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Umbilical cord anomalies in high-risk pregnancy and its association with the perinatal outcome: A cross-sectional study

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Abstract

Background and objective: There are no local investigation on the role of the abnormal umbilical cord on neonatal and maternal outcomes in this region. This study aimed to examine the association of umbilical cord abnormalities on neonatal and maternal outcomes in Iraqi Kurdistan.

Methods: This is a cross-sectional study, the patients who attended the Duhok Obstetrics and Gynecology Teaching Hospital in Duhok city were examined between 1/11/2020 and 1/11/2021. The sample size is 500 women, inclusion criteria are age >18 years, acceptance to participate, gestational age >24 weeks and singleton pregnancy. The exclusion criteria are women who refused to participate, multiple pregnancy and stillbirth.

Results: The mean age of the pregnant women was 29.0 (16 - 45 years old). The most prevalent maternal complications were placenta Previa (7.06%), Polyhydramnios (9.88%), and post-partum hemorrhage (7.06%). In this study the most common abnormalities of UC were abnormal diameter of UC (29.4%), decreased Wharton jelly content (15.5%) and short UC (11.9%).Most of the patients' babies had normal weight (79.64%), (16.94%) had low birth weight and (3.43%) had very low birth weight. A percentage of the babies died either early neonatal (1.41%) or stillbirth (5.24%). The study found that the patients with abnormal diameter of UC cord were more likely to have babies with low birth weight (35.62% vs. 9.14%, *P* <0.0001) and were more likely to suffer from stillbirth (9.59% vs. 3.43%). Patients with short UC were more prone to have abruptio placenta (20.34% vs. 2.75%) and PROM (13.56% vs. 3.66%) ,and neonates with short UC were more likely to be LBW, VLBW and suffer from early neonatal death.

Conclusion: This study showed that the patients with abnormal umbilical cord have significantly higher rates of adverse neonatal and maternal outcomes.

Keywords: Umbilical cord; Abnormalities; High risk pregnancy.

Introduction

The umbilical cord (UC) extends from the fetal umbilicus to the fetal surface of placenta, it is the connecting link between the fetus and the placenta.[1] The UC contain 2 arteries and one umbilical vein, these vessels are covered by Wharton jelly which protect the UC from compression.[2] The UC besides functioning as a conduit between the fetus and placenta, it also serves a role in the transport of water and other substances between the fetal circulation and the amniotic fluid.[3]

Variations in the morphology of the UC are common and are often associated with structural or chromosomal abnormalities, fetal intrauterine growth restriction, and poor pregnancy outcomes.[4] Of the possible reported UC abnormality is nuchal cord, where the umbilical cord becomes wrapped around the fetal neck.[5] Nuchal cords are a probable cause for perinatal adversity and a rarely significant risk factor for long-term neurodevelopmental,[6]

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Although data from larger studies are conflicting about their effects on perinatal outcomes.[7] UC abnormalities may occur in combination with true knots frequently accompanies long cords, which are more prone to cord entanglement, and also associated with poor neonatal outcomes.[8,9]

The incidence of single umbilical artery is approximately 0.5-1% of singleton pregnancies as a result of agenesis, aplasia or atresia of one of the umbilical arteries,[10,11] systematic reviews and meta-analyses articles reported that this anomaly is associated with adverse perinatal outcomes.[12,13] The differences in the Length of the UC have different perinatal outcomes. A short cord may be associated with increased incidence of operative interventions, intrapartum complications, fetal heart rate abnormalities during labor, and more risks of birth asphyxia.[14]

A meta-analysis by Vahanian S. et al. published recently on placental implantation abnormalities and preterm birth found an association of velamentous cord insertion (VCI) and adverse pregnancy outcomes such as preterm birth, SGA infants, perinatal death and neonatal intensive care unit (NICU) admission, in VCI the umbilical vessels are prone to compression and rupture due to the lack of protection of Wharton's jelly.[15]

The variation in published results is may be linked to the differences in study design, definition of abnormalities, time of detection either antenatal or after delivery.[16]

Definition of the normal and abnormal UC:

* The normal length of UC cord was defined as more than 45 cm and less than 95 cm. It was labeled as short cord if the length was ≤45 cm and long if ≥95 cm short umbilical cord was defined if the length was ≤45 cm and long UC if the length was ≥95 cm.[17]

