

ADVANCES AND CHALLENGES IN PRENATAL DIAGNOSIS OF VASA PREVIA: A CRITICAL REVIEW OF THE LITERATURE

Valéria Rampazzo Ribeiro

Anhanguera - Uniderp

Campo Grande - MS

<https://orcid.org/0000-0002-6758-7868>

Mariana Beatriz Basso Macedo

Universidade do Oeste Paulista (Unoeste)

Jaú - SP

<https://orcid.org/0000-0003-4824-3258>

Beatriz Dias Paredes

Centro Universitário Max Planck (UniMAX)

Indaiatuba - SP

<https://orcid.org/0009-0001-6303-7551>

Letícia Bardin

Pontifícia Universidade Católica de

Campinas (PUC-Campinas)

Campinas - SP

<https://orcid.org/0009-0009-9702-8889>

Gabriela Yumi Sakata Guerra

Universidade Estadual de Londrina (UEL)

Londrina - PR

<https://orcid.org/0009-0007-4635-6335>

Kamila Leite da Silva

Universidade Federal de Roraima (UFRR)

Boa Vista-RR

<https://orcid.org/0009-0009-5908-3385>

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Gabriela Nunes Simões

Faculdade de Medicina de Jundiaí (FMJ)
Jundiaí - SP
<https://orcid.org/0009-0005-9321-3789>

Kaila Beatriz de Jesus Teixeira

Centro Universitário Ingá - UNINGÁ
Maringá -PR
<https://orcid.org/0009-0005-2932-4302>

Bruna Alvite Nogueira Gomes

Fundación Hector Alejandro Barceló (FHAB)
CABA - Buenos Aires
<https://orcid.org/0009-0001-9579-5461>

Fabiana Alves Andrade Pessolato

Universidade Nacional de Rosario (UNR)
Rosario - Santa Fé
<https://orcid.org/0009-0003-3494-7876>

Kathleen Priscila Correia Coelho

Universidad Nacional de Rosario (UNR)
Rosario - Argentina
<https://orcid.org/0009-0004-6210-0557>

Abstract: Goal: Critically evaluate risk factors and advances in prenatal diagnosis of vasa previa based on recent studies. Methodology: A bibliographic review was carried out in the PubMed database, using terms such as “vasa previa”, “diagnosis” and “ultrasound detection”. From this process, 1 were selected two articles for in-depth analysis. Results: The review identified a strong correlation between the presence of specific risk factors during pregnancy and the incidence of vasa previa. Studies indicate that early diagnosis through prenatal consultations can significantly reduce maternal-fetal morbidity and mortality rates. Careful monitoring throughout pregnancy, especially in the last trimester, is essential due to the possibility of spontaneous regression of the condition. Final considerations: Early diagnosis of vasa previa at prenatal visits is crucial for maternal and neonatal survival. Careful screening, using targeted screening and imaging, is necessary to ensure adequate detection and correct interpretation of results, emphasizing the importance of rigorous clinical practices in monitoring high-risk pregnancies. **Keywords:** prenatal diagnosis; maternal-fetal morbidity and mortality.

INTRODUCTION

Vasa previa is a rare obstetric condition in which unprotected fetal blood vessels cross the lower segment of the uterus, with an incidence of approximately 0.20 to 2.5 in every 1000 pregnancies (Oyelese, Javinani, Shamshirsaz, 2022). This condition is classified into three types: type 1, where there is a velamentous insertion of the umbilical cord and the vessels insert into the amniotic membranes before reaching the placenta; type 2, resulting from a bilobed or sucenturiate placenta, with vessels passing unprotected between the lobes; and type 3, characterized by vessels that cross from one edge of the placenta to the other (Gross et al., 2021).

Most cases of vasa previa are associated with known risk factors. It is estimated that 80% of cases are related to the presence of placenta previa or the placenta positioned below the uterus, and approximately 25% of cases are associated with in vitro fertilization. Other risk factors include velamentous umbilical cord insertion, bilobed and succenturiate placenta, cord insertion in the lower third of the uterus, and twin pregnancies (Oyelese, Javinani, Shamsirsaz, 2022).

Accurate diagnosis and implementation of clear management plans are crucial to improving neonatal outcomes. These plans usually include performing a planned and timely cesarean section (Villani, Pavalagantharajah, D'Souza, 2020). According to the Society of Obstetricians and Gynecologists of Canada, in cases where the placenta is identified in a low position during a routine ultrasound in the second trimester, additional analysis of the location of the placental cord is recommended. Transvaginal ultrasound examination is indicated to investigate the internal cervical canal in women at high risk of vasa previa, such as those with a low or velamentous umbilical cord insertion, bilobed or succenturiate placenta, or a history of vaginal bleeding (Zhang et al., 2020).

