

True Knot of the Umbilical Cord in Low- and Middle-Income Countries: Incidence, Risk Factors, and Clinical Outcomes from a Two-Case Series

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Abstract

Background: True knot of the umbilical cord (TKUC) is a relatively rare obstetric occurrence with potential for fatal outcomes. While the exact etiology remains unclear, specific maternal and fetal risk factors are significantly linked to adverse perinatal outcomes.

Methods: We evaluated the total number of cases of true knot of the umbilical cord presenting at a reference center over a one-year period in Ibadan, Nigeria.

Results: Two cases of TKUC were incidentally diagnosed out of 108 deliveries, yielding an incidence of 1.85%. Neither case exhibited prenatal ultrasound findings suggestive of the condition. Identified risk factors included multiparity, previous uterine surgeries, and multiple gestations. Both cases were managed with elective surgical delivery resulting in favorable neonatal outcomes without mortality or neurological sequelae.

Conclusion: True knot of the umbilical cord remains an unpredictable obstetric event. Every clinician involved in peripartum care must maintain a high index of suspicion to ensure timely diagnosis and mitigate potential perinatal morbidity and mortality.

Keywords: caesarean section; foetal distress; intrauterine foetal death; umbilical cord; true knot

1 Introduction

True knot of the umbilical cord (TKUC) is a rare obstetric event associated with potential adverse perinatal outcomes. Reported incidence rates range from 0.04% to 3.0%, with the condition carrying up to a four-fold increase in the risk of intrauterine fetal death [1, 2]. Other hypothesized complications include intrauterine growth restriction (IUGR) and severe fetal hypoxia [3, 4]. The likelihood of secondary neurological deficits in surviving neonates remains a subject of ongoing debate and is primarily dependent on the degree of tightness and vascular constriction resulting from the knot [4].

The incidence of true knot of the umbilical cord is notably higher in association with specific clinical parameters, including multiple gestations, long umbilical cords, polyhydramnios, advanced maternal age, male fetal sex, and maternal smoking [5]. Although true knots are uncommon, they can precipitate sudden fetal compromise, requiring prompt recognition and optimized peripartum management to avert catastrophic outcomes. Currently, there is a paucity of clinical data regarding the presentation and management of this entity in low- and middle-income countries (LMICs) such as Nigeria [2, 4]. In this article, we report two cases of TKUC, document its hospital-based incidence, and discuss its clinical implications in resource-limited peripartum care.

2 Research elaborations

2.1 Case 1

AB, a 33-year-old booked gravida 5, para 4+0 (5 alive), presented for routine antenatal care with a desired spontaneous conception first booked at approximately 20 weeks of gestation. Her obstetric history was significant for three previous lower segment caesarean sections, a prior twin delivery at term, and an inter-pregnancy interval of one year. Baseline booking parameters were within normal limits. Past medical history was unremarkable, with no known chronic medical conditions or febrile illnesses during pregnancy. She maintained regular compliance with daily routine hematinics, intermittent preventive treatment for malaria, and tetanus toxoid immunization.

At 36 weeks of gestation, she developed elevated blood pressure (140/90 mmHg) with a trace of proteinuria on urinalysis, for which antihypertensive therapy was initiated. Routine serial obstetric ultrasound examinations and fetomaternal monitoring remained reassuring throughout pregnancy. An elective caesarean section was performed on account of her prior three uterine scars. Intraoperative findings revealed pelvic adhesions, normal volume clear amniotic fluid, and a live female neonate weighing 2.25 kg delivered cephalad with Apgar scores of 9 at 1 minute and 10 at 5 minutes. Notably, a loose true knot of the umbilical cord was observed postpartum (Figure 1). Postoperative and neonatal courses were uneventful; the neonate tolerated early breastfeeding within the first hour of life, maintained stable vital signs, and was discharged home in good condition. Serial follow-up up to six weeks post-partum confirmed normal infant development and maternal recovery.

2.2 Case 2

CA, a 31-year-old booked gravida 8, para 0+7, presented at 6 weeks of gestation following a spontaneous conception. Her history was notable for seven consecutive first-trimester miscarriages and a previous right ectopic pregnancy treated via right salpingo-oophorectomy. She was placed on exogenous progesterone support and managed as a high-risk pregnancy. Her medical history included recurrent urinary tract infections and peptic ulcer disease. Antenatal surveillance, maternal blood pressure, and serial obstetric ultrasonography remained reassuring throughout the gestation.

