

Nature of the Umbilical Cord Knots and Their Effects on the Birth Weight Outcome, in Sudanese Neonates

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ABSTRACT

Objectives: The study was aimed to assess a potential relationship between the umbilical cord knots and the birth weight outcome, in Sudanese neonates.

Materials and Methods: 980 umbilical cords of full term and normal vaginal delivery were studied, with their neonatal weight. The study includes; knot type, number, nature, coil direction and site through cord length, using visual observation. Some knots specimens were fully dissected using natural dissection tools and methods. Data were analyzed by Statistical Package for Social Science version 16 (SPSS).

Results: the study shows that, true knot more in male, and associated with the advanced maternal age, multiparity, cord length and male fetus. The incidence of the false knots in male and female was about the same. A significant correlation was found between the low birth weight and true knot P-V 0.001, and not with the false knot P-V 0.127. True knots were more common in a fetal end of the cord, and coiled to the left side (anticlockwise direction), which is in accordance with general cord coils direction. The Wharton's jelly was found to increase in amount at the knots site in comparison to the rest of cord, making a protective mechanism function around the cord vessels. The dissected knots specimens showed a central vein surrounded by long tortuous arteries, and when cut transversely showed multiple vessels, mainly arteries.

Conclusion: It is concluded that the tight true knot reduces the blood flow within cord vessels, in which birth weight also reduces. Of all cord knots type, the true one is the most serious than false.

Recommendation: the umbilical cord should be fully scanned from end to end during the pregnancy ultrasound, to check for knot type. Any baby born with tight knot should be fully examined, because tight knot reduces baby blood flow or decreases heart rate of the fetus, moreover the baby may be born with low birth weight.

Key words: Sudanese, umbilical knots nature, and birth weight outcome

INTRODUCTION

Umbilical cord abnormalities can be studied antenatally by ultrasound or postnatally by direct cord examination. Cord

abnormalities are varying; some of them can be a source of harm to the developing fetus before and after the delivery, the variations exist in many factors such as the time, type

of abnormality and degree of compression are important. ^(1,2) One of the most common umbilical cord abnormalities which may compress and obstruct blood flow and oxygen from the fetus is the umbilical cord knots. The most obvious unwanted effect of umbilical cord compression is stillbirth. Studying the umbilical cord knots pre and postnatal is important; their incidence may effects fetal growth and outcome. About one percent of babies are born with one or more knots in the umbilical cord. ^(1,2)

The true knots of the umbilical cord are more likely to develop in early pregnancy, when relatively more amniotic fluid is present and greater fetal movement occurs, and most of them are formed during birth when cord is pulled through a loop; and associated and cord length. ^(3,4) The true knots are occurs in 1% to 2% of birth with the highest rate occurring in monoamniotic twins. ⁽⁴⁾ As long as the true knot remains loose, it generally does not harm the baby, but sometimes it can be pulled tight to compress completely or blocks the cord vessels cutting off the baby's oxygen supply and increases the risk of fetal loss, ⁽⁵⁻⁷⁾ During deliver, a tightening knot can cause the baby to have heart rate abnormalities that are detected by fetal monitoring. ^(1, 7, 8) Knot complexity depends on the amount of torsion created at the base of the loop; one torsion creates a single knot, two torsions create double knots, and three or more torsions create complex knots. ⁽⁵⁻⁸⁾ In fact, fetuses with true umbilical knots are at a four-fold increased risk of intrauterine death. ^(9,10) The chance of having a fetus deliver with a true knot of the umbilical cord is on the average 1% to 2% and the chance of fetal demise secondary to a knot blockage is 5% to 10%, and is. It has been reported that true knots are associated with advanced maternal age, obesity, male fetus and long cord. ⁽⁶⁾

A false cord knot also occurs due to kinks in the umbilical cord vessels, specially the arteries, or due to local dilatation vessels, same time due to focal accumulation of Wharton's jelly. ^(2,5) It's

thought to arise as a result from the increased length of the umbilical vein in comparison to the umbilical arteries, and have no known clinical significance. ^(2,5) This study is aim to correlate potential relationship, between the nature of the umbilical cord knots, and the birth weight outcome, in Sudanese neonates.

