

# An Observational Study of Effect of Umbilical Cord Entanglement on Mode of Delivery and Perinatal Outcome

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Received on: 03 January 2024; Accepted on: 03 April 2024; Published on: 29 May 2024

## ABSTRACT

**Background:** Cord entanglement is the most common cord abnormality detected in modern obstetric practice and is one of the reasons for the increase in cesarean section rate. The aim of our study is to detect the incidence of cord entanglement and effect on perinatal outcomes.

**Materials and methods:** Our study is a prospective observational study conducted in a tertiary center over a period of 2 years. A total 375 patients were enrolled for the study, over a 2-year period. Among 375 patients, 257 control without cord entanglement, and 118 had cord entanglement.

**Results:** In the cord entanglement group, 56.8% normal delivery, 15.3% instrumental delivery, and 33% emergency LSCS. In the group without cord entanglement, 77% has a normal delivery, 10.1% instrumental deliveries, and 12.8% emergency LSCS. Low APGAR scores at 1 and 5 minutes and NICU admission were high in the group with cord entanglement as compared to the group without cord entanglement and more significantly in the tight entanglement group.

**Conclusion:** We conclude that pregnant women with cord entanglement require intense observation and close monitoring of labor with partogram and continuous fetal monitoring with cardiotocography to note any adverse events immediately during labor and to expedite delivery if necessary either by instrumental delivery or cesarean section to prevent neonatal compromise. But a fair trial for vaginal delivery can be given and the mother should not be stressed with unnecessary anxiety when cord entanglement is noted on ultrasonography.

**Keywords:** Cesarean section, Instrumental delivery, Perinatal outcome, Umbilical cord entanglement, Vaginal delivery.

*Journal of Obstetric and Gynaecological Practices POGS (2024): 10.5005/jogyp-11012-0024*

## INTRODUCTION

The most common cord abnormality noted in clinical obstetric practice is umbilical cord entanglement. This is due to the increase in the use of ultrasonography in clinical practice. This has led to increased apprehension among the patient and the obstetrician. Because of this, the presence or absence of cord entanglement has become an important factor in decision-making regarding the mode of delivery, leading to an increase in the cesarean section rate in many centers.

Prevalence of cord entanglement varies widely, ranging from 14.7 to 33.9% as it depends on the gestational age at which diagnosis is made, the amount of liquor, and the sonologist dependent.<sup>1</sup> Effect of 360° coiling around the fetal neck is called the nuchal cord.<sup>2</sup> Entanglement is also seen around the body of the fetus.<sup>2</sup> There can be single or multiple loops. Entanglement is called loose if, it can be easily unlooped after delivery of the head and is tight, if it needs to be clamped and cut before delivery. Research conducted so far on the effects of cord entanglement has shown equivocal results.

This study aims:

- To detect the prevalence of cord entanglement at term and its effect on mode of delivery and perinatal outcomes.
- To determine the accuracy of ultrasound in diagnosing cord entanglement.

## MATERIALS AND METHODS

This was a cross-sectional study conducted at a Tertiary Center for a period of 2 years. A minimum sample size of 370 was calculated statistically based on a reference article, which had an incidence of cord entanglement of 19.7% and confidence limits of 4%.

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**How to cite this article:** Yashaswini S, Hebbar S. An Observational Study of Effect of Umbilical Cord Entanglement on Mode of Delivery and Perinatal Outcome. *J Obstet Gynaecol Pract POGS* 2024;2(1): 12–15.

**Source of support:** Nil

**Conflict of interest:** None

The study was conducted on all pregnant women who full filled the inclusion requirement over 37 weeks of gestational age, and who came for induction of labor or in early labor. Pregnant women with multiple gestation, obstetric complications, and medical complications were excluded. The demographic information like name, age, and sex are recorded. Informed written consent was taken before enrolling the patients after explaining that there were no health hazards involved in the research process. At term gestation, ultrasound was performed on the study population and analyzed for cord entanglement around the neck or around body or both body and neck by ultrasound. The women with cord entanglement at the delivery were taken as the study group and those who did not have cord entanglement were the comparative group.

This information is not known to any other doctors the patient or any other staff in the labor room. These patients were followed up

**Table 1:** Distribution of study subjects according to the number of loops (N = 118)

Number of Loops	Frequency	Percent
1	46	39.0
2	53	44.9
3	18	15.3
4	1	0.8

**Table 2:** Distribution of study subjects according to the cord entanglement (N = 118)

Cord position	Frequency	Percent
Neck	106	89.8
Body	5	4.2
Neck and body	7	5.7

**Table 3:** Distribution of study subjects according to tightness (N = 118)

Tightness	Frequency	Percent
Loose	66	55.9
Tight	52	44.1

at delivery when they came in spontaneous labor or for induction and were monitored by partogram and CTG, to note the duration of all stages of labor and fetal distress. After delivery, the presence or absence of cord entanglement, cord position, tightness, number of loops around the fetus, and presence of meconium were noted. APGAR score at 1 and 5 minutes, need for resuscitation and NICU admission was noted and was compared and statistically analyzed by Chi-square test.

