



Original article

Association of Length of Umbilical Cord and Fetal Outcomes

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Abstract: Objective: To determine the length of the umbilical cord of newborns and fetal outcomes and to determine the association of length of umbilical cord and fetal outcomes. **Study design:** Prospective cohort study. **Duration and Study setting:** April 2025 to July 2025. Department of Obstetrics and Gynecology, Khyber Teaching Hospital, Peshawar. **Methodology:** A total of 100 pregnant women aged 18 to 40 years with singleton pregnancies and gestational age between 37 and 42 weeks were included in this study. Patients with ruptured membrane, and fetus malformation were excluded. After delivery the umbilical cord was examined and its length was measured using a flexible measuring tape and categorised as short, normal and long cord groups. Fetal outcomes were assessed such as low Apgar score at five minutes < 6, stillbirth, neonatal intensive care unit (NICU) admission, low birth weight, fetal distress and presence of nuchal cord loops. Data were analysed using IBM SPSS 25. Fisher's exact test was used with $p \leq 0.05$ considered statistically significant. **Results:** Out of 100 patients, short umbilical cords were observed in 16% ($n = 16$), normal cords in 73% ($n = 73$), and long cords in 11% ($n = 11$) cases. Low Apgar score was observed in 4 (25.0%) neonates with short cords and 5 (45.5%) with long cords ($p < 0.001$). Stillbirth occurred in 2 (12.5%) with short cord and 3 (27.3%) with long cord ($p = 0.003$). NICU admission, low birth weight, fetal distress on cardiotocography and nuchal cord loops were also significantly more frequent in cases with short and long cords. **Conclusion:** The present study demonstrated that short and long umbilical cord lengths were associated with significantly adverse fetal outcomes.

Keywords: Umbilical cord length, fetal outcomes, Apgar score, stillbirth, nuchal cord, NICU admission..

INTRODUCTION

The umbilical cord is a fundamental anatomical structure that joins fetus to placenta and plays a critical role in maintaining the fetal life during the pregnancy. It functions as primary channel for oxygen and nutrients transfer between the maternal and fetal circulations. Umbilical cord typically encompasses two umbilical arteries and one umbilical vein entrenched within the protective mucoid connective tissue. Any disruption in morphology or dimensions of umbilical cord may compromise the fetal safety and results in the adverse perinatal outcomes 1-3.

Among the several morphological cord characteristics, its length has gained the considerable attention in the obstetric research due to its potential impact on the pregnancy outcomes. Cords shorter than 40 cm are usually considered as short whereas those surpassing 80 cm are categorized as long. Both

extremes cord length are linked to the neonatal morbidity. Short cords may limit the fetal movement and sometime leads to fetal distress, however markedly long cords may affect to cord entanglement and prolapse 4-6. Complications may eventually present as low Apgar scores, NICU admissions or perinatal mortality 7. A study demonstrated that abnormal umbilical cords lengths were associated with the amplified rates of fetal heart rate irregularities and operative deliveries during the labour. Abnormal cord length was associated to higher frequencies of birth asphyxia in comparison to normal cords length 8. Evidence demonstrated that abnormal cord length is also associated with fetal distress and prolonged labour more commonly when cord length deviates from the normal range 9. A Pakistani study reported that abnormal cords were associated with a higher incidence of stillbirth and birth asphyxia in comparison to normal length cords. Such findings

highlighted the significance of cord characteristics when evaluating fetal health during the labour [10]. Emerging research has emphasized the significance of examining the umbilical cord abnormalities as part of routine obstetric evaluation. Morphological variations of cord may reflect the fundamental placental dysfunction and may consequently serve as indicator of compromised fetoplacental circulation. Early recognition of abnormalities may assist the clinicians to identify pregnancies at greater complications risks and implement suitable surveillance policies.^{9,10} Given the potential impact of abnormal cord length

on fetal wellbeing. A better understanding of its association with the perinatal outcomes is vital for improving the obstetric care. Evaluating such association may assist the clinicians in anticipating intrapartum complications, guiding timely intervention and eventually reducing the neonatal adverse outcomes. This present study aims to evaluate the association between umbilical cord length and fetal outcomes to provide the evidence that may contribute to better maternal and neonatal care.

