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Prenatally Diagnosed Velamentous Cord Insertion (VCI) With Planned Cesarean Delivery: A Case Report and Review of the Literature

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Abstract

Velamentous cord insertion (VCI) is a rare placental abnormality where umbilical vessels traverse fetal membranes before connecting to the placenta, increasing the risk of compression and injury. Although velamentous cord insertion can lead to complications like fetal growth restriction and preterm birth, many pregnancies result in favorable outcomes. A case is presented of a 33-year-old primigravida with prenatally diagnosed velamentous cord insertion at 21 weeks' gestation. The patient underwent a planned cesarean delivery at 37 weeks due to her medical history of arrhythmias requiring a cardiac pacemaker. The cesarean was performed under general anesthesia, yielding a 2,160 g male neonate, with postoperative recovery being uneventful for both mother and child. Follow-up at 40 days postpartum showed the patient was in good health. The report underscores the importance of prenatal diagnosis and individualized delivery planning, emphasizing that velamentous cord insertion does not automatically necessitate cesarean delivery; decisions should be based on comprehensive maternal and fetal clinical evaluations.

Categories: Obstetrics/Gynecology
Keywords: cord insertion, vci, velamentous cord insertion, velamentous cord insertion and cesarean delivery, velamentous cord insertion and gestation

Introduction

Velamentous cord insertion (VCI) is an abnormality of umbilical cord attachment in which the umbilical vessels course through the fetal membranes before entering the placental disc. Unlike normal cord insertion, these membranous vessels lack the protection of Wharton's jelly, rendering them more susceptible to mechanical compression and injury. The prevalence of VCI in singleton pregnancies is estimated at 0.9-1.9%, with variation depending on the patient population and the diagnostic approach used. Assisted reproduction has been identified as a factor associated with an increased likelihood of this anomaly [1]. Prenatal ultrasound assessment of the cord insertion site, particularly through the use of color Doppler, facilitates the identification of VCI and allows the multidisciplinary team to perform the timely evaluation of potential obstetric risks [2]. The clinical significance of VCI extends beyond the anatomical peculiarity of the cord insertion, as it has been related to fetal growth restriction, preterm birth, and adverse perinatal outcomes. In a recent retrospective study of 240 pregnancies, preterm birth and fetal growth restriction were recorded more frequently in the VCI group compared to the control group [1]. Similarly, a population-based analysis of 6,675 singleton pregnancies revealed an association between VCI and an increased incidence of primary cesarean section and adverse neonatal outcomes, even after excluding cases involving vasa previa [3]. Furthermore, recent data underscore the importance of ultrasound monitoring for assessing the risk of preterm birth [4]. During labor, VCI has also been linked to a higher frequency of specific pathological fetal heart rate patterns, which may necessitate prompt obstetric intervention [5].

Although VCI is associated with increased obstetric morbidity, the choice of delivery mode remains a matter requiring careful clinical assessment. The presence of VCI does not, in itself, necessitate a cesarean section, expressly in the absence of vasa previa or other obstetric complications. VCI should be distinguished from vasa previa, in which unprotected fetal blood vessels traverse the membranes over or near the internal cervical os and may be injured or rupture during labor or membrane rupture. Moreover, a recent study on pregnancies involving isolated VCI has highlighted the need for further investigation into the optimal frequency of ultrasound monitoring for fetal growth [6]. Thus, planning for delivery requires an individualized evaluation of ultrasound findings, fetal status, and potential complications to promptly

identify cases where delivery via cesarean section is indicated. This report presents the case of a 33-year-old primigravida diagnosed with VCI during routine second-trimester ultrasonography who subsequently underwent a planned cesarean delivery at 37 weeks of gestation. The case highlights the importance of prenatal recognition of abnormal umbilical cord insertion and individualized delivery planning, especially in the presence of maternal comorbidities that may influence obstetric management. The educational value of this case lies in the coexistence of prenatally diagnosed VCI and significant maternal cardiac comorbidity, highlighting the importance of distinguishing the placental finding from other factors considered in delivery planning.

