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Research Article

PROSPECTIVE STUDY FOR EVALUATION OF THE IMPACT OF UMBILICAL CORD LENGTH WITH FETAL OUTCOME

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ABSTRACT

Objective: The length of umbilical cord and its position in amniotic sac correspond to anomalies in fetus has been a debatable subject to differences and untoward gestational outcome. To evaluate the relationship between umbilical cord length and its impact on the maternal and perinatal outcomes, we conducted a prospective the Department of Gynacology and Obstetric, SK Institute of Medical Sciences (J&K, India)

Material and Method: The study included 1000 cases wherein the umbilical cord length was evaluated and examination of umbilical cord was done to mark its location. Further cord looping around neck, trunk along with number of loops of cord and positions were determined for any cord abnormalities. All the necessary fetal characteristics were noted like sex, placental weight, and length of the newborn. Fetal outcome studied by Apgar score at 1 and 5 min was also recorded.

Results: We found cases presented with a varied cord length from 21 to 125 cm. The mean cord length was 63.86 cm (±15.69 cm) i.e., 25.14" while as the median cord length was reported as 55 cm. Majority of cases (27.4 %) were found to have a cord length in the range between 51 and 60 cm. The long cord was found in 55(5.5%) cases as against 61 (6.1%) with short cords while as 884 (88.4%) cases presented with normal cord length. The incidence of all types of cord complications increases as the cord length increases ($p < 0.001$*). There is increased incidence of fetal heart rate abnormalities with extremes of cord length ($p < 0.001$). The incidence of birth asphyxia was significantly more in long and short cords as compared to cords with normal cord length ($p < 0.001$). Cord length did not vary according to the weight, length, and sex of the baby

Conclusion: Increasing rates of cord complications, higher incidence of operative interference, intrapartum complications, increased fetal heart rate abnormalities, and more chances of birth asphyxia were associated with abnormal cord length

INTRODUCTION

The umbilical cord and vitelline duct are of vital importance to the fetus. An umbilical cord is an intra-amniotic structure which is fixed between the placenta at one side and fetal umbilicus at the other and is 50-60 cm long [1]. The umbilical cord is the lifeline of the fetus where it is responsible for the transport of nutrition, oxygen and fluid necessary for the intrauterine existence of a fetus [2]. Complete occlusion/interruption of the cord can lead to fetal demise while intermittent obstruction has been associated with intrauterine brain damage. Cord length varied and ranged from no cord (achordia) to very long cord of lengths up to three meters. It is assumed that the length of an umbilical cord is determined by environmental as well as genetic factors. Likewise there may be many (up to 40) twists in the cord, as well as false knots and true knots. A short umbilical cord may be associated with a delay in the second stage of labor, adverse perinatal outcomes such as fetal growth restriction, congenital malformations, intrapartum distress, and fetal death [3]. Previous reports showed that a long cord can lead to umbilical cord entanglement (i.e. true knots or cord loops around the neck or body parts). Circulatory stasis and vascular thrombosis are encountered and can lead to early miscarriage [4, 5]. An association between long cord and women with systemic diseases with postpartum and perpartum complications was established. There was also a significant association with birth weight, adverse neonatal outcome, low Apgar score, male gender and cord enlanglement [6].

Many investigations have been performed on umbilical cord length. Recent studies have shown that there is an important relationship between the umbilical cord length and adverse perinatal outcome, and it seems that fetuses with umbilical cord length are more at risk of poor perinatal outcome and it

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can suggest that the umbilical cord length might have a clinical importance [7-10]

Thus the current study was conducted to investigate the determinants and effects of the umbilical cord length on the maternal and perinatal outcomes (length of umbilical cord and its association with adverse fetal outcome).

METHODS

The prospective study was carried out at the Department of Obstetrics and Gynaecology of the Sher- I - Kashmir Institute of Medical sciences Soura Srinagar J & K India

The present study included 1000 cases at random. The patients admitted to labor room with period of gestation>37 weeks were included in present study for a period of one year from October 2013 to September 2014 on women with singleton ≥37weeks pregnant (according to reliable LMP and sonologic confirmation of first trimester), who have been admitted into the labor ward for delivery. Fetal heart rate was monitored clinically during labor. Mode of delivery, vaginal or cesarean, was noted. All umbilical cords of newborns of the participant women were clamped and cut immediately after either vaginal or caesarian delivery

Umbilical cord was examined at the time of delivery and after delivery for the following: entanglement, 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); and any cord abnormalities (cyst, hematoma, velamentous insertion, etc.).

