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The utility of Doppler ultrasonography in diagnosis of delayed postpartum hemorrhage: a case report

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Summary

Although uncommon, delayed postpartum hemorrhage (PPH) can be caused by uterine arteriovenous malformation (AVM), which can lead to severe mortality and morbidity in the mother. Therefore, accurate diagnosis and rapid treatment of uterine AVM may have a significant impact on a patient's prognosis. In the present case, the patient had vaginal bleeding two weeks after the cesarean section and was referred to the present hospital. She was diagnosed quickly with AVM by Doppler ultrasonography and treated with selective uterine artery embolization leading to a full recovery. Here the authors report the usefulness of Doppler ultrasound for early diagnosis of uterine AVM causing delayed PPH in the light of this case.

Key words: Delayed postpartum hemorrhage; Arteriovenous malformation; Doppler ultrasound.

Introduction

One percent of postpartum women have a delayed postpartum hemorrhage (PPH), defined as severe bleeding that occurs between 24 hours and 12 weeks after childbirth [1]. Delayed PPH typically occurs one to two weeks postpartum [1]. The major cause of delayed PPH is subinvolution of the uterus caused by retained placental tissue, endometritis, or uterine fibroids [2]. Another cause is vascular abnormalities such as arteriovenous malformation (AVM) and false aneurysms [3].

A delayed PPH by AVM is rare, but leads to severe uterine bleeding. In most cases, the lesions are acquired and have been associated with trophoblastic disease, previous pelvic surgery or curettage, and cervical or endometrial malignancy [3, 4]. Although a definitive diagnosis is usually made by pelvic angiography, transvaginal scanning with color Doppler provides a valuable and non-invasive method of diagnosis [5]. After PPH treatment, complications can sometimes occur and these are also responsible for half of the maternal morbidities. Therefore, rapid management is crucial for prognosis of patients. Uterine artery embolization for PPH associated with AVM is the most effective treatment with good clinical outcomes.

Here, the authors report the usefulness of Doppler ultrasound for early diagnosis of uterine AVM causing delayed PPH.

Case Report

A 36-year-old woman, gravid 2, para 1, was admitted to the present institute with heavy vaginal bleeding after full-term delivery in a private hospital. She underwent cesarean section two weeks prior, and no specific problems occurred until she was admitted to this institution. Before pregnancy, she had regular periods and an appropriate amount of menstruation. Three years ago, she had a dilation and curettage (D&C) due to a missed abortion. She achieved pregnancy following in vitro fertilization due to male factor infertility. She had a normal antenatal course and denied any medical history. An emergency cesarean section due to arrest of dilatation was performed at 39 weeks gestation. At cesarean delivery, the placenta was located on the posterior wall of uterus. At two weeks of puerperium, she had sudden and profuse vaginal bleeding, which settled spontaneously and repeated vaginal bleeding was continuous. Thus, she was referred to our hospital. On admission, her gross appearance was acutely ill-looking, and was of moderate built. Her height and weight were 163 cm and 61 kg (BMI, 22.5 kg/m^2), respectively, and her weight gain during pregnancy was 12 kg. Her blood pressure was 100/70 mmHg, heart rate was 100 beats/minute, body temperature was 36.3°C, and respiratory rate was 20 breaths/minute. Physical examination revealed a slightly distended abdomen after delivery and good uterine contraction. She had no tenderness and pain on the entire abdomen and vulvovaginal area. Sterile speculum examination revealed active bleeding. The laboratory findings were as follows: hemoglobin 8.8 g/dL, hematocrit 25%, white blood cell count 8,800 /μL, platelet count 182,000 /μL, and serum albumin 2.4 g/dL. Liver and renal functions were normal.