## RESULTS

Incidence of the cord entanglement was found to be 31.5% in our study. Of the 375 recruited study population, cord entanglement was noted in 118 patients and absent in 257 patients. Among 118 patients, 46 (39%) had one loop, 53 (44.9%) had two loops, 18 (15.3%) had three loops (Table 1) and entanglement around the neck was in 106 (89.8%), body 5 (4.2%) and both body and neck in 7 (5.7%) patients (Table 2). Entanglement is considered to be loose if, it can be easily unlooped after delivery of the head and is tight, if it has to be clamped and cut before delivery. Most of them 55.9% were loose cord entanglement and 44.1%, were tight loops (Table 3).

The study revealed that age, parity, gestational age, and spontaneous onset of labor were not significant, or statistically to the presence of cord entanglement.

In this study, CTG changes were noted in 99 patients of which, 56 patients had cord entanglement at delivery. About 57.1% had variable decelerations, 39.3% had early decelerations and 3.6% had late decelerations. This is statistically significant compared to the no cord entanglement group (Table 4).

Meconium staining of the liquor was noted in 97 patients. Of these, 54 patients had cord entanglement at delivery. This is statistically significant compared to no cord entanglement group (Table 5).

In the cord entanglement group, there is also a higher incidence of vacuum delivery (15.3%) and LSCS (28%) in the case group as compared to the control group and is significantly high in tight cord

**Table 4:** Decelerations and cord entanglement at delivery (N = 99)

Decelerations	Cord entanglement at delivery		Total (%)	p-value
	Absent (n = 43) n (%)	Present (n = 56) n (%)		
Early	17 (39.5)	22 (39.3)	39 (39.4)	0.008*
Variable	16 (37.2)	32 (57.1)	48 (48.5)	
Late	10 (23.3)	2 (3.6)	12 (12.1)	

\*p-value significant

**Table 5:** Meconium and cord entanglement at delivery

Meconium	Cord entanglement at delivery		Total (%)	p-value
	Absent (n = 257) n (%)	Present (n = 118) n (%)		
Present	43 (16.7)	54 (45.8)	97 (25.9)	<0.001*
Absent	214 (83.3)	64 (54.2)	278 (74.1)	

\*p-value significant

**Table 6:** Mode of delivery and cord entanglement at delivery

Mode of delivery	Cord entanglement at delivery		Total (%)	p-value
	Absent (n = 257) n (%)	Present (n = 118) n (%)		
Normal	198 (77.0)	67 (56.8)	265 (70.7)	<0.001*
Vacuum	26 (10.2)	18 (15.2)	44 (11.7)	
LSCS	33 (12.8)	33 (28.0)	66 (17.6)	

\*p-value significant

**Table 7:** Comparison of mean duration of first and second stages of labor

	Cord present (n = 118)	Cord absent (n = 257)
Mean duration of first stage of labor (hours)	13.87	13.67
Mean duration of second stage of labor (minutes)	34.4	29.18

entanglement patients. As the p-value is < 0.001 the difference is statistically significant (Table 6).

The major indication for LSCS in patients with cord entanglement at delivery was fetal distress followed by failure to progress. In the patients who had a vaginal delivery, the duration of the first stage of labor in the group with cord entanglement is 13.87 hours as compared to 13.67 hours in the group with no cord entanglement. The duration of the second stage of labor in the group with cord entanglement is 34.4 minutes as compared to 29.18 in the group without cord entanglement (Table 7). There is not much difference in the duration of the first stage between the two groups but there is a prolongation of the second stage in the cases group and this difference is significant statistically. This suggests that there is a prolongation of the second stage in patients with cord entanglement and is significantly high in tight cord entanglement patients (Table 8).

**Table 8:** Comparison of mean duration of first and second stages of labor in tight and loose cord entanglement groups

	<i>Cord loose</i> (n = 66)	<i>Cord tight</i> (n = 52)	<i>p-value</i>
Mean duration of first stage of labor (hours)	13.43	14.50	0.451
Mean duration of second stage of labor (minutes)	33.10	38.00	0.041*

\*p-value significant

**Table 9:** NICU admission and cord entanglement at delivery

	<i>Cord entanglement at delivery</i>		<i>Total (%)</i>	<i>p-value</i>
	<i>Absent</i> (n = 257)	<i>Present</i> (n = 118)		
<i>NICU admission</i>	<i>n (%)</i>	<i>n (%)</i>		
No	248 (96.5)	103 (87.3)	351 (93.6)	0.001*
Yes	9 (3.5)	15 (12.7)	24 (6.3)	

