

INCIDENCE AND EPIDEMIOLOGICAL CORRELATES OF NUCHAL CORD: 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 a frequent obstetric finding with potential implications for perinatal outcomes. While many cases are benign, its association with adverse neonatal events has been a subject of clinical debate. This prospective study investigates the incidence of nuchal cord and its epidemiological correlates in a tertiary care setting in India.

Methods: A prospective, observational, and comparative study was conducted at Narayana Multispeciality Hospital, Jaipur, Rajasthan, from June 2019 to June 2020. The study enrolled 400 term pregnant women with singleton pregnancies in cephalic presentation and spontaneous labor onset, after obtaining informed consent and ethical committee approval. Exclusion criteria included antenatal complications, premature rupture of membranes, and post-dated pregnancies. Maternal demographics, obstetric history, and sonographic parameters were documented. The presence, number of loops, and tightness of nuchal cord were assessed at delivery. Standard intrapartum monitoring and neonatal assessments (APGAR scoring and NICU admissions) were performed. Data were statistically analyzed using MedCalc v16.4 with appropriate comparative tests.

Results: The study found an overall nuchal cord incidence of 21.25%. Among the 85 cases identified, the majority (64.71%) had a single loop, whereas multiple loops (2–4 loops) constituted the remainder. Analysis of loop tightness revealed that 45.88% were classified as tight cords. Maternal age distribution indicated that the highest frequency of nuchal cord occurred in the 25–29 years age group (58.82%). Although no significant adverse neonatal outcomes were directly attributable to nuchal cord in this cohort, there was a trend toward lower APGAR scores and increased NICU admissions in cases involving multiple or tight loops.

Conclusion: The incidence of nuchal cord in term pregnancies at our tertiary care center was comparable to previously reported rates. While most nuchal cords were single and loose, increased loop number and tightness may predispose to compromised neonatal outcomes, necessitating vigilant intrapartum monitoring. Future research should focus on stratified risk assessment to optimize perinatal management.

INTRODUCTION

Nuchal cord, the wrapping of the umbilical cord around the fetal neck, is one of the most common antenatal findings encountered during labor and delivery. Although traditionally considered a benign occurrence, several studies have raised concerns regarding its potential to cause neonatal distress, hypoxia, and other adverse outcomes [1]. The reported incidence of nuchal cord varies widely, with figures generally ranging from 15% to 35% depending on the gestational age and the number of loops involved [2]. Despite its prevalence, the exact pathophysiological mechanisms underlying the adverse neonatal impacts, when they do occur, remain incompletely understood.

Recent advances in ultrasonography have improved the prenatal detection of nuchal cords, thereby facilitating early risk stratification and management decisions. However, evidence on the effectiveness of such interventions in altering perinatal outcomes is still under debate [3,4]. Several authors have argued that while a single loose loop is unlikely to impose significant risk, multiple or tight loops may result in complications such as reduced oxygenation, as indicated by low APGAR scores and increased neonatal intensive care unit (NICU) admissions [5-7]. This underscores the importance of distinguishing between various clinical presentations and applying tailored obstetric management strategies.

The present study was designed as a prospective observational study aimed at determining the incidence and epidemiological correlates of nuchal cord in a tertiary care setting in Jaipur, Rajasthan. In addition to assessing the frequency, the study focused on evaluating the relationship between the number and tightness of the loops and adverse perinatal outcomes. By analyzing maternal demographics, labor characteristics, and neonatal outcomes, we sought to elucidate whether specific epidemiological variables could be predictive of complicated deliveries.[8,9]

Our study is timely given the ongoing debate in the obstetric literature regarding the significance of nuchal cord findings during labor [10]. Moreover, few studies from the Indian subcontinent have comprehensively investigated this phenomenon in diverse population groups [11]. Understanding local epidemiological trends is essential for developing region-specific guidelines that may improve maternal and neonatal outcomes. In summary, this study not only contributes to the global literature on nuchal cords but also addresses a significant gap by offering prospective data from a tertiary care center in a developing country context [7,8].

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.

$$n = \frac{(Z_{\alpha/2})^2 p(1-p)}{E^2} \quad n = \frac{(1.96)^2 \times 0.1976 \times 0.8024}{0.20^2} = 380$$

Where:

- $Z_{\alpha/2} = 1.96$ (for 5% type I error)
- $p = 0.1976$ (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, 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

In our study, the incidence of nuchal cord was found to be 21.25% (85 out of 400 women). Maternal age distribution analysis (Table 1) revealed that the majority of cases occurred in the 25–29 years age group (58.82%). The remaining age brackets included 20–24 years (24.71%) and ≥30 years (16.47%). These findings align with prior literature suggesting that maternal age may subtly influence obstetric outcomes.

