Vasa Previa: Prenatal Diagnosis, Natural Evolution, and Clinical Outcome

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Objective: To describe the prenatal ultrasonographic diagnosis, natural evolution, and clinical outcomes of vasa previa in a large population at a single institution.

Methods: We attempted to view the internal cervical os of 93,874 women with second- and third-trimester pregnancies during an 8–year period. Echogenic parallel or circular lines near the cervix, seen by gray-scale ultrasonography, raised the possibility of vasa previa. Diagnosis was confirmed by Doppler and endovaginal studies if aberrant vessels over the internal cervical os were suspected. Abnormal placental morphology and velamentous cord insertion were documented if they were identified during prenatal scans. Ultrasonographic findings were correlated with clinical courses, perinatal outcomes, and placental pathology examinations.

Results: Eighteen cases of vasa previa were suspected at a mean (± standard deviation) gestational age of 26.0 ± 6.3 weeks; the earliest diagnosis was at 15.6 weeks' gestation. Eight of those cases initially showed placental edge over the internal os and later developed vasa previa after the placenta "receded" from the cervix. Six women had mild vaginal bleeding at a mean gestational age of 31.3 weeks. Three women had normal late third-trimester scans and were allowed to have uncomplicated vaginal deliveries. The remaining subjects delivered by cesarean. There were two deaths (one fetal and one neonatal), and minor preterm complications slightly prolonged infant hospitalizations. One set of preterm twins needed neonatal transfusions. Pathology findings included ten cases of velamentous insertion and three cases each of bilobed placentas, succenturiate lobes, and marginal cord insertion.

Conclusion: Vasa previa was detected in asymptomatic women as early as the second trimester. Perinatal outcome was generally favorable, although several infants had slightly extended newborn nursery admissions due to mild complications of prematurity. (Obstet Gynecol 2000;95: 572–6. © 2000 by The American College of Obstetricians and Gynecologists.)

Vasa previa has an incidence of approximately one per 2000–5000 deliveries.[1] It is typically caused by velamentous insertion of the umbilical cord with fetal vessels between the cervix and presenting part. Bilobed or succenturiate placentas also can be associated with aberrant vasculature over the internal cervical os. Prenatal detection of vasa previa is of practical importance because such vessels are prone to catastrophic laceration after membrane rupture. Compression of unsupported vessels by a presenting part during labor can even lead to fetal bradycardia.

Before widespread availability of obstetric ultrasonography, vasa previa was usually detected during vaginal speculum examination or by direct palpation of vessels during labor. During that era, the perinatal mortality rate associated with late identification of vasa previa ranged from 58–73%.[2,3] Gray-scale ultrasonography has improved our ability to detect vasa previa.[4,5] More recent methods such as color Doppler, transperineal, and endovaginal ultrasonography also have been used.[6–9]

Most reports about vasa previa have consisted of anecdotal cases of no more than two patients from each institution. The medical literature has largely suggested that vasa previa is seldom detected in asymptomatic women.[6–8] Our study examined prenatal diagnosis of vasa previa in a large population at a single institution. Serial ultrasonographic examinations showed the natural evolution of vasa previa with its clinical course, infant outcome, and pathologic anomalies.
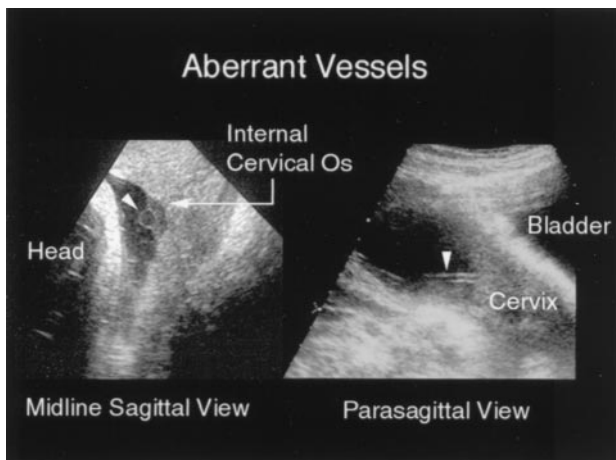
Figure 1. Prenatal gray-scale ultrasonographic findings for vasa previa. Suspicious echogenic or circular structures adjacent to the maternal cervix require further evaluation. The left figure is a midline sagittal view of the cervix, maternal bladder, and fetal head at 34.3 weeks' gestation. An echogenic circular structure (aberrant vessel) overlies the internal cervical os. The right figure shows a parasagittal view of the cervix from another woman at 28.1 weeks' gestation. A linear echogenic structure (aberrant vessel–*arrowhead*) runs along the amniotic membrane and adjacent to the cervix.

