



## Relationship Between Umbilical Cord Length and Maternal and Fetal Outcome

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**ABSTRACT**

**OBJECTIVE** To study the correlation of umbilical cord length with fetal parameters like Apgar score,sex,weight,and length,and its effect on labor outcome.

**DESIGN** Prospective study of 500 cases.

**SETTING** Rajkiya Mahila Chikitsalaya, J.L.N. Medical College, Ajmer

**MATERIAL AND METHOD** Examination of umbilical cord was done for any loop around neck,trunk,etc;no. of loops of cord and position; Knots of cord (True and False),any cord abnormalities.Fetal parameters recorded were sex,weight,and length of the newborn at 1 and 5 min.

**RESULTS** In our study cord length varied from 24 to 124 cm.The mean cord length was 61.7cm.Maximum cases seen were in the group of cord length between 61and 70 cm .Lower 5th percentile was considered as short cord and upper 5th percentile was considered as long cord. Short cord group was associated with significant higher (p<0.05) incidence of LSCS cases .Cord length did not vary according to the weight,length and sex of the baby. The incidence of all types of cord complications increases as the cord length increases (p<0.001). Nuchal cords had higher mean cord length than in cases without nuchal cords(p<0.001). As the number of loops in a nuchal cord increases to more than two loops,the operative interference increases .The significance was tested by using a Chi-Square test, and it was found to be statistically significant(p<0.05) .Nuchal cords were seen to be associated with more cases of fetal heart abnormalities (p<0.001). There is higher incidence of variability in fetal heart rate with extremes of cord length(p<0.001).

**Conclusion** The present study showed that the length of umbilical cord is variable;however,maximum number of cases had normal cord length .Cases which had short and long cords consisted abnormal umbilical cord length. These cases had higher incidence of cord complications,increased incidence of operative interference , intrapartum complications ,increased fetal heart rate abnormalities, and morechances of birth asphyxia .But umbilical cord length did not vary according to the weight,length and sex of the baby.

**KEYWORDS**

**INTRODUCTION**

The umbilical cord is the lifeline of the fetus. "The baby's life hang by a cord",as said by Ian Donald[1].One of the most important part of fetoplacental unit is the umbilical cord .Complete cord occlusion often leads to fetal demise while intermittent obstruction has been associated with intrauterine brain damage. Compression and vasospasm in utero are important factors In fetal distress. Careful umbilical cord examination often reveals significant lesions which may be associated with these processes.

Suspected fetal distress or a failure of the fetus to descend properly during labor is not uncommon. Often no explanation for such intrapartum complications is apparent. Complications associated with long and short umbilical cord may explain this enigma. Excessively short cords have been associated with delay in second stage of labor, irregular fetal heart rate, placental abruption ,rupture of umbilical cord ,inversion of uterus, birth asphyxia, and cord herniation. Excessively long umbilical cord are associated with cord prolapse, torsion ,true knot entanglement around the fetus, and delivery complications .There are more cases of fetal distress, fetal anomalies and respiratory distress.

Cord length at term has appreciable variation, with extremes ranging from no cord (achordia) to length up to 300 cm. At birth,the mature cord is about 50-60 cm in length and 12 mm

in diameter .A long cord is defined as >100 cm and a short cord as <30 cm.There may be as many as 40 spiral twist in the cord,as well as false knots and true knots .Short umbilical cord may be associated with adverse perinatal outcome such as fetal growth restriction, congenital malformations, intrapartum distress, and a twofold risk of death(Krakoviak and associates,2004) [2].

Though the pathogenesis of variability of umbilical cord length remains unclear,this study would provide information about the length of umbilical cord and its association with adverse fetal outcome.

**METHOD**

This is a prospective study conducted in Department of Obs & Gyn, , Rajkiya Mahila Chikitsalaya, J.L.N. Medical College, Ajmer from June 2013 to July2014.The present study included 500 cases at random. The patients admitted to labor room with period of gestation>37 weeks were included in present study .Cases excluded from the study are

-preterm delivery;

-multifetal gestation;

Babies with major congenital anomalies.

Fetal heart rate was monitored clinically during labor.

Mode of delivery,vaginal or cesarean was noted.

Examination of umbilical cord :it was done at the time of de-  
livery and after delivery for the following:

-the 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 abnormality(cyst, hematoma, velamentous insertion etc).

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 and added. It was measured with flexible tape in cm.