The umbilical cord length was measured with a flexible tape, from its insertion into the placenta up to the neonatal umbilicus. The neonatal and placental remaining segments were measured, as well as any other parts of the cord that might have been cut out. All cord parts were measured to the nearest centimeter and the total cord length was calculated after addition of the lengths of all the segments together.

The net placental weight was determined by the addition of umbilical cord and membranes weight. The duration of labour was recorded and the Apgar score was documented.

Fetal parameters were recorded after the time of delivery to observe the sex of the newborn weight (after cutting the cord)and length of newborn was determine. Fetal outcome was studied by Apgar score at 1 and 5 min.

Statistics

All data were collected on predesigned proforma and statistical analysis was performed using the statistical package for social science (SPSS). P values of less than 0.05 were regarded as statistically significant

RESULTS

The study comprised a consecutive series of 1000 cases with age group ranging from 20 to 44 years. We found cases presented with a varied cord length from 21 to 125 cm. The mean cord length was 63.86 cm (±15.69 cm) i.e., 25.14" while as the median cord length was reported as 55 cm. Majority of cases (27.4 %) were found to have a cord length in the range between 51 and 60 cm. The long cord was found in 55(5.5%) cases as against 61 (6.1%) with short cords while as 884 (88.4%) cases presented with normal cord length.

Lower 5th percentile of the present series is 41 cm=short cord. Upper 5th percentile of present series, 95 cm=long cord. Rest is considered normal (table 1)

Table 1 Distribution of patients according to Umbilical Cord Length (in centimeters)

S.No	Umbilical Cord Length (in centimeters)	Number	Percentage (%)
1	Long	55	55.0
2	Normal	884	80
3	Short	61	9

Eccentric type cord (69.2%) was commonest type of attachment in this study group followed by central type (3 was 4.4%) both of which are normal cord attachments. We observed 0.3 and 0.1% of cases who presented with abnormal attachment that included marginal and velamentous insertion respectively.

Cases that presented with short umbilical cord had a higher frequency of LSCS (30%) than cases with long (23.2%) while as those cases that presented with normal cord length had moderately low frequency of LSCS (4.4%) as shown in table 2.

Table 2 Comparison of mode of delivery with results of Umbilical Cord length and the occurrence of foetal distress

S.No	Mode of delivery/ Foetal distress	Normal cord length (n=800) (%)	Long cord (n=110) (%)	Short cord (n=90) (%)
1	Vaginal (n=740)	650(87.8)	60(8.1)	30(4.5)
	FD (n=70)	30(5)	20(43)	20(67)
	No FD (n=670)	620(95)	40(57)	10(50)
	LSCS (n=26)	150(58)	50(15)	60
2	FD (n=9)	20(13)	30(60)	50(83)
	LSCS for other indications (n=17)	130(87)	20(40)	10(16)

The difference in cord length showed significant association for short cord group with significantly higher incidence of LSCS cases ($p<0.05$). 91.2% of cases with normal cord group had maximum number of vaginal deliveries while as there were some differences for long cord 56.4% versus 48% in short cord cases but the association was not significant for any group. Total 111 (22.2%) cases were found to have nucal coiling. The occurrence of nuchal coiling predominated in cases 56.4% (22 cases) with a long cord as compared to only 4% cases with a short cord. On the other hand nucal coiling for subjects with normal cord length was 20.2%.

There were 2 cases of cord prolapse. One case had five tight loops of cord around neck. The cord length was 110 cm in this case with central cord insertion, the duration of second stage of labor was increased, and LSCS had to be done for fetal distress. After delivery, Apgar score of baby was low [Apgar score=4] at 1 min and 6 at 5 min. NICU admission of the baby had to be done. In long cord group, 2.6% had a true knots, whereas in normal-cord group 0.46% were having true knots .There were two cases of cord prolapse of which 1 cases had a long cord, and 1 cases had a normal cord length (Table 2).