Materials and Methods

The Human Investigation Committee at William Beaumont Hospital approved this retrospective study. All gravidas with suspected vasa previa between January 1991 and December 1998, were identified by searching a customized computerized database of all scans done during that period. The imaging staff consisted of approximately seven registered ultrasonographers and four physicians (all obstetrician-gynecologists with additional subspecialty training in either radiology or maternal-fetal medicine). Our main objective was to examine the feasibility of ultrasonographic diagnosis among asymptomatic women who had been referred for indications other than vasa previa.

Women were scanned with a variety of ultrasound systems that provided a variety of gray-scale, color, and endovaginal capabilities (Acuson XP10 and Sequoia systems, Mountain View, CA; Philips Platinum, Santa Ana, CA). We attempted to view the cervix, including the internal cervical os, in all women in their second and third trimesters who presented for examination. If the cervix could not be seen, we did not perform endovaginal ultrasonography unless there was a clinical reason.

Vasa previa was suspected by transabdominal gray-scale ultrasonography if suspicious echogenic linear or tubular structures (aberrant vessels) were seen over or near the internal os (Figure 1). Color Doppler, power D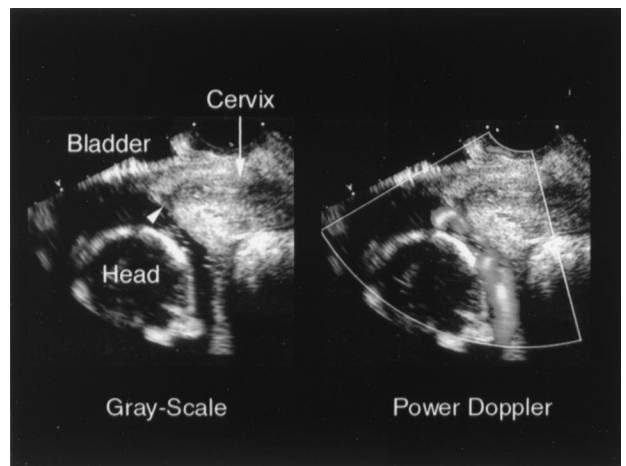oppler, or endovaginal ultrasonography were used to evaluate suspicious findings (Figures 2 and 3). Vasa previa was confirmed if an aberrant vessel was seen clearly across the internal cervical os. Abnormalities of placenta or umbilical cord insertion site were documented when technically feasible.

Ultrasonographic findings were correlated with gestational age, clinical course, and placental pathology (Figure 4). Serial scans were used to characterize the natural history of vasa previa. Neonatal outcomes were reported with preterm complications, need for blood transfusions, and hospitalization days in the newborn nursery. To identify cases that possibly were missed by antenatal ultrasonography, we also examined medical
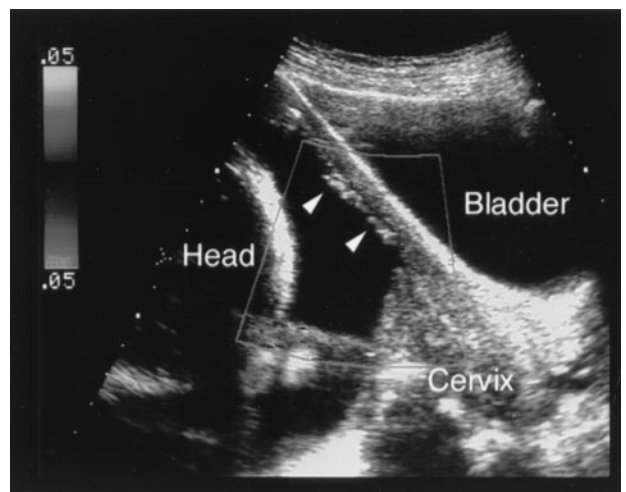