Case Presentation

A 33-year-old primigravida was diagnosed with velamentous cord insertion (VCI) by color Doppler ultrasound during the routine fetal anomaly scan at 21 weeks of gestation (Figure *1*).

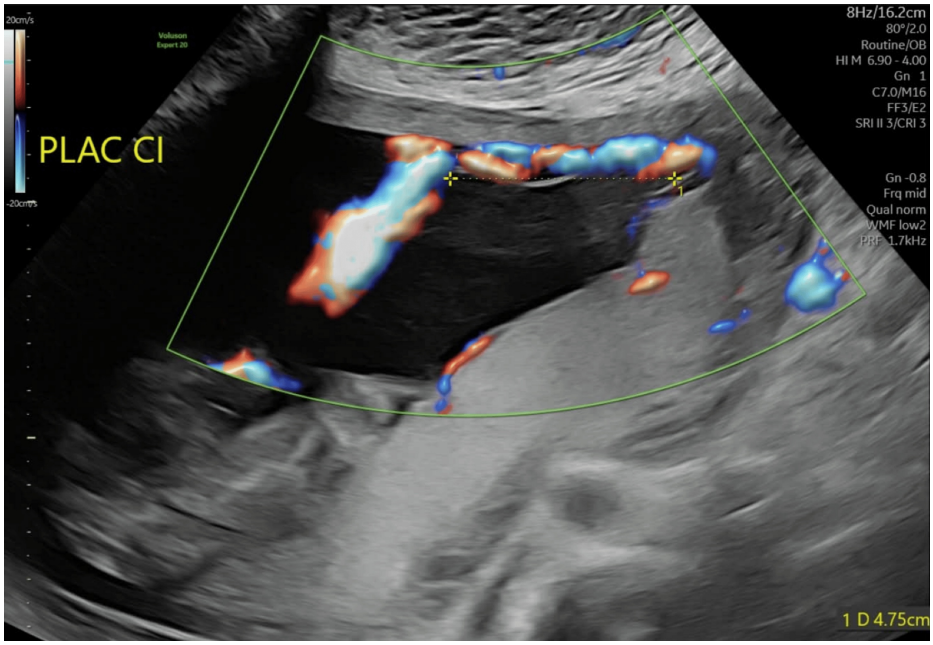


FIGURE 1: Prenatal Ultrasound and Color Doppler of Velamentous Cord Insertion

Anterior velamentous cord insertion originating 4.75 cm from the placental edge at 21 weeks of gestation, with posterior left corpus implantation of the trophoblast. Color Doppler demonstrates an abnormal umbilical vessel pathway, indicated by red and blue signals, extending unprotected through the membranes. PLAC CI: Placenta cord insertion.

At 37 weeks of gestation, she was admitted to the Department of Obstetrics and Gynecology for planned cesarean delivery. On admission, her recorded vital signs included a blood pressure of 125/68 mmHg, a temperature of 36^{O}C, a pulse rate of 80 beats per minute, a respiratory rate of 18 breaths per minute, and an oxygen saturation level of 98%. Her body mass index (BMI) was reported to be normal at 23.5 kg/m^2. Her medical history was notable for serious cardiac arrhythmias and a previously implanted permanent pacemaker. No other relevant medical conditions or drug allergies were reported, and she did not report smoking or alcohol consumption. This was her first pregnancy, conceived naturally without the use of assisted reproductive technology. Gynecological history indicated that menarche started at age 12, with menstrual cycles occurring every 28 days and lasting four days. A prior Pap smear examination yielded a negative result for malignancy. On obstetrical vaginal examination, a 0 cm cervical dilatation was recorded. A non-stress test (NST) performed at admission was reported as reactive, with brief intermittent variable decelerations (Figure *2*).

