Correlation of Antenatal Umbilical Cord Coiling Index with Perinatal Outcome Using Color Doppler at Late Second Trimester

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ABSTRACT

inroduction: Umbilical cord coiling index can help to predict high risk cases at earliest. Our study aimed to determine the association of the antenatal umbilical cord coiling index (aUCI) during the late second trimester with the perinatal outcomes.

Materials and methods: This prospective observational study was conducted in National Institute of Medical Sciences Hospital and Medical College, Jaipur in the department of Obstetrics and Gynecology over a period of one year from Jan 2014 to Dec 2015. The study included 200 booked pregnant patients who delivered in our hospital and were having their antenatal UCI done in our radiology department at late second trimester.

Results: The mean aUCI in the present study was 0.34 ± 0.12 in the normocoiled group, 0.17 ± 0.21 in the hypocoiled group and 0.63 ± 0.22 in the hypercoiled group. Out of 200 cases, 148(74%) of the subjects had normal coiling index, 32 (16 %) had hypocoiling and 20 (10 %) had hypercoiling. IUGR was significantly higher in hypercoiled group while LBW, MSL, preterm and therefore NICU admissions were significantly higher in hypocoiled as compared with normocoiling.

Conclusion: Antenatal umbilical cord coiling index is an important parameter to be studied during late second trimester which may help to screen patients at risk of adverse perinatal outcome.

Keywords: aUCI, hypocoiling, hypercoiling, perinatal outcome.

INTRODUCTION

Umbilical cord is a vital structure of maternal-fetal life that can be used to evaluate pregnancy outcomes. Umbilical cord contains three vessels and it is vulnerable to kinking, torsion and compression which may affect the perinatal outcome. Normally these vessels are protected by Wharton's jelly, amniotic fluid and helical patterns or coiling of blood vessels. This helical fashion of umbilical vessels are called spiral course.[1]

A coil is defined as completed 360^0 spiral course of umbilical vessels around the wharton's jelly.[2] Coiling property of umbilical cord was described by Berengarius in 1521. Umbilical coiling was first quantified in 1954 by Edmonds who divided the total number of coils by umbilical cord length in cm and called it "index of twist.[3] Later strong et al eliminated three dimensional score and named it "UCI" (UCI=no of vascular coils in a cord/ total length of cord in cm).[4] An abnormal umbilical cord coiling index includes both hypocoiled cords (UCI<10^{th} percentile) and hypercoiled cords (UCI>90^{th} percentile). An abnormal umbilical coiling index reported with adverse perinatal outcome.[1-3,5]

Normal coiling index is approximately 1 coil/5 cm of umbilical Cord length or 0.20 to 0.24 coils/cm.[4] Reciprocal value of the distance between a pair of coils measured in cm from inner edge of an arterial or venous wall to the outer edge of next coil along the ipsilateral side of umbilical cord is used to calculate antenatal UCI, the direction being from placental end to fetal end.[6] The final value is the average of three readings at different segments of umbilical cord. It is assumed that the umbilical coiling is completely developed by the end of first trimester and does not change thereafter but rather that the cord lengthens between the established coils[3], the true UCI should be predictable from the ultra sonography assessment in the second trimester.[7] Aim of the study was to determine the association of the antenatal umbilical cord coiling index (UCI) during the late second trimester with the perinatal outcomes.

MATERIAL AND METHODS

This prospective observational study was conducted in National Institute of Medical Sciences Hospital and Medical College, Jaipur in the department of Obstetrics and Gynecology over a period of one year from Jan 2014 to Dec 2015. In one year duration 200 booked pregnant patients delivered in our hospital and were having their antenatal UCI done in our radiology department at late second trimester, so this was taken into the study. Ethical clearance was taken from ethical committee and informed consent from the patients.

The aUCI were measured by single author as a reciprocal value of the distance between a pair of coils measured in cm from inner edge of an arterial or venous wall to the outer edge of next coil with the same side of umbilical cord, the direction being from placental end to fetal end.[6] The final value of aUCI was the average of three readings at three different segments of umbilical cord.

