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Association between some Maternal Disease and Abnormal Umbilical Cord Coiling

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ABSTRACT

Background: The twisting of the umbilical cord is called coiling which is divided into normocoil, hypocoil and hypercoil according to the number of coils per length of the cord**. Objective:** The study aims to verify the relation of hypercoiling and hypocoiling cord with maternal diseases and its effect on the trophoblastic cells**. Results:** The study aims to verify the relation of hypercoiling and hypocoiling cord with maternal diseases and its effect on the trophoblastic The results of the study revealed that hypocoiling cord was associated with hypertensive PIH group which lead to decrease birth weight, Apgar score <7 and increase caesarean section delivery, while hypercoiling was associated with gestational diabetes group which result in an increase birth weight,Apgare score ≥7 and increase caesarean section delivery . Microscopical investigation of the diabetic placenta shown increased fibrin thrombi, edema and syncytial knot on the GDM group while increasing thickness of trophoblastic membrane (syncytio-vascular membranes) and hydropic villi in PIH group cells. **Conclusion:** Therefore, antenatal detection of coiling cord can identify fetus at risk.

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INTRODUCTION

The umbilical cord is a tube structure which is connected between the navel and placenta The umbilical cord is a tube structure which is connected between the navel and placenta Strong (1997). Coiling density was increased at the fetal end of umbilical cord Blickstein et al. (2001). The vessels of the umbilical cord like all hollow rolls are predisposed to torsion, compression, tension, and following disruption of the blood flow. This risk is reduced by their helical statement. It is possible that the coiled umbilical cord has elastic possessions that allow it to resist external forces that might cooperation the umbilical vascular flow. It may be that, the coiled umbilical cord performances like a semi-erectile organ that is more resistant to roaring torsion, stretch, and compression than the non-coiled (an extreme form of hypocoiled) cord Cupta et al. (2006). Hyper-coiled cords often have more thrombi in placental surface veins because the flow is slower, and when coiling becomes excessive, the fetus can stray circulation in the cord vessels Benirschke (2005). In pre-eclampsia cytotrophoblast progenitor cells fail to undergo an epithelial to endothelial alteration. Cytotrophoblast fail to switch a repertoire of bond molecules essential for invasion of the spiral arteries. Increased syncytiotrophoblast apoptosis and increased syncytial knotting Lyall (2006). This work was accompanied to study the relation of hypercoiling and hypocoiling cord with maternal diabetes and pregnancy induced hypertension and their possible effects on the trophoblastic cells.

MATERIAL AND METHODS

Patients:

a prospective cross-sectional study was performed and 136 umbilical cord of full term pregnancy were collected from 100 women with gestational disease and 36 for women without gestational disease attending the Labor Room and Gynecology Operation theatre of Hilla Teaching Hospital (Babylon Governorate). The women with maternal diseases diagnosed by a specialized physician during the late days before delivery.

Umbilical Cord Index:

The cord was evaluated for complete vascular coiling, determined at delivery and the umbilical cord length was measured with a tape, from its insertion into the placenta up to the neonatal umbilicus. A complete vascular coil was defined as a 360° complete round coiling of the vasculature and the total number of these complete vascular coils was determined. A UCI can be determined by dividing

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the total number of complete vascular coils by the total length of cord in centimeters. We determine hypocoiled cords as those with UCI less than 10th percentile and hypercoiled cords as those with UCI more than 90th percentile. Depending upon the direction of the course of vessels, umbilical cords were referred as clockwise, anticlockwise. The chi-square test and correlation value were used. P value < 0.05 was considered statistically significant.

Microscopic Examination:

After separating the baby from the umbilical cord, the cord was tied and as close to the placenta as possible. Any abnormalities of placenta were preserved in 10% formalin. The tissue was dehydrated and followed by embedding in paraffin and 5 micron serial sections were generated with the help of rotator microtome. The sections were stained with hematoxylene and eosin.