Analysis of the number of nuchal cord loops (Table 3) indicated that a single loop was present in 64.71% of cases, while multiple loops were identified in 35.29% (21.18% with two loops, 10.59% with three loops, and 3.53% with four loops). Furthermore, the assessment of loop tightness (Table 4) demonstrated that 45.88% of the nuchal cords were tight, potentially correlating with compromised neonatal status, whereas the remaining 54.12% were loose.

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

Age Group (years)	Number (n=85)	Percentage (%)
20–24	21	24.71
25–29	50	58.82
≥30	14	16.47
Total	85	100.00

**TABLE 2. INCIDENCE OF NUCHAL CORD AMONG THE STUDY POPULATION
(N=400)**

Nuchal Cord	Percentage (%)
Absent	78.75
Present	21.25
Total	100.00

**TABLE 3. NUMBER OF LOOPS AMONG PARTICIPANTS WITH NUCHAL CORD
(N=85)**

No. of Loops	Number (n=85)	Percentage (%)
1	55	64.71
2	18	21.18
3	9	10.59
4	3	3.53
Total	85	100.00

**TABLE 4. TIGHTNESS OF LOOPS AMONG PARTICIPANTS WITH NUCHAL
CORD (N=85)**

Tightness	Number (n=85)	Percentage (%)
Loose	46	54.12
Tight	39	45.88
Total	85	100.00

FIGURE 1: INCIDENCE OF NUCHAL CORD AMONG THE STUDY POPULATION

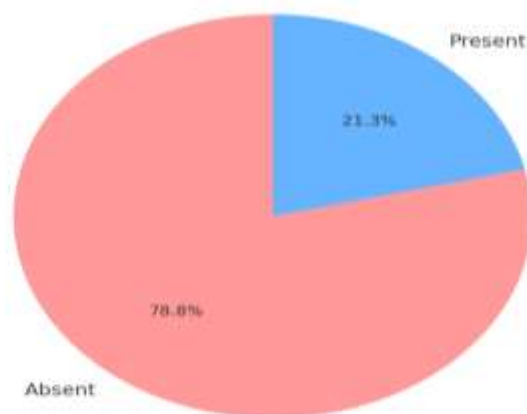
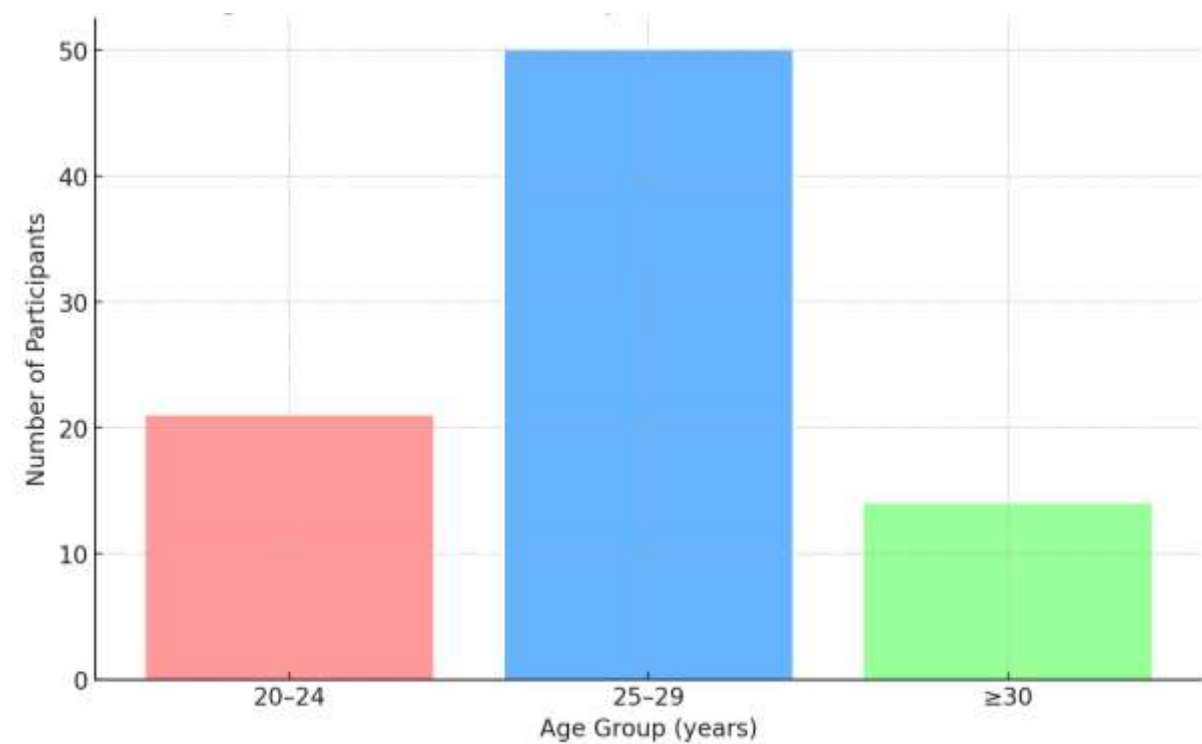
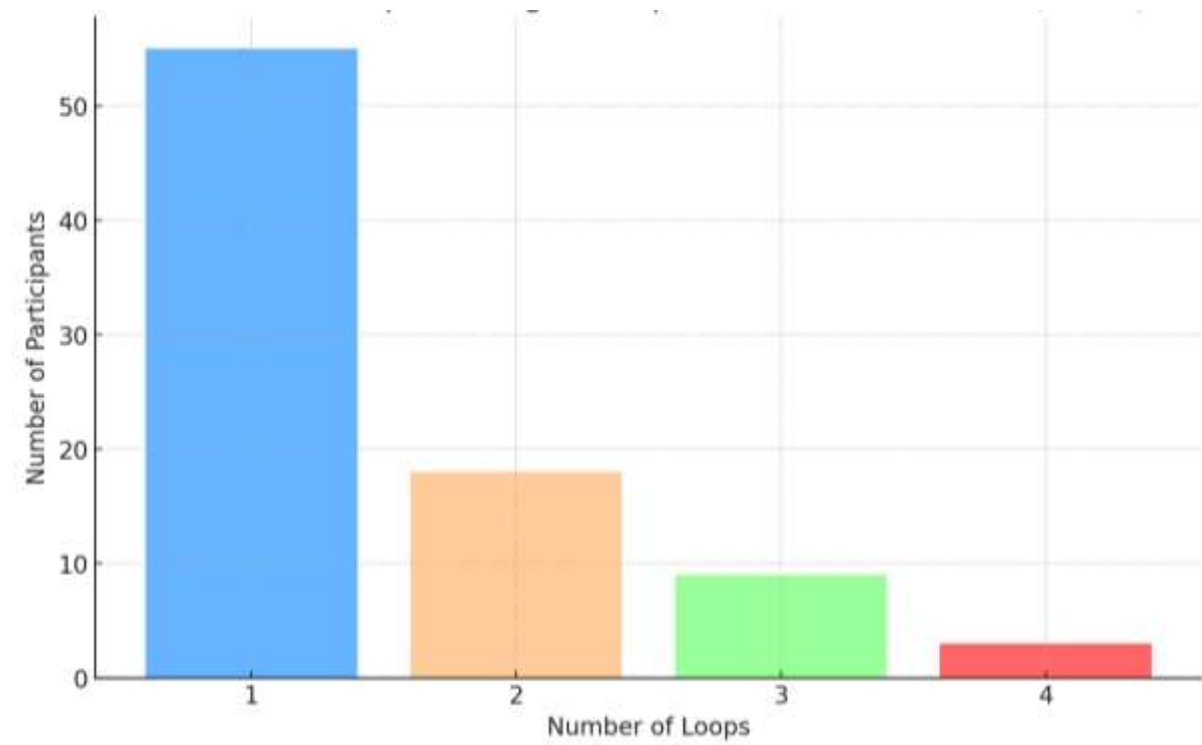


