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Research Article
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Perinatal Mortality and Umbilical Cord Parameters: Is there Any Association?

Vijaya Soliriya[1], Manu Goyal[1]* and CP Kachhawaha[2]

[1]Department of Obstetrics and Gynaecology, All India Institute of Medical Sciences, Jodhpur, India
[2]Department of Obstetrics and Gynecology, Sampurnanand Medical College, Jodhpur, India

Abstract

Introduction: Abnormal cord parameters associate with high rate of asphyxia during delivery, foetal anomalies, non-reassuring foetal status, respiratory distress, foetal growth restriction and delivery interventions.

Objective: To study the correlation between umbilical cord parameters and perinatal mortality.

Materials and methods: This was a prospective study carried out in the Umaid Hospital, Dr. S N Medical College, Jodhpur from March-2014 to November-2014. It included 500 cases admitted to labour room with period of gestation >37 weeks. Details of delivery of baby including mode of delivery, Apgar score, NICU admission and any congenital anomaly found in unbooked cases post-natally was noted down. Umbilical cord parameters were also noted and correlated with perinatal outcome using Fischer's exact test and Chi square test.

Results: Out of 500 cases, the cord length was normal in 88.2% cases while it was short in 6.2% and long in 5.6% cases. True knots were associated with a higher mean cord length of 95.83 ± 24.99 cm. The difference of mean cord length between single loop and more than two loops was highly significant (p value<0.001). Cesarean section rate was found to be significantly different between one loop and more than two loops (p<0.001).

Conclusion: The excessively long cords are associated with cord prolapse, true knot and poor fetal outcome and increased operative interference. Short cords are associated with failed progress, cord rupture and congenital malformations. Nuchal cords are responsible for threatening fetal well being along with other placental as well as intrapartum factors for poor fetal outcome

Keywords: Umbilical cord; Perinatal outcome; Nuchal cord

Introduction

The umbilical cord is the life line of fetus. Despite improved antenatal care, safety during surgery and use of modern monitoring such as ultrasonography, Doppler and intra-partum fetal monitoring, cord complications remain one of the major unavoidable causes of fetal death compromising umbilical blood flow to a degree sufficient to prejudice their life. Abnormal cord parameters associate with high rate of asphyxia during delivery, foetal anomalies, non-reassuring foetal status, respiratory distress, foetal growth restriction and delivery interventions. This study aims at correlation between umbilical cord parameters and perinatal mortality.

Materials and Methods

This was a prospective study carried out in the Umaid Hospital, Dr. S N Medical College, Jodhpur from March-2014 to November-2014 to assess any association between umbilical cord parameters specially related to length and pregnancy outcome**.** This study included 500 cases at random and comprised patients admitted to labour room with period of gestation >37 weeks. The study group included both primi-gravida and multi-gravida with singleton pregnancies only. Ethical approval was taken from the institute for the study. The following cases were excluded from the study: preterm deliveries, multifetal gestation and fetuses with major congenital anomalies (antenatally), intra uterine fetal death**.** Fetal heart rate was monitored clinically during labour by intermittent auscultation with stethoscope and/or fetal Doppler. The maternal and foetal monitoring in labour was done as per partograph and cardiotocograph (CTG, if required in high risk cases). Details of delivery of baby including mode of delivery, Apgar score, NICU admission and any congenital anomaly found in unbooked cases postnatally was noted down. Following parameters of umbilical cord were examined at the time of delivery and after delivery: presence of any loop around neck, trunk, shoulder, etc. cord loops tight or loose in LSCS cases, number of loops of cord and positions, knots of cord (true or false), length and diameter of umbilical cord. Amongst these, we have excluded hypo and hyper-coiled cords as there is much fluctuation in the number of coils with passage of time, postnatally. Determination of length of umbilical cord was done after the delivery of fetus, cord was clamped at two places and cut in between. From the cut end up to fetal umbilicus and placental attachment umbilical cord, length was measured with flexible tape in cm and added. A data check sheet was maintained for each case till completion of delivery. The umbilical cord length measurements were categorized into short, when the measured length was <39 cm, normal, when the measurement was between 39 to 95 cm and long cord if the measurement was >95 cm [1,2]. Statistical analysis was performed using SPSS17.0 for windows. The sample size of the study was calculated as 400 taking the power as 90% and 20% dropout. Continuous data were analyzed by t-test and categorical data by using Chi-square test or Fisher exact test.

