Vasa Previa: Diagnosis and Management

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ABSTRACT

Vasa previa (VP) is a catastrophic condition which, if unrecognized before the rupture of membranes or labor onset, leads to fetal exsanguination due to the laceration of fetal vulnerable blood vessels lacking the protection of Wharton's jelly. Recently, obstetricians seem to be more careful in the scanning of umbilical cord insertion because of the increased awareness of VP and the accumulated knowledge of its risk factors, such as velamentous cord insertion, the presence of second-trimester placenta previa, bilobed placenta, and pregnancy by assisted reproductive technology (ART). However, the detection and management of VP is still challenging. In this review, the authors focus on the ultrasound diagnosis and clinical management of VP.

Keywords: Diagnosis, Management, Ultrasound, Vasa previa.

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INTRODUCTION

Vasa previa (VP) is a catastrophic complication, which can lead to fetal exsanguination due to the laceration of unprotected fetal vessels which run through the membrane without protective Wharton's jelly and in close proximity to the internal cervical os.¹ The morbidity and mortality are estimated to be significantly very high if the rupture of membranes and labor onset occur before the diagnosis of VP is uncertain.² The ultrasound definition of "fetal vessel within 2 cm from the cervical internal ostium is a standard used worldwide."^{3–5}

ETIOLOGY AND RISK FACTORS

The incidence of VP has been estimated to be 1 in 2,500 pregnancies.² However, Hasegawa et al. reported a prevalence of 1 in 365 pregnancies,⁶ and Klahr et al. found it to be 1 in 338 in their study.⁷ Thus, the estimation of incidence should be further reevaluated owing to the increasing demand for assisted reproductive technology (ART) conception. In addition to ART, the risk factors are multiple gestations, resolving placenta previa, and multilobed or succenturiate placentas.⁸

Abnormal shapes of the placenta and cord insertion by ART pregnancies have been observed over the past few decades.^{9–11} A detailed investigation of these placentas and umbilical cords was firstly performed by Jauniaux et al. from 50 singleton pregnancies conceived by ART.¹¹ They observed that ART had a significant impact not only on the cord insertion site but also on placental shapes, such as bilobed and succenturiate.¹¹

Several theories are proposed for the cause of VP. Disorientation of the polarized zygote, where the blastocyst abnormally implants in its axis,¹¹ and trophotropism, where the early placenta migrates to obtain better blood supply¹² have been proposed as possible causes of velamentous cord insertion, whereas superficial implantation of the zygote subsequent contact to the opposite uterine wall¹³ have also been mentioned as possible causes of bilobed and succenturiate placentas. Additionally, Torpin's superficial implantation theory may also effectively explain the reason why a non-velamentous cord insertion tends to be diagnosed in a later gestational week (GW)—that uterine engorgement makes the placental location visible in a separate position.¹³

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PLACENTAL TYPE OF VP

Placental types of VP related to the connection with the umbilical cord are classified as follows: Figure 1 shows a case of type I VP, a velamentous cord insertion into the placenta;¹ Figure 2 shows a case of type II VP, a multilobed or succenturiate placenta with fetal

Fig. 1: Type I vasa previa with velamentous cord insertion

Fig. 2: Type II vasa previa with bilobed placentas

Fig. 3: Type III vasa previa with vessels branching out from the placental surface and returning to the placental cotyledons (boomerang orbit)

Fig. 4: Typical image of vasa previa visualized by transvaginal ultrasound and showing fetal vessel running sagittally just on the uterine internal osium

vessels connecting the placental lobes:¹ and Figure 3 shows a case of type III VP, where vessels branch out from the placental surface and return to the placental cotyledons in a "boomerang orbit".^{14,15}

ULTRASOUND DIAGNOSIS

Several studies have been reported to improve the detection rate of VP. The recent awareness of VP detection and management has greatly improved neonatal mortality and morbidity.^{16–18} A typical ultrasound image of VP is shown in Figure 4, and the diagnosis of VP with the fetal vessels running sagittally on the cervical internal osium is usually not difficult. On the other hand, fetal vessels running transversely, or obliquely near the cervical osium, are relatively difficult to find. Moreover, the diagnosis of VP is still challenging in those cases where fetal vessels branch out from the placental surface and return to the placenta¹⁵ or in cases where the umbilical veins are adjacent to maternal blood within the intervillous space because both blood flows are relatively low and pulseless.¹⁹

For the detection of VP, there are several steps:²⁰

- Check the umbilical cord insertion site into the placenta directly.
- Assure no suspicion of the multilobed or succenturiate placenta.
- Carefully evaluate the lower uterine segment in all cases of resolving low-lying placenta or placenta previa later in the pregnancy.

