journal of South Asian Federation of Obstetrics and Gynaecology* 16.1 (2024): 17-19.
22. Najafi, L., Khamseh, M. E., Kashanian, M., Younesi, L., Abedini, A., Valojerdi, A. E., ... & Malek, M. "Antenatal umbilical coiling index in gestational diabetes mellitus and non-gestational diabetes pregnancy." *Taiwanese Journal of Obstetrics and Gynecology* 57.4 (2018): 487-492.
23. Najafi, L., Honardoost, M., Khajavi, A., Cheraghi, S., Kadivar, M., & Khamseh, M. E. "The association of umbilical coiling and angiogenesis markers: Impact assessment of gestational diabetes." *Placenta* 129 (2022): 70-76.
24. Lv, L. J., Wu, L. L., Wen, J. Y., Lei, Q., Miao, J., Duan, H. L., ... & Niu, J. M. "Excessive umbilical cord coiling confers risk of elevated nocturnal blood pressure and severe/early-onset preeclampsia." *Journal of Hypertension* 37.1 (2019): 187-196.

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