Number of umbilical arteries was not studied in present series. Type of insertion on the placenta was also noted. Adherent blood clots were removed from the maternal surface of the placenta .Placental weight was recorded in grams.

Following parameter were recorded after the time of delivery.

-sex of the newborn.

-weight of the newborn: newborn was weighed after cutting the cord within half an hour of delivery.

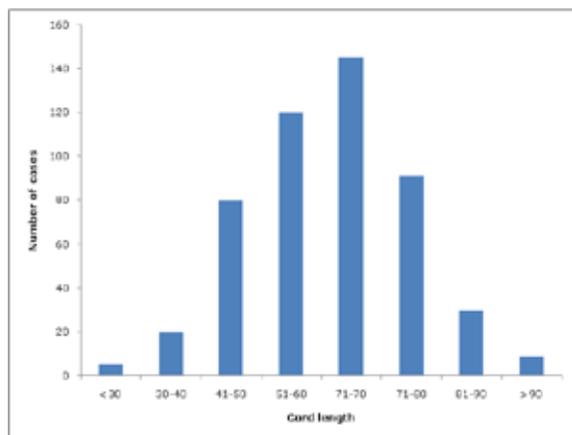
-length of newborn-by keeping two hard plates, one at crown and one at heel and distance between two plates measured and length of newborn measured.

-fetal outcome was studied by Apgar score at 1 and 5 min.

**RESULTS**

In our study ,the cord length varied from 24 to 124 cm. The mean cord length was 61.7cm. Maximum cases seen were in the group of cord length between 61 and 70 cm.

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



The commonest type of cord attachment in this study group is one of eccentric type(67.2%),followed by centraltype(32.4%) both of which are normal cord attachments.there were very few cases of abnormal attachment including marginal and velamentous insertion ,0.3 and 0.1%,respectively.

**Table 1:Cases distribution according to length of umbilical cord**

Length of cord	No of cases	Percentage (%)
Short	25	5
Normal	436	87.2
Long	39	7.8
Total	500	100

Cases of short umbilical cord had maximum cases of LSCS (30%) than cases with long(23.2%) or normal cord length(4.4%).Normal cord group cases had maximum number of vaginal delivery cases(91.2% ) and for long( 56.4%) and for short cord(48% ).Short cord group was associated with significantly higher (p<0.05) incidence of LSCS cases.

Of the total, nuchal coiling was seen in 22.2%(111 cases). In cases with a long cord the incidence of nuchal coiling is 56.4%(22 cases) while in cases with a short cord it was 4% and 20.2% in cases with a normal cord length .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).

The incidence of operative interference increases in cases with cord complications. For all the cases of cord prolapsed, LSCS was done. The percentage of total LSCS cases in the present study was--Thus,cord complications were associated with more incidence of LSCS (17.5%).

As the number of loops in a nuchal cord increases to more than two loops ,the operative interference increases . The significance was tested by using a Chi-square test, and it was found to be stastically significant(p<0.05)(Table 3)

Mean cord length in cases with nuchal cords was 77.24 cm and that in cases without nuchal cords was 60.37 cm.Umbilical cord with nuchal cords had higher mean cord length than in cases without nuchal cords. Significance was tested by using Z test and was found to be highly significant(p<0.001)

True knots were associated with a higher mean cord length of 77.56 cm for cases with true knots those cords without this abnormality. The difference is stastically significant(p<0.001).

There is no significant difference (p>0.05) in the mean cord length with respect to the sex and length of the baby.

Fetal heart rate was monitored by intermittent auscultation as continuous fetal monitoring was not possible. Irregular fetal heart rate was seen in 12%of short cord group and 20% in long cord group. There is higher incidence of variability in fetal heart length with extremes of cord length. It was highly significant (p<0.001) statistically using the Chi square test.

**TABLE2 Umbilical cord length and incidence of cord complications**

Umbilical cord length	No of cases	Nuchal cords	True knots	Cord prolapse	Cord hematoma	total
Short cord	25	1(4%)	-	-	-	1
Normal	436	88(20.2%)	2(0.46)	1(0.23)	-	91
Long cord	39	22(56.4%)	1(2.6)	1(2.6)	-	24

**TABLE3 No of nuchal cords and length of umbilical cord**

Cord length	Number of Loops						Total	%
	1		2		3			
	No. of cases	Percentage	No. of cases	Percentage	No. of cases	Percentage		
Normal	85	19.4	3	0.69	0	-	88	19.4
Short	1	4	0	0	0	-	1	4
Long	13	33.3	8	20.5	1	2.6	22	33.3

