International Journal of Reproduction, Contraception, Obstetrics and Gynecology
Rawal NG et al. Int J Reprod Contracept Obstet Gynecol. 2025 Dec;14(12):4249-4253
www.ijrcog.org
pISSN 2320-1770 | eISSN 2320-1789

DOI: https://dx.doi.org/10.18203/2320-1770.ijrcog20253891

Original Research Article

The study of length of umbilical cord and fetal outcome

Naisargee G. Rawal*, Pushpa A. Yadava, Rupa C. Vyas, Shashwat K. Jani, Kashmira V. Dangar, Heny J. Patel, Nitya P. Asudani

Department of Obstetrics and Gynecology, Smt. Nathiba Hargovandas Lakhmichand Municipal Medical College (SVPIMSR), Ahmedabad, Gujarat, India

Received: 02 October 2025
Revised: 06 November 2025
Accepted: 11 November 2025

***Correspondence:**
Dr. Naisargee G. Rawal,
E-mail: naisargeerawal97@gmail.com

ABSTRACT

Background: The umbilical cord is vital for fetal development, and its length can influence intrapartum complications, mode of delivery, and perinatal outcomes such as FGR, oligohydramnios, preterm delivery, operative delivery for fetal distress, fetal demise/stillbirth, meconium-stained liquor, cord accidents. This study investigated the impact of umbilical cord length on these factors in singleton pregnancies.
Methods: A retrospective study was conducted at SVP Hospital, Ahmedabad, from June 2024 to June 2025, involving 300 randomly selected singleton pregnancies. Inclusion criteria included primigravida and multigravida subjected to ultrasound, excluding malpresentations and multiple gestations. Data on cord length, nuchal loops, true knots, mode of delivery, and perinatal outcomes, including intrauterine fetal demise (IUFD), were analysed.
Results: Of the 300 cases, 58% were booked, and 68% were multigravida. Cord lengths of 66-75 cm were most common (32.33%), with short cords (<45 cm) and long cords (>90 cm) comprising 5.32% and 8.66%, respectively. Short cords were associated with a 31.25% IUFD rate, compared to 11.5% for long cords and 2.7% for medium cords (46-90 cm). Nuchal cords increased caesarean delivery rates (53.33% for one loop, 85.70% for three loops). True knots had a lower caesarean rate (42.86%). The overall IUFD rate was 5%.
Conclusions: Short and long umbilical cords are associated with increased IUFD and caesarean delivery rates, particularly with multiple nuchal loops. Antenatal ultrasound is crucial for identifying cord abnormalities to optimize outcomes.

Keywords: Caesarean delivery, Fetal distress, Intrauterine fetal demise, Nuchal cord, Perinatal outcomes, Ultrasound, Umbilical cord length

INTRODUCTION

The umbilical cord is lifeline of the fetus: "the baby's life hangs by a cord", as said by Ian Donald aptly tells us the importance.[1] Umbilical cord is a pathway between mother, placenta and fetus during pregnancy and delivery. Intermittent or complete cord occlusion leads to hypoxia, HIE and fetal demise.

Compression of cord leads to fetal distress due to vasospasm. Short cord may be associated with fetal growth restriction, congenital malformations, intra-partum distress and two-fold risk of fetal death.[2] Abruption or concealed hematoma may occur in case of short cord. Long umbilical cords are associated with cord prolapse, torsion, true knot and nuchal cord. Nuchal cord can be diagnosed antenatally with an ultrasound.

