

Evaluation of Association of Abnormal Umbilical Cord Coiling and Perinatal Outcome

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ABSTRACT

Introduction: The umbilical cord is very important for the well-being, development and survival of the fetus, however this is susceptible to compressions, kinking, traction and torsion which may influence the perinatal outcome. The present study was undertaken to evaluate any significant association with abnormal umbilical cord coiling and perinatal outcome.

Material and methods: This study was conducted among 130 pregnant women. After delivery of placenta umbilical cord was examined and fetal outcome was evaluated in term of fetal distress, meconium stained liquor, baby weight, operative interference, instrumental delivery, APGAR score, NICU admissions based on the umbilical cord coiling. The data so obtained was evaluated and Pearson Chi-Square test was used for statistical analysis with p-value <0.05 considered as significant value.

Results: Hypercoiling was associated with meconium stained liquor, low apgar score, emergency caesarean section and NICU admission. Hypocoiling was associated with fetal distress and NICU admission. There was statistical significance between umbilical cord coiling and weight of baby. There was no statistical significance between umbilical cord coiling and age of pregnant females.

Conclusion: Both hypocoiling and hypercoiling of cords had significant correlation with adverse fetal outcome. Therefore, antenatal detection of coiling index can identify foetus at risk and thus helps in further management.

Keywords: Coiling; Perinatal outcome; Umbilical cord

(i.e.; cords with UCI >90th percentile) and hypocoiled cords (i.e.; cords with UCI <10th percentile) and abnormal UCI has been revealed to be related to adverse perinatal outcome.⁴ Strong TH et al⁵ suggested that straight, noncoiled umbilical architecture increased the risk of intrauterine death, preterm delivery, operative delivery, meconium staining. The current study was undertaken to evaluate any significant association with abnormal umbilical cord coiling and perinatal outcome. Hereby we have used simple, rapid and easy bed side method to quantify umbilical cord coiling, which is not used in other studies.

MATERIAL AND METHODS

The present prospective study was conducted at Nowrosjee Wadia Hospital over a period of one year among 130 pregnant women. Healthy women with singleton pregnancy and with term gestation, irrespective of their parity, admitted to the labour room with active labour were taken for the study. Pregnancy less than 28 weeks of gestation, malformed baby, elective lower segment caesarean section and patients with multiple gestation were excluded from the study.

Patients were asked relevant obstetric history and risk factors were assessed. Intrapartum fetal monitoring was done. The patient was observed in 2nd and 3rd stage of labour. After delivery of placenta umbilical cord was examined in middle 10 cm. 2 coils in middle 10 cm of umbilical cord was considered as normocoiled, 1 or no coil was classified as hypocoiled, 2 coils or more was classified as hypercoiled and fetal outcome was evaluated in term of fetal distress, meconium stained liquor, baby weight, operative interference, instrumental delivery, APGAR score, NICU admissions based on the umbilical cord coiling. Deceleration of fetal heart sound in peripartum period was taken as fetal distress, any degree of meconium in liquor was considered as meconium stained liquor. Birth weight less than 2.5kg was considered as low birth weight, delivery less than 37 weeks of gestation was taken as preterm delivery, vacuum and forceps assisted vaginal delivery was taken as instrumental delivery, APGAR score less than 7 was taken as low APGAR score, baby requiring resuscitation by AMBU bag and NICU care for observation or ventilator support was taken in NICU admission. Blinding was not done for assessment. The

INTRODUCTION

The umbilical cord is composed of two arteries permeated with venous blood and a vein that transports arterial blood and is responsible for maternal-fetal blood flow. It is cushioned by a Wharton's jelly (WJ) which is a special type of mucous connective tissue and by remnants of the allantoids.¹ It is very important for the well-being, development and survival of the fetus, however this is susceptible to compressions, kinking, traction and torsion which may influence the perinatal outcome. The amniotic fluid, Wharton's jelly, helical patterns and coiling of vessels protects the umbilical cord. Hypotheses regarding the origin of umbilical cord coiling includes active or passive torsion of the embryo, fetal movements, fetal hemodynamic forces, differential umbilical vascular growth rates and the arrangements of muscular fibers in the arterial wall of umbilical cord. The most mysterious and intriguing characteristic of the human umbilical cord, is the spiral or twisted course of its component blood vessels.²

Umbilical cord architecture has varying relationships between artery and vein. The difference indicate subtle blood flow change and vulnerability that alter fetal circulation.³ An abnormal umbilical coiling Index (UCI) includes both hypercoiled cords

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data so obtained was evaluated and Pearson Chi-Square test was used for statistical analysis with p- value <0.05 considered as significant value.

