The OSCAR PUBLISHING Services
American Journal Of Biomedical Science & Pharmaceutical Innovation

VOLUME Vol.05 Issue08 2025
PAGE NO. 9-12
DOI 10.37547/ajbspi/Volume05Issue08-02

Review of Literature on Epidemiology, Diagnostics, Complications of Umbilical Cord Pathology and Management Tactics

Tojiyeva Nigina Iskandarovna
Assistant, department of Obstetrics and gynecology #1, Samarkand State Medical University, Uzbekistan

Received: 17 June 2025; **Accepted:** 13 July 2025; **Published:** 15 August 2025

Abstract: This review systematizes current knowledge about umbilical cord abnormalities (UCAs) — a heterogeneous group of anomalies including length abnormalities, number of vessels, attachments, nodes, cysts, and vascular malformations. Based on the analysis of scientific literature (2000–2024), the epidemiological data are presented: UCAs occur in 15–35% of pregnancies, with single umbilical artery (SUA) — in 0.5–5%, velmen insertion — up to 50% in monochorionic twins, and true nodes — in 0.3–1.2%. The review details complications: fetal growth restriction (FGR), chronic and acute hypoxia, antenatal death, risks during childbirth (vascular rupture in vasa praevia, asphyxia). Particular attention is paid to early diagnostic methods: ultrasound with Doppler (blood flow assessment, EAP), color Doppler mapping (Velmen attachment), 3D/4D ultrasound in STIC mode (nodes, spatial anomalies), CTG monitoring. Differentiated management tactics are substantiated: from dynamic observation at low risk to planned cesarean section for vasa praevia or IUGR. It is emphasized that timely diagnostics and an individualized approach reduce perinatal mortality and improve outcomes.

Keywords: Umbilical cord abnormalities; Single umbilical artery; Velamentous cord insertion; Vasa previa; True umbilical cord knot; Umbilical cord entanglement; Umbilical cord cysts; Umbilical artery Doppler; Prenatal diagnosis; Pregnancy complications; Perinatal outcomes; 3D/4D ultrasound; Fetal growth restriction (FGR); Pregnancy management; Cord structure pathology.

Introduction: Umbilical cord abnormalities (UCAs) are a heterogeneous group of anomalies that include deviations in length, number of vessels, type of attachment, presence of nodes, cysts and vascular malformations. Despite the fact that many UCAs have no clinical consequences, some types are associated with an increased risk of fetal growth restriction (FGR), hypoxia, birth asphyxia, stillbirth and the need for emergency operative delivery [1, 2].

The prevalence of UCAs in the population varies, reaching significant numbers, which emphasizes the relevance of the problem for perinatology [3, 4]. Modern methods of prenatal diagnostics, primarily ultrasound, play a key role in early detection and determination of pregnancy and childbirth management tactics [5, 6].

The purpose of the review: to systematize modern data on the prevalence, diagnosis, complications and management tactics of pregnant women with various umbilical cord abnormalities.

METHODS

An analysis of scientific literature data published for the period 2000-2024 was conducted using the PubMed, MEDLINE, Scopus, Cochrane Library, and eLibrary databases. Key words: "umbilical cord pathologies", "umbilical cord anomalies", "umbilical cord entanglement", "true cord knot", "velmen insertion of the umbilical cord", "diagnosis of umbilical cord pathologies", "pregnancy complications with umbilical cord anomalies". Systematic reviews, meta-analyses, randomized controlled trials, large cohort studies, and clinical guidelines were selected.

RESULTS

The overall incidence of UCAs, according to ultrasound and pathological studies, ranges from 15% to 35% of all

pregnancies [3, 7]. Cord entanglement around the fetus's neck is the most common anomaly, occurring in 21-34% of term births, with multiple entanglements recorded in 2-8% of cases [1, 8]. Single umbilical artery (SUA) occurs with a frequency of 0.5-1% in singleton pregnancies and up to 5% in multiple pregnancies [2, 9]. In 20-30% of cases, SUA is combined with other congenital fetal anomalies (cardiovascular, genitourinary, gastrointestinal tract, central nervous system) or chromosomal pathologies (trisomy 18, 13) [2, 10, 11]. Velmen (membranous) insertion of the umbilical cord is observed in approximately 1% of singleton pregnancies, but its frequency increases to 15% in multiple pregnancies and up to 50% in monochorionic twins [12, 13].