* The average diameter of the UC was defined being 0.8-2cm, thin diameter was defined if the diameter was <0.8cm and thick UC was defined if the diameter was >2cm.[3]

* Abnormalities of UC regarding the Wharton jelly defined being either normal, decreased or absent.[18]

* Insertion to the placenta*:* The UC normally inserts to placental disc either centrally (cord normally inserts centrally into the placental disc) or paracentral (insertion of the UC more than 3cm from the center and more than 2cm from the nearest margin). Abnormal cord insertions include marginal (insertion within 2cm of the placental disc's edge) and velamentous insertions (insertion of UC into the fetal membranes rather than directly to the placenta).[19]

* Umbilical cord knots: The UC may contain knots; most common are false knots which were defined as slight variations in the cord's anatomy, usually formed by swollen blood vessels or an excessive covering of Wharton's jelly .[20]

* True knots were defined as the UC loops or interweaves around it.[20]

* Cord entanglement: Defined as either one or more loops of the UC being encircled around any part of the fetal body or two umbilical cords getting entangled with each other).[20]

* Vasa previa was defined as unprotected umbilical vessels run through the amniotic membranes and cross over the cervix.[21]

* Cord prolapse was defined as the descent of the cord through the cervix alongside (occult) or past the presenting part (overt) in the presence of ruptured membranes.[22]

* Cord thrombosis and hematoma: Cord thrombosis and hematoma were examined by naked
eye for their presence or absence.

* Nuchal cord was defined when the UC wrapped around the fetal neck 360 degrees.[23]

* Hemangioma was defined as an angiomatous nodule containing and encompassed by edema and myxomatous degeneration of Wharton's jelly, cystic ranging from 0.2 -7 cm in the largest dimension.[20]

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* Single umbilical artery SUA was defined as: UC that contains only two blood vessels, instead of the normal three (2 arteries & 1 vein).[20]

The specific objectives of this study are:

-To find the morphological variations of umbilical cords after delivery and the risk factors associated with it.

-To determine the association of these variations of UC with maternal and neonatal outcomes.

Methods

Study Design and Sampling:

A cross-sectional study was conducted on 500 women who delivered at the labor ward of Duhok Obstetrics and Gynecology Teaching Hospital, Duhok city, Kurdistan region, Iraq from first of November 2020 till the first of November 2021 to determine any umbilical cord anomalies.

Age more than 18 years, delivered at 24 weeks and more of singleton pregnancy and accept to participate in the research were the inclusion criteria. Multiple pregnancies, stillbirths and refusal to participate were exclusion criteria.

Data Collection:

Participated in this study were interviewed personally by the researchers and the following information were collected from them: Age, parity, Body mass index (BMI) which was categorized as underweight (BMI < 18.5 kg/m^2), normal weight (BMI: 18.5-24.9 kg/m^2), overweight (BMI: 25-29.9 kg/m^2), and obese (BMI: ≥30kg/m^2).[24] Gestational age (GA) in weeks was measured by 1st trimester US taken between 11-14 weeks, smoking, modes of deliveries were recorded. The obstetric information of the participants was categorized as:

No complications, Abruptio placenta (premature separation of the placenta from the uterus),[25] placenta previa (placenta developing within the lower uterine segment),[26] Premature rupture of the membranes (PROM) defined as rupture of the membranes (amniotic sac) before the start of labor and after 37 weeks. gestation),[27] Polyhydramnios was defined as excessive volume of amniotic fluid AFI >25cm OR Single Deepest pocket >8cm),[28] Oligohydramnios (decreased amount of amniotic fluid resulting in AFI <5cm or single deepest pocket <2cm),[29] Post-partum hemorrhage was defined as the loss of 500ml or more of blood from the genital tract within 24 hrs. of delivery.[30] Medical disorders in pregnancy was categorized as:

Gestational hypertension was defined as a new-onset blood pressure of >140/>90 mmHg after 20 weeks gestation in the absence of proteinuria,[31] Preeclampsia was defined as new onset of hypertension and proteinuria or the onset of hypertension and significant end-organ dysfunction with or without proteinuria after 20 weeks gestation in previously normotensive women,[32] Gestational Diabetes was defined as glucose intolerance diagnosed during pregnancy between 24-28wks gestation and pregestational diabetes (type 1 or type 2 diabetes that is diagnosed before pregnancy).[33.]