There were total 56.9% primigravida out of which 45.9 %had normal coiling, 27% had hypocoiling,27%had hypercoiling.43.1%were multigravida out of which 57.1 %had normal coiling,21.4% had hypocoiling 21.4% had hypercoiling. statistically correlation between gravida and umbilical cord coiling was not significant (table 1).

There were total 70.8%reactive cardiotocograph of which 67.4%had normal coiling,14.1%had hypocoiling,18.5% had hypercoiling. Total 28.5% had nonreactive cardiotocograph of which 10.8% had normal coiling, 48.6%had hypocoiling,40.5% had hypercoiling. total 0.8% equivocal cardiotocograph, all of which had hypocoiling, statistically correlation between cardiotocograph and umbilical cord coiling was significant (table 2).

Of the total deliveries, 61.5% delivered normally of which 73.8% had normal coiling while 13.8%had hypocoiling and 12.5% had hypercoiling. Of the 33.8% requiring caesarean section, 43.2%had hypocoiling and 47.7% had hypercoiling while only 9.1% of normal coiling required caesarean section. Instrumental delivery was done in 4.6% of patients out of which 50% had normal coiling, 33.3% had hypocoiling and 16.7% had hypercoiling. statistically correlation between mode of delivery and umbilical cord coiling was significant (table 3).

Out of the total, 13.8% had meconium stained liquor of which 16.7%had normal coiling,33.3%had hypocoiling,50% had hypercoiling. Total 86.2% had clear liquor of which 56.2% had normal coiling,23.2%had hypocoiling,20.5% had hypercoiling. statistically correlation between meconium stained liquor and umbilical cord coiling was significant (table 4).

Out of the 130 deliveries, 62.3% had no fetal distress, of which 76.5% had normal coiling, 12.3% had hypocoiling n 11.1% had hypercoiling. Total 37.7% had fetal distress of which 8.2% had normal coiling,44.9%had hypocoiling,46.9% had hypercoiling. statistically correlation between fetal distress and umbilical cord coiling was significant (table 5).

NICU admission (table 6) was done in 36.9% deliveries, of which 8.3% had normal coiling, 45.8% had hypocoiling and 45.8% had hypercoiling. 63.1% did not require NICU admission, out of which 75.6%had normal coiling, 12.2% had hypocoiling and same % of patients had hypercoiling. Thus, statistically, correlation was found between umbilical cord coiling and need of NICU admission.

Mean weeks of gestation for normal coiled umbilical cord was 38.4 weeks,that for hypocoiled umbilical cord was 38.6 weeks and for hypercoiled umbilical cord was 37.6 weeks. There was no statistical significance between umbilical cord coiling and weeks of gestation. Mean baby weight for normal coiled umbilical cord was 2.8kg, that for hypocoiled umbilical cord was 2.6kg and for hypercoiled umbilical cord was 2.5kg. There

			gravida		Total
			primi	multi	
Coiling	Normal	Count	34	32	66
		% within coiling	51.5%	48.5%	100.0%
		% within gravida	45.9%	57.1%	50.8%
	Hypo	Count	20	12	32
		% within coiling	62.5%	37.5%	100.0%
		% within gravida	27.0%	21.4%	24.6%
	% within coiling % within gravida Count	Count	20	12	32
		% within coiling	62.5%	37.5%	100.0%
		% within gravida	27.0%	21.4%	24.6%
Total		Count	74	56	130
		% within coiling	56.9%	43.1%	100.0%
		% within gravida	100.0%	100.0%	100.0%
P value			.450		