***Corresponding author:** Manu Goyal, Assistant Professor, Department of Obstetrics and Gynaecology, All India Institute of Medical Sciences, Jodhpur, India, Tel: 91-9971833603; E-mail: drmanu_8@yahoo.co.in

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Results

A total of 500 cases were analysed and the cord length was normal in 88.2% cases while it was short in 6.2% and long in 5.6% cases. The incidence of true knot was found to be 1.2%. True knots were associated with a higher mean cord length of 95.83 ± 24.99 cm than with non-true knot mean cord length i.e, 63.81 ± 20.90 cm. The difference was highly significant (p value<0.001). Out of 6 cases of true knots, there were 3 cases who had undergone LSCS on account of fetal distress. Only one neonate was shifted to NICU with low Apgar score and associated with the largest cord length of this study, i.e., 144 cm. Another was associated with cord prolapse but with good fetal outcome (Table 1).

The incidence of false knot was 5.8% in our study. Only 3 cases were brought for cesarean section on account of fetal distress, of which one baby went to NICU due to low Apgar score.

The incidence of nuchal cord was 119 out of 500 cases. Of 119 cases of nuchal cord, 9.24% (11 out of 119 nuchal cord) were associated with non-reassuring fetal heart rate (FHR). Variable deceleration had accounted for 4.2% of nuchal cord. Out of total 32 (26.89%) cases of fetal dysrhythmia, maximum incidence was of variable deceleration, i.e., 10 (8.4%) cases. Bradycardia was seen in 6.45% of short group and no case was seen in long cord group and 2.72% of normal group in our study. The difference of mean cord length between single loop and more than two loops was highly significant (p value<0.001). Cesarean section rate was found to be significantly different between one loop and more than two loops (p<0.001). However, it was non-significant (p>0.3) between one loop and two loops. Cord entanglement was seen most commonly with long cord. From Table 4, out of 21 cases of inadequate descent, 12 were slow descent cases and 9 were with failed progress. It was present in majority of cases among long group 3.5% and short group 3.2%. An equal distribution of cases in short and long groups for slow descent were found. Cases with nuchal cord had higher mean cord length than those without nuchal cord (Tables 2-4).

Cord group	No. of cases	True knot	False Knot
	N (%)	N (%)	N (%)
Short cord	31 (6.2)	0	1 (3.22)
Long cord	28 (5.6)	2 (7.14)	2 (7.14)
Normal cord	441 (88.2)	4 (0.90)	26 (5.98)
Mean Cord length (cm)	-	95.83 ± 24.99 cm	64.06 ± 16.58 cm
Total cases	500	6 (1.2)	29 (5.8)

*P value<0.001 highly significant true knot mean cord length v/s non true knot mean cord length

Table 1: Correlation of cord knots with cord length group.

Type of Dysrhythmias	N (%)	Nuchal cord (N=119)	Percentage	Tight	Loose
Bradycardia	14 (11.76)	3	2.52	3	0
Tachycardia	0	0	0	0	0
Late deceleration	8 (6.72)	3	2.52	3	0
Variable deceleration	10 (8.40)	5	4.20	4	1
Total	32 (26.89)	11	9.24	10	1

Table 2: Fetal heart rate variations in cases with nuchal cord (N=119).

As seen in Table 5, it has been determined that cord complications associated with other obstetrical and placental risk factors resulted in low Apgar scores and simply responsible for NICU admissions. There were 19 NICU admissions, among them 17 had asphyxia. One was macrosomic baby and other one was having congenital anomaly, i.e., club foot with heart disease and both were sent to NICU for observation despite of normal Apgar score. Among 17 asphyxiated neonates, five cases had malpresentation, three breeches, one face and one compound presentation. Three cases were of abruption placentae and one patient was of placenta praevia. One unbooked case with scanty liquor with caput and leading to failed progress that was admitted in advanced labour and found to have tight loop intraoperatively. Rests of the 7 admissions were due to obvious cord complications (Table 5).

However, as far as cord length is concerned, out of 19 NICU admissions, 3 had short cord length (9.67%), 2 had long cord length (7.14%) and 14 had normal cord length (2.94%).

In the present series there were 3 still births and 3 early neonatal deaths out of those 17 NICU admissions with low Apgar score (Table 6).