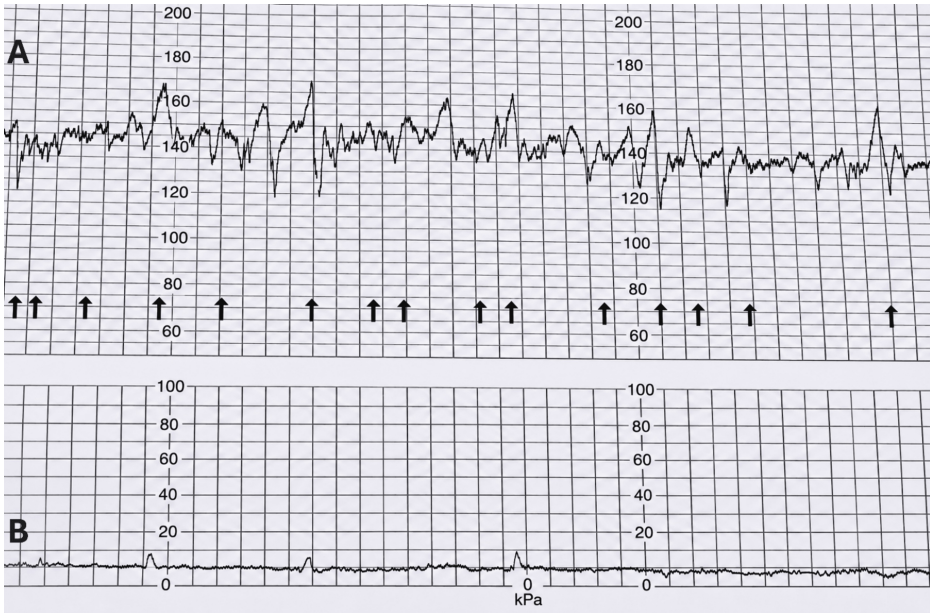


FIGURE 2: Non-Stress Test (NST) Findings

(A) The NST was interpreted as reactive, with a baseline fetal heart rate of approximately 140 beats/min, moderate variability, accelerations, and brief intermittent variable decelerations reaching approximately 115–120 beats/min before spontaneous recovery. (B) Uterine activity was minimal during the recorded interval.

Preoperative laboratory investigations included the following findings: hemoglobin 13.3 g/dL, hematocrit 39.7%, platelet count 194 × 10^3/μL, and white blood cell count 11.24 × 10^3/μL with neutrophils at 70.5%. Coagulation parameters included an international normalized ratio (INR) of 0.98 and activated partial thromboplastin time (aPTT) of 25.4 seconds. Renal and liver functions were also normal, with creatinine at 0.78 mg/dL and urea at 22 mg/dL. Serial laboratory measurements, including a postoperative rise in white blood cell and neutrophil counts and a decline in hemoglobin by day four, are presented in Table *1*.

Parameter	Day 0 (Admission and Operation Day)	Day 1	Day 2	Day 4 (Discharge Day)	40 Day (Postpartum follow-up)	Reference Range
WBC	11.24 k/μL	15.36 k/μL	13.17 k/μL	8.78 k/μL	10.65 k/μL	4-11 k/μL
Neutrophils	70.5 %	86.8 %	87.1 %	72.5 %	68%	40-75%
LYMPH	21.3 %	8.0 %	7.7 %	17.4 %	31%	20-45%
HGB	13.3 g/dl	12.6 g/dl	12.2 g/dl	10.7 g/dl	14 g/dl	11.8-17.8 g/dl
HCT	39.7 %	37%	35.4 %	32.7 %	40.5 %	36-52%
INR	0.98	1.02	N/A	N/A	N/A	0.8-1.2
aPTT	25.4 sec	28.2	N/A	N/A	N/A	26-36 sec
PLT	194 k/μl	182 k/μl	155 k/μl	208 k/μl	310 k/μl	140-450 k/μl
GLC	77 mg/dl	96 mg/dl	N/A	98 mg/dl	101 mg/dl	70-115 mg/dl
URE	22 mg/dl	13 mg/dl	N/A	19 mg/dl	11 mg/dl	10-50 mg/dl
CRE	0.78 mg/dl	0.77 mg/dl	N/A	0.78 mg/dl	0.65 mg/dl	0.5-1.1 mg/dl
K+	4.1 mmol/l	4.3 mmol/l	N/A	3.7 mmol/l	4 mmol/l	3.5-5.1 mmol/l
Na+	137 mmol/l	140 mmol/l	N/A	141 mmol/l	145 mmol/l	136-146 mmol/l
TPR	6.1 g/dl	5.2 g/dl	N/A	5.3 g/dl	6.4 g/dl	6.2-8.4 g/dl
ALB	3.7 g/dl	3.2 g/dl	N/A	3.2 g/dl	3.6 g/dl	3.5-5.1 g/dl
AST	16 U/L	22 U/L	N/A	17 U/L	18 U/L	5-33 U/L
ALT	29 IU/l	20 IU/l	N/A	15 IU/l	13 IU/l	5-32 IU/l
GGT	12 IU/l	11 IU/l	N/A	11 IU/l	10 IU/l	5-31 IU/L
UA	3.0 mg/dl	3.9 mg/dl	N/A	4.7 mg/dl	2.9 mg/dl	2.3-6.1 mg/dl

