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ORIGINAL RESEARCH

Incidence of nuchal cord and its impact on labor progression and neonatal outcomes: A prospective observational study

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ABSTRACT

Background: Nuchal cord, defined as the encirclement of the fetal neck by the umbilical cord, is frequently encountered during term labor. Although often benign, increasing evidence suggests that multiple and/or tight loops may influence labor progression and neonatal health. This study aimed to determine the incidence of nuchal cord, its effect on labor duration, mode of delivery, fetal heart rate patterns during labor, and immediate neonatal outcomes as evaluated by APGAR scores and NICU admissions. **Methods:** A prospective observational study was conducted over 12 months at Narayana Multispeciality Hospital, Jaipur. A total of 400 term pregnant women, presenting with cephalic singleton pregnancies and spontaneous onset of labor, were enrolled after obtaining informed consent and ethical committee approval. Exclusion criteria included antenatal complications such as hypertensive disorders, diabetes, and preterm or post-date pregnancies. Detailed maternal histories, clinical and ultrasonographic evaluations, and intrapartum monitoring (including cardiotocography) were performed. At delivery, the presence, number, and tightness (categorized as "loose" or "tight") of nuchal cords were recorded. Neonatal outcomes were assessed by APGAR scores at 1 and 5 minutes and the need for NICU care. Statistical analysis was carried out using MedCalc (v16.4), with significance set at $p < 0.05$. **Results:** The overall incidence of nuchal cord was 21.25%. Single loops predominated (64.71%), while multiple loops were observed in 35.29% of cases. Tight nuchal cords were noted in 45.88% of patients. Notably, the time from the onset of labor to delivery was significantly prolonged in cases with tight cords (mean first stage: 10.33 hours vs. 9.17 hours; $p = 0.010$). Moreover, abnormal fetal heart rate patterns were more common in multiple and tight cord cases, leading to increased instrument-assisted deliveries (forceps and cesarean section). APGAR scores <7 at 1 minute were significantly associated with tight nuchal cords ($p < 0.05$), and these neonates had a higher rate of NICU admissions. **Conclusion:** Our findings indicate that while nuchal cords occur in approximately one-fifth of term pregnancies, the subset with multiple and tight loops may experience prolonged labor and suboptimal neonatal outcomes. These results underscore the need for vigilant intrapartum monitoring and prompt intervention when adverse fetal heart rate patterns are detected.

Keywords: Nuchal cord, labor duration, neonatal outcome, APGAR score, cesarean section, intrapartum monitoring, prospective study.

INTRODUCTION

Nuchal cord, the wrapping of the umbilical cord around the fetal neck, is one of the most common incidental findings in obstetrics. Although the occurrence is usually benign, its potential effect on fetal well-being has prompted numerous studies. Reported incidences range from 15% to 35% in various populations [1,2]. Despite this high prevalence, the clinical significance remains a matter of debate, particularly in relation to labor dynamics and neonatal health.

Recent advances in obstetric ultrasonography have improved the prenatal diagnosis of nuchal cords, allowing for closer observation during labor [3]. However, the majority of nuchal cord diagnoses are still confirmed during delivery, as the dynamic nature of the cord may render sonographic findings inconclusive [4]. Several studies have suggested that single, loose loops rarely impact neonatal outcomes, whereas multiple or tight loops might be associated with fetal distress, prolonged labor, and a higher likelihood of operative deliveries [5,6]. In particular, abnormal cardiotocography (CTG) findings in the

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presence of nuchal cords have been correlated with low APGAR scores and an increased need for neonatal resuscitation [7].

The exact mechanism through which nuchal cords impact fetal oxygenation remains incompletely understood. It is postulated that tight nuchal cords may compress the umbilical vessels during uterine contractions, leading to transient fetal hypoxia [8]. This hypoxic episode is typically evidenced by abnormal fetal heart rate patterns and may necessitate immediate obstetric interventions. Furthermore, the impact on the mode of delivery is of significant clinical importance since a higher rate of forceps-assisted or cesarean deliveries has been reported in cases with severe cord entanglement [5,7].

Given the current debates in the literature, this prospective study was designed to evaluate the incidence of nuchal cord in a tertiary care setting and to assess its effects on labor duration, delivery methods, and neonatal outcomes. The study additionally emphasizes the difference between "loose" and "tight" nuchal cord presentations to determine whether loop characteristics influence the observed clinical outcomes. A better understanding of these factors may provide obstetricians with critical information to strategize intrapartum management and improve neonatal care. In this context, the present study fills an important gap in research conducted within the Indian population, where few studies have systematically evaluated these parameters [1,2,4,6].