Table 7 out of 5 cases of congenital malformations, no cases was found in long cord group while it was only one baby with swelling around neck

No. of Loop	N=119	Intrapartum complication	Short N (%)	Long N (%)	Normal N (%)	Mean cord length ± SD (cm)
Single Loop	98	Single loop cases	3 (3.06)	10 (10.20)	85 (86.73)	71.37 ± 6.71
		MSL	1 (3.22)	3 (10.7)	19 (4.3)	
		Dysrhythmia	0	4 (14.2)	6 (1.36)	
		NICU/Mother Shift/SB	1 (3.22)/2 (6.45)/0	1 (3.57)/9 (32.14)/0	4 (0.90)/80 (18.14)/1 (0.22)	
		CS	0	5 (17.85)	15 (3.40)	
		Vaginal	3 (9.68)	5 (17.85)	70 (15.87)	
Two loops	16	Two loops cases	0	6 (37.5)	10 (62.5)	90.31 ± 1.96
		MSL	0	1 (3.57)	2 (0.45)	
		Dysrhythmia	0	1 (3.57)	1 (0.22)	
		NICU/Mother Shift/SB	0	0/6 (21.4)/0	0/10 (2.26)/0	
		LSCS	0	2 (7.14)	4 (0.90)	
		Vaginal	0	4 (14.28)	6 (1.36)	
More than 2 loops	5	More than 2 loops cases	0	4 (80)	1 (25)	99 ± 9.59
		MSL	0	1 (3.57)	0	
		Dysrhythmia	0	0	0	
		NICU/Mother Shift/SB	0	0/4 (14.28)/0	0/1 (0.22)/0	
		LSCS	0	1 (3.57)	0	
		Vaginal	0	3 (10.71)	1 (0.22)	

Table 3: Association of intrapartum complications of nuchal cord and mode of delivery with cord length.

Cord length group	MSL N (%)	Dysrhythmia		Descent disorders		Cord entanglement		Cord prolapse	Abruption
		Brady-cardia N (%)	Tachycardia N (%)	Slow progress N (%)	Failed progress N (%)	Nuchal N (%)	Non Nuchal N (%)	N (%)	N (%)
Short N=31	5 (16.1%)	2 (6.45%)	0	1 (3.23%)	0	3 (9.6%)	2 (6.45%)	0	0
Long N=28	8 (28.5%)	0	0	1 (3.57%)	0	20 (71.4)	2 (7.14%)	3 (10.71%)	0
Normal N=441	51 (11.56)	12 (2.72%)	0	10 (2.26%)	9 (2.04%)	96 (21.7%)	9 (2.04%)	3 (0.68%)	4 (0.9%)
Total	64	14	0	12	9	119	13	6	4

Table 4: Distribution of cases according to intrapartum complication.

	N (%)	Short cord group N (%)	Long cord group N (%)	Normal cord group N (%)	Mean cord length (cm) ± SD
NICU	19 (3.6%)	3 (9.67%)	2 (7.14%)	14 (2.94%)	61.89 ± 19.64
Mother shift	478 (95.8%)	28 (90.3%)	26 (92.85%)	425 (96.37%)	64.29 ± 17.20
SB	3 (0.6%)	0	0	3 (0.68%)	69 ± 14.530
Apgar score <7 at 5 minute	19 (3.82%)	4 (12.9%)	3 (10.71%)	15 (3.4%)	65 ± 26.68
Apgar score <7 at 1 minute	34 (6.8%)	6 (19.35%)	6 (21.4%)	22 (4.98%)	66.91 ± 26.27

Table 5: Correlation of fetal outcome and cord length.

	Length of cord (cm)	Mode of delivery	Specific cord abnormality	Nuchal cord
SB-1	55	Vaginal	NIL	NIL
SB-2	68	CS	Prolapse+Varix	NIL
SB-3	84	Vaginal	NIL	1 tight loop
END-1	56	CS	NIL	1 tight loop
END-2	86	Vaginal	NIL	NIL
END-3	74	CS	NIL	1 tight loop

*Perinatal mortality include still births and early neonatal death

Table 6: Association of perinatal mortality with mode of delivery and abnormal cord length and cord parameters.