METHODOLOGY

This study was conducted in the Department of Obstetrics and Gynecology, Khyber Teaching Hospital, Peshawar from 2nd April 2025 to 2nd July 2025. Ethical approval was obtained from the Institutional Research and Ethical Review Board under number 712/DME/KMC. The study was approved by the Research Evaluation Unit, College of Physicians and Surgeons Pakistan (CPSP), vide Ref No. CPSP/REU/OBG-2022-020-11422, dated April 2, 2025. The sample size was 100, which was calculated using the WHO sample size calculator using the frequency of stillbirth as 12.57% in neonates of women with long umbilical cord, 10 confidence level of 95% and a margin of error of 6.5%. The calculated sample size was 100 patients. Non-probability consecutive sampling technique was used for select the patients.

The inclusion criteria required women aged 18 to 40 years with gestational age between 37 and 42 weeks and with singleton pregnancy. Women with ruptured membranes and women with fetus malformations were excluded from the study.

All women were ensured that participation in this study will not pose them any risk, and objective of the study was clearly explained to them. All women who agreed to participate in the study provided an informed written consent form. Baseline demographics details were taken such as maternal age, along with gestational age and parity. Patients were assessed for umbilical cord. It was thoroughly examined at the time of delivery for existence of loop around the neck. The cord was clamped at two places and cut in the middle. Length of the umbilical cord

(short or long) was measured by using a flexible tape, a short umbilical cord was defined as a condition in which the length of the umbilical cord connecting the fetus to the placenta was shorter than expected, which was measured by using a flexible tape in centimeters i.e (31 to 40 cm), a long umbilical cord was defined as condition where the length of the umbilical cord connecting the fetus to the placenta was longer than expected, which was measured by using a flexible tape in centimeters i.e (> 70 cm), while a normal umbilical cord was defined as cord length between 41 to 70 cm, these definitions were taken from a previous study.¹⁰ The fetal outcome were determined in terms of low Apgar score < 6 at 5 minutes, low birth weight (< 2.5kg), NICU admission, fetal distress was defined as the presence of abnormal fetal heart rate patterns on cardiotocography, including persistent fetal tachycardia (>160 beats/min), fetal bradycardia (<110 beats/min), repetitive late decelerations, prolonged decelerations, and reduced/absent variability, and the presence of nuchal cord loops. This entire assessment was performed under the guidance of a consultant with at least 5 years of post-fellowship experience.

Data were analyzed using IBM SPSS 25. Numerical variables like maternal age and gestational age were recorded using median IQR after assessing for normality with Shapiro Wilk test. Categorical variables like fetal outcomes, umbilical cord length (short, normal and long), and mode of delivery (C section/vaginal), parity and gender of the neonate were presented as frequency and percentages. Fisher exact test was used for assessing the association between umbilical cord length and fetal outcomes, p value ≤ 0.05 was taken as significant

RESULTS

The study enrolled 100 pregnant women. The median maternal age was 28 years (22 to 33 years) (Table I).

Table II presents the distribution of patients according to the length of umbilical cord. A short cord was observed in 16 cases (16.0%). The majority of women, 73 (73.0%) had a normal cord. A long cord was found in 11 cases (11.0%) (Table II). In the present study caesarean section was performed in 19% (n = 19) patients, while 81 (81%) neonates were delivered normally.

Table III presents the fetal outcomes of the study population.

Table IV presents the association of fetal outcomes with the length of umbilical cord. Neonates with short cords 4 (25.0%) had a lower Apgar score, while 3 (4.1%) neonates in the normal cord group had lower APGAR score. Five (45.5%) of those with long cords had a low Apgar score (p < 0.001).