Inclusion criteria were healthy women with term gestation with singleton live fetus with no maternal and fetal complications. Exclusion criteria were multiple gestations, preterm deliveries, IUGR, IUFD, pregnancy with medical disorders (chronic hypertension, diabetes, cardiac disease, hepatic and renal impairment), or obstetric complications (pre-eclampsia, antepartum hemorrhage, malpresentations, Gross fetal anomalies).

Antenatal UCI was calculated for all booked antenatal patients with uncomplicated singleton pregnancy at late second trimester, and these subjects were then followed till their delivery to assess the perinatal outcome. Parameters studied were: mode of delivery, perinatal outcomes (in terms of preterm, IUGR,

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Characteristics	Normocoiling	Hypocoiling	Hypercoiling	P Value
Number of cases	N=148	N=32	N=20	
Maternal age	31.4±3.21	34.2±4.13	33.4±4.29	NS
Primipara	52(35.13%)	13(40.6%)	7(35%)	NS
Multipara	96(64.8%)	19(59.3%)	13(65%)	NS
Gestation age at USG	23.62±1.22	24.31±1.05	24.23±1.38	NS

Table-1: Maternal demographic characteristics

	Sinistral		Dextral		P Value
	No.	%	No.	%	
Normocoil	100	67.6	48	32.4	NS
Hypocoil	21	65.6	11	34.3	
Hypercoil	13	65	7	35	

Table-2: Correlation of direction of twist with UCI

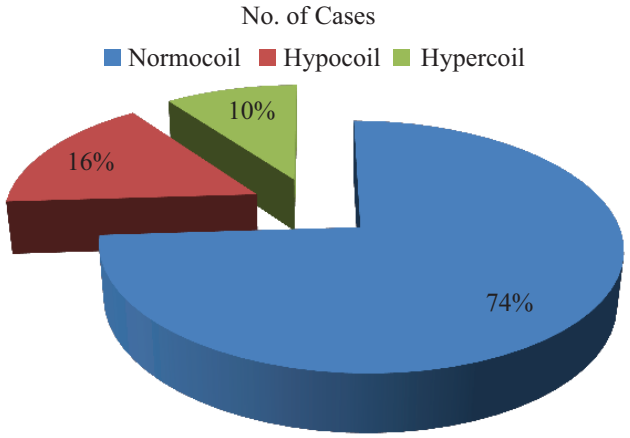

Figure-1: Distribution of cases according to aUCI

LBW, Low APGAR score, meconium staining of liquor, NICU admissions) and direction of twist: sinistral or dextral.

STATISTICAL ANALYSIS

SPSS version 15.0 and chi square test was used for data analysis. Microsoft word and MS excel have been used to generate graphs, tables etc.

RESULTS

During the study period more than 500 pregnant patients had fetal anatomic scans with aUCI measurements in late second trimester. Out of those, 200 booked patients undertaken in the study had adequate sonographic umbilical cord images and were fulfilling inclusion and exclusion criteria. Mean maternal age was 31.4 ±3.21 in normocoiled group, 34.2±4.13 in hypocoiled group and 33.4±4.21 in hypercoiled group. Total number of primigravida were 72(36%) out of which 52 (35.13%) were normocoiled, 13 (40.6%) were hypocoiled and 7 (35%) were hypercoiled. Total number of multigravida were 128 (64%) out of which 96 (64.8%) were normocoiled, 19 (59.3%) were hypocoiled and 13 (65%) were hypercoiled. Mean gestation age at late second trimester was 23.62±1.22 in normocoiled group, 24.31±1.05 in hypocoiled group and 24.23±1.38 in hypercoiled group (Table-1).

Out of 200 cases, 148 (74 %) of the subjects had normal coiling index, 32 (16 %) had hypocoiling and 20 (10 %) had hypercoiling (Figure-1).

The direction of twist of umbilical cord were also observed. Out of 200 cases 134 (67%) cases had sinistral (anticlockwise) twist while 66 (33%) cases had dextral(clockwise) twist. However, the difference was nonsignificant (Table-2).

