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Original Research Article

PROSPECTIVE EVALUATION OF NUCHAL CORD INCIDENCE AND ITS ASSOCIATION WITH LABOR DURATION, DELIVERY MODE, AND NEONATAL HEALTH

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Abstract: ***Background:*** Nuchal cord, whereby the umbilical cord encircles the fetal neck, remains a notable concern in obstetrics due to its potential influence on labor and neonatal outcomes. Although frequently incidental, emerging data indicate that the presence of multiple and/or tight nuchal cords may prolong labor and contribute to fetal distress. This study aimed to determine the incidence of nuchal cord and explore its association with labor duration, mode of delivery, and neonatal well-being. ***Methods:*** A one-year prospective observational study was conducted at a tertiary care hospital in Jaipur between June 2019 and June 2020. Four hundred term, singleton pregnancies in cephalic presentation with spontaneous labor were enrolled after ethical committee approval and obtaining informed consent. Exclusion criteria included antenatal conditions such as hypertensive disorders and diabetes, as well as PROM and post-date pregnancies. Detailed maternal evaluations, ultrasonographic assessments, and continuous intrapartum CTG monitoring were performed. At the time of delivery, the presence, number of loops, and tightness (classified as "tight" or "loose") of the nuchal cord were documented. Neonatal outcomes were measured using APGAR scores at 1 and 5 minutes and observation of any NICU admissions. Statistical significance was defined as $p < 0.05$. ***Results:*** The nuchal cord was detected in 21.25% of deliveries (85/400). Single loop cords accounted for 64.71% of nuchal cord cases; multiple loops were observed in 35.29%, with 45.88% of cases having cords classified as tight. Prolongation of labor was significantly associated with tight cords, with an increased duration of the first stage. Additionally, an elevated rate of operative deliveries—particularly forceps-assisted birth—was observed in nuchal cord cases compared to controls. Neonates with tight nuchal cords had a higher frequency of APGAR scores less than 7 at 1 minute and a greater need for NICU care. ***Conclusion:*** This study demonstrates that although nuchal cords are common, their clinical impact is primarily dependent on loop number and tightness. Enhanced intrapartum surveillance is recommended in cases with tight nuchal cords to optimize neonatal outcomes.

Keywords: Nuchal cord, labor duration, neonatal outcome, operative delivery, APGAR score, NICU admission, prospective study

INTRODUCTION

Nuchal cord, defined as the winding of the umbilical cord around the fetal neck, has been widely reported as an incidental finding in term pregnancies. With an incidence varying between 15% and 35%, its presence is considered relatively common [1,2]. Nevertheless, the clinical implications of nuchal cords continue to be debated. Whereas a single, loose nuchal cord is generally harmless, multiple and/or tight loops have been implicated in adverse intrapartum events such as prolonged labor and fetal distress, thereby necessitating operative interventions [3,4].

Ultrasonographic advancements have allowed for

improved prenatal identification of nuchal cords, although the dynamic behavior of the cord during labor often results in intraoperative confirmation being the definitive diagnosis [5]. Studies have indicated that the degree of cord tightness plays a more critical role than mere presence in influencing fetal outcomes, as a tight nuchal cord may exert pressure on the umbilical vessels during uterine contractions, potentially compromising fetal oxygenation [6]. Consequently, the assessment of nuchal cord characteristics is now considered essential for risk stratification during labor.

Recent literature has emphasized the association between nuchal cords and various adverse obstetric outcomes. For instance, multiple studies have reported a correlation between tight nuchal cords and increased rates of instrumental deliveries and cesarean sections [3,7]. Additionally, neonatal outcomes, as measured by APGAR scores and the requirement for NICU care, appear to be adversely affected in the presence of a tight cord [4,6]. Such findings underscore the importance of detailed intrapartum evaluation in pregnancies complicated by nuchal cords.

The present study was designed to prospectively evaluate the incidence of nuchal cord and determine its relationship with labor parameters and neonatal outcomes in a tertiary care setting in Jaipur. By categorizing nuchal cords by the number of loops and degree of tightness, we aimed to ascertain the extent to which these characteristics influence the duration of labor, the mode of delivery, and immediate neonatal health. Understanding these associations is crucial for improving perinatal management and counseling. In addition, it may assist obstetricians in identifying high-risk scenarios that require more aggressive monitoring and intervention [8].

This study therefore contributes to the current body of knowledge by providing regional data on nuchal cord incidence and its potential implications for maternal and neonatal care in an Indian context.

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.

o Fetal heart rate was monitored by Doppler and cardiotocography (CTG) for baseline rate and variability.
o 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
o Nuchal cord was diagnosed at the time of delivery. The number of loops (single, double, triple, or quadruple) was noted, as well as whether the cord was tight or loose around the fetal neck.
4. Labor Progress Monitoring
o All participants underwent standard labor management protocols, with close monitoring of fetal heart rate (FHR) and progression of cervical dilatation.
o 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
o APGAR scores at 1 minute and 5 minutes were documented to evaluate immediate neonatal well-being.
o 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
o 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

Over the study period, nuchal cords were identified in 85 (21.25%) of 400 deliveries. In-depth analysis showed that 64.71% of these cases exhibited a single loop, while 35.29% had multiple loops. Additionally, 45.88% of cases were classified as having tight nuchal cords.