After delivery of the baby the following neonatal outcomes were recorded; fetal gender (male or female), viability of the new borne determined as alive, fresh stillbirth (intrauterine death of a fetus after 20 weeks gestation or during labor or delivery),[34] and early neonatal death (death of newborn in 1st seven days of life).[35] Weight of the new borne was categorized as very low birth weight (VLBW: <1.5 KG), low birth weight (LBW: <2.5 Kg), and normal weight (≥2.5 Kg).[36] Presence or absence of congenital anomaly and admission to NICU.

Examination of the UC after Delivery of the Placenta:

After delivery of the new borne the cord was clamped and cut leaving 5cm from the fetal end. The length and diameter were measured by a flexible tape by (cm) from the placental end without giving excessive traction on the cord and additional 5 cm added to the length.

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The following parameters of UC were examined: Length, Diameter, UC placental site insertion, UC knots, Wharton's jelly content, UC abnormalities (vasa previa, cord prolapse, nuchal cord, single umbilical artery, cord hematoma, hemangioma)

Ethical Approval:

This study was approved by the Kurdistan Board of Medical Specialties (KBMS) ethics and scientific committee (approval No.926 on November 26, 2020), informed written consent was obtained from all women in labor or during preparation for cesarean section.

Statistical Analysis:

The general information of the patients was presented in mean and standard deviation or number and percentage. The values of the umbilical cord length and diameter were determined in mean and SD. The prevalence of abnormality in the umbilical cord was determined in number and percentage. The perinatal outcomes were determined in number and percentage. The association of umbilical cord abnormality with perinatal outcomes was examined in Pearson Chi-squared test. The significant level of association was determined in a *P*-value of less than 0.05. The statistical program (JMP Pro 14.3.1) was used for statistical analysis.

Results

Of the total 532 patients who were invited in this study, 500 of them were participated in the study. Four cases were excluded from the study due to being twins, the number of the cases that included in the study were 496 lady. The mean age of the pregnant women who were included in this study was 29. (range 16-45 years). Most of the mothers were multiparous (59.59%). Early neonatal death was 1%. The patients were normal weight (4.03%), overweight (67.54%), and obese (28.43%). The study found that 32.9% of the mothers had preterm gestational age (Table 1). Around 5% had abruptio placenta, oligohydramnios (4.44%), placenta Previa (7.06%), polyhydramnios (9.88%), gestational hypertension (6.40%), preeclampsia (5.85%), gestational diabetes (7.45%), post-partum hemorrhage (7.06%), and PROM (4.84%). A small percentage of mother has more than one complication (0.40%). The fetal presentations were breech (15.12%), cephalic (81.65%), and transverse lie (3.23%). The study found that the mean length of the umbilical cord was 57.36 ± 10.18 cm. We found that 11.9% of the babies of the patients had a short umbilical cord. The UCs were in central in (38.31%), Velamentous (1.61%) and most of the babies had no umbilical cord knots. Cord prolapse was seen in (3.02%) a total of 15 cases, 9 of those cases were delivered by emergency C/S, 10 of those 15 cases were admitted to NICU and 4 them were stillbirth. UC loops, or nuchal cord (6.05%) a total of 30 cases, 21of those cases were delivered by C/S delivery and 25 of them were admitted to NICU and Vasa Previa (1.21%), (Table 1)

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Table 1 Umbilical Cord characteristics among Pregnant Women.

Total number of patients (n=496)	**Frequency Distribution**	
	Number	**Percentage**
Umbilical Cord length– Range: 32-85 cm Mean (SD)		
Normal umbilical cord	437	88.10
Short umbilical cord	59	11.90
Umbilical Cord insertion		
Central	190	38.31
Marginal	79	15.93
Paracentral	219	44.15
Velamentus	8	1.61
Umbilical cord knots		
Absent	389	78.43
Entanglement	3	0.60
False	83	16.73
True	21	4.23
Warton's jelly		
Normal	419	84.48
Abnormal	77	15.52
Diameter UC		
Umbilical cord diameter (Range: 0.4-2.5 cm) Mean (SD)		
Abnormal	146	29.44
Normal	350	70.57
Presentation anomalies		
Normal	428	86.29
Cord prolapses	15	3.02
Cord thrombosis and hematoma	3	0.60
Hemangioma	6	1.21
Single umbilical artery	8	1.61
UC loops or nuchal cord	30	6.05
Vasa Previa	6	1.21
Total	496	100