MATERIALS AND METHODS

Study Design and Setting

A prospective, observational, and comparative study was conducted in the Department of Obstetrics and Gynecology at Narayana Multispeciality Hospital, Jaipur, Rajasthan, from June 2019 to June 2020. This tertiary care hospital caters to both urban and rural populations, providing an ideal setting for studying various obstetric conditions, including nuchal cord.

Ethical Approval and Informed Consent

Prior to commencement, the study protocol was reviewed and approved by the Institutional Ethics Committee. Written informed consent was obtained from each participant after a thorough explanation of the study objectives, procedures, potential risks, and benefits.

Study Population

The study targeted pregnant women who were admitted to the labor ward for delivery and met the following criteria:

Inclusion Criteria

1. **Singleton pregnancy**
2. **Cephalic presentation**
3. **Spontaneous onset of labor** with intact membranes
4. **Gestational age** within term limits (not post-dated)
5. Willingness to provide informed consent and comply with study procedures

Exclusion Criteria

1. **Antenatal complications** such as preeclampsia, eclampsia, and other medical disorders (e.g., diabetes, cardiac disease, pregnancy-induced hypertension)
2. **Premature rupture of membranes** (PROM)
3. **Post-date pregnancy** (beyond 41 completed weeks)

Participants fulfilling inclusion criteria were enrolled consecutively until the required sample size was reached.

Sample Size

Sample size estimation was based on the reported incidence of nuchal cord (approximately 19.76%) in a reference study. At a 95% confidence level and a 20% relative allowable error, the minimum required sample size was calculated to be 380, which was increased to 440 to account for potential attrition (~15% dropouts). A final sample of 400 participants completed the study.

n=(Zα/2)2 p(1−p)E2n = \frac{(Z_{\alpha/2})^2 \, p(1-p)}{E^2}n=E2(Zα/2)2p(1−p)

Where:

- Zα/2=1.96Z_{\alpha/2} = 1.96Zα/2=1.96 (for 5% type I error)
- p=0.1976p = 0.1976p=0.1976 (anticipated incidence of nuchal cord)
- E=0.10E = 0.10E=0.10 (precision)

Data Collection and Study Procedure

1. Enrollment and Baseline Assessment

- Eligible pregnant women were identified in the labor ward and antenatal clinic.
- A detailed history was recorded, including maternal age, obstetric history, and any relevant co-morbidities.
- General physical examination (weight, height, blood pressure, pulse) and systemic examinations (cardiovascular, respiratory, and central nervous systems) were performed.

2. Obstetric and Ultrasound Evaluation

- Abdominal palpation to assess fundal height, fetal lie, and presentation.
- **Fetal heart rate** was monitored by Doppler and cardiotocography (CTG) for baseline rate and variability.
- **Ultrasonography (USG)** was performed to confirm gestational age, estimate fetal weight, assess amniotic fluid index (AFI), and determine placental position. Doppler studies were done as clinically indicated.

3. Assessment of Nuchal Cord

- Nuchal cord was diagnosed at the time of delivery. The number of loops (single, double,

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triple, or quadruple) was noted, as well as whether the cord was tight or loose around the fetal neck.

4. **Labor Progress Monitoring**

- All participants underwent standard labor management protocols, with close monitoring of **fetal heart rate (FHR)** and progression of cervical dilatation.
- The **mode of delivery** (normal vaginal delivery, forceps-assisted delivery, or cesarean section) and **duration of each stage of labor** were recorded.

5. **Neonatal Outcome Assessment**

- **APGAR scores** at 1 minute and 5 minutes were documented to evaluate immediate neonatal well-being.
- **NICU admission** was noted if neonates required specialized care. Other complications such as meconium aspiration or low birth weight were also documented.

6. **Laboratory Investigations**

- Routine hematological and biochemical tests were performed as per the hospital's standard antenatal protocol (e.g., complete blood count, blood grouping, and screening for infections).

Definitions

- **Nuchal Cord**: The umbilical cord encircling the fetal neck by at least one loop.
- **Tight vs. Loose Nuchal Cord**: Subjectively defined during delivery; a **tight** loop is one that cannot be easily unlooped over the fetal head during birth, while a **loose** loop slips off easily.
- **APGAR Score**: Assessed at 1 and 5 minutes on a scale of 0–10 based on Appearance, Pulse, Grimace, Activity, and Respiration.

