ISSN NO. 2320-5407

Journal homepage: http://www.journalijar.com
Journal DOI: 10.21474/IJAR01

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH

RESEARCH ARTICLE

EVALUATION OF UMBILICAL CORD THICKNESS, CROSS-SECTIONAL AREA AND COILING INDEX DURING LABOUR AND FETAL OUTCOME.

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Manuscript Info

Manuscript History:

Received: 11 April 2016
Final Accepted: 13 May 2016
Published Online: June 2016

Key words:

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Abstract

Objectives:- To evaluate the perinatal outcome with the abnormal umbilical cord thickness, cross sectional area and index.

Study Design:- This prospective study was carried out in Benha university hospital faculty of medicine Obs and Gyna department. Two hundred women were in active labour at term gestations, and irrespective of their parities, they were having singleton pregnancies with live babies , were delivered by vaginal root Umbilical cord coiling index , thickness and cross sectional area were calculated and were correlated with various perinatal parameters like birth weight, meconium stained liquor, Apgar score, ponderal index and foetal growth restriction.

Results:- There was a significant correlation between the hypercoiled cords (UCI >90th percentile) and meconium staining (p value < 0.001) and Apgar score at 1 min of <4 and at 5 min of <7 (p value 0.001) and there was a significant correlation between hypocoiling and meconium stainging p<0.001 FBW and apgar score at 1<4 and at 5 mint >7 (P–value 0.001).

Conclusion:- Hypercoiled cords or UCI which was > 90th percentile was associated with meconium staining and low apgarscore at one and five minute. While hypocoiled cord or UCI which was <10th percentile was associated with low birth weight, meconium staining and apgerscore at 1 min <4 and at 5 min of <7.

Introduction:-

The umbilical cord is vital for the development, wellbeing and survival of the foetus and yet, it is vulnerable to kinking, compressions, traction and torsion, which may affect the perinatal outcome. vessels are the most vulnerable part of the foetal anatomy. The total number of coils for any particular cord is believed to be established early in gestation. The pattern of coiling develops during second and third trimesters, presumably due to snashes in the cord and this coiling changes as pregnancy advances. The three blood vessels pass along the length of the cord in helical or coiled fashions [1]. The helical fusion of these umbilical vessels is termed as spiral course [2].

A coil is defined as having completed a 360 spiral course of umbilical vessel around Wharton's jelly. Coiling property of umbilical cord was described by Berengarius in1521 [1]. In 1954, umbilical coiling was first quantified by Edmonds who divided the total number of coils by umbilical cord length in centimetres and called it "Index of twist". He assigned positive and negative scores to clockwise and anticlockwise coiling, respectively [1,3]. Later, Strong et al simplified it by eliminating three directional score and named it "The umbilical cord coiling index" [1,4]. An abnormal umbilical cord coiling index includes both hypocoiled cords (cords with an umbilical cord coiling index which is < 10th percentile) and hypercoiled cords (cords with an umbilical cord coiling index which is > 90thpercentile). An abnormal umbilical coiling index has been reported to be related to adverse perinatal outcomes [1,2,5–6].

The present study aimed to evaluate the perinatal outcomes with abnormal umbilical cord thickness cross sectional area coiling indices.

Material and methods:-

This study was Carried out at Benha University hospital ,Faculty of Medicine, Department of Obstetrics & Gynaecology at aperiod of six month. Ethical committee clearance was obtained .200patients who were in active labour with term gestations, irrespective of their parities, who had singleton pregnancies with live babies who had delivered by vaginal root and with intact membrane cervical dilatation 4-8 cm, with no medical disorder like hypertension pre eclampsia, diabetes mellitus and no congenital anomalies for all women the following were done. General examination ultrasonogarphy for accutate measurement of gestational age marketing the outer edges of the umbilical cord for thickness and by encircling the outer edge of the cord in transverse section for cross-sectional area. UCI was calculated as a reciprocal valve of the distance between the inner edge of one artery to the outer edge of the same artery at the adjacent umbilical twist along the ipsilateral cord side. After examination of pregnant women and fetal assessment, artificial rupture of membrane was done with assisted as regard clear or meconium stained after delivery and separating baby from umbilical cord, the cord was tied and cut as close to baby as possible. The umbilical cord was measuredincluding the length of the placental end of the cord and umbilical stump on the baby. Number of complete coils or spirals were counted from neonatal end towards the placental end of cord and it was expressed in cm. After this, UCI was calculated by dividing the total number of coils by the total length of cord in cm.

$$UCI = \frac{\text{Number of coils}}{\text{Total length of cord in cms}}$$

Then, perinatal factors like meconium staining, foetal weight, Apgar score and ponderal index were correlated with UCI. Thus, the effect of umbilical vascular coiling on perinatal outcome was carried out. All patients and babies were followed till they were discharged.