TABLE 1: Laboratory Findings During Hospitalization and at 40-Day Postpartum-Follow-Up

WBC: white blood cell; LYMPH: lymphocyte; HGB: hemoglobin; HCT: hematocrit; INR: international normalized ratio; aPTT: activated partial thromboplastin time; PLT: platelet; GLC: glucose; URE: urea; CRE: creatinine; K+:potassium; Na+: sodium; TPR: total protein; ALB: albumin; AST: aspartate aminotransferase; ALT: alanine aminotransaminase; GGT: gamma-glutamyl transferase; UA: uric acid;

The patient was prepared by the nursing staff for the scheduled cesarean section. At the theatre, the patient was positioned supine under general anesthesia. A Pfannenstiel transverse skin incision was made; the abdominal wall tissues were opened, and we identified the pregnant uterus. A low transverse uterine incision was performed, and a male neonate weighing 2,160 g was delivered. This meets the definition of low birth weight (<2,500 g). The placenta was delivered following the administration of 4 IU of oxytocin diluted in 500 mL of normal saline, with gentle application of the Credé maneuver to the uterine fundus to promote uterine contraction and reduce the risk of postpartum hemorrhage. On physical examination, VCI of the placenta was identified (Figure *3*).

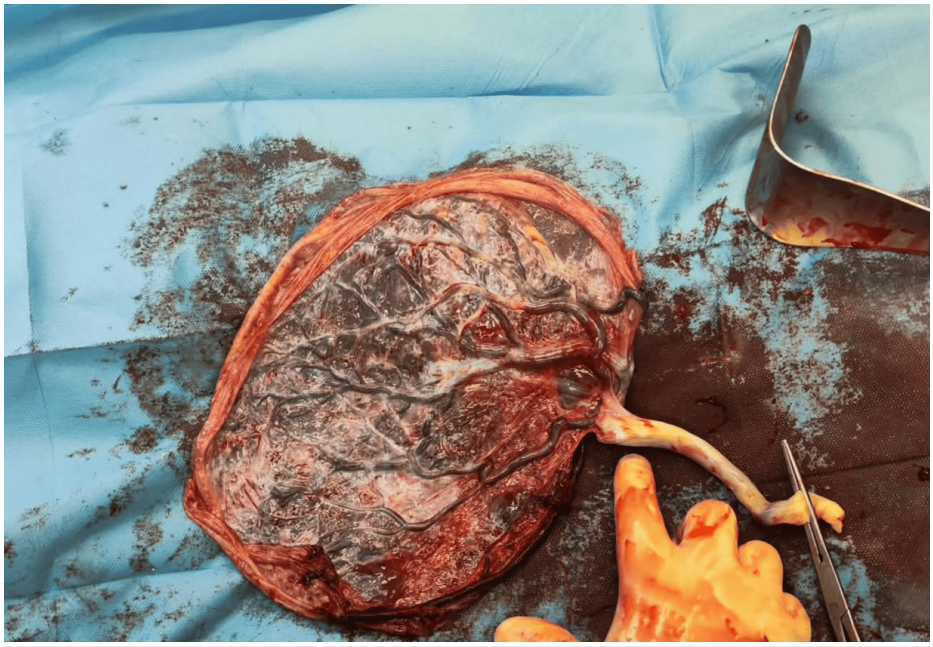


FIGURE 3: Placental Examination Showing Velamentous Cord Insertion

Placental examination reveals a velamentous cord insertion, in which the umbilical cord attaches to the fetal membranes rather than directly to the place