Statistical Analysis

All data were entered into a spreadsheet and analyzed using **MedCalc v16.4** (MedCalc Software Ltd, Belgium). Continuous variables (e.g., maternal age, labor duration) were summarized as **mean ± standard deviation (SD)**. Categorical variables (e.g., presence of nuchal cord, mode of delivery, APGAR <7) were represented as **frequencies and percentages**. Between-group comparisons were made using the following tests:

- **Unpaired t-test** for continuous variables
- **Chi-square test** or **Fisher's exact test** for nominal or categorical variables

A **p-value < 0.05** was considered statistically significant for all tests.

RESULTS

The study revealed an overall nuchal cord incidence of 21.25% (85/400). In two broad paragraphs, the results are described below:

Labor and Delivery Findings: Women with nuchal cords exhibited a significantly prolonged first stage of labor compared with those without (mean: 10.33 vs. 9.17 hours; p = 0.010). Out of the 85 cases, 64.71% had a single loop, while 35.29% had multiple loops. Notably, 45.88% were classified as having a tight cord. Mode of delivery differed significantly between groups: normal vaginal delivery was observed in 58.82% of nuchal cord cases versus 72.06% in controls; forceps delivery occurred in 12.94% of cord cases (p < 0.001).

Neonatal Outcomes: APGAR scores at 1 minute were significantly lower among neonates born with tight nuchal cords (with 38.46% scoring <7 vs. 13.04% in the loose loop group; p = 0.011). Additionally, NICU admissions were higher in neonates from the tight cord group (28.21% vs. 2.17% in loose cord cases; p = 0.001).

TABLE 1. AGE DISTRIBUTION OF NUCHAL CORD CASES (N=85)

Age Group (years)	Number	%
20–24	21	24.71
25–29	50	58.82
≥30	14	16.47

TABLE 2. INCIDENCE AND LOOP CHARACTERISTICS (N=85)

Parameter	Number	%
Single Loop	55	64.71
Multiple Loops	30	35.29
Tight Cord	39	45.88
Loose Cord	46	54.12

TABLE 3. MODE OF DELIVERY IN NUCHAL CORD VS. CONTROLS (N=400)

Mode	Nuchal Cord (n=85)	No Nuchal Cord (n=315)	p-value
Normal Vaginal	50 (58.82%)	227 (72.06%)	<0.001
Forceps	11 (12.94%)	0	
Cesarean Section	24 (28.24%)	88 (27.94%)	

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FIGURE 1. BAR CHART DEPICTING THE DISTRIBUTION OF LOOP NUMBERS IN NUCHAL CORD CASES.