Statistical analysis:-

Data were collected, revised, coded and entered to the Statistical Package for Social Science (IBM SPSS) version 20. Qualitative data were presented as number and percentages while quantitative data with parametric distribution were presented as mean, standard deviations, ranges, median and interquartile range (IQR). The comparison between two groups with qualitative data were done by using Chi-square test and/or Fisher exact test was used instead of Chi-square test when the expected count in any cell was found less than 5. Comparison between two independent groups regarding quantitative data with parametric distribution were done by using Independent t-test. Comparison between two paired groups regarding quantitative data with parametric distribution were done by using paired t-test. Comparison between more than two groups were done by using One Way Analysis of Variance (ANOVA) followed by post hoc analysis (LSD). The confidence interval was set to 95% and the margin of error accepted was set to 5%. So, the p-value was considered significant as the following:

P > 0.05: Non significant
P < 0.05: Significant
P < 0.01: Highly significant.

Results:-

Among 200 women who were studied, primigravida were 70 multigravida were 130, Age from 20-35 were 175 case. Age above 35 wear 25 case. In the present study UCI which <10th percentile <0.3was considered as hypcoiled. Whereas UCI which was > 90th percentile > 0.52 was considered as hypercoiling. 172 cords showed normal coiling, 18 showed hypocoiling, and 21 showed hypercoiling. 18 babies weighed < 2.5kg. Meconium staining liquor was present in 38 cases. An Apgar score at 1 min of < 4 was observed in 12 cases and that of > 4 was seen in 178 cases. Apgar score at 5 min was <7 in 8 and it was > 7 at 5 mint was 19 and 2 cases were died. The twist of the cord was clock wise in 153 cases and 47 were anti clockwise. 103 were female and 97 were male.there was statistically significant association between hypocoiled umbilical cord and meconium staining of p value 0.006 and fetal body weight, of p value < 0.001low apgar score after one minute of p value < 0.001 and apgar score at five minutes of p value < 0.001, there is a significant relation between hypercoiled and meconium staining of p value0.018 and apgar score after one and five minute of p value **< 0.001** and there is a statistically significant correlation between thin

UC and fetal body weight of p value0.000 and meconium staining of p value0.015. A significant correlation between thick UC and meconium staining of p value0.0005 and FBW of p value 0.019 and pundreal index of p value0.013 and there is a statistically significant correlation between large cross sectional area and meconium of p value0.0113, fetal body weight of p value0.020, pundreal index of p value0.000, apgar score after 1 min of p value 0.000 and Apgar score after 5 minutes of p value0.000.

Table 1:- Show correlation of meconium stating F.B.W apgar score at 1 mint and pondral index. This are statistically significant, Suggesting that hypercoiled cords are associated with meconium staining and Apgar scores at 1 and 5 min and hypocoiled cords were significantly associated with meconium staining L.B.W and apgar score at 1 and 5 mint.

	Min.	**Max**	**Mean**	**10th centile**	**90th centile**
UC Thick	1.2	2.7	1.8	1.4	2.328
Coiling index	0.3	0.9	0.4	0.3	0.527
Cross sectional area	1.26	4.18	2.81	1.98	4.093

Table 2:- Show the correlation between UC thickness and meconium staining FBW ponderal index and apar score at one and 5 min. it was significant it suggest that thick umbilical cord associated with meconium stating and low birth weigh while hypercoild was significant with meconium stating F.B.W and low pondral indices.

	Minimum	**Maximum**	**Mean**	**SD**	**Paired t-test**	
Antipartum UCI	0.3	0.9	0.41	0.10	0.951	0.342
Post partum UCI	0.18	0.85	0.40	0.11		
Post partum thickness	0.70	1.50	1.08	0.23	-	-

Table 3:- Show the correlation between larg cross sectional area meconium stating FBW low ponderal index and apgar score at 1 and 5 min

