Effect of Umbilical Cord Abnormalities on Fetal Heart Pattern Leading to Operative Delivery

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ABSTRACT:

BACKGROUND:

Umbilical cord abnormalities may be associated with fetal heart rate irregularities this might change the mode of delivery from vaginal delivery to cesarean delivery and may be responsible for adverse perinatal outcomes.

OBJECTIVE:

To verify the association between umbilical cord abnormalities and fetal heart irregularities that lead to urgent cesarean delivery.

MATERIALS AND METHODS:

One hundred and six full term singleton pregnant women were enrolled in this study, 51 of them developed non reassuring fetal heart rate (Abnormal CTG) and emergency cesarean delivery was done for them, those represent the study group, the other 55 women had reassuring CTG and delivered vaginally, those represent control group. Umbilical cord and the neonate were examined after delivery for abnormality. The data obtained were fixed on questionnaire papers and then subjected to analysis.

RESULTS:

Umbilical cord abnormalities were present in higher significant rate (43.1%) in emergency cesarean delivery group than vaginal delivery group. Although single umbilical cord abnormalities was present more than multiple umbilical cord abnormalities but the latter associated significantly with increase rate of cesarean delivery (P value is 0.05). Nuchal cord was present in (31.3%) of women of study group and in (16.4%) of control group. The most fetal heart abnormality found was fetal deceleration (96.1%) and most commonly was late deceleration (42.8%).

Newborns with multiple umbilical cord abnormalities had significantly lower weight and lower Apgar scores than those with single cord abnormalities, P value 0.018, 0.037 respectively.

CONCLUSION:

Umbilical cord abnormalities are associated with increase rate of cesarean delivery because of fetal heart rate irregularities. The most common abnormality is umbilical cord entanglement around the fetal neck.

Multiple umbilical cord entanglement are responsible significantly for increased cesarean rate and adverse perinatal outcomes.

KEY WORDS: umbilical cord, fetal heart rate, caesarean section.

INTRODUCTION:

Umbilical cord contains two arteries and one vein and the ground substance, in which the vessels are embedded, is called Wharton's jelly[1]. It consists of a spongy network of interlacing collagen fibres and small woven fibrous bundles, the ground substance is composed mainly of hyaluronic acid (70%) and some sulphated glycosaminoglycans and proteoglycans (30%) [2].At birth, umbilical cord is about 50–60 cm in length and 12 mm in diameter. A long cord is defined when it is more than 100 cm and a short cord is less than 30 cm[3]. long cords are associated with nuchal cord, knots, cord presentation, and cord prolapse [3].Very short cord may cause difficulties during delivery by pulling the placenta from its attachment [4]. A coil is defined as complete 360 spiral courses of umbilical vessels around the Wharton's jelly [5].

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The spiraling of the umbilical cord is well established by 9 weeks, with a usual range of 0-40 twists, Coiling to the left occurs seven times more frequently than coiling to the right [3].Normal umbilical cord coiling is approximately 1 coil/5 cm of umbilical cord length or 0.20 to 0.24 coils/cm[6].

A nuchal cord occurs when the umbilical cord becomes wrapped 360 degrees around the fetal neck [7]. It has been referred to as "one of the dangers of eighth month" by Hippocrates [8].Finding of single or multiple loops of cord around the fetal neck is physiological and is seen in 25% of deliveries [9]. Umbilical cord has 11 vascular coils in its length on average between the fetus and placenta[10]. Coiling is established by the 9th week of gestation, however in a few others development may be as late as after the 20th week. Both right and left sided coiling has been reported with a preponderance of the left sided twist (7:1 ratio) [11].

Knots in umbilical cord two types: true and false. True knots occur in 1% of pregnancies, with the highest rate occurring in monoamniotic twins and arise from fetal movements. They are more seen when advanced maternal age, multiparity, and long cords. While false knots are more common and simply they are kinks in umbilical cord and are not associated with pregnancy complications [11,12].