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Most of the patients' babies had normal weight (79.64%) 16.94% had low birth weight and 3.43% had very low birth weight. A small percentage had congenital anomalies (2.82%). Different types of anomalies were found among newborns. Spina bifida was the more prevalent type of anomaly (30.77%). Fetal Outcomes were alive with normal APGAR scores (93.3%), early neonatal death (1.4%) and fresh stillbirths (5.24%) The study found that the patients with short UC cord were more likely to have low (32.20% vs. 14.87%) and very low birth weight babies (18.64% vs. 1.37%) in compassion to patients with normal UC length, *P* <0.0001). In addition, the patients with short umbilical cord were more likely to have early neonatal deaths (1.69% vs. 1.37%) or stillbirth (15.25% vs. 3.89%, *P* = 0.0011). Also, they were more likely to be admitted to NICU (50.85% vs. 39.13%, *P* <0.0001 (Table 2).

Table 2 Association of Umbilical Cord length Abnormalities with Fetal outcomes among Pregnant Women.

perinatal outcomes (n=496)	Umbilical cord length		*P*-value (two-sided)
	Normal umbilical cord No. (%)	Short umbilical cord No. (%)	
Birth weight			<0.001
Normal weight	366 (83.75)	29 (49.15)	
LBW	65 (14.87)	19 (32.20)	
VLBW	6 (1.37)	11 (18.64)	
Fetal Outcome			0.001
Alive	414 (94.74)	49 (83.05)	
Early neonatal death	6 (1.37)	1 (1.69)	
Fresh stillbirth	17 (3.89)	9 (15.25)	
Admission to NICU			< 0.001
No	251 (57.44)	20 (33.90)	
Yes	171 (39.13)	30 (50.85)	
Dead	15 (3.43)	9 (15.25)	
Fetal Presentation Breech	66 (15.10)	9 (15.25)	0.327
Cephalic	355 (81.24)	50 (84.75)	
Transverse lie	16 (3.66)	0 (0.00)	
Fetal Congenital anomalies			0.264
No	426 (97.48)	56 (94.92)	
Yes	11 (2.52)	3 (5.08)	
Presentation abnormalities			0.018
Cord prolapses	14 (3.20)	1 (1.69)	
Cord thrombosis and hematoma	1 (0.23)	2 (3.39)	
Hemangioma	5 (1.14)	1 (1.69)	
Normal	375 (85.81)	53 (89.83)	
Single umbilical artery	6 (1.37)	2 (3.39)	
UC loops or nuchal cord	30 (6.86)	0 (0.00)	
Vasa Previa	6 (1.37)	0 (0.00)	
Total	437 (100.0)	59 (100.0)	

Pearson chi-squared test was performed for statistical analysis.

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The study showed that the patients with short umbilical cord were more likely to have maternal complications (e.g. Abruptio placenta 20.34% vs. 2.75; PROM 13.56% vs. 3.66%; *P* <0.0001). In addition, they were more likely to have gestational hypertension (12.25% vs. 5.26%, *P* = 0.0034), and preeclampsia (15.25% vs. 4.58%; *P* = 0.0010), see (Table 3).

Table 3 Association of Umbilical Cord length Abnormalities with Perinatal outcomes among Pregnant Women.

perinatal outcomes (n=496)	Umbilical cord length		P-value (two-sided)
	Normal umbilical cord	Short umbilical cord	
Maternal complications			**< 0.001**
Abruptio placenta	12 (2.75)	12 (20.34)	
Multiple complications	2 (0.46)	0 (0.00)	
No complication	280 (64.07)	25 (42.37)	
Oligohydramnios	18 (4.12)	4 (6.78)	
Placenta Previa	30 (6.86)	5 (8.47)	
Polyhydramnios	48 (10.98)	1 (1.69)	
Post-partum hemorrhage	31 (7.09)	4 (6.78)	
PROM	16 (3.66)	8 (13.56)	
Gestational Hypertension			**0.003**
No	414 (94.74)	50 (84.75)	
Yes	23 (5.26)	9 (15.25)	
Preeclampsia			**0.001**
No	417 (95.42)	50 (84.75)	
Yes	20 (4.58)	9 (15.25)	
Total	437 (100.0)	59 (100.0)	

Pearson chi-squared test was performed for statistical analyses.