Table-1: Correlation of coiling and gravida

			IPM			Total
			reactive	not reactive	equi vocal	
Coiling	Normal	Count	62	4	0	66
		% within coiling	93.9%	6.1%	.0%	100.0%
		% within ipm	67.4%	10.8%	.0%	50.8%
	Hypo	Count	13	18	1	32
		% within coiling	40.6%	56.2%	3.1%	100.0%
		% within ipm	14.1%	48.6%	100.0%	24.6%
	Hyper	Count	17	15	0	32
		% within coiling	53.1%	46.9%	.0%	100.0%
		% within ipm	18.5%	40.5%	.0%	24.6%
Total		Count	92	37	1	130
		% within coiling	70.8%	28.5%	.8%	100.0%
		% within ipm	100.0%	100.0%	100.0%	100.0%
p-value			0.000			

Table-2: Correlation of Coiling and intrapartum (ipm) cardiotocograph

			Mode of delivery			Total
			Normal	Section	instrument	
coiling	Normal	Count	59	4	3	66
		% within coiling	89.4%	6.1%	4.5%	100.0%
		% within mod	73.8%	9.1%	50.0%	50.8%
	Hypo	Count	11	19	2	32
		% within coiling	34.4%	59.4%	6.2%	100.0%
		% within mod	13.8%	43.2%	33.3%	24.6%
	Hyper	Count	10	21	1	32
		% within coiling	31.2%	65.6%	3.1%	100.0%
		% within mod	12.5%	47.7%	16.7%	24.6%
Total		Count	80	44	6	130
		% within coiling	61.5%	33.8%	4.6%	100.0%
		% within mod	100.0%	100.0%	100.0%	100.0%
P value			.000			

Table-3: Correlation of coiling and Mode of delivery

			Meconium		Total
			No	yes	
coiling	Normal	Count	63	3	66
		% within coiling	95.5%	4.5%	100.0%
		% within meconium	56.2%	16.7%	50.8%
	Hypo	Count	26	6	32
		% within coiling	81.2%	18.8%	100.0%
		% within meconium	23.2%	33.3%	24.6%
	Hyper	Count	23	9	32
		% within coiling	71.9%	28.1%	100.0%
		% within meconium	20.5%	50.0%	24.6%
Total		Count	112	18	130
		% within coiling	86.2%	13.8%	100.0%
		% within meconium	100.0%	100.0%	100.0%
P value			.004		

Table-4: Correlation of coiling and meconium

			outcome		Total
			No	Yes	
coiling	Normal	Count	62	4	66
		% within coiling	93.9%	6.1%	100.0%
		% within outcome	76.5%	8.2%	50.8%
	Hypo	Count	10	22	32
		% within coiling	31.2%	68.8%	100.0%
		% within outcome	12.3%	44.9%	24.6%
	Hyper	Count	9	23	32
		% within coiling	28.1%	71.9%	100.0%
		% within outcome	11.1%	46.9%	24.6%
Total		Count	81	49	130
		% within coiling	62.3%	37.7%	100.0%
		% within outcome	100.0%	100.0%	100.0%
P value			.000		

Table-5: Correlation of coiling and outcome

was statistical significance between umbilical cord coiling and weight of baby. Mean age of pregnant female for normal coiled umbilical cord was 26years, that for hypocoiled umbilical cord was 27 years and for hypercoiled umbilical cord was 26 years. There was no statistical significance between umbilical cord coiling and age of pregnant females.

DISCUSSION

The umbilical cord is fundamental for the survival, wellbeing

and development of the foetus and the number of coils for any cord is assumed to be established early in gestation.⁶

In the present study, after delivery of placenta, umbilical cord was examined in middle 10 cm and the perinatal factors like meconium staining, birth weight, APGAR score at 1 min, mode of delivery, NICU admission, gestational weeks, age of patient, fetal distress was correlated with umbilical cord coiling. A clinical correlation of the perinatal outcome with the umbilical cord coiling was found.