Ultrasonography was performed equipped with a volume endovaginal probe (6–12 MHz). Transvaginal ultrasonography revealed a well-defined anechoic cystic mass (arrow), measuring 24×26×15 mm in the posterior myometrium (Figure 1A). Color Doppler analysis revealed swirling blood flow within the anechoic

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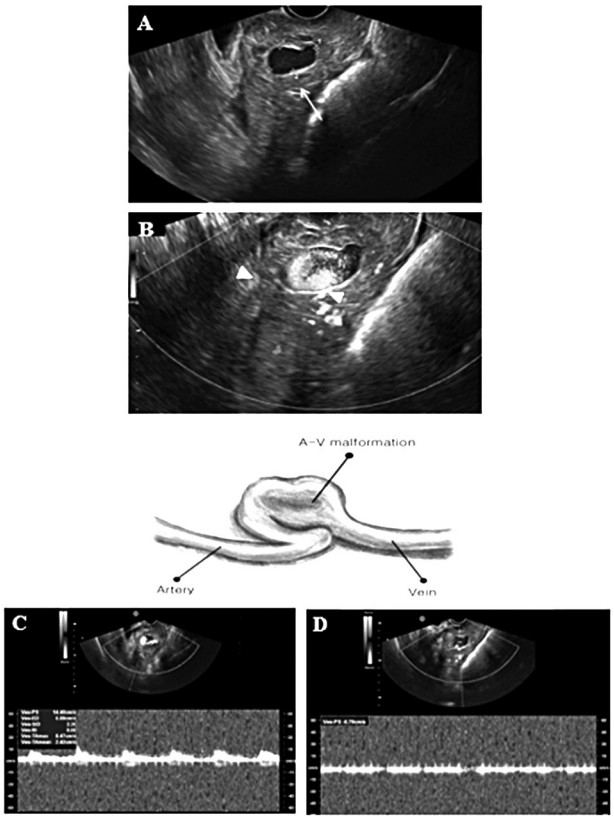

Figure 1. — Sonography of the uterine vascular malformation within the uterine cavity. (A) Gray-scale image showing an anechoic cystic mass (arrow) in the posterior myometrium. (B) Color Doppler image showing swirling blood flow (arrowheads) within the anechoic spaces. Schematic diagram of AVM (arrowheads) showing shunt of blood directly from the arterial to the venous circulation. (C) Spectral color Doppler showing high peak systolic velocity with low resistance of arterial waveform. (D) Spectral color Doppler showing pulsatile high-velocity venous waveform with little variations in systolic-diastolic velocities.

spaces (arrow) in the surrounding myometrium (Figure 1B). Spectral Doppler image revealed the classic features of AVM which were characterized by high peak systolic velocity (14.40 cm/s), low resistance (resistance index: 0.58), low pulsatility (pulsatility index: 0.98) of the arterial waveform (Figure 1C), and pulsatile high velocity venous waveforms (6.79 cm/s), with little variations in systolic-diastolic velocities (Figure 1D). AVM was suspected. Since she had continuous vaginal bleeding, interventional therapy was necessary.

Pelvic arteriogram and left uterine arteriogram were performed. It was discovered that the malformation was fed predominantly by the left uterine artery (Figure 2). Therefore, the left uterine artery was selectively embolized with a combination of gelatin sponge particles and a mixture of N-butyl-2-cyanoacrylate (NBCA) and lipiodol. Her vaginal bleeding decreased after the procedure. A repeat transvaginal scan performed three days later demonstrated that the cystic lesion on gray-scale image disappeared, and the blood flow pattern on color Doppler was markedly reduced. The patient's post-embolization period was uncomplicated. She was discharged from the hospital after five days.