Figure 2. Vasa previa at 18.1 weeks' gestation. The left figure shows suspicious echogenic linear structures near the internal cervical os (*arrowhead*). Color Doppler ultrasonography (*right figure*) verifies vessels over the area of interest.

Figure 3. Aberrant vessel. This anomalous vessel (*arrowhead*) is detected by color Doppler ultrasonography as it runs along the amnion toward the cervix at 35.1 weeks' gestation. A succenturiate placental lobe was the source of the vessel (not shown).
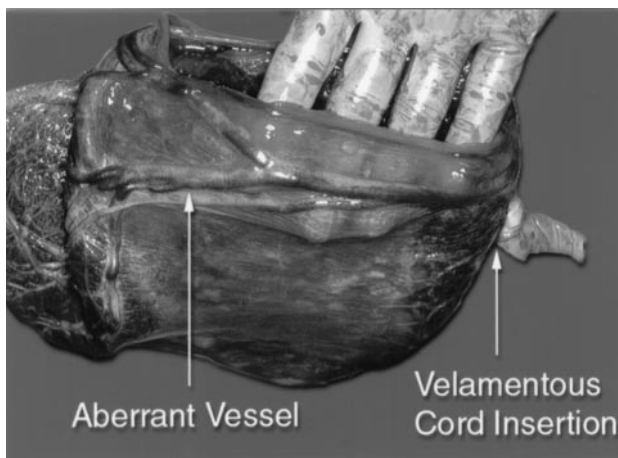
Figure 4. Placental pathology specimen. A velamentous umbilical cord insertion (not shown) was approximately 5 cm from the nearest placental margin.

records of all hospitalized women with discharge diagnoses of vasa previa or velamentous cord insertion after delivery (ICD-9-CM code 663.5).[10] Mean values were reported within 1 standard deviation.

Results

Our fetal ultrasound unit examined 93,874 women over 8 years. Eighteen women initially had vasa previa on gray-scale ultrasonography; three cases involved twin pregnancies. All 18 had evidence of aberrant vessels over the internal cervical os by gray-scale ultrasonography. Initial diagnoses were made at a mean (± standard deviation) gestational age of 26.0 ± 6.3 weeks, with 16 of 18 cases identified before 31 weeks. The earliest suspicion of vasa previa was in an asymptomatic woman at 15.6 weeks' gestation. Most were referred initially for fetal growth evaluation (seven cases) or suspected placental edge over the internal cervical os from prior scans (eight cases).

In the eight women who initially had placental edges covering the internal cervical os (19.2 ± 0.9 weeks), subsequent ultrasound examinations detected vasa previa at a mean of 29.5 ± 2.0 weeks, which presumably was related to differential growth between the placenta and lower uterus with advancing pregnancy.[11,12] Aside from aberrant vessels, only seven of 18 pregnancies were suspected of having other placental findings such as bilobed placentas, succenturiate placental lobes, or marginal cord insertion.

Clinical symptoms varied. There were antepartum bleeding complications in six women at a mean gestational age of 31.3 ± 2.2 weeks. Two of those women also had preterm uterine contractions. Fetal heart rate (FHR) abnormalities occurred in two pregnancies. Three

women needed antepartum hospitalization for preterm labor, whereas two others were admitted for decreased fetal movement and mild bleeding with uterine contractions. Five had maturity amniocentesis at a mean gestational age of 35.0 ± 1.0 weeks; two needed a second procedure because of immature lung maturation studies.