True umbilical cord knots are less common, occurring in approximately 0.3-1.2% of pregnancies, but their clinical significance is high [14].

Short umbilical cord (<35-40 cm) - 4-6%, long umbilical cord (>70-80 cm) - 5-7% [1, 15]. Umbilical cord cysts (true and false) are detected in 0.4-3.4% of cases [16].

Intrauterine growth retardation (especially with a single umbilical artery without associated anomalies, velmen attachment, thrombosis) is one of the common antenatal complications in umbilical cord pathologies [2, 9, 12]; chronic fetal hypoxia; spontaneous abortions (more often with early detection of SUA or multiple cysts) [16] also occur in various organic pathologies of the umbilical cord. Antenatal fetal death occurs with true knots, thrombosis, severe varicose veins, tight multiple entanglement [14, 17]. Acute fetal hypoxia/asphyxia during labor occurs with tension of a short umbilical cord, tightening of a true knot, tight entanglement, prolapse of the umbilical cord [1, 8, 14]; placental abruption is the most serious complication that occurs with a short umbilical cord or tension with a velmen insertion [12]; rupture of the umbilical vessels with fatal bleeding in the fetus is most typical for a velmen insertion, especially with vasa previa [12, 13]; a prolonged course of the second stage of labor occurs due to a short umbilical cord, which is expressed in the need for an emergency cesarean section [1, 8].

Children born with these pathologies have an increased risk of low scores on the Apgar scale, an increased need for neonatal resuscitation, and they can also develop hypoxic-ischemic encephalopathy and the worst - stillbirth [1, 14, 17]. The risk of perinatal mortality with a true umbilical cord knot increases by 4 times [14].

Modern methods of examination and early detection of umbilical cord pathologies are intended to prevent these complications. Standard 2D ultrasound (II trimester, 18-22 weeks) is the main screening method. It allows diagnosing vascular pathology (assessment of the number of vessels in the cross-section), cysts, attachment anomalies (especially with a thorough examination of the placental disk), length (indirectly by the presence of loops, their number), varicose veins [5, 6, 9]. Color Doppler mapping (CDM) and power Doppler (PD) are new methods, especially in the conditions of Uzbekistan. These methods are critically important for confirming vascular anomalies, diagnosing Velmen attachment (visualization of vessels running in the membranes), assessing blood flow in the umbilical vessels and cysts, differentiating true and false nodes [5, 12, 13]. Doppler ultrasound allows us to study the resistance index, systolic-diastolic ratio and pulsation index in the umbilical artery, which makes it possible to assess the state of fetoplacental blood flow. An increase in resistance indices predicts unfavorable perinatal outcomes [6, 9, 18]. The absence or reverse diastolic blood flow is an indication for emergency delivery.

3D / 4D ultrasound with reconstruction in the STIC (Spatio-Temporal Image Correlation) mode allows us to obtain a detailed image of the umbilical cord in volume, improving the diagnosis of nodes, attachment features and spatial relationships with the fetus [5, 19].

Cardiotocography (CTG) makes it possible to monitor the condition of the fetus in the third trimester and during labor. Allows to identify signs of hypoxia (decelerations, decreased variability), especially if there is a suspicion of entanglement or knot [1, 8], this makes it possible to avoid serious complications and improve birth outcomes.

Prenatal karyotyping/chromosomal microarray analysis (CMAA) is recommended when a single umbilical artery is detected in combination with other ultrasound markers of fetal abnormalities or intrauterine growth retardation to exclude chromosomal pathology [2, 10].

Magnetic resonance imaging (MRI) of the fetus is rarely used, in complex diagnostic cases, for example, to clarify the nature of large cysts or vascular relationships if vasa praevia is suspected with a velmen attachment [20].