Two stillbirths (12.5%) occurred in the short cord group, while one (1.4%) in the normal cord group and 3 stillbirths (27.3%) in the long cord group ($p = 0.003$). In short cord group neonates 5 (31.2%) neonates required admission, while 6 (8.2%) in the normal cord group. In the long cord group 3 neonates (27.3%) were admitted to NICU ($p = 0.019$). Similarly Low birth weight was more common in the short and long cord group ($p = 0.021$). Fetal distress on CTG was also associated with short and long cord groups ($p = 0.014$). Nuchal cord loops were present in only 1 (6.2%) of the short cord group and 8 (11.0%) of the normal cord group, while in 6 cases (54.5%) in the long cord group ($p = 0.002$).

Table I Baseline parameters

Baseline parameters		Median	IQR
Maternal Age (Years)		28	22-33
Gestational age (Weeks)		40	39-41
		(n)	%age
Parity	Nullipara	13	13.0%
	Primipara	33	33.0%
	Multipara	54	54.0%
Gender of baby	Male	56	56.0%
	Female	44	44.0%
Mode of delivery	Caesarean section	19	19.0%
	Normal vaginal delivery	81	81.0%

Table II Distribution of umbilical cord length

Umbilical Cord length	(n)	%age
Short 31 to 40 cm	16	16.0%
Normal 41 to 70 cm	73	73.0%
Long > 70 cm	11	11.0%

Table III Fetal outcomes

Fetal outcomes		(n)	%age
Low APGAR score at 5 mins < 6	Yes	12	12.0%
	No	88	88.0%
Still birth	Yes	6	6.0%
	No	94	94.0%
NICU admission	Yes	14	14.0%
	No	86	86.0%
Low Birth Weight (<2.5kg)	Yes	17	17.0%
	No	83	83.0%
Fetal distress on CTG	Yes	14	14.0%
	No	86	86.0%
Nuchal cord loops	Yes	15	15.0%
	No	85	85.0%

Table IV Association of umbilical cord length with fetal outcomes

Fetal outcomes		Cord length						p value
		Short 31 to 40 cm		Normal 41 to 70 cm		Long > 70 cm		
		(n)	%age	(n)	%age	(n)	%age	
Low APGAR score at 5 mins < 6	Yes	4	25.0%	3	4.1%	5	45.5%	< 0.001
	No	12	75.0%	70	95.9%	6	54.5%	
Still birth	Yes	2	12.5%	1	1.4%	3	27.3%	0.003
	No	14	87.5%	72	98.6%	8	72.7%	
NICU admission	Yes	5	31.2%	6	8.2%	3	27.3%	0.019
	No	11	68.8%	67	91.8%	8	72.7%	
Low Birth Weight (<2.5kg)	Yes	5	31.2%	8	11.0%	4	36.4%	0.021
	No	11	68.8%	65	89.0%	7	63.6%	
Fetal distress on CTG	Yes	4	25.0%	6	8.2%	4	36.4%	0.014
	No	12	75.0%	67	91.8%	7	63.6%	
Nuchal cord loops	Yes	1	6.2%	8	11.0%	6	54.5%	0.002

	No	15	93.8%	65	89.0%	5	45.5%	
Fisher exact test								

DISCUSSION

The findings of the present study revealed that both short and long umbilical cords were significantly associated with adverse fetal outcomes, The normal cord length group consistently exhibited the most favourable outcomes across all parameters.

The prevalence of short cords in this study was 16.0% (n = 16), while long cords were observed in 11.0% (n = 11) cases. In a recent study by Akhtar et al. conducted in Peshawar, short cords were found in 9.8% and long cords in 17.65% of their sample.¹³ The slightly higher proportion of long cords in their study may be attributed to differences in sample size and population characteristics. Another study by Mehr et al. from Peshawar reported short cords in 21.6% and long cords in 7.5% of their patients, using a slightly different cut-off values of less than 35 cm for short cords and more than 80 cm for long cords.¹⁴ The variation in prevalence across studies can be attributed to the definitions used for cord length categories.