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The study showed that patients with a single umbilical artery 3.55% were obese, 13.51% had gestational diabetes, 12.24% associated with polyhydramnios, more likely to deliver by C/S 3.54% and neonatal outcome were more likely to be alive, term with higher incidence of NICU admission. (Table 4).

Table 4 Association between Maternal and Neonatal Conditions and Single Umbilical Artery.

Maternal conditions	Presentation abnormalities		*P*-value (two-sided)
	Normal (488)	Single umbilical artery (8)	
Gestational Diabetes			<0.001
No	456 (99.35)	3 (0.65)	
Yes	32 (86.49)	5 (13.51)	
Pre-gestational diabetes			<0.001
No	481 (98.57)	7 (1.43)	
Yes	7 (87.50)	1 (12.50)	
Mode of delivery			<0.001
Elective C/S	104 (97.20)	3 (2.80)	
Emergency C/S	109 (96.46)	4 (3.54)	
Vaginal delivery	275 (99.64)	1 (0.36)	
Maternal complications			<0.001
Abruptio placenta	23 (95.83)	1 (4.17)	
Oligohydramnios	22 (100)	0 (0.0)	
Placenta Previa	35 (100)	0 (0.0)	
Polyhydramnios	43 (87.76)	6 (12.24)	
Post-partum hemorrhage	35 (100)	0 (0.0)	
PROM	24 (100)	0 (0.0)	
Multiple complications	2(100)	0(0.0)	
No complications	304(99.67)	1(0.33)	
BMI			<0.001
Normal weight	20 (100)	0 (0.0)	
Overweight	332 (99.10)	3 (0.90)	
Obese	136 (96.45)	5 (3.55)	
Gestational age			<0.001
Preterm	161 (98.77)	2 (1.23)	
Term	327 (98.20)	6 (1.80)	
Preeclampsia			<0.001
No	461 (98.72)	6 (1.28)	
Yes	27 (93.10)	2 (6.90)	
Neonatal outcome			0.003
Alive	457 (98.70)	6 (1.30)	
Early neonatal death	7 (100)	0 (0.0)	
Fresh stillbirth	24 (92.31)	2 (7.69)	
Birth weight			<0.001
Normal weight	389 (98.48)	6 (1.52)	
LBW	83 (98.71)	1 (1.19)	
VLBW	16 (94.12)	1 (5.88)	
Congenital anomalies			<0.001
No	481 (99.79)	1 (0.21)	
Yes	7 (50)	7 (50.0)	
Admission to NICU			<0.001
Dead	22 (91.67)	2 (8.33)	
Non admitted	270 (99.63)	1 (0.37)	
Admitted	196 (97.51)	5 (2.49)	
Total	488 (100)	8 (100)	

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The study showed that the patients with multiple UC anomalies were more likely to be preterm, have gestational hypertension, Preeclampsia, smokers, have C/S, and have low and very birth weight, dead babies, and admitted to NICU (Table 5).

Table 5 Association of Multi-Anomalies with Maternal and Fetal Conditions.