PATIENTS AND METHODS:

A prospective case-control study was conducted at Al_Yarmook Teaching Hospital department of Obstetrics and Gynecology in Baghdad from Sept 2015 to Oct 2016.

The study Included 106 singleton pregnant women with cephalic presentation, their gestational age was between completed 37 to 41 weeks (according to their last menstrual cycle and recorded Ultrasound), they were admitted to the labour room for delivery in the first stage of labour and were recruited for the study and classified according to their mode of delivery to:

Study group which consisted of 51women who delivered by cesarean delivery for fetal distress and ***Control*** group included 55 participants who delivered vaginally without developing fetal distress.

Patient assessment

The participants were assessed while they are in labor room by taking history and doing examination with basic investigations including blood count, urine analysis and blood sugar.

They were monitored closely during labour by partogram and intrapartum cardiotocography. Fetal heart rate was monitored interruptedly during the first stage and continuously in second stage of labour. Nonreassuring fetal heart was considered when fetal heart accelerations or decelerations developed. Emergency caesarean delivery was decided in these cases. While those in whom fetal heart rate remained normal, they delivered vaginally.

After delivery the umbilical cord was examined for its length, diameter, entanglement of umbilical cord around trunk or limb, nuchal cord, true or false knot, hypercoiling, hypocoiling any structural abnormality. The cord abnormalities were identified and the findings were arranged to statistical study.

The newborns were examined by pediatrician for any abnormality, weight and Apgar score. All details were documented in the questionnaire form.

Exclusion criteria

Fetal anomaly, Twin pregnancy, Preterm labour, Malpresentation and Maternal medical condition.

Ethical issues.

1. The study protocol was approved by the scientific council of the Obstetrics and Gynecology of the Arab board of health specialization.
2. Verbal consent of the participants was obtained before participation.

Statistical analysis

Continuous data follow normal distribution so mean and standard deviation used to represent the data, while for discrete variables their number and percentage was used. t test is used to test the statistical significance, for discrete variable chi square test to test the statistical significance in distribution. Level of significance (p value) considered to be significance when it is below 0.05.

RESULTS:

The mean maternal age in study group was (26.19 ± 7.54) and that of control groups was (26.24 ± 6.68). Mean gestational age in study group was (38.15 ± 1.15) and that of control group was (38.24 ± 1.17). There were no significant differences in term of maternal and gestational age.

Table 1, shows that 43.1% of study group had cord abnormality and the most common abnormality is single cord entanglement around the fetal neck in both groups. Multiple cord entanglement seen in 7 (13.7%) women in the study group. Nuchal knot was found in two cases only (3.9%) both of them were true knot. Length of cord range from 50 to 110 cm, only two women (3.9%) had short cord (below 46 cm).

Table 1: Umbilical cord abnormalities in the study and the control group.

Umbilical cord abnormalities	Control group (Vaginal delivery)	Study group (C/S)	P value
Number	55	51	-
Umbilical cord abnormalities	11 (20%)	22 (43.1%)	0.021[a]
-Single umbilical cord entanglement	11 (20%)	11 (21.6%)	0.869[a]
+Nuchal loop	9 (16.4%)	9 (17.6%)	0.88[a]
+umbilical cord around limb	2 (3.6%)	2 (3.9%)	0.99[b]
+umbilical cord around trunk	0	0	-
-Multiple cord entanglements	0	7 (13.7 %)	0.005[b]
+Nuchal loop	0	7 (13.7 %)	0.005[b]
-Nuchal knot	0	2(3.9 %)	0.13[a]
+True knot	0	2(3.9%)	0.13[a]
+False knot	0	0	0
-Short cord (below 46 cm)	0	2(3.9 %)	0.13[a]
[a] Chi square test, [b] Fisher exact test			

Fetal heart abnormalities were noted in the emergency cesarean delivery group as illustrated in table 2. Only 2(3.9%) from 51 participants developed fetal heart acceleration while 49(96.1%) developed fetal heart deceleration. Both fetal acceleration and deceleration are highly significant in study group.

Table 2: Fetal heart abnormalities in both groups.