16% (160 of 1000) patients developed Fetal Distress (FD) as compared to no FD in 84% patients (840 of 1000) as depicted in table 3. In 160 patients who developed FD, 31% (50/160) had normal umbilical cord length whereas 69% (110/160) had

abnormal cord length. Out of 840 patients who had no FD, 89% (750/840) patients had normal umbilical cord length and 11% (90/840) patients were having abnormal umbilical cord length. Statistically, Foetal Distress and umbilical cord length changes are significantly associated ($p<0.001$) as shown in table 3. There was marginally higher number of vaginal deliveries in patients with normal and long cord length as compared to patients with short cord length but could not achieve statistical significance ($p>0.05$).

Table 3 Incidence of Foetal distress in relation to Umbilical Cord Length changes

S.No	Umbilical Cord Length (in centimeters)	Number of cases with Fetal Distress n (%)	Number of cases with No Fetal Distress n (%)	
1	Normal (800)	50 (6)	750(94)	
2	Long (110)	50(45)	60(55)	0.000
3	Short (90)	60(67)	30(33)	0.000
	Cord Length (Vaginal Delivery)	Foetal distress (n)(%)	No Foetal distress	
	Short cord (n=3)	2(67)	1(33)	0.05
	Normal cord (n=38)	4(11)	34(89)	ref
	Long (n=33)	1(3)	32(97)	0.3

A statistically significant relationship between cord length and LSCS was found ($p=0.03$ wherein significantly higher number of caesarean sections for FD among the patients with short cord length was observed as compared to long cord ($p>0.05$) as shown in table 4. Further Perinatal outcome in relation to umbilical cord length is given in table 5

Table 4 Relationship between cord length, LSCS and Foetal distress

S.No	Cord length (LSCS)	LSCS for Foetal distress	LSCS for other indications	P value
1	Normal (n=17)	6(35%)	11(65%)	
2	Short cord (n=3)	4(100%)	0(0)	0.03
3	Long cord (n=6)	0 (0)	6(100%)	0.1

Table 5 Perinatal outcome in relation to umbilical cord length

S.No	Perinatal Outcome	Short cord (N=6) (n)(%)	Normal cord (N=55) (n)(%)	Long cord (N=39) (n)(%)
1	Presence of meconium	5(83)	10 (18)	1
2	A/S <7 at 1 min	3(50)	6(10)	0 (0)
3	A/S <7 at 5 min	0(0)	1(2)	0 (0)
4	Admission to NICU	1(16)	2(3)	0 (0)
5	Neonatal deaths	0(0)	0(0)	0 (0)

DISCUSSION

The main finding of the current study was the significant association between parity, birth weight, and the umblical cord length whereas age, occupation, history of miscarriage, gestational age, pregnancy, labour characteristics and perinatal outcome were not associated with it. It has been recently shown that cord length did not vary according to the weight and sex of the baby. Short cord was associated with significantly higher incidence of cesarean delivery. Higher incidence of variability in fetal heart rate was reported with extremes of cord length [11]. In this study, we found that a shorter cord is associated with higher risk of adverse pregnancy outcomes. The rate of unplanned cesarean delivery significantly increased as umbilical cord length decreased. Factors such as female sex of the fetus, primiparity, lower maternal BMI, and lower placental and neonatal weight were also associated with shorter cord length. In this study, we found that a shorter cord is associated with higher risk of adverse pregnancy outcomes. Our results are generally consistent with those of previous studies that investigated the relationship between cord length and pregnancy outcomes. In a large population study, shorter cords were associated with low-birth-weight infants, primiparity, female neonates, and advanced maternal age [9]. A population-based retrospective study using the Washington State Birth Events Records Database showed that women with short-cord infants are less likely to be overweight and more likely to be primiparous and to give birth to female infants [3]. Other reports have correlated short cords with female infants [12] and primiparity [13]. Placental weight is also known to affect umbilical cord length [12, 14, 15].

The main outcome of our study was the rate of cesarean delivery. We found that the frequency of unplanned cesarean delivery increased in the short cord groups. However, previous studies have shown conflicting results. Nnatu [15] observed a higher occurrence of cesarean delivery in patients with cord lengths of <46 cm, whereas Krakowiak *et al*. (2004) [3] observed a 50% decrease in the rate of cesarean delivery and an increase in the rate of vacuum and forceps delivery in the short cord group. However, in the study by Krakowiak *et al*. (2004) [3], a short cord was identified not by the absolute length of the umbilical cord and the results of this study may not be comparable with those of our study. Sornes *et al*. (1989) [16] observed no differences in the cesarean delivery rate according to cord length, but the relatively small sample size (n = 3019) may have affected the results. Most studies agree that a short cord is associated with an increased risk of NRFS [17, 18].

