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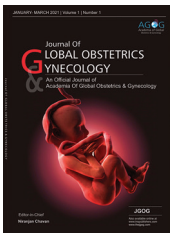
Case Series



Entangled yet Survived: Evaluating Perinatal Outcomes in Near-Miss Cases of True Knot in the Umbilical Cord

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ABSTRACT

Aim: This study aims to preview the perinatal outcome in cases with a true knot in the umbilical cord. **Background:** True umbilical cord knots, formed early in gestation, can compromise fetal circulation and increase stillbirth risk, especially if tight. In contrast, false knots are benign vessel redundancies without clinical significance. Prenatal diagnosis of true knots remains difficult. **Clinical Significance:** True umbilical cord knots, though rare, carry a significant risk of fetal hypoxia, growth restriction, and intrauterine fetal demise, particularly when the knot tightens. Early recognition in high-risk pregnancies can improve outcomes through closer surveillance and timely delivery. False knots, in contrast, are incidental findings with no clinical implications and require no intervention.

Key words: Assisted reproduction, Caesarean section, Fetal distress, Fetal hypoxia, Intrauterine fetal demise (IUFD), Meconium-stained amniotic fluid, Neonatal acid–base status, Prenatal diagnosis, Perinatal outcome, True umbilical cord knot, Umbilical cord abnormalities

INTRODUCTION

The umbilical cord begins to form around the 3rd week of gestation from the connecting stalk, which merges with the omphalomesenteric (vitelline) duct. By approximately the 7th week, it is typically fully developed. Structurally, the umbilical cord consists of two umbilical arteries, one umbilical vein, the vitelline duct, and a gelatinous connective tissue known as Wharton's jelly, all enclosed by the amniotic membrane. Its primary function is to facilitate blood exchange between the fetus and the placenta. The umbilical arteries transport deoxygenated blood from the fetus to the placenta, whereas the umbilical vein returns oxygenated blood to the fetus.

Cord elongation occurs throughout the second trimester. On average, the umbilical cord measures 40–50 cm in length and about 2 cm in diameter, typically forming around 40 helical coils.[1]

Umbilical cord abnormalities may involve variations in structure, insertion into the placenta, vessel number, blood flow, and the presence of cystic or solid masses. In utero distortions include cord knots, torsion, nuchal cord loops, and entanglement – especially in monoamniotic twin pregnancies. A true knot forms when the cord loops and tightens on itself, whereas false knots are benign kinks without clinical significance. Loose knots are not fully tightened and are generally less concerning than true knots, which often develop between 9 and 12 weeks of gestation, though some may form during labor.[2,3]

True knots occur in approximately 0.3–2% of pregnancies and are more frequently associated with conditions such as polyhydramnios, smaller fetal size, gestational diabetes, and male fetuses.[4,5] These knots may reduce blood flow through the cord, increasing the risk of fetal hypoxia and even intrauterine death.[6] While ultrasound can detect cord knots, they may be overlooked, which poses a significant risk to fetal well-being.[2,7] Management depends on the degree of knot tightening and close monitoring of fetal heart rate. Evidence of fetal distress or hypoxia generally necessitates prompt delivery through cesarean section.[8,9]

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CASE SUMMARIES

Case 1

A 32-year-old gravida 4, para 3, living 1, with a history of one intrauterine fetal demise and one previous normal vaginal delivery, presented at 36 weeks of gestation with a known case of autoimmune hemolytic anemia. Labor was induced; however, due to failure of induction, the patient underwent emergency lower segment cesarean section (LSCS).

Intraoperatively, a true umbilical cord knot [Figure 1] was identified along with meconium-stained amniotic fluid. The neonate cried immediately at birth, and no clinical signs of perinatal asphyxia were observed. Arterial blood gas (ABG) analysis revealed a pH of 7.28, pCO_2 of 42 mmHg, pO_2 of 28 mmHg, and base excess of −3.2 mmoL/L, consistent with normal neonatal acid-base status.

