CASE REPORT

In utero laser treatment of type II vasa previa

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(Received 12 September 2007; revised 24 September 2007; accepted 24 September 2007)

Abstract

Vasa previa, defined as fetal vessels coursing within the membranes between the presenting part and the cervix, occurs in approximately 1:2500–5000 pregnancies. Type II vasa previa consists of fetal vessels crossing over the internal os connecting a bilobed placenta or a succenturiate lobe with the main placental mass. These vessels are prone to compression during labor or may tear when membranes rupture potentially resulting in fetal exsanguination and neonatal death. This complication could be avoided altogether if the vessels could be obliterated in utero. The purpose of this communication is to report the successful in utero laser ablation of type II vasa previa at 22.5 weeks of gestation. Subsequent ruptured membranes did not result in untoward fetal consequences. Risks and benefits of this novel procedure are discussed.

Keywords: Vasa previa, operative fetoscopy, ultrasound, Doppler, fetal therapy

Introduction

Bilobed placentas are characterized by the presence of two placental lobes separated by a segment of membranes. This type of placentation occurs in approximately 0.04% to 4.2% of pregnancies, with a mean frequency of 1.7% (based on the examination of over 46 000 placentas as part of the Collaborative Perinatal Project [1]). In one-third of bilobed placentas, the umbilical cord inserts in the larger lobe. In two-thirds of bilobed placentas the umbilical cord insertion is velamentous [2].

Vasa previa, defined as fetal vessels coursing within the membranes between the presenting part and the cervix, occurs in approximately 1:2500–5000 pregnancies [3,4]. The precise prevalence of this condition is uncertain because the diagnosis is often missed with ultrasound or at surgical pathologic examination of the placenta. Moreover, the ICD-9 code for vasa previa is the same as for velamentous insertion of the umbilical cord [5].

Vasa previa is classified into type I, where the fetal vessels crossing over the internal os correspond to a velamentous insertion of the umbilical cord, and type II, in which the fetal vessels crossing over the internal os connect a bilobed placenta or a succenturiate lobe with the main placental mass [6]. These vessels are prone to compression during labor or may tear when membranes rupture resulting in fetal exsanguination.

The perinatal mortality in undiagnosed vasa previa ranges from 22% to 100% [3]. A recent retrospective review showed a perinatal survival of 96% in prenatally diagnosed cases [7]; however, 8% of patients had ruptured membranes prior to the onset of labor and 27.9% required emergency cesarean delivery for bleeding, labor, or ruptured membranes. Another study reported 10 patients with a prenatal diagnosis of vasa previa among 33 208 patients scanned in an 8-year period. The overall perinatal loss was 17% (2/12), which included two undiagnosed patients [6]. Bleeding in the third trimester occurred in 80% (8/10) of cases, and 50% (5/10) of patients required prolonged or multiple hospitalizations. Another study reported 15 patients with a prenatal diagnosis of vasa previa among 93 874 women scanned in the second and third trimesters, including three cases of twin pregnancies. Bleeding complicated 40% (6/15) of patients and 33% (5/15)
required hospitalization. There were two perinatal deaths: one fetal death at 26 weeks of gestation in a twin pregnancy complicated by hypertension, disseminated intravascular coagulation, and preterm labor, and one early neonatal death due to extreme prematurity birth. In all series, all patients were delivered by cesarean section [5].

There is not a uniformly agreed standard of care for patients with vasa previa. Current management recommendations include prolonged hospitalization at 27–28 weeks, and elective cesarean delivery at 35–36 weeks, with or without prior confirmation of fetal lung maturity [7]. However, fetal losses from this condition continue to be reported, particularly in the public media (www.vasaprevia.com). Alternatively, the risk of perinatal loss associated with vasa previa could be avoided altogether if the vessels were ablated in utero. This report communicates the first case of type II vasa previa treated with laser photocoagulation of the vessels linking the two placental lobes.