Labor Duration and Mode of Delivery: Women with tight nuchal cords demonstrated a significantly longer first stage of labor compared with those having loose cords (mean 10.33 vs. 9.17 hours; p = 0.010). Instrumental delivery rates were higher among nuchal cord cases, with forceps-assisted deliveries significantly more common than in the non-nuchal cord group (12.94% vs. 0%; p < 0.001).

Neonatal Outcomes: Neonatal evaluation revealed that infants born with tight nuchal cords had a higher incidence of APGAR scores <7 at 1 minute and an elevated need for NICU admission compared to those with loose cords. Statistical analysis confirmed that these differences were significant (p < 0.05).

TABLE 1. INCIDENCE AND LOOP DISTRIBUTION (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 2. MODE OF DELIVERY COMPARISON (N=400)

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

TABLE 3. NEONATAL APGAR SCORE AT 1 MINUTE (N=400)

APGAR Score	Nuchal Cord (n=85)	No Nuchal Cord (n=315)	p-value
<7	21 (24.71%)	29 (9.21%)	<0.001
≥7	64 (75.29%)	286 (90.79%)	

FIGURE 1. A COLUMN GRAPH DEPICTING THE DISTRIBUTION OF LOOP NUMBERS AMONG NUCHAL CORD CASES.

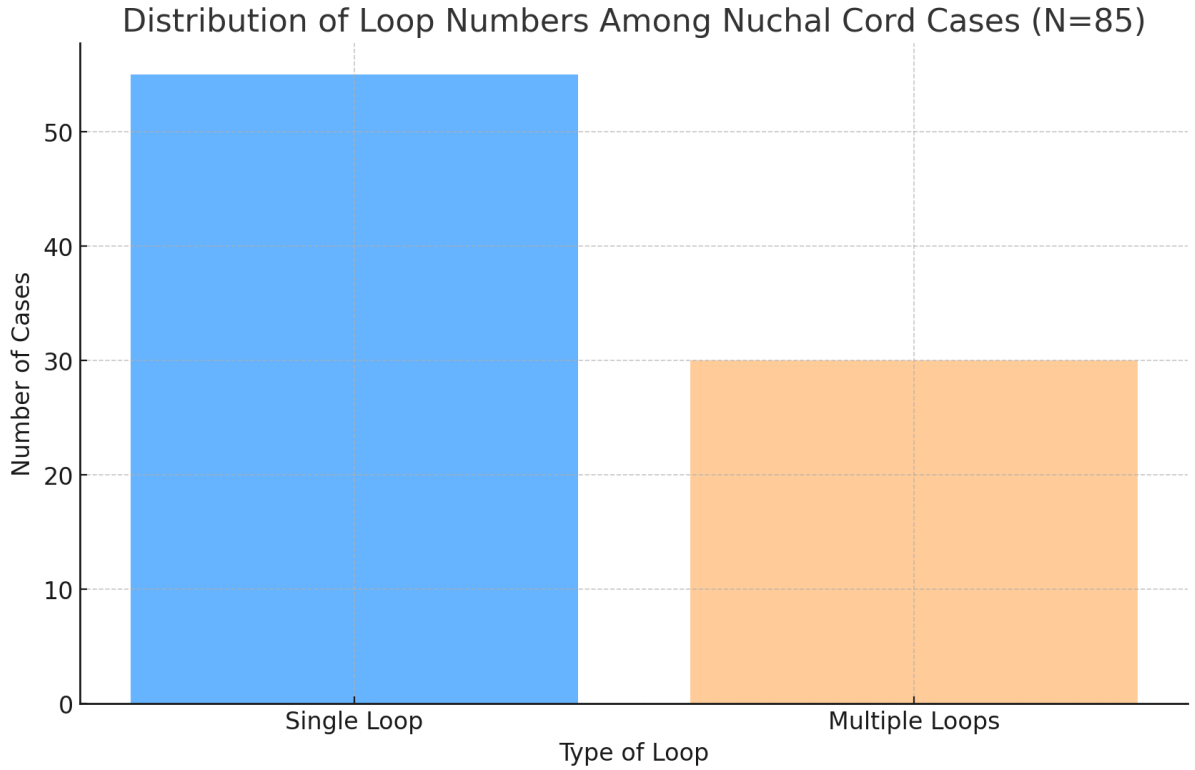
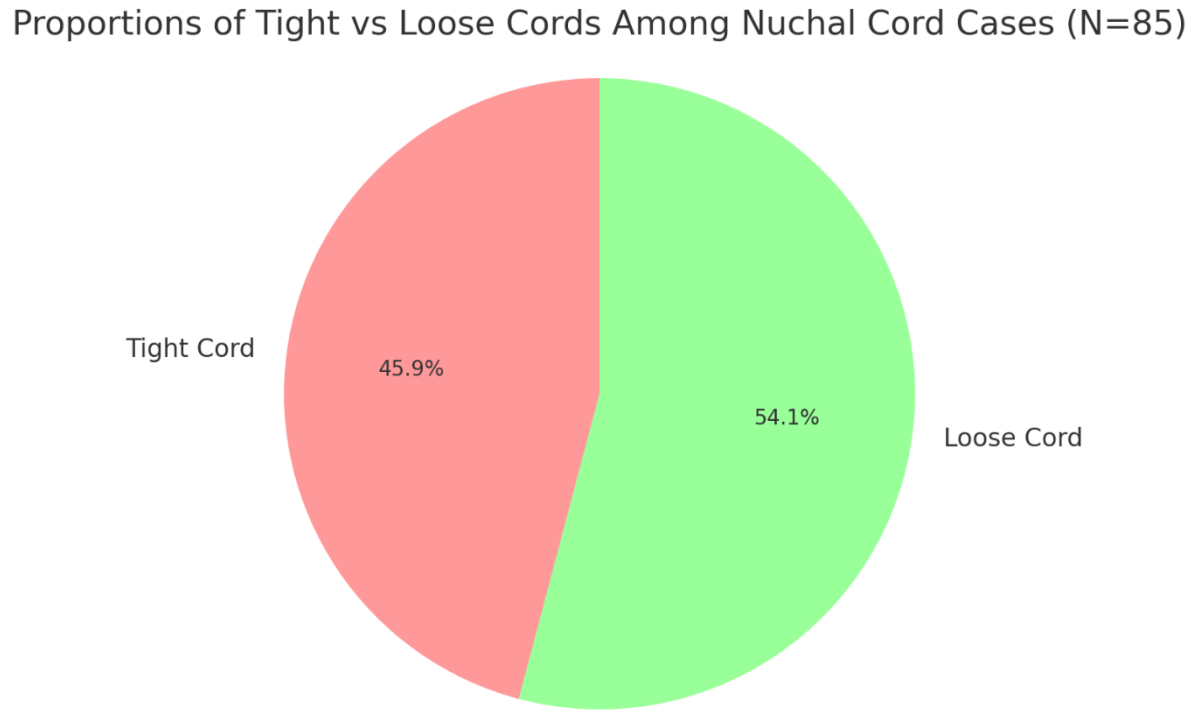