**Table 4 :Relation of cord length and neonatal outcome**

Cord length	SB	Total asphyxia 8-10							
		2		3-4		5-7		8-10	
		No. of cases	Percentage	No. of cases	Percentage	No. of cases	Percentage	No. of cases	Percentage
Normal	3	0.69	8	12	15	35	8.01	398	91.3
Short	1	4	1	1	3	5	20	19	76
Long	1	2.6	1	2	4	7	17.9	31	79.5

The incidence of birth asphyxia was significantly more in long and short cords as compared to cords with normal cord length. When studied in comparison to cords with normal, short cord and long cord were associated more commonly with birth asphyxia. Apgar score of <6. Birth asphyxia was seen maximum 20% in cases with short cord length. The difference was measured by using Chi square test. It was statistically highly significant (p<0.001).

Maximum still birth 4% in short cord group and maximum early neonatal death also in short cord group. Still birth and early neonatal death are more with short and long cord group than those in normal cord group. It was found that perinatal mortality was more with short and long group than that in normal ones, and the difference was highly significant (p<0.001). (table 4)

**Discussion  
Umbilical cord length**

Mean Umbilical cord length in the present series is comparable to mean Umbilical cord length of other authors. The length of Umbilical cord varies widely. Cord length varies between 0[3] to 300 cm[4]. The average length of Umbilical cord is usually between 50 to 60 cm[5]. This study is comparable with the findings of Mishra et al.[6], where the average cord length was 50-60 cm and in Malpas[4] study it was 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 it was found in 67.2%.

In the study of Mishra et al. criteria for short cord was <20

cm, long cord >100 cm and control group between 50 and 60 cm. They also included the same set of patient, i.e., full term from 38 to 40 weeks of gestation, and cases with maternal and fetal complications were excluded from study. 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.

**Table 5 Distribution of cases according to changes in fetal heart rate**

Cord length	Bradycardia	Tachycardia	Irregular FHS	Percentage
Normal	4	3	9	3.7
Short	1	2	-	12
Long	3	1	4	20.5

Lamonica et al.[9] in their study "minimum cord length to allow spontaneous vaginal delivery" stated that uterine axis and birth canal are not so long as to impede spontaneous vaginal delivery in the presence of a short umbilical cord. They also reported that placental location makes no difference except perhaps when cord 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 compared to the cord length increases. The present study by Rayburn et al.[10] and Greenhill[11]. Both the studies have shown statistically significant (p<0.001) with short and long cord group.

The incidence of all types of cord complications increases as association of cord complications with increase in the cord length (i.e. long cords). The exact cause of a slow neonatal heart is not known; it is probably due to vagotonia rather than true hypoxia[12].

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) as the number of cases was less. Thus, we confirm the finding of Sarwano et al who showed that the risk of complications increased linearly with the cord length. The reported incidence of prolapsed of the umbilical cord varies between 0.2 and 0.6%

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

long cord group it was 17.9% to normal cord group (8.01%). Higher percentage of birth asphyxia in long cord group may be due to more incidence of cord abnormalities (nuchal cord,true knot,and cord prolapsed).In cases of short cord excessive traction will cause spasm of umbilical vessel;premature separation of placenta will lead to increase in birth asphyxia.

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[10].

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.[15] found no relation between umbilical cord indices and intrapartum FHR decelerations,meconium staining of the amniotic fluid, or mode of delivery .Spellacy et al[12] showed that all cord complications shows significantly low Apgar scores at 1 min.

Shrestha[16] 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 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 thanin control group,which was stastically significant (p=0.01)

## CONCLUSION

The present study shows that the length of umbilical cord is variable; however maximum number of cases had normal length of cord. Cases which had short and long cords consisted abnormal cord length .These cases had higher incidence of cord complications ,increased incidence of operative interference ,intrapartum complications, increased fetal heart rate abnormalities and more chances of birth asphyxia.

Thus,this study shows the importance of the knowledge of cord length.

The finding of a worrisome fetal heart rate tracing, or failure of fetal descent during labor is not uncommon. A keen obstetrician would not only be interested in proper management of such complications, but also in documenting these important findings for further research.

There is a huge arena for research in this field as what we are seeing is just the tip of an iceberg.The challenge should be taken up ,and newer equipment and strategies should be developed to analyze and avoid cord complications. This would decrease the incidences of the perinatal morbidity and mortality due to cord complications in the future and help in realizing the expectios for the delivery of healthy baby.

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