MATERIALS AND METHODS

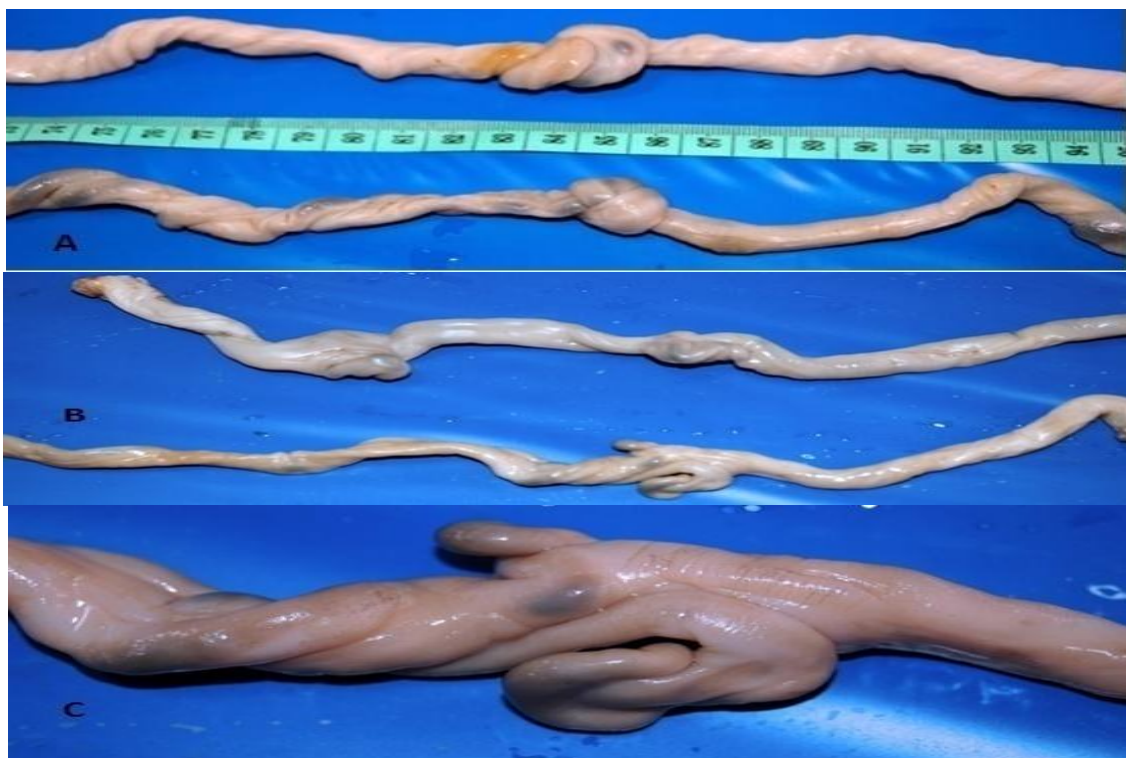
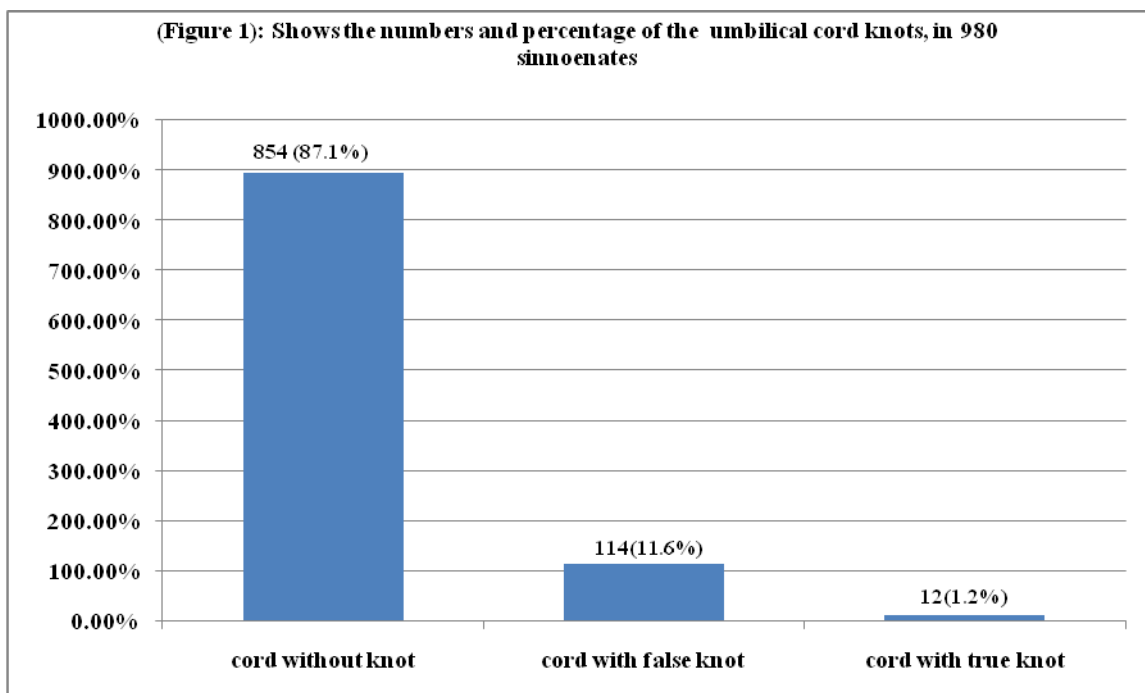
The study was conducted in 2015, in the department of Obstetrics and Gynecology, Omdurman Maternity Hospital, Sudan; it's a main reference Maternity Hospital in Sudan, with a high incidence rate of deliveries. The including criteria; full term neonates of both sexes, of normal vaginal delivery, excluding criteria; still birth, caesarean section, abnormal vaginal deliveries, and look unhealthy neonates. 980 umbilical cords of both sexes were full examined immediately after birth, using visual observation. The study includes; knot type, number, nature, coil direction and their location through the cord length. Some false knots were dissected longitudinally and while others were cut transversely, using anatomical dissection tools and method, their vessels were delivered from surrounding tissues and full studied. Then the neonatal weight was measured using Siltec electronic baby weighing scale BS1. Data were entered to computer software programs and analyzed using Statistical Package for Social Science version 16 (SPSS, V16. Armonk, NY: IBM Corp, USA). Percentage, mean, standard deviation and correlation are taken to identify the association between variables, and confidence interval of a P-value equal 0.05 or less as consider statistically significant