FIGURE 2. A PIE CHART REPRESENTING THE PROPORTIONS OF TIGHT VERSUS LOOSE CORDS.



DISCUSSION

This study evaluated the incidence of nuchal cord and its association with intrapartum events and neonatal outcomes. The overall incidence of 21.25% corroborates findings from earlier studies [9,10]. Our analysis reveals a clear distinction between cases with single loops and those with multiple loops, with the latter demonstrating a greater prevalence of cord tightness. The association between tight nuchal cords and prolonged labor, particularly the first stage, suggests that cord compression may compromise fetal oxygenation and impede the progression of labor [11,12].

The increased rate of operative deliveries, most notably forceps-assisted deliveries, in nuchal cord cases aligns with previous literature that associates cord complications with fetal distress [13,14]. The absence of forceps delivery in the control group further emphasizes the potential for nuchal cord complexity to necessitate operative intervention. Although cesarean section rates were similar between groups, the marked difference in instrumented deliveries highlights a subset of patients for whom nuchal cord may present a higher risk.

Neonatal outcomes were also notably influenced by the degree of cord tightness. Infants born with tight cords were more likely to have APGAR scores <7 at 1 minute and a higher frequency of NICU admissions. These findings suggest that tight nuchal cords might lead to acute intrapartum hypoxic events, reinforcing the need for heightened monitoring and timely intervention when such findings are anticipated. Early identification of potential distress through continuous CTG monitoring allowed prompt action in our study population, which likely mitigated further complications.[15,16]

Strengths of this study include its prospective design and a robust sample size from a tertiary care center, which enhances the reliability of the findings. However, limitations exist—most notably, the subjective assessment of cord tightness and the single-center design, which may limit the generalizability of the results. Future research should focus on standardizing the assessment criteria for nuchal cord tightness and involve multicentric studies to validate these observations further [17,18].

In summary, while nuchal cords are commonly encountered, their clinical significance is largely determined by the number of loops and the tightness of the cord. The data presented here provide compelling evidence that tight nuchal cords adversely affect labor progression and neonatal outcomes. These findings support the need for vigilant intrapartum monitoring and suggest that early recognition and management of tight nuchal cords may improve neonatal outcomes.

CONCLUSION

In conclusion, this prospective study confirms that nuchal cords are common in term pregnancies, with 21.25% of deliveries affected. While a single, loose nuchal cord generally poses minimal risk, multiple and tight cords are significantly associated with prolonged labor, increased instrumental delivery rates, and adverse neonatal outcomes, including lower APGAR scores and higher NICU admissions. These findings highlight the critical importance of detailed intrapartum surveillance in pregnancies complicated by a nuchal cord. Enhanced monitoring and timely intervention may mitigate adverse outcomes, paving the way for improved clinical management and better perinatal care.

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