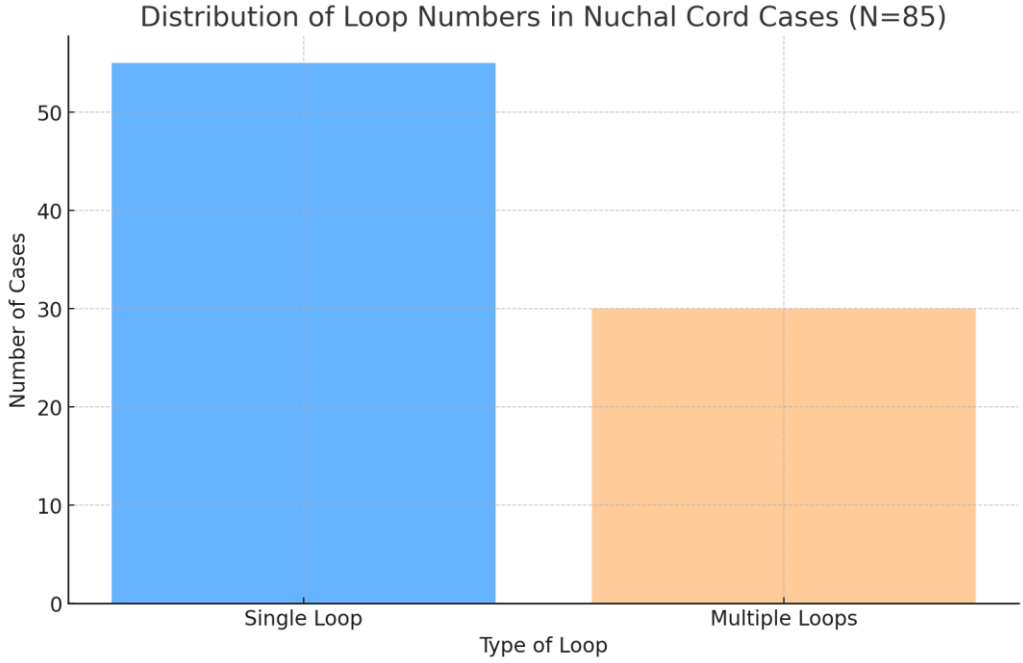
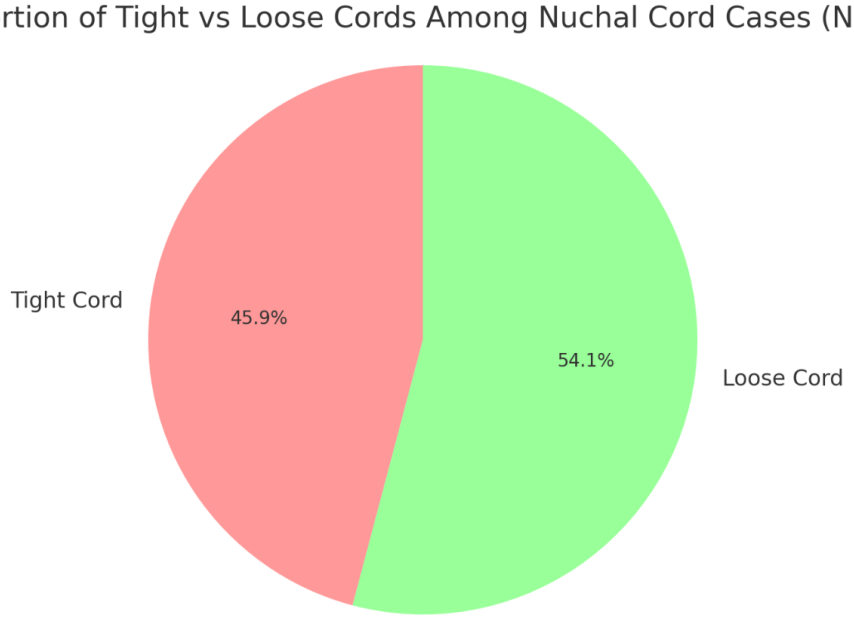


FIGURE 2. PIE CHART ILLUSTRATING THE PROPORTION OF TIGHT VERSUS LOOSE CORDS.



DISCUSSION

The present prospective study demonstrates that nuchal cords are a common finding in term pregnancies, with an incidence of 21.25%, which is consistent with previous reports [1,2]. Our investigation specifically focused on labor progression, mode of delivery, and neonatal outcomes in cases of nuchal cord. A noteworthy finding is the significant prolongation of the first stage of labor in patients with tight cords. This observation is likely attributable to transient fetal hypoxia secondary to cord compression during uterine contractions, a phenomenon reported in earlier studies [8,9]. Although the association between nuchal cords and prolonged labor is not uniformly observed across all research, our results underscore the importance of cord tightness in affecting intrapartum dynamics.

The study further highlights the influence of nuchal cord characteristics on the mode of delivery. Operative interventions, particularly forceps-assisted deliveries, were significantly more frequent in nuchal cord cases. The elevated incidence of operative deliveries in this subgroup may be linked to abnormal CTG findings that necessitate expedited delivery.

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These results are in line with earlier investigations suggesting that multiple loop cases and those with tight cords are at higher risk for fetal distress, thereby increasing the likelihood of instrumental or cesarean deliveries [10,11]. Importantly, while the overall cesarean rates did not significantly differ between groups, the subset analysis indicates that forceps deliveries are markedly increased in cases with a nuchal cord.

Neonatal outcomes, as assessed by APGAR scores and NICU admissions, were also adversely affected by tight nuchal cords. A significant proportion of neonates delivered with a tight cord had APGAR scores of less than 7 at 1 minute and required NICU care. This finding suggests that the severity of cord entanglement, rather than the mere presence of a nuchal cord, is the critical factor determining neonatal compromise. Similar conclusions have been drawn in several reports that emphasize the prognostic importance of loop tightness and multiplicity [12,13].

Our study has several strengths, including its prospective design, rigorous intrapartum monitoring, and detailed stratification of cord characteristics. However, limitations exist. The single-center design and the inherent subjectivity in assessing cord tightness may affect the generalizability of the findings. Future multicenter studies with larger sample sizes and objective criteria for evaluating cord tightness are warranted to confirm these results.[14,15]

Overall, our findings suggest that while a nuchal cord is often a benign finding, the presence of multiple and/or tight loops is associated with prolonged labor and an increased risk of neonatal compromise. Obstetricians should therefore maintain a high index of suspicion and apply enhanced monitoring strategies during labor to promptly identify and manage potential complications. The integration of detailed cord assessment into routine intrapartum evaluations could ultimately improve maternal and neonatal outcomes [16].