RESULTS

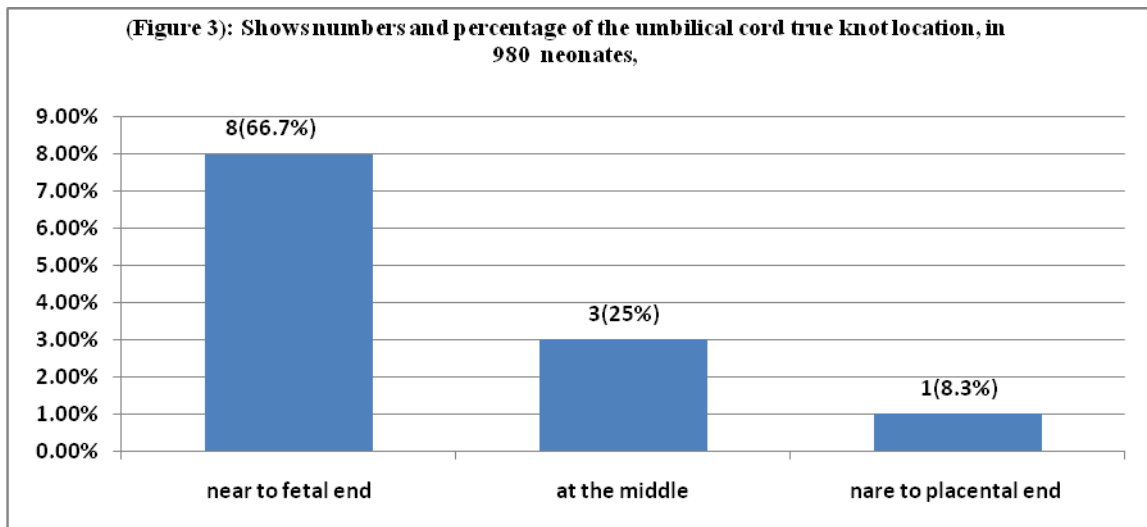
126 (12.9%) umbilical cord specimens shows knot, of them 114(11.6%) were false and 12(1.2%) were true, (Fig. 1 and 2, A, B, C). Concerning the distributions of the true knots through the cord length; 8 (66.7%) are found near to the