The umbilical cord insertion site into the placenta should be screened in every pregnancy at any GWs, if possible. The cord insertion site can be visualized at the 11th–13th week *via* ultrasound evaluation. In those cases where the placenta is lying in the lower part of the uterus, a reevaluation should be scheduled later in the pregnancy. Figure 5A shows the placenta covering the cervical internal osium at the 21st GW. The same case was diagnosed as VP at the 32nd GW after the resolution of placenta previa, and Figure 5B shows the fetal vessel running transversely on the cervix. Figure 6A displays an anterior and posterior located placenta where VP was confirmed by transvaginal ultrasound. Macroscopic finding from the same case is shown in Figure 6B.

There are some other findings, as well, to suspect VP. Relative thick vessels running on the peripheral part of the placental surface should be evaluated by color Doppler imaging (Fig. 7). Vessels that seem to be "floating isolatedly" in the amniotic cavity also give us some clues (Fig. 8). This finding might be explained by the fact that the isolated fetal vessel running through the membrane is tented in the amniotic cavity and slightly detached from the uterine wall with the progression of uterine engorgement. The vessels are shown in Figure 8A connect the bilobed placentas. Velamentous cord insertions are also visualized, as shown in Figures 8B and C, and both are floating in the amniotic fluid.

Funic presentation is a confusing condition (Fig. 9). However, multilobed placentas might be recognized with careful scanning, and obstetricians should always keep in mind the possible concomitancy with VP if they find an abnormal placental location and/or abnormal cord insertion site into the placenta.

MANAGEMENT

Antenatal hospitalization after the diagnosis of VP has been recommended from 30 to 32 weeks of gestation, although the

Figs 5A and B: (A) Placenta covering the cervical internal ostium at the 21st gestational week. The same case was diagnosed as vasa previa at the 32nd gestational week after the resolution of placenta previa; (B) Fetal vessel running transversely on the cervix

Figs 6A and B: Vasa previa was confirmed by a transvaginal ultrasound with the anterior and posterior located placenta (A); (B) Macroscopic findings from the same case are shown

Fig. 7: Relatively thick vessels running on the peripheral part of the placental surface should be carefully evaluated with color Doppler imaging

concrete evidence to support this is lacking. Several authors have proposed that outpatient management can be individually considered for patients with a stable condition and living in the proximity of the hospital.^{21,22} However, careful assessment of cervical length and uterine activity should always be paid to avoid potential emergencies, including the rupture of the membranes and labor onset. Catanzarite et al.¹ reported on the frequent administration of tocolytics. One possible bias of their report might be their routine management of scheduled hospitalization and close monitoring by cardiotocogram. However, their inpatient management helps to raise the chances of giving antenatal steroids to mature fetal lungs. Recently, some authors reported that fetoscopic laser ablation of type II VP was technically achievable and brought favorable outcomes.²³⁻²⁷ However, this treatment can be applied only for type II cases which perfuse a relatively small segment of the placenta ($\leq 10\%$).²⁷ Case accumulation and investigation with a larger population is needed to help better management for VP cases with a shortened uterine cervix.

Figs 8A to C: Vessels seem to be “floating isolatedly” in the amniotic cavity and give us some clues. The vessels are shown in Figure A connect the bilobed placentas. Velamentous cord insertions are also visualized, as shown in Figures B and C, and both are floating the amniotic fluid

Figs 9A and B: A case of vasa previa with multilobed placentas (B), suggesting the difficulty in the exact differential diagnosis between funic presentation and vasa previa (A)

The rate of resolution of VP is reported to be from 5.8 to 39%, and our overall results showed that the resolution rate (21.8%) was in line with the previous studies.^{7,16,17,28,29} A higher resolution rate could be anticipated in those cases where the diagnosis was made earlier and around the 20th GW.^{7,29} Several studies have reported that vaginal deliveries after VP resolution might be estimated to still be <70 cases.^{7,8,17,28–30} Careful counseling, along with individual assessment, should be considered before deciding the mode of delivery after VP resolution.

The optimal timing of cesarean delivery remains to be elucidated, although a prospective randomized study is ethically difficult. To balance the risk of premature rupture of membranes, fetal exsanguinations, and the risk of prematurity, cesarean delivery between 34 weeks and 36 weeks of gestation is generally recommended. Before cesarean delivery, the operation team, including well-experienced obstetricians, should perform meticulous preoperational mapping of placental and fetal vessels by transabdominal and transvaginal ultrasound, especially at the site where the uterine incision is to be made. For those cases with anteriorly located placenta covering the incision site, the operator should pay careful attention to avoid injury of the placental/fetal vessels, which might result in neonatal anemia/hypovolemia. The prognosis for neonates is anticipated to be favorable if antenatally diagnosed cases of VP are managed properly.

CONCLUSION

Owing to the increased attention and accumulated knowledge of VP, obstetricians seem to be more cautious in the screening of umbilical cord insertion. In the prenatally diagnosed cases, favorable outcomes of both mothers and neonates could be anticipated by careful monitoring and appropriate measures. Adequate perioperative strategies to avoid injury of the placenta and/or fetal vessels should be discussed by obstetrical team members.

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