Case report

A 37-year-old, gravida 2 para 0 was referred at 22 3/7 weeks with the diagnosis of vasa previa. Chorionic villus sampling in the first trimester had revealed a normal 46,XX karyotype. Transabdominal ultrasound showed an anterior portion of the placenta (which was the largest) and a smaller posterior lobe (Figure 1). Estimation of the placental mass of the smaller posterior placental lobe was performed using the XTD-view mode (Extended View, General Electric Voluson 730 Expert, Zipf, Austria). Approximately 85% of the placenta was on the anterior surface of the uterus and 15% represented the posterior lobe (Figure 1). The umbilical cord was inserted in the anterior lobe of the placenta, which also showed multiple lakes. Transabdominal and transvaginal color and pulsed Doppler as well as 3D ultrasound over the area of the internal os showed two vessels connecting the anterior portion of the placenta with the smaller posterior lobe (Figure 2). Pulsed Doppler interrogation of the vessels indicated that there was an artery with a heart rate of 152 bpm similar to that of the fetus. The second vessel had a venous Doppler waveform. The amniotic fluid volume was within normal limits.

The patient was counseled about the different management alternatives, including bed rest, hospitalization at 27–28 weeks, and elective cesarean delivery at 35–36 weeks. The patient was also advised about laser ablation of type II vasa previa. Potential benefits of the procedure include avoidance

Figure 1. Sonographic demonstration of type II vasa previa via transvaginal ultrasound. Combined color and pulsed Doppler demonstrate two vessels, an artery and a vein, crossing over the internal cervical os. Pulsed Doppler shows a heart rate of 152 bpm, consistent with the fetal heart rate. No intervening placental tissue is noted over the os, ruling out placenta previa.
of: (1) the risk of fetal hemorrhage from spontaneous ruptured membranes; (2) prolonged hospitalization; and (3) cesarean delivery. The patient was also counseled that potential risks of the procedure included ruptured membranes, miscarriage, preterm delivery with its attendant complications, iatrogenic placental insufficiency, possible neurological damage, and fetal or neonatal demise. The patient was advised that this procedure had never been performed before and, therefore, would represent innovative therapy. After extensive counseling, the patient elected to proceed with an attempt at laser ablation of type II vasa previa and she gave written informed consent. The procedure was approved by the ethics committee of Tampa General Hospital. The procedure was also presented to and approved by the Office of Clinical Research of Tampa General Hospital. The Division of Research Integrity and Compliance, Institutional Review Board of the University of South Florida (USF IRB) was also apprised of the innovative nature of the surgery and the informed consent. No specific approval from the USF IRB was required.

The patient was taken to the operating room at 22 4/7 weeks. Under local anesthesia and ultrasound guidance, a 3.8-mm trocar was inserted into the amniotic cavity, bypassing the anterior portion of the placenta. Amniotic fluid was sent for microbiologic studies. Endoscopic assessment of the area over the internal os confirmed the presence of type II vasa previa, with an arterial and a venous vessel connecting the two lobes (Figure 3). The vessels were photocoagulated close to the anterior lobe using 25 watts of YAG laser energy without complications. Transabdominal and transvaginal intraoperative ultrasound examination demonstrated lack of blood flow through the lasered vessels (Figure 4). Weekly follow-up ultrasounds showed that the placental lakes in the anterior portion of the placenta became more pronounced. The patient presented in labor at 27 weeks of gestation with spontaneous ruptured membranes in breech presentation. The fetal heart rate was normal. A cesarean delivery was performed because of fetal malpresentation. Surgical removal of the placenta proved difficult, suggesting a placenta accreta (which correlated with the antenatal sonographic findings of worsening placental lakes), preventing further surgical pathology evaluation. The baby weighed 1235 g and had Apgar scores of 7 and 8 at 1 and 5 minutes, respectively and an initial hematocrit of 40.9%. The infant remained in the nursery until 39 weeks of corrected gestational age with minimal morbidity, which included grade I retinopathy of prematurity, spontaneous closure of a small patent ductus arteriosus, and apnea and bradycardia and mild respiratory distress syndrome, which required intubation for only 48 hours. At 6 months of age the baby has no complications.