Chi-square test, \*p-value significant

**Table 10:** Resuscitation and cord entanglement at delivery

	<i>Cord entanglement at delivery</i>		<i>Total (%)</i>	<i>p-value</i>
	<i>Absent</i> (n = 257)	<i>Present</i> (n = 118)		
<i>Resuscitation</i>	<i>n (%)</i>	<i>n (%)</i>		
No	245 (95.3)	71 (60.2)	316 (84.3)	<0.001*
Yes	12 (4.7)	47 (39.8)	59 (15.7)	

Chi-square test, \*p-value significant

**Table 11:** Sensitivity, Specificity and Predictive accuracy of USG diagnosed cord entanglement

<i>USG NC</i>	<i>Cord entanglement at delivery</i>		<i>Total</i>
	<i>Yes</i>	<i>No</i>	
Yes	105	37	142
No	13	220	233
Total	118	257	375

Sensitivity = 89.0%

Specificity = 85.6%

Positive predictive value = 73.9%

Negative predictive value = 94.4%

In delivered babies, NICU admission (Table 9) and the need for resuscitation (Table 10) are high in babies with cord entanglement as compared to babies free of cord entanglement. This difference is statistically significant as the p-value is < 0.001. This difference is more observed in the tight cord entanglement group compared to the loose entanglement.

APGAR scores at 1 and 5 minutes were low in the group with cord entanglement, specifically in tight loop babies compared to the control group and is significant statistically.

Need for resuscitation and NICU admission were noted to be high in the group with cord entanglement and are statistically significant (Table 9).

Perinatal mortality was not noted.

Ultrasound identifies 105 cases, out of 118 cord entanglement cases at delivery. Sensitivity 89%, specificity 85.6%, positive predictive value 73.9%, negative predictive value 94.4% (Table 11).

## DISCUSSION

From our study, we noted that the incidence of cord entanglement was 31.5% at 38 weeks of gestation and is comparable to other studies like Schaffer L et al.<sup>1</sup> and Larson et al.<sup>2,3</sup> The Sensitivity of 89%, specificity of 85.6%, positive predictive value of 73.9%, and negative predictive value of 94.4% of ultrasonography were noted in diagnosing cord entanglement. In a study conducted by Elie Nkwabong et al.<sup>4</sup> sensitivity, specificity, positive predictive value, and negative predictive value of ultrasound was noted to be 84.2, 85.4, 80.0, and 88.7% respectively in detecting cord entanglement.

In the group with cord entanglement, there is a high incidence (89.8%) of cord around the neck (89.8%) followed by neck and body (5.7%) and a lower incidence of cord entanglement around the body (4.2%). We noted that 39% had a single loop, 44.9% had two loops, 15.3% had 3 loops, and 0.8% had 5 loops of cord entanglement.

Our study assessed that the mean duration of the first stage of labor in patients with cord entanglement and without cord entanglement is 13.87 hours and 13.67 hours respectively. Thus, the duration of the first stage of labor is almost the same in both groups. The mean duration of the second stage of labor in patients with cord entanglement and without cord entanglement is 34.4 and 29.18 minutes and is prolonged specifically in patients with tight cord entanglement. This is according to the study conducted by Ogueh O et al.,<sup>5</sup> who concluded that pregnant women with cord entanglement had a longer second stage of labor especially if they are primigravida with tight nuchal cord.

Mode of delivery is the main challenge to Obstetricians. In the cord entanglement group, 15.3% instrumental delivery, 56.8% normal delivery, 33% emergency LSCS. In the group without cord entanglement, 77% had a normal delivery, 10.1% instrumental deliveries, and 12.8% emergency LSCS. The comparison was considered to be statistically significant with p-value of <0.001. Our study showed that there is an increased rate of cesarean section and instrumental delivery in the group with cord entanglement compared with the no cord entanglement group. This is in comparison to the study conducted by Singh and Dasgupta,<sup>6</sup> Assimakopoulos et al.<sup>7</sup>

In our study, meconium staining of the liquor- was noted in 38.3% of patients and clear liquor in 71.6% of patients with cord entanglement and meconium in 14.1% of patients, clear liquor in 83.2% of patients without cord entanglement and the difference is statistically significant. This is in comparison to the study conducted by Gupta et al.<sup>8</sup>

APGAR scores at 1 and 5 minutes <7 were noted significantly in the cord entanglement compared to the group without cord entanglement. This is in correlation with the study done by Farnaz Zahoor et al.<sup>9</sup> We noted that the need for resuscitation is high in the cord entanglement group, 39.8% as compared to 4.7% in the group without cord entanglement. No perinatal mortality was noted.

## CONCLUSION

We conclude that pregnant women with cord entanglement require intense observation and close monitoring of labor with partogram and continuous fetal monitoring with cardiotocography to note any adverse events immediately during labor. Any features of fetal distress or failure to progress in labor need appropriate management to expedite delivery either by instrumental delivery or by cesarean section. Neonatal compromise may be noted due to cord entanglement but a fair trial for vaginal delivery can be given

and mother should not be stressed with unnecessary anxiety when cord entanglement is noted on ultrasonography.

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