All subjects had uncomplicated delivery courses. Three women were allowed to deliver vaginally because subsequent late third-trimester scans showed that vasa previa was no longer present. The remaining 15 women had scheduled cesarean deliveries without excessive blood loss or need for transfusion.

Infant outcome was generally favorable, despite one set of premature twins with multiple complications. Eleven male and nine female liveborn infants (two sets of liveborn twins) were born at 35.4 ± 3.6 weeks' gestation. The mean birth weight was 2660 ± 660 g. No infants had depressed Apgar scores, although autopsy was unable to determine the cause of one stillbirth at 26 weeks' gestation. That twin pregnancy was complicated by pregnancy-induced hypertension, disseminated intravascular coagulation, and preterm labor. Another twin pregnancy led to preterm delivery of infants at 27.1 weeks. In the first twin, hyaline membrane disease, bronchopulmonary dysplasia, intraventricular hemorrhage, preterm retinopathy, and anemia requiring multiple transfusions developed. Twin B had hyaline membrane disease, pulmonary emphysema, intraventricular hemorrhage, and anemia that also required multiple transfusions. The second twin died 3 days after delivery. The poor outcome of this twin pregnancy (one infant death and one instance of severe intraventricular hemorrhage) was primarily attributed to severe hypovolemic shock as a consequence of vasa previa.

Reasons for extended neonatal admissions were related mainly to prematurity. Several neonates were affected by mild complications that included transient tachypnea of the newborn and hyperbilirubinemia. There were no cases of necrotizing enterocolitis or infection. The average newborn hospitalization was 10.8 ± 24.4 days, although one twin required a hospital stay of 114 days. Only four infants required hospital stays of 10 days or more.

Pathology findings included velamentous cord insertion in ten women, bilobed placenta in three, succenturiate placental lobe in two, and marginal cord insertion in two. No placental or membrane anomalies were confirmed from the pathology specimens provided for three women.

The medical charts of 81 women at our hospital with postpartum hospital discharge diagnoses of vasa previa and velamentous insertion were examined during the same period for possible undetected cases. Of those, 49 had been seen at least once in our imaging unit. Internal

cervical oses were not viewed on videotape for various technical reasons, such as acoustic shadowing by fetal head or empty maternal bladder, in slightly more than one third of scans analyzed.

Our videotape review found a single missed case of vasa previa at 30.4 weeks' gestation. Retrospective diagnosis was made on the basis of an aberrant vessel over the internal cervical os that had not been recognized before delivery. That pregnancy occurred around the time (1992) that color Doppler and transvaginal ultrasonography were first being reported in the medical literature for detecting vasa previa.[7,8] The woman's fetus had bradycardia with peripartum hemorrhage and needed an emergent cesarean delivery at term. The infant was discharged 4 days after birth. Pathology examination found a velamentous cord insertion. There were no additional unsuspected cases of vasa previa from this high-risk group of women. Most of the women had pathologic confirmation of velamentous umbilical cord insertion without reported bleeding complications.

Discussion

Vasa previa can be detected in some asymptomatic pregnant women as early as the second trimester. The first diagnostic clue might be echogenic linear or tubular structures seen near the internal cervical os during routine gray-scale ultrasonography (Figure 1). Such findings warrant more detailed examination by color or power Doppler ultrasonography. Endovaginal studies are not contraindicated because they do not cause or worsen vaginal bleeding in suspected cases. Unusual placental morphology, velamentous umbilical cord insertion, or aberrant vessels along the membranes help to support the diagnosis. However, absence of pathologic findings might not correlate with prenatal observations with a grossly distorted or incomplete specimen.