The three blood vessels pass along the length of the cord in helical/coiled fashion. A nuchal cord occurs when the umbilical cord becomes wrapped around the fetal neck 360 degrees.[3] Nuchal cords are common with prevalence of 6% to 37%.[4]

Coiling develops as early as 28 days after conception and is present in about 95% of fetuses by 9 weeks of conception. Since the lengthening of the cord occurs from fetal end, perhaps coiling of cord represents a long-term record of fetal well-being.[5]

At birth, the mature cord is about 50-60 cm in length. A long cord is defined as >100 cm and a short cord as <30 cm. Umbilical cord length may vary depending upon the gravidity i.e. multigravida may have longer umbilical cord length in comparison to primigravida. While in case of twin pregnancy, umbilical cord length of fetus may be shorter than singleton pregnancy.[6]

Umbilical coiling index (UCI) is number of complete vascular coils / umbilical cord length (in cm). Expressed as coils per cm. First described by Strong et al.[7] Normal range is between 0.07-0.03 coils/cm. It is known as hypocoiled if UCI<0.07 coils/cm and hypercoiled if UCI>0.30 coils/cm.

Figure 1: Gross appearance of umbilical cords showing (top to bottom): hypercoiled, normocoiled and hypocoiled cords respectively.

Hypocoiling is associated with FGR, Oligohydramnios, Preterm delivery, Operative delivery for fetal distress, Low APGAR score.[8] While hypercoiling is associated with fetal demise/stillbirth, meconium-stained liquor, cord accidents (torsion, true knot, strangulation), thrombosis of umbilical vessels and small for gestational age babies.

Pathogenesis is not entirely clear. While it appears that fetal movements may result in cord entanglement and that excessive movements and long umbilical cords are prone to entanglement.[9]

Clinical diagnosis can be made on cardiotocography or non-stress test as there is increased incidence of variable FHR decelerations i.e., three or more variable decelerations ≥15 beats/minute lasting at least 15 seconds, associated with fetal movements unrelated to uterine contractions).[10,11]

For accurate diagnosis ultrasound is used. Both sagittal and transverse sections are required to avoid overdiagnosis. 'W pattern" is the formation of circular indentations of the fetal nuchal cord created on the fetal neck.[12] Colour doppler may assist in confirming the diagnosis.

Figure 2: "W pattern" formed by two loops of cord around neck on USG.

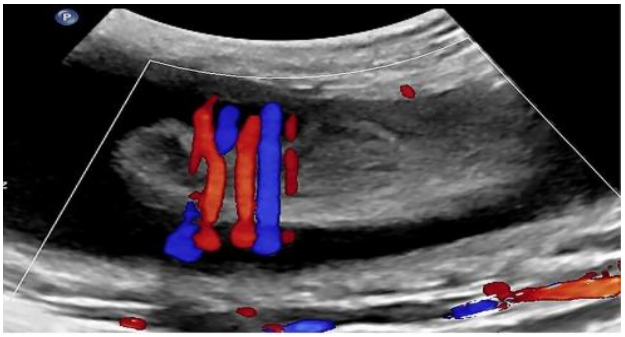

Figure 3: Longitudinal (sagittal) colour doppler view of neck.

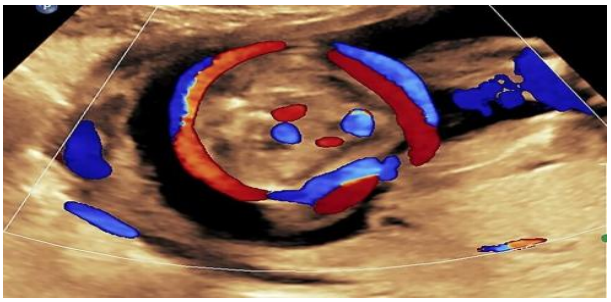

Figure 4: Transverse (axial) colour Doppler view of neck.

Nuchal cords are particularly dangerous if it is tightly wrapped around the neck or wrapped multiple times with low amniotic fluid which permits umbilical cord compression. Other potential problems include umbilical cord prolapse, hypoxic ischemic encephalopathy (HIE)/ birth asphyxia, fetal death, IUGR, meconium aspiration syndrome.

The aim of this study was to measure the length of the umbilical cord in delivered newborns, to assess the relationship between umbilical cord length and fetal outcome and to identify any correlation between abnormal cord length and adverse perinatal outcomes.