Case 2

A 24-year-old primigravida at 38 weeks of gestation presented in spontaneous labor with non-reassuring fetal heart rate patterns. An emergency LSCS was performed for suspected acute fetal distress.

A true knot of the umbilical cord [Figure 2] was noted intraoperatively. The neonate required initial resuscitation. ABG analysis showed a pH of 7.15, pCO_2 of 55 mmHg, pO_2 of 19 mmHg, and a base excess of −8.5 mmoL/L, suggestive of mild hypoxia with compensated metabolic acidosis. The neonate stabilized post-resuscitation and was monitored in the neonatal care unit.

Case 3

A 29-year-old primigravida with a 33.6-week dichorionic diamniotic twin pregnancy, conceived through *in vitro* fertilization (IVF), was admitted for elective LSCS due to prematurity and assisted reproduction.

Intraoperatively, both sacs had meconium-stained amniotic fluid. One twin was found to have a true umbilical cord knot [Figure 3]. ABG values for this neonate were pH 7.30, pCO_2 40 mmHg, pO_2 30 mmHg, and base excess −2.0 mmoL/L, indicating normal acid-base balance. The baby required resuscitation, attributed to gestational immaturity rather than cord compromise. The co-twin had similar ABG parameters and did not require resuscitation. Both neonates were transferred to the neonatal intensive care unit for supportive management.

DISCUSSION

True umbilical cord knots represent a relatively rare obstetric entity, occurring in approximately 0.3–2% of all pregnancies.[4,5] Although often clinically silent, they possess the potential for significant perinatal morbidity and mortality if the knot tightens, particularly in late gestation or during labor.[6] The pathophysiology primarily revolves around mechanical constriction of the umbilical vessels, which compromises fetoplacental circulation, leading to intermittent or sustained fetal hypoxia, growth restriction, and, in severe cases, intrauterine fetal demise.[6,9]

The formation of true knots is believed to occur between 9 and 12 weeks of gestation, facilitated by increased fetal mobility and excess amniotic fluid volume.[2,4] Risk factors associated with true knots include long umbilical cords, polyhydramnios, male fetuses, small for gestational age infants, grand multiparity, and assisted reproductive techniques such as IVF.[5,8] Our case series reinforces these associations, with one case involving a twin IVF pregnancy and another involving a grand multiparous woman with a previous IUFD.

Prenatal diagnosis of true knots remains challenging. Although advanced Doppler sonography and three-dimensional

Figure 1: True umbilical knot noted along with meconium-stained liquor

Figure 2: True umbilical knot

Figure 3: True umbilical knot noted along with meconium-stained liquor

ultrasonography may suggest the presence of a cord knot – through signs such as the "cloverleaf" or "hanging noose" sign – these are often non-specific and highly operator-dependent.[2,7] Consequently, most true knots are detected incidentally at the time of delivery, as was the case in our series.

In our study, all three cases of true knots were associated with meconium-stained amniotic fluid, which may reflect intermittent episodes of fetal distress or hypoxia. However, none of the neonates exhibited severe metabolic acidosis or required advanced neonatal resuscitation beyond initial supportive care, indicating successful outcomes with timely intervention. The ABG findings, although variable, showed no profound acid-base disturbances, with pH values ranging from 7.15 to 7.30 and base excess values between −8.5 and −2.0 mmoL/L.

Our findings corroborate earlier literature suggesting that not all true knots lead to adverse outcomes, particularly when detected intraoperatively during elective or emergency cesarean section.[9] Prompt recognition and intervention, especially in the presence of abnormal cardiotocographic findings, meconium-stained liquor, or high-risk antenatal profiles, can significantly mitigate the risks posed by true knots.[8]

Despite favorable outcomes in our cases, the unpredictable nature of true knots and the lack of reliable prenatal diagnostic tools highlight a critical need for vigilance in monitoring high-risk pregnancies. Enhanced fetal surveillance in the third trimester, especially through non-stress tests and biophysical profiling, may aid in the early identification of fetal compromise, thereby guiding timely delivery decisions.[3,8]

Furthermore, the case involving a preterm IVF twin pregnancy emphasizes that prematurity itself can compound perinatal risk independent of cord pathology. This distinction is vital when counseling patients and planning delivery.