Characteristics (n=496)	Multi-anomalies 213 (42.94%)	Normal (NO anomalies) 77 (15.52%)	Single anomaly 206 (41.53%)	*P*-value
BMI categories				0.126
Normal weight	11 (5.16)	2 (2.60)	7 (3.40)	
Overweight	134(62.91)	49 (63.64)	152 (73.79)	
Obese	68 (31.92)	26 (33.77)	47 (22.82)	
Gestational age				<0.001
Preterm	91 (42.72)	17 (22.08)	55 (26.70)	
Term	122 (57.28)	60 (77.92)	151 (73.30)	
Maternal complications				<0.001
No complication	104 (48.83)	49 (63.64)	152 (73.79)	
Abruptio placenta	18 (8.45)	1 (1.30)	5 (2.43)	
Multiple complications	2 (0.94)	0 (0.0)	0 (0.0)	
Oligohydramnios	15 (7.04)	2 (2.60)	5 (2.43)	
Placenta Previa	26 (12.21)	4 (5.19)	5 (2.43)	
Polyhydramnios	20 (9.39)	9 (11.69)	20 (9.71)	
Post-partum hemorrhage	11 (5.16)	12 (15.58)	12 (5.83)	
PROM	17 (7.98)	0 (0.0)	7 (3.40)	
Gestational Hypertension				0.008
No	191 (89.67)	73 (94.81)	200 (97.09)	
Yes	22 (10.33)	4 (5.19)	6 (2.91)	
Preeclampsia				<0.001
No	190 (89.20)	74 (96.10)	203 (98.54)	
Yes	23 (10.80)	3 (3.90)	3 (1.46)	
Gestational Diabetes				0.399
No	196 (92.02)	69 (89.61)	194(94.17)	
Yes	17 (7.98)	8 (10.39	12 (5.83)	
Pregestational diabetes				0.543
No	211 (99.06)	75 (97.40)	202 (98.06)	
Yes	2 (0.94)	2 (2.60)	4 (1.94)	
Smoking				<0.001
No	183 (85.92)	77 (100)	199 (96.60)	
Yes	30 (14.08)	0 (0.0)	7 (3.40)	
Mode of delivery				<0.001
Elective C/S	48 (22.54)	20 (25.97)	39 (18.93)	
Emergency C/S	68 (31.92)	10 (12.99)	35 (16.99)	
Vaginal delivery	97 (45.54)	47 (61.04)	132 (64.08)	
Fetal Presentation				0.053
Breech	43 (20.19)	10 (12.99)	22 (10.68)	
Cephalic	164 (77.00)	66 (85.71)	175 (84.95)	
Transverse lie	6 (2.82)	1 (1.30)	9 (4.37)	
Newborn weight				<0.001
Normal weight	136 (63.85)	74 (96.10)	185 (89.81)	
LBW	62 (29.111)	3 (3.90)	19 (9.22)	
VLBW	15 (7.04)	0 (0.0)	2 (0.97)	
Congenital anomalies				0.485
No	205 (96.24)	76 (98.70)	201 (97.57)	
Yes	8 (3.76)	1 (1.30)	5 (2.43)	
Fetal Outcome				0.001
Alive	187 (87.79)	76 (98.70)	200 (97.09)	
Early neonatal death	5 (2.35)	0 (0.0)	2 (0.97)	
Fresh stillbirth	21 (9.86)	1 (1.30)	4 (1.94)	
Admission to NICU				<0.001
Dead	20 (9.39)	1 (1.30)	3 (1.46)	
No	78 (36.62)	52 (67.53)	141 (68.45)	
Yes	115 (53.99	24 (31.17)	62 (30.10)	
Total	213 (42.94%)	77 (15.52%)	206 (41.53%)	

Pearson chi-squared test was performed for statistical analyses. **Single anomaly:** Patients with one anomaly; **Multi anomaly:** Patients with more than one anomaly; **Normal**: Patients without anomaly

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The study showed that the patients with abnormal umbilical cord diameter were more likely to have maternal complications, pre-eclampsia, low birth weight, fresh stillbirth, and admission to NICU (Table 6).

Table 6 Association of Diameter Abnormality with Fetal and Maternal outcomes.

Fetal and maternal outcomes (n=496)	Umbilical cord diameter		*P*-value
	Abnormal	Normal	
Maternal complications			**<0.001**
No complication	79 (54.11)	226 (64.57)	
Abruptio placenta	15 (10.27)	9 (2.57)	
Multiple complications	0 (0.00)	2 (0.57)	
Oligohydramnios	13 (8.90)	9 (2.57)	
Placenta Previa	9 (6.16)	26 (7.43)	
Polyhydramnios	9 (6.16)	40 (11.43)	
Post-partum hemorrhage	5 (3.42)	30 (8.57)	
PROM	16 (10.96)	8 (2.29)	
Gestational Hypertension			0.066
No	132 (90.41)	332 (94.86)	
Yes	14 (9.59)	18 (5.14)	
Preeclampsia			**0.022**
No	132 (90.41)	335 (95.71)	
Yes	14 (9.59)	15 (4.29)	
Gestational Diabetes			0.145
No	139 (95.21)	320 (91.43)	
Yes	7 (4.79)	30 (8.57)	
Pregestational diabetes			0.289
No	145 (99.32)	343 (98.00)	
Yes	1 (0.68)	7 (2.00)	
Newborn weight			**<0.001**
Normal weight	81 (55.48)	314 (89.71)	
LBW	52 (35.62)	32 (9.14)	
VLBW	13 (8.90)	4 (1.14)	
Fetal Outcome			**0.014**
Alive	131 (89.73)	332 (94.86)	
Early neonatal death	1 (0.68)	6 (1.71)	
Fresh stillbirth	14 (9.59)	12 (3.43)	
Admission to NICU			**<0.001**
Dead	13 (8.90)	11 (3.14)	
No	59 (40.41)	212 (60.57)	
Yes	74 (50.68)	127 (36.29)	
Total	350 (100.0)	146 (100.0)	