The uterine incision was sutured in two layers, and hemostasis was confirmed throughout the surgical area. Examination of the ovaries and fallopian tubes revealed no abnormalities. The layers of the abdominal wall were carefully returned to their proper anatomical arrangement, and the skin was closed with continuous intradermal stitches. Her postoperative course was uneventful. Her daily medical regimen in postpartum care included administration of methylergometrine in 3 L normal saline for two days. Ferrous sulfate 800 mg/15 mL twice daily for one month. Calcium 500 mg was administered twice daily for one month. Tinzaparin sodium 4,500 IU was administered subcutaneously once daily for 15 days as postoperative thromboprophylaxis, and cefuroxime twice daily for three days. Both the mother and the neonate were discharged on the fourth day after admission. At the gynecology outpatient follow-up visit 40 days postpartum, the mother was reported to be in good overall health.

Discussion

The international literature indicates that VCI is linked to higher obstetric and perinatal morbidity, though optimal delivery methods remain debated. A study by Räisänen et al. with 26,849 singleton pregnancies found that unplanned cesarean deliveries were more common in VCI cases (15.3%) compared to normal insertions (8.3%), alongside increased preterm deliveries and low birth weights [7]. Furthermore, Yang et al. reported a higher emergency cesarean delivery rate (16.1% versus 8.9%) and poorer neonatal outcomes in 501 VCI pregnancies [8]. Liang et al. confirmed these trends, noting a cesarean delivery rate of 68.3% in the VCI group versus 32.5% in controls [1]. Esakoff et al. analyzed data from 482,812 pregnancies, finding no significant association between VCI and primary cesarean delivery [adjusted odds ratio (aOR): 0.97] after adjusting for confounding factors. However, VCI was linked to increased risks of intrauterine fetal death, postpartum hemorrhage, and small-for-gestational-age neonates [9]. Similarly, Yerlikaya et al. found no significant difference in cesarean rates between 108 pregnancies with VCI and controls, although the VCI pregnancies had earlier deliveries and lower neonatal birth weights [10]. The clinical significance of isolated VCI was examined by Sinkin et al., who found links to low umbilical arterial blood pH and manual placenta removal. An increase in operative delivery due to non-reassuring fetal heart rate patterns was noted but not statistically significant [11]. Hasegawa et al. found that VCI in the lower uterus correlates with more fetal heart rate abnormalities and emergency cesarean deliveries [12]. Their further study showed a rise in atypical variable decelerations in the first labor stage [13]. In a large population-based study of 623,478 singleton pregnancies, Ebbing et al. found that VCI was associated with an increased likelihood of emergency cesarean delivery at term [odds ratio (OR) 1.6, 95% confidence interval (CI) 1.5-1.7], whereas elective cesarean delivery was not significantly increased [14]. Moral-Moral et al. reported a small case series of nine pregnancies with a succenturiate placental lobe, four linked to VCI, noting complications such as intrapartum fetal bradycardia [15]. Additionally, twin pregnancies with abnormal umbilical cord insertion showed negative perinatal outcomes, though these results may not apply to singleton pregnancies [16,17]. Koorn et al.'s retrospective study of 199 singleton pregnancies with VCI versus 398 controls found no significant difference in intrauterine fetal death rates (0.5% vs. 0.8%), but a higher rate of fetal growth restriction in VCI cases (23.1% vs. 10.3%) [18]. Taken together, observational studies suggest that VCI is

associated with adverse perinatal outcomes, but reported cesarean rates vary with study design, adjustment for confounding factors, and whether vasa previa and elective versus emergency procedures are considered. These associations do not establish that VCI alone requires cesarean delivery.