CONCLUSION

In conclusion, this prospective study confirms that while nuchal cords are common in term pregnancies, only the presence of multiple and tight loops significantly impacts labor progression and neonatal outcomes. A prolonged first stage of labor, increased rates of instrumental deliveries, and lower neonatal APGAR scores were observed among affected cases. These findings advocate for meticulous intrapartum monitoring and a proactive management strategy when nuchal cords—particularly tight ones—are identified. Future research should focus on multicenter validation and the development of standardized criteria for cord assessment to improve perinatal care.

REFERENCES

1. Kong CW, Chan LW, To WW. Neonatal outcome and mode of delivery in the presence of nuchal cord loops: implications on patient counselling and the mode of delivery. *Arch Gynecol Obstet*. 2015;292(2):283-289. doi:10.1007/s00404015-3630-4
2. Tamrakar SR. Incidence of nuchal cord, mode of delivery and perinatal outcome: a notable experience in Dhulikhel Hospital - Kathmandu University Hospital. *Nepal Med Coll J*. 2013;15(1):40-45.
3. Masad R, Gutvirtz G, Wainstock T, Sheiner E. The effect of nuchal cord on perinatal mortality and long-term offspring morbidity. *J Perinatol*. 2020;40(3):439-444. doi:10.1038/s41372-019-0511-x
4. Kobayashi N, Aoki S, Oba MS, Takahashi T, Hirahara F. Effect of Umbilical Cord Entanglement and Position on Pregnancy Outcomes. *ObstetGynecol Int*. 2015;2015:342065. doi:10.1155/2015/342065
5. Heifetz SA. The umbilical cord: obstetrically important lesions. *Clin Obstet*
6. *Gynecol*. 1996;39(3):571-587. doi:10.1097/00003081-199609000-00007
7. Krakowiak P, Smith EN, de Bruyn G, Lydon-Rochelle MT. Risk factors and outcomes associated with a short umbilical cord. *Obstet Gynecol*. 2004;103(1):119-127. doi:10.1097/01.AOG.0000102706.84063.C7
8. Naeye RL. Umbilical cord length: clinical significance. *J Pediatr*. 1985;107(2):278-281. doi:10.1016/s0022-3476(85)80149-9
9. John L Crichton. Tensile strength of umblical cord ACOG January1, 1973 Lacro RV, Jones KL, Benirschke K. The umbilical cord twist: origin, direction, and relevance. *Am J Obstet Gynecol*. 1987;157(4 Pt 1):833-838. doi:10.1016/s0002-9378(87)80067-4
10. Gupta S, Faridi MMA, Krishnan J. Umbilical coiling Indes. J ObstetGynecol India. 2006;56:315–9.
11. Horn LC, Faber R, Stepan H, Simon E, Robel R, Wittekind C. Umbilical cord hypercoiling and thinning: a rare cause of intrauterine death in the second trimester of pregnancy. Pediatr Dev Pathol. 2006 Jan-Feb;9(1):20–4. Epub 2006 Apr 4
12. Strong TH Jr, Elliott JP, Radin TG. Non-coiled umbilical blood vessels: a new marker for the fetus at risk. *Obstet Gynecol*. 1993;81(3):409-411.
13. Dap M, Bertholdt C, MorelO, GaletP. Consequences of nuchal cord- a literature review European Journal Of Obstetrics and Gyneacology and Reproductive Biology, 2019-03-01, volme 234, Pages e11-e11, copyright 2018
14. Sanand ZF, Sayyed TM, Ammar HA, El-Kherbawy MF. Effect of umbilical cord entanglement on pregnancy outcomes Menoufia Medical Journal. Menoufia Med J 2019;32:448-52
15. Mariya T, Fujibe Y, Shinkai S, et al. Multiple part umbilical cord entanglement and neonatal outcomes. *Taiwan J Obstet Gynecol*. 2018;57(5):672-676. doi:10.1016/j.tjog.2018.09.001
16. IMAI, K.. The Presence of Nuchal Cord Does Not Hinder the Normal Progression of Labor. Journal of Clinical Gynecology and Obstetrics, North America, 8, jul. 2019