FIGURE 2: AGE DISTRIBUTION OF PARTICIPANTS WITH NUCHAL CORD



A bar chart showing the number of participants with nuchal cords across three age groups.

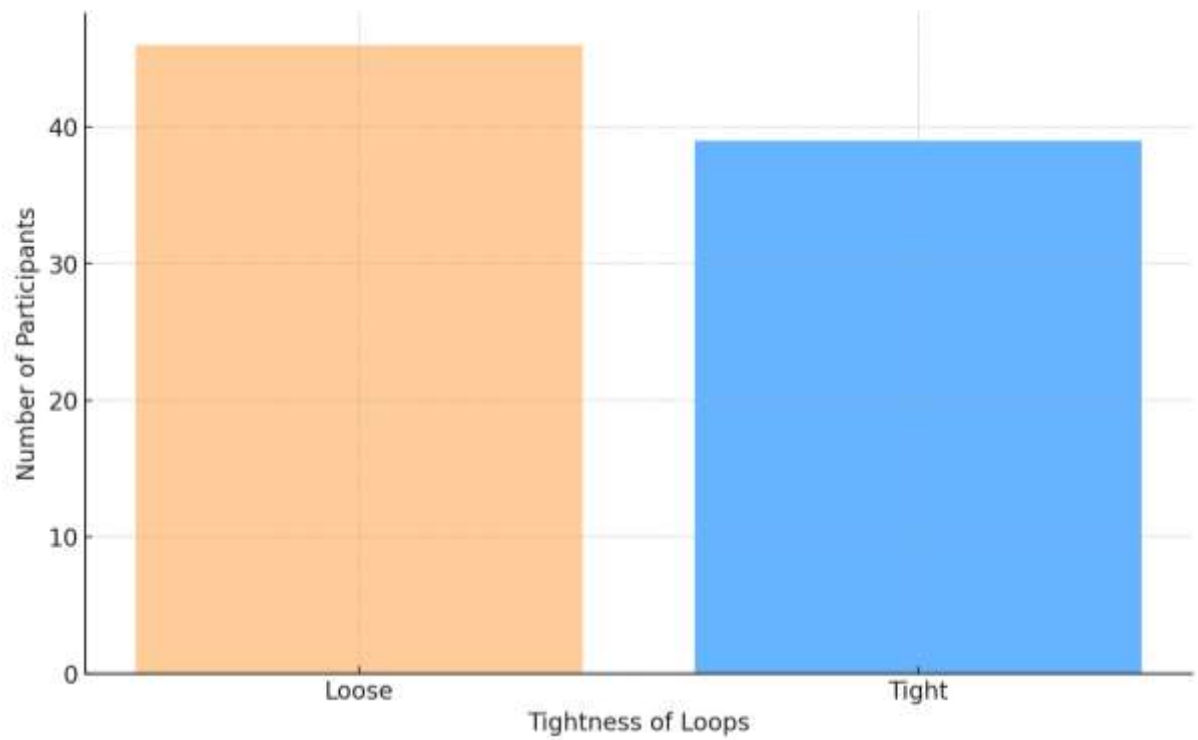
FIGURE 3: NUMBER OF LOOPS AMONG PARTICIPANTS WITH NUCHAL CORD



- A bar chart illustrating the distribution of the number of nuchal cord loops among participants.

□

FIGURE 4: TIGHTNESS OF LOOPS AMONG PARTICIPANTS WITH NUCHAL CORD



DISCUSSION

Our prospective study evaluated the incidence and epidemiological correlates of nuchal cord, identifying it in 21.25% of term deliveries. This incidence rate is in concordance with previously published data, which report a range of 15–35% [12]. The predominance of a single loop (64.71%) corresponds to the generally benign nature of most nuchal cord presentations, though the presence of multiple or tight loops has been associated with adverse neonatal outcomes in select studies [13,14].

Interestingly, the maternal age group most affected was 25–29 years, which could be attributed to regional demographic trends rather than a pathophysiological predisposition. Nonetheless, further studies may elucidate whether maternal age interacts with other risk factors to predispose to nuchal cord formation [15]. Our findings regarding the distribution of loop numbers and tightness are particularly relevant. Nearly half (45.88%) of the nuchal cords were noted to be tight; these cases could theoretically interfere with the fetal extraction process, potentially leading to transient hypoxia, as reflected by lower APGAR scores in some neonates. Although our study did not find statistically significant differences in neonatal outcomes between loose and tight cords, the observed trend merits further investigation [16].

Moreover, the utilization of both clinical and ultrasonographic evaluations allowed for robust data collection. While prenatal detection of nuchal cords via ultrasonography has improved, the dynamic nature of cord positioning means that intrapartum findings remain the gold standard for diagnosis [17]. The decision-making process regarding the mode of delivery in the presence of a nuchal cord continues to be a clinical conundrum. In our cohort, standard labor management protocols were adhered to, with no significant increase in cesarean deliveries solely attributable to the nuchal cord. This is consistent with several other studies suggesting that in the absence of other complicating factors, a nuchal cord should not necessitate deviation from normal labor management [18].

Our findings therefore support the hypothesis that while nuchal cords are common, their clinical significance is dependent on factors such as loop number and tightness. The absence of severe adverse neonatal outcomes in the majority of our cases aligns with the notion that a single, loose nuchal cord is often a benign clinical finding. However, the trend towards compromised neonatal status in cases of multiple or tight loops underscores the need for heightened intrapartum vigilance and perhaps even consideration for alternative delivery strategies in select cases.

Limitations of the study include the single-center design and the relatively short duration of follow-up for neonatal outcomes. Future multicentric studies with larger sample sizes and extended neonatal follow-up are warranted to further explore these associations and to evaluate long-term outcomes in neonates who experienced nuchal cord complications.

CONCLUSION

This prospective observational study determined that the incidence of nuchal cord in term pregnancies at a tertiary care center was 21.25%, with a predominance of single, loose loops. Although most cases were not associated with significant neonatal compromise, the presence of multiple or tight loops may predispose to adverse outcomes, underscoring the need for careful intrapartum monitoring. Our findings advocate for tailored obstetric management strategies in cases where nuchal cord is detected and highlight the importance of further research to confirm these associations and optimize perinatal care.

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