		Normal coiled	**Hypo coiled**	**Hyper coiled**	**P1**	**Sig.**	**P2**	**Sig.**	**P3**	**Sig.**
Age (years)	20 – 35 years	145 (89.5%)	16 (88.9%)	14 (70.0%)	0.933	NS	0.013	S	0.154	NS
	> 35 years	17 (10.5%)	2 (11.1%)	6 (30.0%)						
Parity	1	61 (37.7%)	4 (22.2%)	5 (25.0%)	0.317	NS	0.444	NS	0.977	NS
	2	47 (29.0%)	9 (50.0%)	9 (45.0%)						
	3	20 (12.3%)	2 (11.1%)	3 (15.0%)						
	> 4	34 (21.0%)	3 (16.7%)	3 (15.0%)						
Sex of baby	Females	81 (80.0%)	11 (61.1%)	11 (55.0%)	0.371	NS	0.673	NS	0.703	NS
	Males	81 (50.0%)	7 (38.9%)	9 (45.0%)						
Duration of pregnancy	Mean ± SD	38.4±1.36	38.17 ± 1.25	38.1 ± 1.41	0.493	NS	0.355	NS	0.870	NS
	Range	37 – 40	37 – 40	37 – 41						
Amniotic fluid	Normal	130 (80%)	6 (33.3%)	8 (40%)	< 0.001	HS	< 0.001	HS	0.000	HS
	Oligo	16 (10%)	12 (66.7%)	0 (0%)						
	Poly	16 (10%)	0 (0.0%)	12 (60%)						

P1: Comparison between normal group and hypo group regarding to neonatal factor
P2: Comparison between normal group and hyper group regarding to neonatal factor
P3: Comparison betweenhypo groupand hyper group regarding to neonatal factor

Table 4:- Distributive frequency of three group according to neonatal factor

		Normal coiled	**Hypo coiled**	**Hyper coiled**	**P1**	**Sig.**	**P2**	**Sig.**	**P3**	**Sig.**
		Total no.= 172	**Total no.= 18**	**Total no.= 20**						
Meconium	Clear	65 (40%)	14 (77.8%)	14 (70%)	0.006	HS	0.018	S	0.102	NS
	Thick greenish	33 (20%)	0 (0.0%)	4 (20%)						
	Thin greenish	64 (40%)	4 (22.2%)	2 (10%)						
FBW	Mean ± SD	3.27 ± 0.25	2.05 ± 0.12	3.35 ± 0.37	<0.001	HS	0.205	NS	0.000	HS
	Range	3 – 4	2 – 2	3 – 4						
Ponderal index	Mean ± SD	2.64 ± 0.67	2.52 ± 0.51	2.71 ± 0.73	0.441	NS	0.663	NS	0.364	NS
	Range	1.52 – 4.4	1.52 – 3.30	1.7 – 4.4						
APG after 1 min	< 4	0 (0%)	6 (33.3%)	8 (40%)	<0.001	HS	<0.001	HS	0.671	NS
	>4	162 (100%)	12 (66.7%)	12 (60%)						
APG after 5 min	<7	0 (0%)	4 (22.2%)	4 (20%)	<0.001	HS	<0.001	HS	0.387	NS
	>7	162 (100%)	14 (77.8%)	14 (70%)						
	Death	0 (0%)	0 (0.0%)	2 (10%)						

P1: Comparison between normal group and hypo group regarding to neonatal factor.
P2: Comparison between normal group and hyper group regarding to neonatal factor.
P3: Comparison betweenhypo groupand hyper group regarding to neonatal factor.

Table 5:- Descriptive frequency of umbilical cord thickness according to neonatal factors

		Normal	**Thin UC**	**Thick UC**	P1	Sig	P2	Sig.	P3	Sig.
		no. = 174	**no. = 8**	**no. = 18**						
meconium	Clear	83 (47.7%)	8 (100.0%)	2 (11.1%)	0.015	S	0.0005	HS	0.000	HS
	Thick greenish	21 (12.1%)	0 (0.0%)	16 (88.9%)						
	Thin greenish	70 (40.2%)	0 (0.0%)	0 (0.0%)						
FBW	Mean±SD	3.22 ± 0.42	2.45 ± 0.67	2.99 ± 0.03	0.000	HS	0.019	S	0.002	HS
	Range	2 – 4	2 – 4	3 – 3						
Pundeal index	Mean±SD	2.60 ± 0.67	2.44 ± 0.48	3.01 ± 0.55	0.509	NS	0.013	S	0.018	S
	Range	1.52 – 4.4	1.86 – 3.2	2.27 – 3.49						
APG after 1 min	< 4	14 (8%)	0 (0.0%)	0 (0.0%)	0.403	NS	0.211	NS	1.000	NS
	>4	160 (92.0%)	8 (100.0%)	18 (100.0%)						
APG after 5 min	<7	8 (4.6%)	0 (0.0%)	0 (0.0%)	0.784	NS	0.579	NS	1.000	NS
	>7	164 (94.3%)	8 (100.0%)	18 (100.0%)						
	Death	2 (1.1%)	0 (0.0%)	0 (0.0%)						

P1: Relation between normal and thin umbilical cord regarding to neonatal factor.
P2: Relation between normal and thick umbilical cord regarding to neonatal factor.
P3: Relation between thin umbilical cord and thick umbilical cord regarding to neonatal factor.