Results:

One hundred thirty six cords were evaluated at birth. Table (1) exhibit the distributive frequency of the three groups according to maternal diseases .The highest percentage was 41 (62.12%) hypocoiled in PIH group and 6 (60%) hypercoiled in diabetes group, while, 35(97.22%) normocoiled in normal group. Table (2) shows the percentage of length and the direction of coiling cord in the maternal diseases. The highest percentage of the cord length less than 50cm was 52 (78.78%) in the PIH group and the higher rate of the cord length between (50-70 cm) was 34 (94.44%) in the normal group. Also the highest percentage of the cord length more than 70cm was 6 (25%) in GDM group. The direction of umbilical coiling is predominantly found anticlockwise twists in normal group. In contrast, clockwise coils direction of vessels was more frequent in PIH and GDM groups. Table (3) exhibit the relation between maternal diseases and perinatal outcome; the gestational age<37wks was 50 (75.75%) observed in PIH group. The neonates gender, males was 40 (60.60%) in PIH group more than other groups. Apgar <7 was related to the group with PIH & GDM, which was 11 (78.57%). The delivery approach mostly caesarean section in the GDM group was 9 (90.00%) more than other groups. The mean birth weight of newborn babies was 4.300±0.661 in GDM and 2.04 ± 0.185 in hypertension group. The results of microscopic examination display in fig.1 and fig.2.

Table 1: Frequency distribution of three type UCI according to the disease.

Number of cases	Hypocoiled		Normocoiled		Hypercoiled	
	%	No.	i%	No.	%	No.
Hypertention(PIH) (66)*	62.12	41	33.33	22	4.54	3
Gestational diabetes (10)*	20	2	10	1	60	6
PIH and GDM (14)*	50	7	o.14	1	42.85	6
Hyperthyroidism (10)	10	1	90	9	0	0
Normal cases (36)	2.77	1	97.22	35	0	0

***** P value < 0.05

Table 2: Morphological features of umbilical cord among the study groups.

Type of umbilical cord observation		Gestational diabetes(GDM		Hypertention (PIH)		Hyperthyroidism		Hypertention (PIH)+Gestational diabetes (GDM)		Normal cases	
		No.	%	No.	%	No.	%	No.	%	No.	%
Length of cord	Less than 50 cm	O	O	52	78.78	2	20	5	50	O	O
	70-50 cm	18	21.68	14	21.21	8	80	9	90	34	94.44
	More than 70 cm	6	75	0	0	0	0	0	0	2	5.55
Umbilical cord direction	Anticlockwise	6	13.04	9	13.63	2	20	7	70	22	61.11
	Clockwise	18	17.30	57	86.36	8	80	7	70	14	38.88

*P value < 0.05

Table 3: Perinatal Factor according to maternal diseases.

Perinatal factors		Diabetes		Hypertension		Hyperthyroidism		Diabetes and Hypertension		Control	
		No.	%	No.	%	No.	%	No.	%	No.	%
Gestation al age*	<37 w	6	60.00	50	66.66	1	10.00	7	9.33	2	5.55
	≥37 w	4	40.00	16	21.33	0	0.00	7	9.33	34	94.44
Sex	Male	6	60.00	40	50.63	4	40.00	10	12.65	12	33.33
	Female	4	40.00	26	36.61	6	60.00	4	5.63	24	66.66
Apgar scores*	<7	2	20.00	59	89.39	0	0.00	3	30	0	0.00
	≥7	8	80.00	7	10.60	10	100	11	7.85	36	100
Delivery approach	Normal	1	10.00	16	23.88	6	60.00	7	10.44	36	100
	Caesarean section	9	90.00	50	60.24	4	40.00	7	8.43	0	0.00
Mean birth weight of babies in kg.*		GDM (insuli n) 10	4.300±0. 661	66	2.04 ± 0.185	10	3.400. ±123	14	2.03 ± 0.364	36	3.55± 0.128

*P value < 0.05

Discussion:

The coiling pattern of cord vessels has effects on the lifeline of the neonate. In our study the hypercoiled and the cord length more than 70 cm was associated with the maternal diabetes GDM. Also the hypocoiled and cord length less than 50 cm associated with the hypertension PIH group. While the cord length and UCI among the hyperthyroidism group were found near to that in the normal group. Ezimokhai et al. (2000) found that the UCI might have a clinical impotence. Also correspond with another study of Ezimokhai (2001) who found that non-coiling were associated with gestational diabetes. Chitra et al. (2012) mentioned that abnormal umbilical coiling index is associated with several antenatal and perinatal adverse features. The present study in promise with study by Cupta et al. (2006) who, stated that the direction of UCI is mainly found anticlockwise in normal cases while, in this study clockwise direction was predominant in PIH group this may be depend on active or passive rotation of fetus . In addition, the parameters in our study gestational age<37wk, Apgar score <7and caesarean delivery were increased while, birth weight decrease in PIH group this might be due to placental insufficiency and hypoxia in PIH .Also these parameter was variable in GDM group especially increase in fetal birth weight due to fetal hyperinsulinism is associated with macrosomia (hyperplasia) lead to caesarean delivery. Ercal et al. (1996) found that Apgar score <7 in the hypertention group were higher than normal group, which can be regarded as indicative for diagnosis of a neonate with poor outcome. The trophoblast is the key tissue that underlies the most villi gave changes .Hydropic villi were diagnosed when large terminal villi were present with edematous fluid and with separation of the trophoblast lining from the underlying stroma, villas fibrinoid necrosis, basement membrane thickening lead to reduced perfusion between fetal and maternal blood lead to hypoxia and formation of Syncytial knot which could be contributed to trophoblastic hypoxia and hypovascularity. This study covenant with Red–Horse (2004). In hypertension, cytotrophoblasts proliferate under hypoxic circumstances because the cytotrophoblasts have the aptitude to sense oxygen.The microscopic appearance of the chorionic villi of PIH group has shown damage endothelial cells of lumen vessels followed by proliferation which may lead to reduce blood flow due to narrowing of the lumen. Our study agree with Abdul Hafeez et al. (2012) who mentioned that the hypertension in pregnancy causes placental hypoxia which leading to the loss of a large quantity of parenchymal cells, this lead to syncytial knots and villous stromal fibrosis which are responsible for subtrophoblastic basement membrane thickness. In this study, placenta from diabetic pregnancies displays the villous edema, fibrin thrombi, and villous immaturity. This is in contract with study by Al-Okail (1994) and co-workers were seen histologically the fibrin thrombi, villous edema and thickening of basement membrane in placentae of poorly controlled diabetic mothers. Shams et al. (2012) reported that fibrinoid necrosis is augmented in diabetes and hypertention when compared to normal. This study in contract also with Makhseed et al. (2004). In conclusion the antenatal examination of coiling cord can identify a fetus at risk.

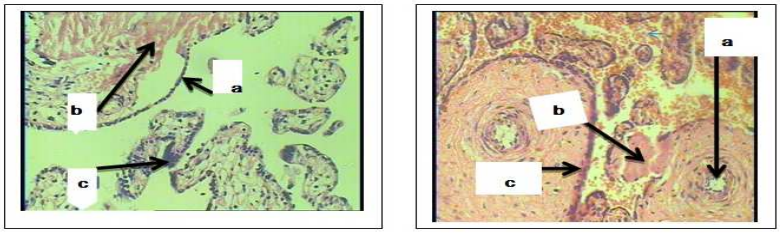

Fig.1: (left): (a) Hydropic villi in placenta from pregnancy induced hypertention showing separation of the trophoblast lining from the underling stroma, (b) villous fibrinoid necrosis and(c) syncytial knot formation(c). (Right): (a) proliferation of endothelial lining of blood vessels, (b) villous fibrin deposition(C) increased thickness of sub-trophoblastic basement membrane .H&E10x.

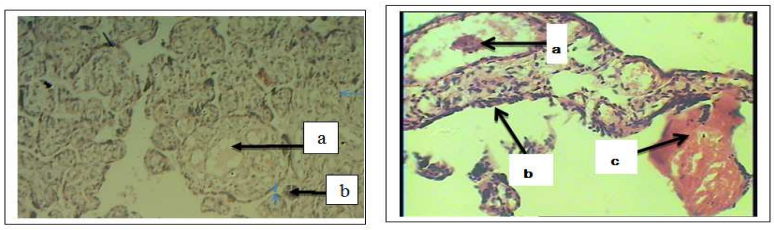

Fig. 2: Placenta of GDM group. (Left) :(a) Placental villi shows edema (b) syncytial knot. H&E 10x.(right):(a)fetal vascular thrombosis ,(b)immature villous cytotrophoblasts , (c) fibrin deposit H&E 40 x(right).

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