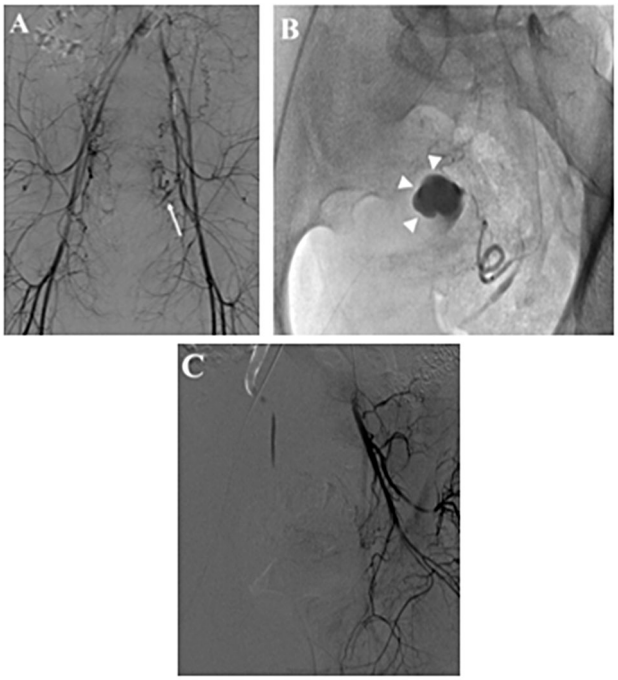

Figure 2. — Angiographic image during uterine artery embolization. (A) Pre-embolization arteriogram shows the left uterine artery (arrow) as the main feeder of acquired AVM. (B) Selective left uterine arteriogram reveals AVM with large pseudoaneurysm (arrowheads) at the uterus. (C) Post-embolization arteriogram shows absence of circulation of the occluded uterine artery.

Discussion

AVM are caused by an abnormal communication between an artery and vein, with proliferation of each vessel with interconnecting fistulae. Ultrasound with color Doppler is a sensitive modality for diagnosing uterine vascular malformations [5]. It is believed that these malformations may result from venous sinuses incorporating in scars within the myometrium after necrosis of the chorionic villi [6]. The majority are acquired after pregnancy and may result from trophoblastic disease, previous uterine curettage, uterine or cervical malignancy [3, 4] or cesarean section [7, 8]. In the present case, the patient had a history of dilation and curettage, three years prior to consultation and delayed PPH two weeks after cesarean delivery. When she arrived at this hospital two weeks after delivery, her uterine contraction was good and there were no abnormal findings on the external genital area. At delivery, the placenta was located on the posterior uterine wall and an AVM of the uterus occurred in the posterior wall of the uterus. Therefore, her PPH was thought to be caused by AVM sustained by vascular injury. However, transvaginal sonography revealed an anechoic cystic mass within the uterus, so the residual placenta, pseudoaneurysm, and AVM

of the uterus should have been distinguished.

Retained placenta is the second cause of PPH after uterine atony, but is the most common cause of delayed PPH. Ultrasound results that show echogenic material within the endometrium are not specific for either retained placenta or AVM, but color and power Doppler sonography have provided a valuable, non-invasive method for the definitive diagnosis of AVM [8]. The typical color Doppler sonographic pattern of an AVM is 'chaotic' flow characterized by a turbulent flow velocity waveform [9]. The chaotic or turbulent flow results from the area being filled with numerous individual velocity vectors randomly occurring in all directions [10]. The diagnosis of AVM could be made from these findings on color Doppler ultrasound, but confirmation of the diagnosis is usually achieved by angiography [9, 11]. An accurate diagnosis of AVM is very important, because the primary treatment modality for retained placenta, like D&C, can worsen vaginal bleeding and cause fatal consequences in patients with AVM.

Pseudoaneurysm can be also differentiated from AVM by Doppler ultrasound. Color flow Doppler demonstrates the typical "yin-yang" pattern of pseudoaneurysms anywhere in the body and a "to-and-fro" pattern at the neck of the pseudoaneurysm [12]. AVMs are characterized by distinguished aliasing on color flow Doppler and arterialized venous flow on spectral Doppler imaging [10]. In the present case, the lesion revealed the arterialized venous flow on spectral Doppler evaluation.

PPH due to uterine AVM can cause a life-threatening situation. Therefore, a rapid diagnosis and appropriate treatment are very important for the patient's prognosis. Doppler sonography is a quick diagnostic bedside tool that can potentially be used for the rapid diagnosis of uterine AVM. In the case of delayed PPH not due to uterine atony but with a history of uterine surgery or cesarean section, if Doppler ultrasonography demonstrates a bidirectional and high velocity blood flow within the mass of the uterine cavity, this could be clinically sufficient to doubt PPH occurring due to the uterine AVM. CT angiography and arteriography can then be used to confirm the diagnosis. Embolization can preserve future fertility. In the present case, the patient was diagnosed with uterine AVM by color Doppler ultrasound and treated with selected uterine artery embolization.

In conclusion, color Doppler sonography is very useful for the early diagnosis of AVM in patients with delayed PPH. When faced with cystic lesions in the uterine cavity by ultrasonography, Doppler sonography can be used for investigation.

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