Discussion:-

Several trials in the past have correlated the relationship between perinatal outcomes and the UCI. In the present study, UCI was compared with various parameters. On comparing UCI with parity, it was found that there was no statistical significance between primigravida and multigravida and that there was a significant correlation between age above 35 and hypercoiled group. This study was in agree with study non by Ezmi Kahi et al. who fined hyperouling more significant with patient above 35 in one study on 656 neonates and their cords they found that hyperolied were associated with maternal age more than 35 and less than 18 years old while our results disagreed by result of chita et al., as they found no significant association between cord coiling and maternal age we didn't find any significant relation ship between UCI and six, parity and gestational age van Diik et al., evaluated the UCI in uncoulecated pregnancy they didn't found any relation between UCI and maternal age, parity, gestational age at time of delivery which is compatible with the present study except for age neonatal weight. In the present study, it was observed that meconium staining was significantly associated with UCI which was <10th percentile. Gupta S et al., studied 107 umbilical cords and found that in hypocoiled group, meconium staining was significantly higher than in those with normocoiled group [1]. Strong et al., studied 100 cases and they found that meconium staining was associated with UCI values of less than 10th percentile, with a p value of 0.03, which was highly significant [4]. In another study which was done by Padmanabhan LD et al., 130 cases were studied, where they found that meconium staining was significant in hypercoiled group [7].In a similar study which was done by Monique WM et al., 885 patients were studied and it was found that hypercoiling was associated with small for gestational age infants [8]. Georgiou AM et al., studied 34 cords and it was found that hypercoiled cords were associated with IUGR [9].

In the present study, There was 174 normal; umbilical cord thickness, 8 thin umbilical cord and 18 thick umbilical cord.

There was a significant association between meconium stained amniotic fluid F.B.W, and thick and thin umbilical cord.

While there was to no significant correlation between umbilical cord thickness and APG score at 1 and 5 min.

In the present study, there was no significant correlation between small cross sectional area and mecnoium staining, fetal body weight, ponderal index and apger score at 1 and 5 min. While there was a highly significant correlation between large cross sectional area and mecnoium staining, fetal body weight, ponderal index and apger score at 1 and 5 min.

Pediatricians consider the Apgar score as a practical method for urgent systematic evaluation of a newborn to detect the need for resuscitation. A low Apgar score is the result of a relatively acute and short-term insult. LBW, on the other hand, maybe due to IUGR, preterm delivery, or both, and is a major factor affecting neonatal and infantile mortality. It has been directly correlated to the infant mortality rate in different countries.[10] LBW likely reflects a severe and long-term pathological process, which is more likely to be associated with decrease in the Wharton's jelly content of the umbilical cord. This is probably why the umblical cord indices predict LBW better than the Apgar score.

Apgar score at 1 min of < 4 was found with both hypo and hypercoiled group. Gupta S et al., studied 107 umbilical cords and found that in hypocoiled cords, low Apgar scores were present [1]. In another study which was done by Padmanabhan et al., 130 umbilical cords were studied and it was found that in hypocoiled group, there were significantly low Apgar scores[7].

In the present study, Apgar score at 5 min of <7 in relation to UCI was seen with both hypo and hypercoiled group. Monique WM et al., studied 885 cases and found that hypocoiling was associated with low Apgar scores [8]. Gupta S et al., studied 107 cords and found that babies with Apgar scores of < 7 had significantly lower UCIs than the babies with Apgar scores of > 7 [1]. Padmanabhan LD et al., studied 130 umbilical cords and found that hypocoiled group was associated with low Apgar scores of < 7 [7].

Conclusion:-

The abnormal umbilical coiling index is associated with adverse perinatal outcomes. The hypocoling and it is associated with foetal growth restriction. Hypo and hypercoiling associated with meconuim stating and low apger score at 1 and 5 min and the umbilical cord indices predict LBW better than the apger score. And reduction in the umbilical cord thickness and diameter can compromise fetal growth.

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