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True Knot of the Umbilical Cord – Five Cases Report

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ABSTRACT

Umbilical cord is life line of the fetus[1], which connects between fetus and placenta to transport oxygen, nutrition and metabolite. Mechanical complications have been of practical interest to physicians for years because of their frequent occurrence in routine obstetric practice, yet there are few comprehensive discussion on the subject. This paper reviews the problem of true knots, its incidence and formation mechanism. Five cases of true knots of cord among 5620 deliveries in Taipei Municipal Women's and Children's Hospital were reported.

MATERIALS AND METHODS

From 1st January, 1981 to 31st December 1981, we encountered 5 cases of true knot of umbilical cord among 5620 deliveries in Taipei Municipa.l Women's and Children's Hospital. All cases of true knot of umbilical cord and placenta had routine pathological examination with macroscopical scrutiny and fixed in 10% formalin for microscopic examination after H - E staining.

RESULT

All of the placenta and umbilical cord were investigated as Table 1. Neither infarction nor calcification was found in placenta but true knot was found in the umbilical cord. The site of true knots were 14.5cm, 17cm, 8cm, 40cm, and 4.8cm in distance from placenta. All umbilical cords had well developed Wharton's jelly. The mean cord diameter was 1.12cm and 2 arteries and 1 vein to be found in all umbilical cords. The incidence of true knot of umbilical cord was 0.089% in 5620 cases of deliveries (5/5620).

COMMENT

True knot can be formed in the umbilical cord (Figure 1 & 2) which is to be distinguished from false knot (Figure 3). The later is either a local dilatation and tortuous umbilical vessels or a focal accumination of Wharton's jelly. The incidence of cord knot were reported by various authors i.e.; Browne (1952)[2] Lundgren and Boice (1939)[3], Hennessy (1944)[4], Corkill (1961)[1], Lucchetti (1965), Mele (1968), Ragucci and Moraudi (1969), Scheffel and Langanke (1970)[5] and Chasnoff and

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Table 1. Summary of 5 Cases

Character \ Cases	1	2	3	4	5
1. Age	26	29	28	29	33
2. C.P.	5.3	3.3	4.2	1.1	4.4
3. gestational age	39wks	38	38	40	42
4. prenatal care	+	–	+	+	+
5. methods of delivery	vagina	vagina	C/S	vagina	vagina
6. baby sex	M	M	F	F	M
7. weight	3880	3410	3150	3400	4110
8. apgar score	7-9	7-9	7-9	7-10	7-10
9. placenta (gm)	650	600	810	810	620
10. excess of amniotic fluid	–	–	–	–	–
11. calcification	–	–	–	–	–
12. type of placenta delivery	s	s	manual	D	s
13. location of the knot (cm) (distance from insertion site of placenta)	14.5	17	8	40	4.8
14. length of cord (cm)	100	50	74	90	80
15. diameter (cm)	1.1	1.2	1.0	1.1	1.2
16. nuchal cording	+	–	–	+	+
17. meconium stain of amniotic fluid	–	–	–	–	–
18. malformation of baby	–	–	–	–	–

Table 2. Reported Incidence of Umbilical Cord of True Knot

Author	Total number of delivery	Number of knots encounted	Incidence
Earn (1951)	5676	3	0.05 %
Diterlizzi & Rossi (1955)	15416	48	0.3 %
Corkill (1961)	12695	5	0.04 %
Rage & Morondi (1969)	8365	84	1 %
Scheffel & Langanke (1970)	61810	115	0.19 %
Chasnoff & Fletcher (1977)	2000	7	0.35 %
Roan & Hsu (1982)	5620	5	0.089%

Fletcher (1977)[6]. The incidence varied quite widely from 0.04 per cent to 1.0 per cent. Our series shows 0.089% (Table 2). The indidence is notably high in monoamniotic twin and it is thought that a long cord and an excess of amniotic fluid and overvigorous fetal movements all predispose to knot formation.