The most frequent complication in this study was IUGR, LBW followed by MSL and preterm. IUGR was significantly associated with hypercoiled group (P value < 0.001) while LBW, MSL, preterm and therefore NICU admissions were significantly higher in hypocoiled group (P value < 0.001) (Table-3).

DISCUSSION

The mean aUCI in the present study was 0.34 ± 0.12 in the normocoiled group, 0.17 ± 0.21 in the hypocoiled group and 0.63 ± 0.22 in the hypercoiled group. The mean aUCI in this study was near to similar study by Predanic and Perni[8] and de Laat et al[9] being 0.403 ± 2SD coils/cm and 0.3 ± 0.09 coils/cm respectively.

Anticlockwise twist were more common and the ratio of sinistral verses dextral was 2.09:1. Similar study was done by Lacro et al[5] and gupta S et al[2] who also observed that anticlockwise twist was more common and the ratio being 8:1 and 4.3:1 respectively.

Out of 200 cases, IUGR was seen in 14 (70%) cases with hypercoiled group which was significant (P value < 0.001) and results were in agreement with the study by Georgiou HM et al[10], Rana et al[1] and Monique WM et al[11] who also observed that hypercoiling was associated with IUGR.

In present study preterm deliveries were found in 19 (9.5%) cases out of which 15 (46.8%) cases had hypocoiled cords which was found to be significant (P value < 0.001). None in the hypercoiled group had preterm delivery. De Laat and Nikkels[11] demonstrated that both hypercoiling and hypocoiling were associated with preterm Births.

In present study of 200 cases, it was observed that meconium staining was present in 28(14%) cases which was significantly higher in hypocoiling group being 22 (68.7%) (P value <0.001). Our study was correlated with the study by Strong et al[4] and Gupta S et al[2] who also observed that meconium staining was associated with UCI values less than 10th percentile.

19 (14.5%) babies had APGAR < 7 at 1 minute, out of which 10 (31.2%) had hypocoiled cords while only 3 (15%) had hypercoiled cords. APGAR score <7 was significantly associated with hypocoiled group (P value < 0.001). Hence our study correlates to the study of Monique et al[11] and Gupta et al[2] who also reported the same.

22 (11%) babies were admitted to NICU. Out of which 9 (28.12%) had hypocoiled cords while only 1 (5%) had hypercoiled cords which is strongly significant (P value < 0.001). The results of our study are in agreement with the study of Monique WM et al[11] who also concluded the same.

In the present study of 200 cases 57 (28.5%) cases had LSCS which was significantly higher in the hypocoiled group being

Parameter	Normocoiling		Hypocoiling		Hypercoiling		P Value
	N=148	%	N=32	%	N=20	%	
IUGR	72	48.6	3	9.3	14	70	< 0.001
Preterm (<37week)	4	2.7	15	46.8	0	0	< 0.001
LBW	15	10.13	17	53.12	3	15	< 0.001
MSL	7	4.7	22	68.7	1	5	< 0.001
Apgar <7 at 1 minute	16	10.8	10	31.2	3	15	
NICU admission	12	8.10	9	28.12	1	5	< 0.001
LSCS	42	28.3	11	34.3	4	20	NS

Table-3: Correlation of aUCI with perinatal outcome

11(34.3%) while only 42 (28.3%) LSCS in normocoiled group and 4 (20%) LSCS in hypercoiled group. Since IUGR, LBW and MSL was more commonly associated with hypocoiled group, rate of LSCS was higher in hypocoiled group being 11 (34.3%), but the result was not significant (P value = 0.166)

CONCLUSION

We concluded that antenatal umbilical cord coiling index is an important parameter to be studied during late second trimester which may help to screen patients at risk of adverse perinatal outcome.

The present study concluded that the pregnant patients who were having hypercoiling of the umbilical cord during the late second trimester of pregnancy were associated with IUGR and those who showed hypocoiling were at risk for preterm delivery, low birth weight, meconium stained liquor and consequently increase admissions to the neonatal intensive care unit. Hence both hypo and hypercoiling of cords had significant correlation with adverse fetal outcome and aUCI measurement can help identify fetus at risk and thus to plan timely intervention.

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