The principles of managing patients with umbilical cord pathology include, first of all, clarifying the diagnosis. A thorough ultrasound with color Doppler/ED and Doppler to confirm the type of pathology and assess fetoplacental blood flow [5, 6]. Extended echographic and genetic screening is used when a single umbilical artery or umbilical cord cysts are detected with a mandatory detailed examination of the fetal anatomy (echocardiography, neurosonography, etc.). In the presence of combined markers, a consultation with a geneticist and invasive diagnostics are prescribed [2, 9,

10, 16]. Regular ultrasound monitoring (fetal growth, amniotic fluid volume, Doppler) and CTG allow monitoring the condition of both the fetus and the mother. The frequency is determined by the type of pathology and the presence of complications (IUGR, impaired blood flow). In the case of an uncomplicated single umbilical artery or false nodes - standard monitoring. In case of velmen attachment, true nodes, short umbilical cord, blood flow disorders - enhanced monitoring (weekly or more often in the third trimester) [1, 6, 12]. Treatment of placental insufficiency in case of IUGR and blood flow disorders is carried out in hospital, vascular therapy and hemostasis control are indicated [18].

In most umbilical cord pathologies (entanglement without blood flow disorders, single umbilical artery without intrauterine growth restriction/anomalies), vaginal delivery is possible under careful continuous CTG monitoring [1, 8].

Indications for planned cesarean section (CS): Confirmed velum insertion with risk of vasa praevia (especially with low placenta/presentation) [12, 13]; severe intrauterine growth restriction against the background of umbilical cord pathology with blood flow disorders; some cases of true knots (debatable, individual decision) [14]; short umbilical cord less than 40 cm.

If signs of acute fetal hypoxia appear according to CTG during labor, rupture of vessels (vasa praevia), or prolapse of the umbilical cord, an emergency CS is performed [1, 13].

In case of entanglement or suspicion of a knot, careful management of the second period is necessary (exclusion of pushing "for contractions", episiotomy), and readiness for an emergency CS. In case of a velem attachment, extremely careful opening of the fetal bladder (amniotomy) is contraindicated if vasa praevia is suspected [12, 13]. Discussion. Pathologies of the umbilical cord structure are a frequent finding in obstetric practice. Despite the often benign course of many anomalies (false knots, isolated single umbilical artery without IUGR, loose entanglement), their diagnosis requires increased attention due to the potential risk of serious ante- and intranatal complications. Modern ultrasound methods, especially those using Doppler technologies and 3D/4D reconstruction, are the cornerstone of prenatal diagnostics of umbilical cord pathologies, allowing to identify most significant anomalies in the second trimester [5, 6, 19]. The key aspect of management is a differentiated approach: from standard observation at low risk to intensive monitoring and planned operative delivery at high risk (Velmen insertion, vasa praevia, true nodes with impaired blood flow, severe IUGR against the background of a single umbilical artery) [1, 12, 14]. The importance of early diagnosis of vasa praevia cannot be overestimated, since timely planned CS prevents catastrophic bleeding in the fetus [13]. Further research should be aimed at clarifying the prognostic significance of various Doppler parameters in different pathologies, developing risk stratification algorithms and optimizing the timing of delivery.

CONCLUSION

Pathologies of the umbilical cord structure are a significant perinatal risk factor. Knowledge of their prevalence, pathogenesis of possible complications and mastery of modern diagnostic methods (ultrasound with Doppler, 3D/4D) are mandatory for a practicing obstetrician-gynecologist. Early detection, careful assessment of the fetus (exclusion of combined anomalies, monitoring of growth and blood flow) and an individualized approach to planning the timing and method of delivery can significantly improve perinatal outcomes. Particular attention should be paid to diagnostics and management tactics in case of vasa praevia insertion (risk of vasa praevia) and conditions associated with acute intranatal hypoxia.

REFERENCES

Airas U, Heinonen S. Clinical significance of true umbilical knots: a population-based analysis. Am J Perinatol. 2002;19(3):127-32. doi:10.1055/s-2002-25304.

Chow JS, Benson CB, Doubilet PM. Frequency and nature of structural anomalies in fetuses with single umbilical arteries. J Ultrasound Med. 1998;17(12):765-8. doi:10.7863/jum.1998.17.12.765.

Ebbing C, Kessler J, Moster D, Rasmussen S. Single umbilical artery and risk of congenital malformation: population-based study in Norway. Ultrasound Obstet Gynecol. 2017;49(4):450-455. doi:10.1002/uog.15920.

Derbala Y, Grochal F, Jeanty P. Vasa previa. J Prenat Med. 2007;1(1):2-13.

Ghi T, Youssef A, Pilu G, et al. Sonographic diagnosis of umbilical cord abnormalities: a national survey. Ultrasound Obstet Gynecol. 2019;53(6):806-811. doi:10.1002/uog.20192.