CONCLUSION

This study highlights the clinical significance of true umbilical cord knots as rare but potentially hazardous obstetric complications. Despite their relatively low incidence (0.3–2%), true knots can lead to significant fetal distress, hypoxia, and intrauterine fetal demise if not promptly managed.[6] Our cases demonstrate that timely diagnosis and intervention can lead to favorable perinatal outcomes, even in high-risk scenarios such as meconium-stained liquor, fetal distress, and prematurity.

The outcomes of the cases reviewed – despite the presence of true knots in the umbilical cord – suggest that early recognition, close monitoring, and appropriate resuscitation strategies can mitigate the risks associated with cord knots. In Case 1, despite the true knot and meconium-stained amniotic fluid, the neonate had no signs of hypoxia, which highlights the potential for favorable outcomes even in the presence of a true knot. Case 2 illustrates that when a true knot causes fetal distress, immediate resuscitation and timely delivery can restore normal acid-base balance, though mild hypoxia may still be observed initially. Finally, Case 3, involving twin pregnancies, reinforces that even with true knots present in one of the twins, appropriate management of both neonates leads to positive outcomes, particularly when prematurity is the primary concern.

The findings from this study underscore the importance of continuous fetal monitoring in pregnancies complicated by true umbilical cord knots. Early diagnosis through imaging, such as ultrasound, and vigilance during labor can help guide management decisions, minimizing the risk of intrauterine fetal demise and improving perinatal survival.[7,8]

Given the relatively low incidence of true knots, further large-scale studies are needed to refine management protocols and enhance predictive capabilities for high-risk pregnancies.[6,9] This could potentially reduce the incidence of adverse perinatal outcomes and improve neonatal survival rates in cases with cord knots.

REFERENCES

1. Clapp JF 3rd, Stepanchak W, Hashimoto K, Ehrenberg H, Lopez B. The natural history of true knots of the umbilical cord. Am J Obstet Gynecol 2003;189:740-4.
2. Hadi HA, Thakor AS. Umbilical cord abnormalities: Prenatal diagnosis and management. Obstet Gynecol Surv 2009;64:445-56.
3. American College of Obstetricians and Gynecologists. ACOG practice bulletin No. 106: Intrapartum fetal heart rate monitoring: Nomenclature, interpretation, and general management principles. Obstet Gynecol 2009;114:192-202.
4. Hershkovitz R, Silberstein T, Sheiner E, Shoham-Vardi I, Holcberg G, Katz M, *et al*. Risk factors associated with true knots of the umbilical cord. Eur J Obstet Gynecol Reprod Biol 2001;98:36-9.
5. Airas U, Heinonen S. Clinical significance of true umbilical knots: A population-based analysis. Am J Perinatol 2002;19:127-32.
6. Collins JH. Umbilical cord accidents: Human studies. Semin Perinatol 2002;26:79-82.
7. Sepulveda W, Shennan AH, Bower S, Nicolaides P, Fisk NM. True knot of the umbilical cord: A difficult prenatal ultrasonographic diagnosis. Ultrasound Obstet Gynecol 1995;5:106-8.
8. Kampan N, Jarusriwanna A, Wanitpongpan P. Umbilical cord abnormalities and associated perinatal outcomes. J Med Assoc Thai 2015;98:327-32.
9. Schaefer BC, Giampietro PF. Prenatal sonographic diagnosis of a true umbilical cord knot. J Ultrasound Med 1992;11:299-301.

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