Mpourazanis et al. reported a case of a 28-year-old primigravida with prenatally diagnosed VCI who had a vaginal delivery at 38 weeks, resulting in a healthy female neonate weighing 2,770 g. The maternal postpartum course was complicated by hemorrhage, necessitating obstetric curettage [19]. Hafsi et al. documented a case of pregnancy affected by vasa previa and bipartite placenta, leading to a planned cesarean delivery at 36 weeks, resulting in a healthy female neonate weighing 2,600 g and achieving favorable Apgar scores [20]. In 2025, Papasavva et al. reported a late-preterm neonate born via emergency cesarean section at 36 weeks due to serious fetal distress. Despite no recorded membrane rupture, umbilical vessel rupture was confirmed. The infant suffered severe hemorrhagic shock and hypoxic-ischemic encephalopathy, requiring intensive care measures. The neonate died on the fourth day of life due to multiorgan failure [21]. Published case reports involving pregnancies complicated by VCI, with or without associated vasa previa, have demonstrated varying obstetric and neonatal outcomes. Potosí-García et al. documented successful elective cesarean delivery without major complications [22]. Inatomi et al. described a case with significant complications leading to emergency cesarean delivery [23]. Li et al. reported a case of a 31-year-old multiparous woman at 37 weeks of gestation who experienced umbilical cord prolapse and fetal bradycardia after artificial rupture of membranes. A vaginal delivery was successfully conducted in about 24 minutes, resulting in a female neonate weighing 2,130 g, with Apgar scores of 7, 9, and 10. Both the mother and the neonate had favorable outcomes afterward [24]. Relevant published case reports with VCI are summarized in Table *2*.

Publication	Type of Study	Patient Age (years)	Gestational Weeks	Type of Delivery	Placenta Pathology
Mpourazanis et al. [19]	Case report and review of the literature	28	38	Vaginal delivery	Velamentous cord insertion
Hafsi et al. [20]	Case report	24	36	Cesarean delivery	Bipartite placenta and velamentous cord insertion
Papasavva et al. [21]	Case report	N/A	36	Cesarean delivery	Furcate-velamentous insertion of the umbilical cord
Potosí-García et al. [22]	Case report and review of the literature	27	38.5	Cesarean delivery	Velamentous cord insertion
Inatomi et al. [23]	Case report and review of the literature	38	40	Cesarean delivery	Velamentous cord insertion and single umbilical artery
Li et al. [24]	Case report	31	37	Vaginal delivery	Velamentous cord insertion

TABLE 2: Case Studies with VCI

N/A: not available; VCI: velamentous cord insertion.

These reports highlight the need for individualized obstetric management based on prenatal diagnosis, cord insertion location, associated abnormalities, and fetal well-being. Current evidence does not mandate cesarean delivery for all pregnancies complicated by VCI. In the present case, planned cesarean delivery was undertaken in the context of a history of serious maternal cardiac arrhythmias and a pre-existing permanent pacemaker, rather than based on VCI alone. The available clinical description does not establish a specific cardiac indication for delivery precisely at 37 weeks or explain the choice of general anesthesia. These limitations should be considered when interpreting the management decisions in this case.

Conclusions

Velamentous cord insertion is a placental abnormality linked to increased risks of adverse obstetric and perinatal outcomes, especially with complications like fetal growth restriction or vasa previa. Prenatal detection through ultrasound and color Doppler facilitates appropriate surveillance and individualized obstetric management. Although isolated VCI does not necessitate cesarean delivery, decisions regarding delivery mode should be individualized based on clinical factors. In this case, VCI was detected prenatally, and planned cesarean delivery at 37 weeks was followed by discharge of both the mother and the neonate on day four. This observation does not establish that cesarean delivery was necessary because of VCI or responsible for the outcome. More research is needed to develop standardized surveillance protocols and

clear guidelines on delivery timing in VCI-affected pregnancies.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

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Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. **AI use statement:** The authors used ChatGPT (OpenAI OpCo, LLC; GPT-6) as follows: language polishing, translation in manuscript text (linguistic editing and grammatical refinement only). All AI-assisted linguistic suggestions were reviewed and verified by the authors. Scientific content, factual statements, and references were independently checked for accuracy. AI was not used to generate scientific content, interpret findings, or formulate conclusions. The authors retain full responsibility for the accuracy, originality, and integrity of the final manuscript. The authors confirm that they have reviewed and verified all AI-assisted content and take full responsibility for the work. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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