Pearson chi-squared test was performed for statistical analyses

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Discussion

The data from this study demonstrate the normal characteristics of umbilical cord (UC), and report the frequency of abnormalities and their correlation with adverse maternal and neonatal outcomes. the incidence of UC abnormality in this study was 83.3%, most common abnormalities were, abnormal diameter of UC, decreased Wharton jelly content and short umbilical cord.

The mean diameter of UC in our study was 1.04 ranging between 0.4-2.5cm, in a study by BE Udoh the UC diameter ranged between (0.73-1.68cm),[36] in our study up to 29.4% of patients had abnormal diameter UC which was the most common anomaly, 94% of them have thin cord <0.8cm , and these patients were more likely to have babies with LBW , VLBW , NICU admission in comparison to control group , in a study by SOYSAL, Et al. , stated that thin UC is associated with increased risk of fetal distress in risky pregnancies,[37] in the study by BE Udoh in Nigeria 2020 also concluded that UC diameter showed a positive correlation with gestational age and birth weight.[36]

The length of UC considerably varies between 10-300cm.[38] In a study by Balkawade N. Et al in India 2012, the average length of UC is 50-60cm.[14] in our study the mean length is 57.36cm, and 11.9% of patients had short cord the remaining have normal UC length, there were no long cords in our study. Patients with short cord were more prone to have (abruptio placenta, PROM), and more likely to have gestational hypertension and preeclampsia, and these results were supported by result of other study.[39] Neonates with short cord are more likely to LBW, VLBW, early neonatal death and stillbirth, which were analogous to the findings of Balkawade N, Et al.,[14] and had higher incidence of NICU admission, and this finding was concluded by other studies.[14,40]

Up to 15.5% of patient had decrease Wharton jelly content in our study, which has correlation with maternal HTN and higher incidence of emergency C/S, and neonates were more likely have LBW, admission to NICU and fresh stillbirth, in a study by AA FILIZ found significant positive correlation between Wharton jelly content, birth weight and placental weight.[41,42]

The incidence of nuchal cord (NC) in this study was 6.05%, in up to 95% of NC cases the cord length was more than 60cm, and these cases had higher chance of cesarean delivery (CD), which was analogous to the result of the study by M Mlodawskal due to non-reassuring fetal heart rate,[7] in another study by JDK Ngowa the rate of CD in loose and tight NC was less than the control group.[43] Also, neonates with NC have higher incidence of NICU admission in our, study which is not consistent with the result by JDK Ngowa study.[43]

The incidence of UC knots, 16.7% of patients have false knots, which didn't show to have any significant impact on maternal or neonatal outcome. true knots were present in 4.23%, these neonates had higher incidence of NICU admission and stillbirth, our results were similar to the result of other study done by S. Raisanen which stated that true knots are relatively common and associated with higher incidence of SGA infants, premature delivery, need for NICU admission and fetal death.[44]

Single umbilical artery (SUA) incidence in this study was 1.6%, patients with this abnormality were more likely to be obese, diagnosed with gestational diabetes and delivered by emergency C/S. up to 87% of the neonates with SUA were born with a congenital abnormality including cleft lip and palate and pinnatifida. They also had higher incidence of NICU admission, another study by Luo, Shishito al revealed that SUA itself is a risk factor for C/S and these neonates might have prolonged NICU stay.[7]

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Conclusion

This cross-sectional study demonstrated links between UCA and several adverse pregnancy outcomes, the incidence of UC abnormality in this study was 83.3%, the study showed the mean length of umbilical cord was 57.3cm, and most common abnormality was abnormal diameter of umbilical cord which was associated with LBW and high rate of NICU admission, abruptio placenta and gestational hypertension were significantly higher among fetuses with short UC. Appropriate examination and documentation of UC abnormalities is necessary. this will provide more information on fetal-wellbeing, neonatal outcome and basis for further studies. A prenatal diagnosis of abnormalities of the UC is rarely encountered: therefore, sonography skills are essential.

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Competing interests

The authors declare that they have no competing interests.

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