fetal end, 3 (25%) are found at middle and 1(8.3%) at near the placental end of the cord (Fig.3), all are appears as single knot, (Fig.1, a). Out of the true knots 8(66.7%) are coiled to left (anticlockwise direction) and 4(33.3%) are coiled to right (clockwise direction), (Fig.4 and 5), the left to right coiling direction ratio was approximately

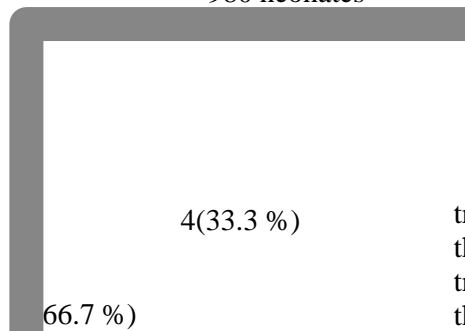
2:1. The false knots was found vary in size, numbers, location and shape, and when dissected longitudinally showed central vein surrounded by tortuous arteries (Fig. 6, A), and when cute transversally showed multiple blood vessels mainly arteries, (Fig. 6, B).



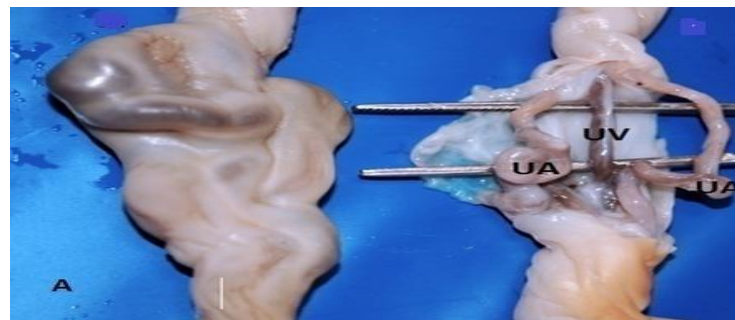
(Figure 2): shows types of umbilical cord knots. A. true knot, B. false knot and C. bilateral false knots



(Figure 4): Shows the numbers and percentage of the umbilical cord true knot coiling direction in 980 neonates



(Figure 5): shows the umbilical cord true knot coil direction. A. true knot coiled to left and B. true knot coiled to right. (PE= placental end of the umbilical cord, FE= fetal end of the umbilical cord)



(Figure 6): shows the umbilical cord false knot. Before and after the longitudinal dissection. B. and C. transverse section. (UA= umbilical artery, UV= umbilical vein and W= Wharton jelly).