In 1875, Chantreuil postulated that true knots were formed between the ninth

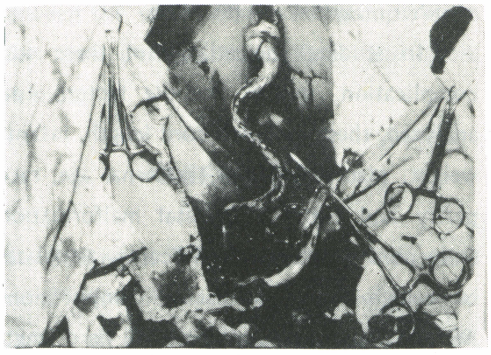

圖1　眞性臍帶打結之臨床分娩例

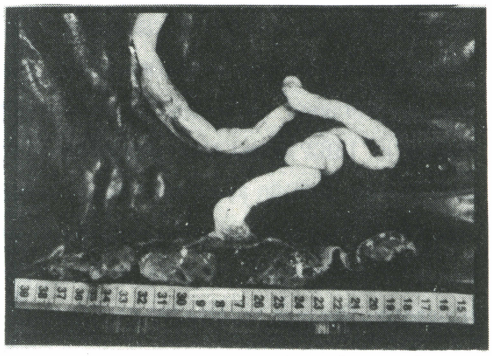

圖2　臍帶假性結係臍靜脈扭曲而成

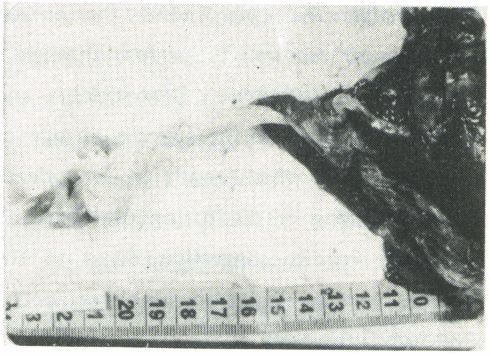

圖3　臍帶眞性打結

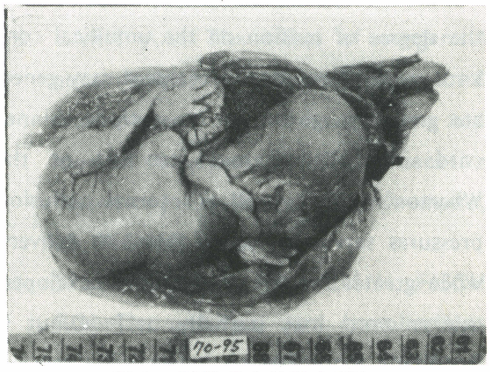

圖4　臍帶環套於胎兒頸部

and twelfth week of gestation, because at that time the fetus was much active and there was a relatively large amount of amniotic fluid. The frequency of knot in aborted fetus is 0.9% which indicates that they are formed early in pregnancy. We agree with this view-point based on a case of nuchal coil (Figure 4). If there was over-vigorous fetal movement, true knot of umbilical cord would develope. Some authers had said that the knots are formed during labor. Hyrtl presumed that the time of the formation of knot could be determined by the site of the knot on the cord. The closer the knot to fetus, the earlier it was formed. Browne 1952[2] had pointed out that recently formed knots of this type can be distinguished from longstanding knots on the following grounds:

1. In an old knot there is marked and permanent grooving of the cord at the site of the knot.
2. At the site of a longstanding knot there is a loss of Wharton's jelly and a constriction of the umbilical vessels.
3. When an old knot is undone there is persistent curling of cord at the site of the knot.

A knot formed during early labor will not usually, although possible be responsible for intrapartum death, cause fetal distress or neonatal asphyxia. Examination of such knot will show edema, congestion or thrombosis. In the absence of these change it would not be justifiable to attribute any functional significance to a knot.