Regarding low Apgar scores, the present study found that 25.0% (n = 4) of neonates with short cords and 45.5% (n = 5) with long cords had scores below 6 at five minutes. These findings align with Shafqat et al. who reported low Apgar scores in 30.64% of the short cord group and 23.89% of the long cord group in their large scale study of 3,300 deliveries.¹⁰ Akhtar et al. observed low Apgar scores in 40% of the short cord group and 25.9% of the long cord group.¹³ The consistency of these findings across multiple studies conducted in similar settings validates the evidence that abnormal cord length compromises neonatal wellbeing at birth.

Stillbirth was another outcome of interest in the present study, with rates of 12.5% (n = 2) in the short cord group and 27.3% (n = 3) in the long cord group, while only one case 1.4% in the normal cord group. Shafqat et al. also reported higher stillbirth rates at both extremes of cord length, with 11.29% in the short cord group and 12.57% in the long cord group.¹⁰ Hayes et al. in their analysis reported that multiple nuchal loops are commonly associated with associated with significantly increased risk of stillbirth.¹⁵

NICU admission was required for 31.2% (n = 5) of neonates with short cords and 27.3% (n = 3) of those with long cords. These findings are consistent with those of Mehr et al. who reported NICU admission rates of 31.0% in the short cord group and 20.0% in the long cord group.¹⁴ Kulshrestha et al. also found significantly higher NICU admission rates in the presence of cord abnormalities, further validating the association between cord length and neonatal morbidity.¹⁶

The study also found that Low Birth Weight was more common in short and long umbilical cord group as compared to normal cord length. This pattern is consistent with the findings of Mehr et al, who reported low birth weight in 41.4% of their short cord group and 20.0% of their long cord group.¹⁴ The association between short cords and low birth weight may reflect the shared underlying factors that restrict both fetal growth and cord elongation such as reduced fetal movement or intrauterine constraint. Fetal distress in the presents was also associated with the short and long umbilical cord length. Shafqat et al, reported fetal heart rate abnormalities in 48% of the short cord group and 47% of the long cord group. ¹⁰

Nuchal cord loops were present in 54.5% (n = 6) of the long cord group, compared to only 6.2% (n = 1) of the short cord group and 11.0% (n = 8) of the normal cord group. Shiva Kumar et al, reported that the incidence of nuchal cord increases significantly with cord length reaching 70% in their long cord group. ¹⁷ Studies have shown that long cords are strongly associated with nuchal entanglement and adverse fetal outcomes, including fetal distress, arrest of descent, and perinatal death, with the risk increasing further when knots are also present..¹⁸⁻²⁰

The present study demonstrates that both extremes of cord length are associated with poorer fetal outcomes. This highlights the concept that the umbilical cord is an active determinant of fetal wellbein and deviations from normal length warrant clinical attention.

Several limitations of this study must be acknowledged. The sample size of 100 patients is relatively modest for such study, which may limit the precision of the estimates. The study was conducted in a single tertiary care setting, which may limit generalisability to other settings. Future research with larger, multicentre samples are required to address the underlying mechanisms and inform strategies for early intervention.

CONCLUSION

In conclusion, the present study demonstrated that deviations from normal umbilical cord length were associated with adverse fetal outcomes. Short and long umbilical cords were associated with higher rates of low Apgar scores, stillbirth, NICU admission, low birth weight, fetal distress and nuchal cord loops compared with normal length umbilical cords. Future research with larger, multicentre samples are required to address the underlying mechanisms and inform strategies for early intervention.

Conflict of Interest: No conflict of interest was declared by the authors of this study

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Consent was taken from all patients

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