DISCUSSION

Incidence of the umbilical cord knots is not only very low, often they are diagnosing antenatal or postnatal, but postnatal detection is more common than antenatal one. When the true knot remains tight, it may impede the circulation of the fetus and may result in fetal death in utero especially during labor. In the majority of the cases, true knots of the umbilical cord occur without any clinical significance, however in some rare cases, an association between umbilical cord true knots and intrauterine fetal death was found. A numbers of factors have been described by Hershkovitz *et al.* in (2001) ⁽¹⁰⁾ and Ikechebelu in (2014); ⁽⁷⁾ the increase the incidence of umbilical cord true knot due to advanced maternal age, multiparty, male fetus and cord length, similar results were found in this work also. The present study found that incidence of the true knot more in male than female and associated with the cord length, because the measurement of the cord length in the baby which born with knotted cord were found more than 60cm long, and their mother age was found over 30 years old and delivered more than 6 babies, his in according with the results of Hershkovitz and Ikechebelu. ^(7,10) A multiparty increase uterine room beside cord length, these allow the fetus to move free within the uterus, and knot well created. The incidence of the false knots in male and female was about the same in this study. Furthermore the present study found significant correlation between the true knot and low birth weight P-V 0.001, most babies which were born with true knotted cord weighing less than 2000kg. This enhances the results of Ramony, *et al.* in (2006), who reported similar observation in his study. If the true knot remains very tight it will eventually cause collapse of the cord vessels, which reduce the blood flow to the baby and fetal weight gain will reduce also. Majority of the umbilical knots in this study showed great thickness amount of Wharton's jelly, an increasing amount of the Wharton's jelly substance at the site of knot

in the cord segment, make a cushion like mechanism protective function around the cord vessels to preventing the against occlusion. Therefore, the Wharton's jelly which surrounds the fetal blood vessels has potential of withstanding significant tensional and compression force. Occasionally, adequate Wharton's jelly may not develop in all segments of the cord, if this occurs, the fetal vessels are no longer protected from tensional force and they are prone to occlusion if twisted leading to fetal demise in uterus.

Sornesi in (2000) ⁽¹¹⁾ described that, true knot can occur anywhere through cord length. Furthermore the present study found that the most of the true knots were occur near to the fetal end of the umbilical cord, because the fetal end move free with fetal movements while the placental of the cord is not. Moreover most true knots were found coiled to the left side (anticlockwise direction); this is according with general cord coiling direction, which is commonly to the left. This could explain why the fetus rotates commonly on the left side within the uterus, thus the normal cord coils and even the true knot also were found to left site. The direction of the cord knot true could be related to fetus mobility within the uterus, these phenomena in according with pregnancy examination of the fetal back position is commonly found located on the left side within the uterus.

Hertzberg *et al* in (1988) ⁽¹²⁾ and, Ramon et al in (2006), ⁽⁵⁾ studied cord knots, they reported that the false cord knots were occurring due to increased length of the umbilical vein in comparison to the arteries. The dissected knots specimens in the present study showed long tortuous arteries with central straight vein. The finding in this study is disagreeing with the results of Hertzberg et al in (1988) ⁽¹²⁾ and, Ramon et al in (2006). ⁽⁵⁾ The results of this study showed that the false knots are occurring due to increased length of the umbilical arteries not a vein, because normally the arteries longer than the vein and running in spiral way around the vein within the cord,

but when the tortuosity of the arteries increases more than ever within cord segment, the false knot are created, thus the false knot occurring due to increase the tortuosity of the arteries not a vein. Any tortuosity of the umbilical vein within cord segment decrease blood flow, and increase fetal risk factors during the pregnancy. False knot is not shows any clinical significance, as reported by Hertzberg *et al* in (1988) ⁽¹²⁾ and, Ramon *et al* in (2006). ⁽⁵⁾ Also in this study did not found any correlation between the false knot and the fetal weight P-V 0.127. It's concluded that the tight true knot reduces the blood flow within cord vessels, in which birth weight also reduce, off all cord knots type, the true one is remains the most serious than false. Our recommendation that the umbilical cord should full scanned form end to end during the pregnancy ultrasound, to check for knots and their type, and when a baby born with tight knot should be full examine, because tight knot reduce baby blood flow or may decrease heart rate of the fetus, moreover the baby may born with low birth weight

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