Congenital anomaly	Cord length (Cord group)	Apgar 1 m	Apgar 5m	Mother shift	NICU
2 central lower incisors present	44 cm (Normal)	10	10	Yes	
Bat ears	93 cm (Normal)	10	10	Yes	
Swelling around neck	35 cm (Short)	5	6	-	Yes
Left leg club foot with heart disease	61 cm (Normal)	4	8	-	Yes
Double thumb	62 cm (Normal)	10	10	Yes	

Table 7: Distribution of congenital anomalous babies among cord group.

found in short group with rest of the cases occurred in normal group. The incidence of anomalous baby was 1% among 500 cases (Table 7).

Discussion

False knots may have little clinical significance whereas true knots of the umbilical cord although rare may lead to obstruction of the fetal circulation and subsequent intrauterine death [3]. False knots have no known clinical significance. True knots of the umbilical cord occur in approximately 1% (0.04 to 1%) of pregnancies, with the highest rate occurring in monoamnionic twins [4].

There was higher association of tight nuchal (4 out of 5) loops with variable deceleration. This coincides with Begum et al. in which they found only 22 (14.47%) of fetuses manifested fetal heart rate variation mostly variable deceleration (10 out of 22) [5].

Long umbilical cords may be directly associated with poor fetal outcome and umbilical cord accidents such as entanglement, knot formation (multiple) and torsion [1].

Neonates born with tight nuchal cord had low Apgar score in one minute in comparison to loose ($p<0.05$), whereas significantly low Apgar score after 5 min was observed in babies born with multiple nuchal cord [5].

The incidence of nuchal coiling in our study was 23.8% which correlates with finding of Balkawade and Shinde which had total nuchal coiling in 20.7% cases [6]. The incidence of single loop found in 19.6% cases in our study which is comparable with the finding of Ogueh O et al. where one loop around the neck occured in approximately 20% of cases [7]. The incidence of multiple loops was 4.2% which corresponds with the study of Schaffer et al., where the incidence of multiple nuchal cords were 5.8% of term pregnancies [8].

Begum et al. [5] in their series had no perinatal mortality with nuchal cord which is similar to observation of Larson et al. [9] and Miser [10] which does not correspond to our study.

Rayburn et al. found that "the measurement of umbilical cord length has explained certain intra-partum FHR abnormalities or an arrest of fetal descent" [2]. Inadequate fetal descent was significantly more common when a long cord or an excessively short cord (25 cm or less, lower first percentile) was found, which is partly similar to the present study and possibly presumed that arrest of labour not only depends upon cord length but also with some additional factors.

Total abruptions in our study were 4 cases from normal cord group which did not correspond to Georgiadis et al. [11] and Beall [12] who stated that short cords were associated with abruption.

The study of Shereen et al., explained poor perinatal outcome and reasons for NICU admissions other than nuchal cords such as LBW, LBW with respiratory distress, LBW with IUGR, preterm and congenital anomaly (duodenal atresia) [13].

Nuchal cords rarely cause fetal demise and are not intrinsic reasons for intervention [8].

Umbilical cord accident (UCA) is an emergency situation, as it threatens fetal well-being and or results into fetal jeopardy. Cord prolapse, cord compression, cord entanglement, true knot formation, thrombosis and rupture of cord blood vessels are some of the known cord related causes of still-births [14].

According to Balkawade and Shinde, excessively short cords have been associated with a delay in second stage of labor, irregular fetal heart rate, placental abruption, rupture of umbilical cord, inversion of uterus, birth asphyxia and cord herniation [6]. Excessively long umbilical cords are associated with cord prolapse, torsion, true knot entanglement around the foetus and delivery complications. There are more cases of fetal distress, fetal anomalies, and respiratory distress.

Miller et al. analysed that real shortness is found in newborns with early intrauterine constraint and in those with gross structural or functional limb defects that limit intrauterine movement [15].

Yadav et al. found high perinatal mortality in long cords (0.6%) [16]. Gross cord abnormalities predispose the foetus to stasis-induced vascular ectasia and thrombosis, thus leading to vascular obstruction and adverse neonatal outcome, including IUGR and still-birth [17].

Low percentage of still-birth in infants with cord knots was reported earlier as 2/246 (0.8%) [18].

Conclusion

The excessively long cords are associated with cord prolapse, true knot and poor fetal outcome and increased operative interference. Short cords are associated with failed progress, cord rupture and congenital malformations. Nuchal cords are responsible for threatening fetal well-being along with other placental as well as intrapartum factors for poor fetal outcome and perinatal mortality. These are not indication for active intervention except fetal distress.

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