METHODS

This was a retrospective study of 300 patients conducted in the department of obstetrics and gynecology of SVP hospital Ahmedabad, a tertiary care teaching institute in western India from June 2024 to June 2025.

Our institute drains patients from urban, semi-urban and nearby rural areas. After due permission from the authority, data were entered and analyzed using Microsoft Excel 2019. Results were expressed in terms of frequency and percentage of all the women who delivered during the stated period. Study reviewed patient's age, parity, mode of delivery, cord length and its relation with IUFD.

Inclusion criteria

The study included both primigravida and multigravida with singleton pregnancies only who were subjected to ultrasonography.

Exclusion criteria

Malpresentation and multiple gestation.

RESULTS

The majority of cases were from age group 26-35 years, as it is the period of peak fertility and common age for marriage and childbearing.

Table 1: Age distribution.

Age (in years)	18-25 years	26-35 years	Above 36 years	Total
No. of cases	127	170	03	300
Percentage	42.33	56.66	1	100

Table 2: Gravida status.

Gravida	No. of cases	Percentage
Primigravida	96	32
Multigravida	204	68
Total	300	100

Table 3: Cord length.

Length of cord (cm)	No. of cases	Percentage
<35	5	1.66
36-45	11	3.66
46-55	22	7.33
56-65	72	24
66-75	97	32.33
76-85	56	18.66
86-95	18	6
96-105	17	5.66
>106	02	0.66
Total	300	100

In my study, 68% patients were multigravida and 32% patients were primigravida (Table 2).

In our study, 97 cases out of 300 had cord length of 66-75 cm. Only two cases had cord length more than 106 cm. Out of two cases, one had two tight loops and another one had three tight loops (Table 3).

Table 4: Relation between cord loops and mode of delivery.

No. of loops	Normal delivery		Cesarean delivery		Total
	Case	%	Case	%	
1 loop	14	46.67	16	53.33	30
2 loop	07	25.9	20	74.07	27
3 loop	01	14.28	06	85.70	07
True knot	08	57.14	06	42.86	14
Loop + knot	02	66.67	01	33.33	03
Total	32	39.6	49	60.4	81

The rate of caesarean section was directly proportional to the number of loops. Out of 300 cases, 81 cases had cord around neck (27%). In this study, 30 cases had one loop of cord around neck, 27 cases had two loops of cord around neck and 7 cases had three loops of cord around neck.

In Shivkumar et al study, they had 22% case with cord around neck.[13]

Table 5: Relation between cord length and IUFD.

Cord length	No. of cases	Total no. of IUFD	%
Short (<45 cm)	16	5	31.25
Medium (46-90 cm)	258	7	2.7
Medium (46-90 cm)	26	3	11.5
Total	300	15	5

Out of 16 cases of short cord, 5 cases with short cord (31.25%) were associated with intrauterine fetal death. It suggests that short cords were more associated with IUFD. In comparison to the study of Birla et al, cord length varied from 24 to 124 cm.[14] The mean cord length was 61.7 cm. Short cord group was associated with significant higher incidence of LSCS. In Sharma et al, the incidence of birth asphyxia (21%), was significantly more in short and long cords as compared with normal length cords.[15]

DISCUSSION

The present study evaluates the implications of umbilical cord length on the mode of delivery, intrapartum complications, and perinatal outcomes in 300 singleton pregnancies at SVP Hospital, Ahmedabad, from June 2024 to June 2025. The findings highlight significant associations between umbilical cord length, the presence of nuchal cords or true knots, and adverse perinatal

outcomes, corroborating existing literature on the clinical significance of umbilical cord characteristics.