Dr. Chasnoff and Fletcher[6] reported that a loose knot did not affect the venous

perfusion pressure as a tightened knot. The smaller the cord radius the greater the pressure required to perfuse through a specific obstruction. Benirschke and Driscoll[7] described the specific change of umbilical knot which result in fetal death show flattening or dissipation of Wharton's jelly and venous congestion distal to the knot as well as partial or completely occlusive vascular thrombi.

In utero, the fetal movement determines the degree of tension on the umbilical cord knot while these fetal movement may generate great enough tension to occlude thinner cord. The myxomatous structure of the Wharton's jelly as well as internal perfusion pressures serves to loosen knot. At delivery when greater tension on the cord developes, thicker cord may partially occlude but is less likely to remain occluded unless tension persists during descent of the baby particularly with nuchal cord or large infant in breech presentation. The significance of a true knot in the umbilical cord is controversial but only occassionally does knot seem tight enough to result in death of the fetus, fetal distress or neonatal asphyxia due to restricted fetal placenta blood flow. The reported mortality rate in infants with one or more umbilical knot ranges from 4 to 40% depending on the criteria used to determine whether or not is cause by cord occlusion. For example, in a 1965 perinatal mortality reported by Hatch and Schoenick[8], there were 46 deaths attributed to umbilical knot but 31 of these cases were complicated by significant high risk factor such as toxemia preeclamisa & prematurity. Fortunately, in our cases, the babies were all clinically normal due mostly to their long umbilical cord, loose knots and lack of other maternal complication.

In studing the etilogy of these cord complication, several possible factors were analyzed, these included cord length, infant's weight, placenta weight, maternal age, race, parity and other congenital malformation. Only cord length was significantly associated to a high degree with cord complications. In this study the total umbilical cord length were measured. It was found that there seems to be increased rate of occurrence for all of cord complication with increasing cord length. In regard to umbilical cord length, Napier in 1882 found that cords vary from 5 to 170cm with an average length of approxinately 50cm. The average length of the cords collected in our hospital is 50 ± 15cm in length. There is reportedly no correlation of cord length with maternal age, parity or infant size. After 28 weeks of gestation, the cord does not appear to lengthen significantly, but males reportedly have slightly longer cords than females. In regard to placenta, weight was not related to true knot. But more cord complication was found among Negroes than among Caucasians. No relationship was found to exist between cord complication and maternal age, parity and fetal congenital malformation. They presumably did not serve as etiologic factor. A study of the one-minute Apgar scores showed significantly low scores with all of the cord complications in any birth weight. Hon has postulated that a slow neonatal heart rate is produced by a vagotonic and not by true anoxia damage, perhaps the tighter coils produce more vagal stimulation. In studying the 5-minute Apgar score, it was apparent that there was no difference

between the scores of the two groups; those with true umbilical cord knot and those without.

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臍帶眞性打結－五例病例報告

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摘　要

臍帶乃爲懷孕期間胎兒由胎盤自母體吸取營養、氣體交換，排洩的主要通道。因此有人稱它爲胎生時期的「生命線」。由於臍帶受到物理性壓迫或打結常會造成胎兒血液循環障礙引起胎兒窘迫或死亡。臍帶打結在臨床上可區分是假性結和眞性結。假性結乃由於臍動脉比臍靜脉長很多，環繞臍靜脉多層次而形成，又有人稱它爲「臍帶血管曲張」。而眞性打結則爲胎兒浮遊在羊水中，因具有比較長的臍帶時，伴有臍帶的環繞，偶而在胎兒激烈運動時形成。若在分娩過程或臍帶拉力太大時使原本鬆疏的結打緊，致使血流循環障礙即會使胎兒窘迫甚或死亡。作者等由5620生產例中收集了5例臍帶眞性打結病例，其發生率約爲0.089％，討論其相關條件並以早期流產之胎兒之臍帶環繞標本來探討發生臍帶眞性打結的可能原因。

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