Differential diagnosis of vasa previa includes chorioamniotic membrane separation, normal umbilical cord loop, and marginal placental vascular sinus. Chorioamniotic membrane separation occurs normally up to 16 menstrual weeks.[13] Color Doppler ultrasonography can distinguish between aberrant vessels and membrane separation because the latter has no vascular flow. An aberrant vessel also can be confused with a normal umbilical cord loop. Manual ballotment of the lower maternal abdominal wall might help temporarily displace a loop of free cord away from the cervix; aberrant vessels would not have that mobility. A marginal placental venous sinus also should be considered. Endovaginal ultrasonography, with a color Doppler study, should be able to differentiate a vascular placental edge from an aberrant vessel over the internal os.

The natural evolution of vasa previa initially might involve low-lying placenta. Approximately 1.1% of normal pregnancies between 15 and 20 weeks' gestation will have low-lying placentas, of which 14% will persist until delivery.[14] More than one third of our cases presented initially with a placental edge over the internal os. Other investigators have reported association between low-lying placentas and vasa previa,[15,16] or velamentous cord insertion.[17] Therefore, prior ultrasonographic evidence of a placental edge over the internal os represents an important risk factor for women with suspected vasa previa.

Aberrant vessels might regress from the cervix in some women during late pregnancy. Three of our subjects had resolution of their vasa previa by the late third trimester and later had uncomplicated vaginal deliveries. That relative movement was probably caused by differential growth between the lower uterus and placenta.[11,12] From a practical perspective, an aberrant vessel does not need to be exactly over the internal os to pose increased risk of peripartum bleeding. Uterine contractions can lead to cervical dilation and exposure of vessels to presenting fetal parts. Spontaneous or artificial rupture of membranes might even cause vessels to rupture during the peripartum period. We recommend at least one additional late third-trimester scan to confirm diagnosis before delivery because evolutionary changes can affect treatment.

Fung and Lau[15] examined outcomes for women known to have vasa previa versus those without antepartum diagnoses. They analyzed 48 cases of vasa previa from 34 articles published between 1980 and 1997, in which antepartum ultrasound diagnosis was established in 16 women. They concluded that fetal loss rate and incidence of neonatal transfusion were significantly less if diagnoses were known before delivery. Our series included only one set of preterm twins that needed transfusions after delivery.

The accuracy of vasa previa detection by prenatal ultrasonography was not examined directly because diagnoses could not be established easily after birth. Therefore, sensitivity and specificity of antepartum diagnosis were not studied. Similar limitations prevented us from estimating incidence of undetected vasa previa. Once the placenta was delivered, it was difficult to confirm that an aberrant vessel had covered the internal cervical os, an essential diagnostic criterion for vasa previa. We could only document apparently missed cases of vasa previa from videotape review of high-risk women with pathology-proven velamentous cord insertion, but the widely-used ICD-9-CM classification system does not distinguish between vasa previa and velamentous umbilical cord insertion.[10] The National Center for Health Statistics is currently considering a

separate diagnostic code for velamentous cord insertion as a result of our inquiry. Nonetheless, with the exception of one patient, we did not find additional cases beyond those suspected by prenatal ultrasonography.

Although it is not possible to detect every case of vasa previa, our results suggest that prenatal ultrasonography can be used to identify some asymptomatic women before delivery. When technically feasible, evaluation of the internal os is very important for women at risk for vasa previa. Risk factors include a placenta edge over the internal os documented by an earlier scan, multiple gestation, velamentous cord insertion, bilobed or succenturiate placenta, and suspicion of aberrant vessels. However, the internal os can be extremely difficult to see when empty maternal bladder, obesity, or suboptimal fetal positions cause acoustic shadowing.

Prenatal diagnosis encourages women and physicians to monitor bleeding symptoms more closely. It also facilitates elective delivery under controlled circumstances that allow rapid access to volume replacement and blood products. Over most of the past decade, our institution has generally experienced favorable perinatal outcome among patients with known diagnosis. However, infant death can still occur and elective preterm delivery may be associated with extended newborn hospitalizations from other mild complications of prematurity.

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