The study observed that the majority of umbilical cords (32.33%) measured between 66-75 cm, with only 1.66% classified as short (<35 cm) and 0.66% as long (>106 cm). This distribution aligns with prior studies indicating that the average umbilical cord length at term is approximately 50–60 cm, with extremes (<30 cm or >100 cm) being relatively rare. Short cords (<45 cm) were associated with a higher incidence of intrauterine fetal demise (IUFD) at 31.25%, likely due to restricted fetal movement, placental abruption, or cord compression leading to hypoxia. Long cords (>90 cm), though less frequent, were associated with an 11.5% IUFD rate, potentially linked to complications such as cord prolapse, torsion, or true knots, as noted in the literature.

The presence of nuchal cords significantly influenced the mode of delivery. Cases with one nuchal loop had a caesarean delivery rate of 53.33%, which increased to 74.07% for two loops and 85.70% for three loops. This trend suggests that multiple nuchal loops increase the likelihood of fetal distress, necessitating operative intervention. The higher caesarean rates may be attributed to variable fetal heart rate (FHR) decelerations, as detected in non-stress tests, which are indicative of cord compression. In contrast, cases with true knots had a lower caesarean rate (42.86%), possibly because true knots may not always cause immediate distress detectable during labor.

The study found a 5% overall IUFD rate, with short cords contributing the highest proportion (31.25% of short cord cases). This is consistent with the literature linking short cords to fetal growth restriction (FGR), intrapartum distress, and a twofold risk of fetal death. Long cords, while less frequently associated with IUFD (11.5%), were implicated in complications such as true knots and nuchal cords, which can lead to hypoxia, meconium aspiration, or hypoxic-ischemic encephalopathy (HIE).[10] The presence of nuchal cords, particularly tight or multiple loops, was noted to increase the risk of adverse outcomes, including low Apgar scores and operative deliveries for fetal distress, aligning with the documented risks of cord compression and reduced amniotic fluid.

The findings underscore the importance of antenatal ultrasound with color Doppler to diagnose nuchal cords and assess cord length. The “W pattern” on ultrasound and variable FHR decelerations on non-stress tests are critical diagnostic tools for identifying at-risk fetuses.[12] Early detection of cord abnormalities could guide clinical decision-making, such as closer monitoring during labor or planning for elective caesarean delivery in high-risk cases. The high proportion of emergency cases (42%) in this tertiary care setting highlights the need for preparedness to manage cord-related complications promptly.

The limitations of the study on umbilical cord length and fetal outcome include the lack of longitudinal follow-up, which prevents assessment of long-term neonatal outcomes related to cord abnormalities. Many studies rely on delivery room measurements, which may not account for cord stretching or shrinkage after clamping, introducing measurement inaccuracies. The absence of standardized definitions for “short” and “long” cords across studies can lead to inconsistent categorization and interpretation of results. Lastly, interobserver variability and lack of blinding of investigators to fetal outcomes may introduce bias in interpretation.

CONCLUSION

The length of the umbilical cord and the presence of nuchal cords or true knots significantly impact intrapartum complications, mode of delivery, and perinatal outcomes. Short cords (<45 cm) are strongly associated with intrauterine fetal demise, likely due to restricted fetal growth and cord compression. Long cords (>90 cm) and nuchal cords, especially multiple loops, increase the risk of caesarean delivery due to fetal distress and are linked to complications such as cord prolapse and hypoxia. Antenatal ultrasound with color Doppler is essential for identifying cord abnormalities and guiding clinical management. These findings emphasize the need for vigilant monitoring of umbilical cord characteristics during pregnancy to optimize maternal and fetal outcomes. Future research should focus on larger, more diverse populations and incorporate umbilical coiling index measurements to further elucidate the relationship between cord characteristics and perinatal outcomes.

ACKNOWLEDGEMENTS

The authors express sincere gratitude to the department of obstetrics and gynecology, Smt. NHLMMC (SVPIMSR), Ahmedabad, for their valuable guidance and support throughout the study.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Rawal NG, Yadava PA, Vyas RC, Jani SK, Dangar KV, Patel HJ, et al. The study of length of umbilical cord and fetal outcome. Int J Reprod Contracept Obstet Gynecol 2025;14:4249-53.