	Control group	Study group	P value
Number	55	51	-
Fetal tachycardia	0	2 (3.9%)	0.005
Fetal deceleration	0	49 (96.1%)	<0.001
Type of deceleration abnormalities in study group			
	No	Percentage	
Persistent bradycardia	13	26.5	
Late decelerations	21	42.8	
Variable decelerations	15	30.6	

Table 3 shows, no significant difference in the fetal heart abnormalities observed in the single cord entanglement.

Table 3: The association between Single umbilical cord entanglement and fetal heart abnormalities.

cord abnormality	Others cord abnormalities	Single entanglement	Total	P value
Number	40	11	51	
Persistence bradycardia				
Other fetal heart abnormalities	32 (80%)	6 (54.55%)	38	0.086[a]
Persistence bradycardia	8 (20%)	5 (45.45%)	13	
Late decelerations				
Other fetal heart abnormalities	21 (52.50%)	9 (81.82%)	30	0.08[a]
Late decelerations	19 (47.50%)	2 (18.18%)	21	
Variable decelerations				
Other fetal heart abnormalities	29 (72.50%)	7 (63.64%)		
Variable	11 (27.50%)	4 (36.36%)	15	
Chi square test				

Table 4, shows that persistent heart abnormalities were significantly higher in the multiple umbilical cord abnormality. Also variable deceleration was present in multiple UC entanglement but not in significant rate.

Table 4: The association between multiple cord entangelmaent and fetal heart abnormalities.

Umbilical cord abnormality	Other umbilical cord abnormalities	Multiple cord entangelment	Total	P value
Number	44	7	51	-
Persistence bradycardia				
Other fetal heart abnormalities	35 (79.55%)	3 (42.86%)	38	0.039[a]
Persistence bradycardia	9 (20.45%)	4 (57.14%)	13	
Late decelerations				
Other fetal heart abnormalities	23 (52.27%)	7 (100%)	30	0.033[b]
Late decelerations	21 (47.73%)	0	21	
Variable decelerations				
Other fetal heart abnormalities	32 (72.73%)	4 (57.14%)	36	0.406[b]
Variable deceleration	12 (27.27%)	3 (42.86%)	15	
Chi square test				

Figure 1, shows the neonatal weight in single and multiple cord entanglement and Apgar score.
Only two neonates with single cord entanglement had been admitted to intensive care unit (18.2%) while 6 neonates (85.7%) with multiple cord entanglements had been admitted to intensive care unit.

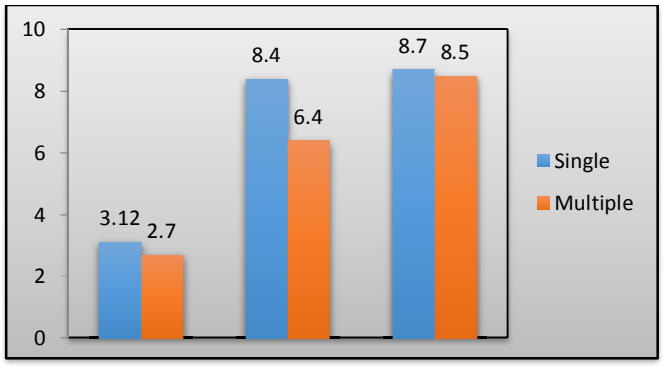

Fig1. Neonatal outcomes in single and multiple umbilical cord entanglement.

DISCUSSION:

Several umbilical cord abnormalities have been associated with the development of nonreassuring fetal heart rate and adverse perinatal outcome like cord entanglement, hypercoiling, true knots, strictures, and short cords [13]. Cord entanglement is the most common pathological reportedly increases the risk of prolonged labor and nonreassuring fetal status due to umbilical cord compression [14].

The present study shows no significant difference between control and study group regarding maternal and gestational age (P value was 0.972, 0.953,0.851 respectively) this finding supported with ***Tantbirojn et al*** and ***Kobayashi et al*** who reported also no significant difference between patients with normal and abnormal cords[14,15].