She was counseled for an elective surgical delivery at term given her recurrent pregnancy loss history and solitary adnexa. Intraoperative findings confirmed the absence of the right adnexa, clear amniotic fluid, and a live female neonate weighing 2.4 kg delivered cephalad with Apgar scores of 9 at 1 minute and 10 at 5 minutes. A loose true knot of the umbilical cord was incidentally identified following delivery. The neonate developed bilateral ophthalmia neonatorum during the early post-natal period, which was successfully treated with topical antibiotics. Both mother and infant were discharged in satisfactory condition and remained well at six-week post-natal evaluation.

3 Results or findings

During the one-year study period, a total of 108 deliveries were conducted at the reference facility in Ibadan, Nigeria. The two documented cases yielded an institutional incidence of 1.85%, which aligns with international literature reported from high-income settings (0.04% to 3.0%) [1, 2]. Neither case demonstrated features suggestive of TKUC on routine antenatal gray-scale ultrasound imaging. Shared maternal and fetal characteristics across both cases included previous pelvic/uterine surgical history, multiparity, and relative low birth weight for gestational age.

4 Discussion

The umbilical cord serves as the essential lifeline for fetal development; consequently, structural or functional cord compromise places the fetus at grave risk of hypoxia and perinatal loss [5]. A normal human umbilical cord averages 55 cm in length and 100 g in weight [6], containing two umbilical arteries, one umbilical vein, and protective Wharton's jelly to prevent compression [7, 8]. A true knot forms when the fetus maneuvers through a loop of cord during early or mid-pregnancy.

The observed incidence of 1.85% in this series indicates that TKUC is not geographically restricted to high-resource environments, but rather may be underreported in sub-Saharan Africa due to limited routine perinatal autopsy and post-delivery cord examination [2, 4]. Documented risk factors for TKUC include polyhydramnios, long cords, male sex, advanced maternal age, and gestational diabetes [3, 9]. In our report, multiparity and previous pelvic surgical procedures were primary co-factors, consistent with findings by Hourì et al. [8] and other investigators [5, 10, 11].

Although both cases had favorable outcomes without fetal distress or perinatal mortality, true knots remain associated with intrauterine growth restriction, fetal vascular thrombosis, and sudden intrauterine death [8, 13, 14]. The uncomplicated clinical course in these index cases may be attributed to close surveillance under structured antenatal care models, early identification of maternal hypertension, and elective surgical delivery prior to the onset of strenuous labor contractions that could tighten the knot [12].

Antenatal diagnosis of TKUC remains technically challenging. Sonographic markers such as the 'hanging noose' sign or 'cloverleaf' pattern on 3D/4D ultrasound and color Doppler imaging have been described, but routine detection rates remain low [7, 11, 19]. In LMIC settings where advanced Doppler ultrasonography is not universally available for low-risk screens, maintaining a high index of clinical suspicion and rigorous intrapartum monitoring is crucial [17, 18].

5 Conclusion

True knot of the umbilical cord is an unpredictable obstetric occurrence capable of precipitating severe fetal compromise. Although prenatal detection remains challenging, close maternal-fetal monitoring and timely intervention are essential to prevent adverse outcomes. Further multi-center prospective studies in developing countries are warranted to better elucidate risk profiles and standardize intrapartum management algorithms.

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Author Contributions

Demilade Akinbola Omoniyi: Conceptualization, Writing – original draft preparation, Data curation, Editing and formatting. Olukayode Samuel Bello-Zion: Visualization, Clinical investigation, Supervision, Final review.

Oyeyemi Moromoke Afolabi: Editing and Final review.

Conflict of Interest

The authors declare that they have no competing interests.

Ethics Statement

Informed written consent was obtained from the patients for the publication of these clinical case reports and accompanying images. Patient identity and confidential data have been protected in accordance with ethical standards.

Data Availability

Data sharing is not applicable to this article as no extra datasets were generated or analyzed during the current study.

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