**Discussion**

This case shows that in utero laser ablation of type II vasa previa is feasible. This adds further face value to the ultrasound diagnosis of type II vasa previa using combined color and pulsed Doppler. The purpose of laser treatment of type II vasa previa is to avoid the potential risk of fetal exsanguination with subsequent neonatal death or injury as a result of unpredictable rupture of membranes and tearing of the blood vessels. Indeed, in our case, subsequent spontaneous rupture of membranes occurred but did not result in fetal bleeding or exsanguination. Laser treatment of type II vasa previa could also eliminate the need for prolonged hospitalization and obligatory cesarean section, and may allow prolongation of pregnancy to term and vaginal delivery.
In utero laser ablation of type II vasa previa has potential limitations. First, an accurate diagnosis is pivotal prior to any further considerations. The differential diagnosis would include type I vasa previa and complete placenta previa with a thin portion of placenta and chorionic vessels covering the os. Laser ablation of type I vasa previa would result in immediate fetal demise. Laser ablation of chorionic vessels in placenta previa could result in vaginal bleeding, placental abruption, and fetal
demise. As shown in our case, the diagnosis of type II vasa previa can be easily confirmed during the endoscopic assessment of the amniotic cavity, by demonstrating the two separate placental lobes and the connecting vessels over the internal os without intervening placental tissue. Thus, the surgeon would still be in time to correct an ultrasound misdiagnosis of type II vasa previa and not proceed with laser ablation of type I vasa previa or placenta previa. Second, laser treatment of type II vasa previa eliminates an entire segment of the placenta which could result in fetal demise, damage to the fetal economy, or impairment of fetal growth. It is unknown how much placental mass can be acutely rendered non-functional without resulting in any adverse fetal consequences. From our observations in monochorionic twins, fetuses may survive with as little as 10% of the entire placental mass [8]. Nonetheless, surgery should not be entertained if the umbilical cord inserts in the smaller of the two lobes. In our case, the umbilical cord was inserted in the larger placental mass. Third, complications from the surgical procedure may negate altogether its potential benefits. Aside from fetal demise or adverse effects from reduced placental mass, surgery may also be associated with an increased risk of prematurity from ruptured membranes. Our current incidence of premature rupture of membranes with operative fetoscopy is 7.6%. This is similar to the incidence of spontaneous ruptured membranes in type II vasa previa of 8% [7]. Although premature rupture of membranes in our case is unlikely to have been associated with the surgical procedure, as it occurred 4.5 weeks out, it is a potential risk to take into consideration. To overcome this potential complication, surgery could be delayed until 26–27 weeks to decrease the potential complications of prematurity. This decision would need to be weighed against the increased surgical degree of difficulty associated with the larger size of the vessels to be ablated.

This case demonstrates, for the first time, that type II vasa previa can be confirmed and treated in utero via operative fetoscopy and that surgery can indeed be a life-saving procedure. Whether or not a randomized clinical trial to assess the risks and benefits of laser surgery vs. expectant management for type II vasa previa is required would depend upon the frequency of the prenatal diagnosis of this condition and further observations about the effectiveness of the procedure and its risks.

Acknowledgements

We would like to thank our colleagues Dr William Spellacy, Dr Michael Parsons and Dr David Keefe for their ethical review of the case, our anesthesiologists Dr Dev Mangar and Dr Luminita Vladitou, Lynn Modlin from the Department of Ultrasound at Tampa General Hospital, our sonographers Rhonda Mabry, Marcelline Dolhancryk, Susan DeShong, Jessy Gervais, and Mary Miranda, our operating room team Maria Jaramillo, Linda Chizari, June Curley, Iris Sanchez, Stacey Zabel, Estee Baker, and Zahira Medina, Dr Tom Danzi from the Office of Clinical Research of Tampa General Hospital, and Norma Epley and Dr Barry Bercu from the USF IRB.

References