In our study, the presence of a short cord was associated with a higher likelihood of cesarean delivery but was not associated with acidemia. Previous studies on umbilical cord length have reported that a short cord is associated with poor fetal and neonatal prognosis. Krakowiak *et al*. [3] reported that SGA births, hypoxic-ischemic encephalopathy, NRFS, and infant death were associated with short cords, and thus concluded that these infants need close postpartum monitoring. In our study, short cord was not related to SGA after adjusting for confounding variables. Berg and Rayburn [19] stated that the acid-base balance of the umbilical artery is not affected by cord length, which was consistent with our results.

It is a well known fact that the length of umbilical cord varies widely among individuals. It varies between 0 [20] 1 to 300 cm [21] with an average length of the cord being determined usually between 50 to 60 cm [5]. Our report is comparable with the findings of Mishra *et al*.[6],where the average cord length was 50-60 cm and study conducted by Malpas *et al* (1964) [21] where cord length has been documented between 46 and 79 cm.

Eccentric insertion of cord is commonest finding. In Fox's series of 1,000 cases, it was seen in 62% cases, and in our study 67.2%.

In present study, normal-cord group included 40-80 cm, and so percentage of LSCS in both studies are comparable and there are increased incidence of LSCS in short (30%) and long-cord (4.4%) groups. There was no difference in the overall mode of delivery for the cord entangled or non-entangled and all twins, although cord entanglement was more prevalent in spontaneous vertex vaginal deliveries.

This increased incidence of operative interference may be due to cord abnormalities (coiling around neck, body cord abnormalities, and true knot) in long cord group (table 5). The percentage of total LSCS cases in the present study was 7% (35 per 500 cases). The cord complications were associated with more incidences of LSCS. Study conducted by Lamonica *et al.* [22] reported that placental location makes no difference except perhaps when cord is excessively short.

In the present series, there is increased incidence of LSCS in short cord group. There is an increased incidence of normal delivery (91.8%) in normal cord group compare the cord length increases. Studies by Rayburn *et al.* (1981) [18] and Greenhill *et al.* (1969) [23] have shown statistically significant ($p<0.001$) with short and long cord group.

In the present series, out of 500 cases 111 had nuchal cord (i.e.22.2%). Longer cords tend to become looped around neck. In our study, there are 2 cases of cord prolapsed. The mean cord length in cases with cord prolapsed was 71.87 cm which was more than cases without prolapse. However, it was statistically insignificant ($p>0.05$). Thus, we confirm the finding of Sarwano *et al*. [24] who showed that the risk of complications increased linearly with the cord length.

In the present series, out of 500 cases, babies having birth asphyxia (Apgar<6) were 44 (i.e.32.5%). Out of these incidences birth asphyxia was maximum in short cord group (20%) as against 17.9% in long cord group while as it was (8.01%) in normal cord group.

The incidence of fetal heart rate abnormalities was more in cases with short and long cord in our study. The study is comparable in its percentage of fetal heart abnormality in relation to variable cord length with the study by Rayburn *et al*. (1981) [18].

There were more cases of birth asphyxia in short and long cord groups as compared to cords with normal length. On the other hand, Atalla *et al*. (1953) [25] found no relation between umbilical cord indices and intrapartum FHR declerations, meconium staining of the amniotic fluid, or mode of delivery. Spellacy *et al*. (1966) [26] showed that all cord complications shows significantly low Apgar scores at 1 min. Shrestha *et al*. (2007) [27] studied Nuchal cord and perinatal outcome. Neonatal outcome was analyzed by Apgar score at 1 and 5 min and the need for neonatal unit admission. Apgar score <7 at 1 min was more in abnormal cord length group than in control group

CONCLUSION

We conclude that among the different sizes of the umbilical cord, subjects with short and long cords had one or the other complications which included more frequency of surgical interventions, intrapartum complications, and fetal heart rate abnormalities coupled with more chances of birth asphyxia.

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