Risk indicators for vasa previa and its consequences for the fetus/neonate include fetal heart rate, gestational age at delivery, birth weight, Apgar score, presence of neonatal anemia, umbilical cord blood gas analysis, need for blood transfusion and the mortality rate (Villani, Pavalagantharajah, D'Souza, 2020). Correct prenatal identification of vasa previa and appropriate monitoring and management of these pregnancies have the potential to significantly reduce the overall stillbirth rate by approximately 10% (Zhang et al., 2020).

This study aims to comprehensively analyze the scientific literature to identify the

main risk factors associated with vasa previa and evaluate prenatal diagnostic strategies. The aim is to improve early identification and clinical management of this obstetric condition, aiming to minimize the risks to maternal and fetal health.

METHODOLOGY

This literature review was developed following the PVO strategy, which is based on the principles of "Population or research problem", "Variables" and "Outcome". The guiding question that guided this analysis was: "What are the significant risk factors related to vasa previa, and what advances and challenges are present in prenatal diagnostic strategies, as evidenced by the most recent scientific literature?"

For data collection, searches were carried out in the PubMed and MEDLINE (Medical Literature Analysis and Retrieval System Online) databases, using descriptors related to the topic together with the Boolean operators "AND" and "OR". This search strategy resulted in the initial identification of 2947 articles.

The defined inclusion criteria were: articles in English, published between 2019 and 2024, that directly addressed topics related to vasa previa, specifically meta-analyses and clinical trials, and that were available in full. Articles that did not meet these inclusion criteria, those that did not specifically address the problem studied and those that were duplicates were excluded.

After rigorous application of the inclusion and exclusion criteria, the total number of articles was reduced to 12. These articles were then selected to form the collection of this study, providing a comprehensive analysis of the risks, advances and challenges in vasa previa diagnostic strategies in the context of prenatal care, based on the most recent evidence available in the scientific literature.

DISCUSSION

PRENATAL DIAGNOSIS STRATEGIES FOR VASA PREVIA

Vasa previa is a relatively rare pathology that affects approximately 1 in every 2,500 pregnancies and presents a significant risk of maternal and fetal morbidity and mortality, especially when not diagnosed early. In cases where diagnosis is not made before birth, the survival rate may be as low as 40% (Mitchell et al., 2022; Tsakiridis et al., 2019). According to Mitchell et al. (2022), a more favorable prognosis can be achieved by planning the birth before the rupture of the amniotic membranes, at which time the risks of fetal hemorrhage, exsanguination and death increase significantly.

There is currently debate in obstetrics and gynecology guidelines regarding the most effective prenatal diagnostic methods for vasa previa. A consensus has been established that the combination of transvaginal ultrasound (TVUS) with Doppler and abdominal ultrasound with Doppler offers the greatest diagnostic accuracy.

This protocol is recommended by several organizations, including the American College of Obstetrics and Gynecology (ACOG), the Society for Maternal-Fetal Medicine (SMFM), the Society of Obstetrics and Gynecology of Canada (SOGC), and the College of Obstetricians and Gynecologists of Australia and New Zealand (RANZCOG) (Tsakiridis et al., 2019). Although magnetic resonance imaging (MRI) is also an accurate diagnostic technique, due to its high cost and low accessibility, it is not commonly indicated in obstetric practice (Tsakiridis et al., 2019).

A systematic review and meta-analysis carried out in 2021 analyzed 21 studies on the impact of prenatal diagnosis of vasa previa. The results demonstrated that, in pregnancies diagnosed early, perinatal survival rates

reached 99%. On the other hand, in cases without prenatal diagnosis, a significant increase in morbidity and mortality was observed, with perinatal survival rates of only 72% and a total mortality of 28% (Zhang et al., 2021).

These data confirm that the absence of prenatal diagnosis of vasa previa is associated with a dramatic increase in the risks of morbidity from hypoxia—a 50-fold increase—and perinatal death, with a 25-fold increased risk (Zhang et al., 2021). These statistics underscore the urgent need for early identification of this condition to significantly improve maternal and neonatal outcomes.

Tsakiridis et al. (2019) also indicate that vasa previa screening must be targeted at patients with known risk factors. This is due to the fact that routine TVUS is not cost-effective and could increase the false positive rate. Furthermore, although prenatal diagnosis is most effective in mid-pregnancy, it is recommended that confirmatory tests be performed during the third trimester, as approximately 20% of previously diagnosed cases of vasa previa disappear before delivery.

With an adequate prenatal diagnosis, the indication for premature birth can be carried out with greater safety, considering that the benefits of late prematurity outweigh the risks associated with spontaneous rupture of the amniotic membranes. Consensus guidelines also favor elective cesarean delivery over spontaneous labor, recommending that birth can be considered acceptable from the 35th gestational week onwards (Tsakiridis et al., 2019; Mitchell et al., 2022).