Heifetz SA. Single umbilical artery. A statistical analysis of 237 autopsy cases and review of the literature. Perspect Pediatr Pathol. 1984;8:345-78.

Hasegawa J, Matsuoka R, Ichizuka K, et al. Velamentous cord insertion: significance of prenatal diagnosis. J Ultrasound Med. 2009;28(7):899-903. doi:10.7863/jum.2009.28.7.899.

Lee VR, Darwin C, Goffinet F, et al. Umbilical cord

complications: a review. Am J Obstet Gynecol MFM. 2021;3(6):100431. doi:10.1016/j.ajogmf.2021.100431.

Martínez-Payo C, Caballero P, Ruiz F, et al. [Single umbilical artery: prenatal diagnosis and perinatal implications]. Prog Obstet Ginecol. 2004;47(8):355-362.

Predanic M, Perni SC, Friedman A, et al. Fetal growth assessment and perinatal outcome in pregnancies with an isolated single umbilical artery. Obstet Gynecol. 2005;106(5 Pt 1):1093-7. doi:10.1097/01.AOG.0000182579.41577.0c.

Rembouskos G, Cicero S, Longo D, et al. Single umbilical artery at 11-14 weeks' gestation: relation to chromosomal defects. Ultrasound Obstet Gynecol. 2020;56(6):843-847. doi:10.1002/uog.21968.

Sepulveda W, Rojas I, Robert JA, et al. Prenatal detection of velamentous insertion of the umbilical cord: a prospective color Doppler ultrasound study. Ultrasound Obstet Gynecol. 2003;21(6):564-9. doi:10.1002/uog.132.

Sullivan EA, Javid N, Duncombe G, et al. Vasa previa: diagnosis, management, and the role of ultrasound. Aust N Z J Obstet Gynaecol. 2021;61(3):331-338. doi:10.1111/ajo.13332.

Vora S, Walls M. True knot of the umbilical cord: a difficult prenatal diagnosis. Ultrasound. 2018;26(1):55-61. doi:10.1177/1742271X17724153.

Weissman A, Jakobi P, Bronshtein M, Goldstein I. Sonographic measurements of the umbilical cord in pregnancies complicated by gestational diabetes. J Ultrasound Med. 1995;14(12):907-11. doi:10.7863/jum.1995.14.12.907.

Zangen R, Boldes R, Yaffe H, et al. Umbilical cord cysts in the second and third trimesters: significance and prenatal approach. Ultrasound Obstet Gynecol. 2010;36(3):296-301. doi:10.1002/uog.7606.

Prefumo F, Fichera A, Pagani G, et al. The natural history of umbilical cord cysts: a role for three-dimensional ultrasound? Prenat Diagn. 2016;36(13):1196-1200. doi:10.1002/pd.4961.

Baschat AA, Gembruch U, Harman CR. The sequence of changes in Doppler and biophysical parameters as severe fetal growth restriction worsens. Ultrasound Obstet Gynecol. 2001;18(6):571-7. doi:10.1046/j.0960-7692.2001.00591.x.

Ghi T, Youssef A, Piva M, et al. The use of STIC in the diagnosis of umbilical cord knots. J Matern Fetal Neonatal Med. 2012;25(11):2249-51. doi:10.3109/14767058.2012.684169.

Lau WC, Leung WC, Chin R. Prenatal diagnosis of vasa previa by magnetic resonance imaging. Hong Kong Med J. 2003;9(1):69-71.

Iskandarovna T. N. REVIEW OF THE LITERATURE ON RECENT RESEARCH IN THE FIELD OF OBSTETRICS AND GYNECOLOGY //International Journal of Medical Sciences And Clinical Research. – 2024. – Т. 4. – №. 12. – С. 28-33.

Iskandarovna T. N. CURRENT TRENDS IN GYNECOLOGY //International Journal of Medical Sciences And Clinical Research. – 2024. – Т. 4. – №. 05. – С. 91-96.

Zafarovna B. Z. SEXUAL DYSFUNCTION IN PREGNANCY: PROBLEMS AND SOLUTIONS //International Journal of Medical Sciences And Clinical Research. – 2024. – Т. 4. – №. 10. – С. 30-34.