			NICU admission		Total
			No	Yes	
coiling	Normal	Count	62	4	66
		% within coiling	93.9%	6.1%	100.0%
		% within nicu	75.6%	8.3%	50.8%
	Hypo	Count	10	22	32
		% within coiling	31.2%	68.8%	100.0%
		% within nicu	12.2%	45.8%	24.6%
	Hyper	Count	10	22	32
		% within coiling	31.2%	68.8%	100.0%
		% within nicu	12.2%	45.8%	24.6%
Total	Count	82	48	130	
	% within coiling	63.1%	36.9%	100.0%	
	% within nicu	100.0%	100.0%	100.0%	
P value			.000		

Table-6: Correlation of coiling and nicu

The women included in present study were in the age group ranging from 18-35 years. Majority of women were in age group 21-30 years with no statistical significance. Distribution of gravidity was not significant. Hypercoiled group were associated with more caesarean section. Birth weight in relation to Umbilical cord coiling was studied and it was found to be strongly significant. Hypercoiled group were associated with low birth weight. Statically correlation between meconium stained liquor and umbilical cord coiling was significant. Meconium stained was more in hypercoiled group. In a study conducted by Padmanabhan LD et al⁷ significant correlation was found between meconium staining and hypercoiled group. In another study conducted by Gupta S et al⁸ they analysed 107 umbilical cords and reported that meconium staining was significantly higher in hypocoiled group than in those with normocoiled group. Strong TH et al,⁵ conducted a study and reported that UCI values less than 10th percentile were associated with meconium staining and were highly significant.

In the present study, apgar at 1 min was found to be significantly associated with hypocoiling as well as hypercoiling. In a similar study by Gupta S et al,⁸ hypocoiled cord was found to be associated with low apgar score. Padmanabhan LD et al,⁷ also found significant low apgar in hypocoiled group. In a similar study by Monique WM et al,⁹ it was found that undercoiling (hypocoiling) was associated with low apgar less than 7 at 5min. This was explained by a study conducted by Georgious HM et al¹⁰ in which cords were subjected to a standardized tight encirclement force to measure venous perfusion and a significant inverse relationship was found between the minimum weight required to occlude venous perfusion and coiling index. Consequently, overcoiling may result in occlusion in cases with cord entanglement whereas undercoiling may result in kinking and compression of the cord. This may help to reveal the relation with low APGAR score in hypocoiled or undercoiled cords. In another study by Gupta S et al,⁸ it was found that babies with apgar less than 7 had significantly lower UCI than the babies with apgar > 7. In the present study, it was found that hypocoiled as well as hypercoiled cords have more NICU admissions. Monique WM et al,⁹ conducted a similar study and reported that undercoiling of the cord was related with NICU admissions of fetal death. In another study carried out by Strong TH et al,⁵ it was reported that incidence of fetal death was significantly

greater in non coiled group. Patil NS et al⁶ conducted a study to find the perinatal outcome in relation to the abnormal umbilical cord coiling index and reported that hypocoiled cords or UCI which was <10th percentile was associated with meconium staining, Apgar score at 1 min of <4 and at 5 min of <7, more LSCS rates and more NICU admissions and hypercoiled cords or UCI which was > 90th percentile was associated with intrauterine growth restriction (IUGR). It is important to identify abnormal cord coil index by antenatal detection by ultrasound which could lead to reduce the fetal death rate by about one-half by elective delivery of fetuses at risk.^{11,12}

CONCLUSION

The umbilical cord and its vital blood vessels are the most vulnerable part of fetal anatomy. There was significant difference between the hypercoiled and hypocoiled group with respect to the perinatal parameters like meconium staining, low apgar score. Thus, both hypo and hyper coiling of cords had significant correlation with adverse fetal outcome. Hypercoiling was associated with meconium stained liquor, low apgar score, emergency caesarean section and NICU admission. Hypocoiling was associated with fetal distress and NICU admission. Therefore, antenatal detection of coiling index can identify foetus at risk and thus helps in further management. Method used to analyze coiling of umbilical cord also gave same correlation as used in other studies but we found our method easy, rapid and can be used bed side immediately after delivery.

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