To differentiate type I from type II vasa previa, the criterion of the distance from the unprotected vessels to the internal os of the cervix is used. If this distance is up to 2 cm, it is classified as type II vasa previa. Although specific evidence for this type is limited, its characteristics and outcomes appear

similar to type I. However, studies indicate an association between type II vasa previa and higher neonatal mortality, highlighting the critical importance of prenatal diagnosis to mitigate risks to the maternal-fetal binomial (Matsuzaki et al., 2022).

Type III vasa previa, a rare form where aberrant vessels course from the placenta to the amniotic membranes near the internal cervical os, is not necessarily associated with other placental or vascular anomalies. This type of vasa previa requires special attention due to the diagnostic challenges, especially considering that in up to 83% of the cases analyzed, prenatal symptoms do not manifest. This information was identified in a systematic review that encompassed 18 cases of type III vasa previa, published in the PubMed, MEDLINE and EMBASE databases until March 2023 (Pozzoni et al., 2024).

Diagnostic strategies for type III vasa previa primarily involve transvaginal ultrasound. Linear echogenic structures close to the internal os of the cervix can be observed at a mean gestational age of 29 weeks, where the use of color Doppler is crucial to confirm prenatal diagnosis. Furthermore, this technique is vital to exclude differential diagnoses such as umbilical cord presentation, chorioamniotic separation, and uterine varicosity. However, adequate visualization of the structures can be hampered by factors such as scars on the abdominal wall, obesity or a half-filled maternal bladder (Pozzoni et al., 2024).

According to Ruban-Fell et al. (2022), the routes of detection of vasa previa currently include screenings aimed at women undergoing in vitro fertilization, pregnant women with placenta previa and those with a velamentous cord insertion or bilobed or succenturiate placenta. An analysis of outcomes in each group of this hypothetical cohort showed that the highest proportion of vasa previa diagnoses occurred in screening

targeting placenta previa, representing 53.5% of all diagnosed pregnancies.

Therefore, screening for vasa previa by transvaginal ultrasound is recommended, especially in women diagnosed with placenta previa or morphologically abnormal placenta and women undergoing assisted reproduction treatments, as these are risk factors frequently associated with this condition (Pozzoni et al., 2024). However, it is necessary to exercise caution when interpreting the results of the studies analyzed, given limitations, such as the use of comparative parameters of moderate or low quality and the lack of robust data related to the costing of these proposed approaches (Ruban-Fell et al., 2022).

RISK FACTORS ASSOCIATED WITH ``VASA PRÉVIA``

Vasa previa is a rare but potentially fatal obstetric complication, with an estimated incidence of 0.6 per 1,000 pregnancies, equivalent to one occurrence in every 1,666 pregnancies (Zhang et al., 2023). This condition is often not diagnosed prenatally, contributing to the high rate of associated fetal mortality. Due to the rarity of this condition, there is no specific screening established; therefore, recognition of associated risk factors is crucial for early detection of vasa previa (Pavalagantharajah; Villani; D'Souza, 2020).

Risk factors for vasa previa can be identified during prenatal care. A study by Pavalagantharajah, Villani and D'Souza (2020) showed that the presence of placenta previa and the velamentous insertion of the umbilical cord are the most prevalent factors in diagnosed cases of vasa previa, followed by bilobed placenta, use of any reproduction technique assisted, in vitro fertilization, smoking, advanced maternal age and multiple pregnancy.

Furthermore, a systematic screening study for vasa previa presented 21 cases, all diagnosed during prenatal care. Of these cases, 18 had marginal or velamentous cord insertion, while the remaining 3 involved placental anomalies. Notably, in all pregnancies affected by vasa previa, all fetuses survived and no blood transfusion was required in any case (Gross et al., 2021).

Therefore, the importance of early vasa previa screening stands out as an effective and viable measure, playing a crucial role in promoting maternal-fetal safety. Performing comprehensive prenatal assessments, including screening for vasa previa, is essential to identify this complication early and implement appropriate management strategies, ensuring a healthy pregnancy and safe delivery (Gross et al., 2021).

FINAL CONSIDERATIONS

Although universal screening for vasa previa is not recommended, studies demonstrate that early diagnosis during prenatal care significantly reduces the risks of maternal and fetal mortality. Screening for risk factors is complex due to the rarity of the condition, resulting in heterogeneity in research on risk factors and screening protocols. Placenta previa, in vitro fertilization and velamentous cord insertion are the main risk factors identified. Transvaginal ultrasound combined with Doppler is highlighted as the most accurate diagnostic method, especially indicated for the third trimester of pregnancy. Challenges include limited access to advanced equipment and high costs for effective prenatal strategies. The review highlights the importance of in-depth knowledge of risk factors and the use of appropriate technology to ensure safe gestational development and the application of appropriate therapeutic approaches based on shared decisions.

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