The study demonstrates high significant rate of umbilical cord abnormalities in those underwent emergency cesarean delivery due to nonreassuring fetal heart rate. Umbilical cord abnormalities were found in 43.1|% in emergency cesarean delivery (ECD) group. This finding goes with ***Weiner et al*** study who reported that 45.8 % of cases of ECD due to

nonreassuring fetal heart rate (NRFHR) had umbilical cord (UC) abnormalities, our finding also supported by ***Tantbirojn et al*** who observed that UC abnormalities were found in ECD group as a result of nonreassuring fetal heart rate (NRFHR) in 33.5%[13,14].

Only four types of UC abnormalities were reported here,these are single, multiple UC entanglement, cord knots and short cords.

UC entanglement is found to be the most common abnormality (35.3%), this finding goes with ***Weiner et al*** study who documented that (39.1%) of cases that had umbilical cord entanglement as the most common abnormality [13].

Single umbilical cord entanglements are found in higher rate than multiple UC entanglement in both groups (study and control groups).

The most common site of UC entanglement was neonatal neck, found in 16.4% and 31.3% in vaginal delivery (VD) and emergency cesarean delivery (ECD) groups respectively, this finding goes with ***Weiner et al*** who found nuchal neck in 18.6% and 28.6% in vaginal delivery (VD) and emergency cesarean delivery (ECD) groups respectively [13].

Single nuchal cord is found to be more common than multiple nuchal cord, ***Ali*** demonstrated in her study the presence of single nuchal loop in 85.4% of cases and multiple nuchal loops in the remaining 14.6%. ***Önderoğlu et al*** also mentioned that multiple nuchal loops are seen in 10.6% of the neonates in their study [16, 17].

Although single UC entanglement (21.6%) is reported to be more common than multiple cord entanglement (13.7%), multiple cord entanglement is found to be associated significantly with increase rate of emergency cesarean delivery (ECD). This finding doesn't go with ***Kobayashi et al*** who reported that the presence or absence of umbilical cord entanglement did not affect the delivery mode [14].

It can be explained that multiple umbilical cord entanglements cause cord compression in more than one site leading to decrease oxygen transfer to the fetus and developing fetal hypoxia and as a result it causes non reassuring fetal heart rate (NRFHR). The only multiple umbilical cord abnormality found in our study was nuchal cord.

Nuchal knot is a rare abnormality, seen only in two participants (3.9%). ***Weiner et al*** found it in (3.4%) of cases. ***Cajal et al*** reported that true nuchal knot was present in only 0.3 to 2.1% [13, 18].

Regarding length of umbilical cord, all umbilical cords had normal length range from 50 to 110 cm except for two cases (3.9%) both of them in emergency cesarean delivery (ECD) group. Those participants had the length of umbilical cord below 46 cm. while ***Lamonica et al*** demonstrated extremely short cord (13 cm and less) in two cases in her study in percentage of (1.2%). While ***Sornes*** reported that The incidence of cesarean section was also higher for the shorter cords [19,20].

Fetal heart deceleration was the dominant type of fetal distress (96.1%). The most common type of deceleration was late deceleration (45.1%). While ***Hasegawa et al*** disagree with this finding, as they reported that variable deceleration was the most common type of fetal distress in patients with umbilical cord (UC) abnormalities[4].

Participants with multiple UC entanglement had more adverse neonatal outcomes than those with single UC entanglement while neonatal weight in single UC group was significantly higher those in multiple UC group. This finding disagree with ***Weiner et al*** who found that neonatal weight in single UC group is lower than neonatal weight in multiple UC abnormalities but not in significant difference [13].

Ogueh et al reported that birth weight of fetuses with nuchal cord entanglement was 55g lower than those without nuchal cord entanglement [21].

CONCLUSION:

Umbilical cord abnormalities in general, are found more in women delivered by cesarean section due to fetal heart irregularities and although single nuchal cord is more common abnormality seen but increasing number of entanglements is clearly adverse the perinatal outcome and increase rate of cesarean section.

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