Embolization of a Traumatic Uterine Arteriovenous Malformation

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ABSTRACT

Uterine arteriovenous malformation (AVM) is a rare but potentially life-threatening source of bleeding. A high index of suspicion and accurate diagnosis of the condition in a timely manner are essential because instrumentation that is often used for other sources of uterine bleeding can lead to massive hemorrhage. Although angiography remains the gold standard for diagnosis, ultrasound (US) and magnetic resonance imaging (MRI) are the modalities of choice for the evaluation of a suspected AVM. US and MRI cannot only accurately define a uterine AVM, but they also have the ability to assess the extent of pelvic involvement noninvasively. The definitive treatment of uterine AVM is hysterectomy. However, most women diagnosed with the condition are of childbearing age. Transcatheter uterine artery embolization offers a safe and effective alternative to surgery, with the major advantage of retaining childbearing capacity.

KEYWORDS: Uterine artery embolization, uterine arteriovenous malformation

Objectives: Upon completion of this article, the reader should be aware (1) of the characteristic US and MRI features of uterine AVMs and (2) of uterine artery embolization as an effective conservative treatment option.

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CASE REPORT

A 28-year-old woman presented with a missed abortion. Dilation and curettage were performed, and in the following months the patient experienced intermittent and irregular vaginal bleeding including one episode of acute, excessive blood loss that required hospitalization. Ultrasound (US) revealed an irregular and thickened endometrium with increased vascularity (Fig. 1A). Magnetic resonance imaging (MRI) demonstrated a mass of tortuous vessels extending from the uterine cavity into the myometrial wall, most suggestive of an arteriovenous malformation (AVM) (Fig. 1B,C). The patient was

referred to interventional radiology for uterine artery embolization of the traumatic uterine AVM.

After informed consent was obtained, conscious sedation was achieved with Versed and fentanyl. The right common femoral artery was accessed, and a 5F flush catheter was placed through a 6F sheath. Contrast injection with the catheter in the distal aorta demonstrated a tangle of vascular structures overlying the uterus fed primarily via the left uterine artery (Fig. 2A). A 5F selective catheter was placed into the left uterine artery. Contrast injection demonstrated a serpiginous and dilated arterial structure with early filling of prominent

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Figure 1 Ultrasound (US) and magnetic resonance imaging (MRI) features of a traumatic uterine arteriovenous malformation in a 29-year-old woman. (A) Transvaginal color and spectral Doppler US demonstrates increased vascularity of the endometrium and high velocities, indicating low resistance within the vascular structure. (B) and (C) Axial T1-weighted MRI pre- and postcontrast show a bulky mass containing multiple flow-related signal voids extending from the uterine cavity to the myometrium. There is avid enhancement of the vascular structure with gadolinium.

veins (Fig. 2B,C). Gelfoam pledgets were injected into the left uterine artery until near stasis of flow was encountered. The 5F catheter was then withdrawn and placed in the right uterine artery. Contrast injection showed a normal-appearing vessel with no evidence of AVM. Because of the potential for recruitment of the right uterine artery to contribute to the AVM in non-macroscopically visible means, we decided to embolize the vessel. Gelfoam pledgets were injected into the right uterine artery until near stasis of flow. Following exchange of the 5F catheter for a flush catheter placed in the aorta, contrast material injection demonstrated patency of the proximal uterine arteries without visualization of the AVM. The patient recovered without complications. Follow-up clinic visits revealed termination of her menometrorrhagia. Approximately 4 months following embolization, the patient became pregnant. She went on to deliver a healthy term baby.

DISCUSSION

AVMs of the uterus are a rare cause of uterine bleeding, with only over 100 cases reported since 1926.¹ They consist of a tangle of vessels with abnormal communication between arteries and veins and lack evidence of an intervening capillary network.

AVMs can either be congenital or acquired. Congenital uterine AVMs are thought to develop secondary to faulty arrest in the angiogenic process.¹⁻³ Acquired uterine AVMs are thought to be related to uterine trauma including curettage or cesarean delivery, retained products of conception, choriocarcinoma, endometrial or cervical carcinoma, gestational trophoblastic disease, and diethylstilbestrol exposure.¹⁻³

Regardless of the etiology, uterine AVMs are a potential source of significant morbidity and, rarely, mortality. The true incidence is unknown, but the majority of cases are found in women of reproductive

Figure 2 Embolization of the traumatic uterine arteriovenous malformation. (A) Initial pelvic arteriogram reveals a tangle of vessels projected in the region of the uterus fed primarily by the left uterine artery. (B) and (C) Selective uterine artery injection shows a tortuous vascular mass supplied by the left uterine artery and early venous filling during the late arterial phase. Note that there is filling of the superior vesical artery in (B).

age. Most commonly, they present with menorrhagia or menometrorrhagia requiring blood transfusions in 30% of reported cases.³ The differentiation between a uterine AVM and other causes of uterine bleeding is necessary because instrumentation can lead to massive hemorrhage.

Historically, uterine AVMs were diagnosed by laparotomy or pathologically after hysterectomy. Angiography has since become the gold standard for diagnosis, classically showing complex vascular connections supplied by hypertrophied feeding arteries and early drainage through enlarged and hypertrophic veins.³ Although angiography has the ability to assess the size of AVMs and vessel involvement, it is invasive and

cannot accurately detect the degree of pelvic extension.^{3,4} US and MRI accurately delineate the extent of adjacent organ involvement and are now considered the modalities of choice when evaluating a patient with suspected uterine AVM.

Gray-scale US features of uterine AVMs include multiple anechoic structures with a serpentine contour within the myometrium.⁴ However, these features are often confusing and nonspecific.^{3,4} The addition of color and spectral analysis can lead to more accurate diagnoses. On color Doppler, these hypoechoic structures exhibit vascular flow. Huang et al suggested two distinct color patterns consistently associated with uterine AVMs. The first is the juxtaposition of blue and red components,

suggesting blood flow reversals caused by overlapping vessels of varying orientations and flow directions. The second is color aliasing and the separation of red and blue components by yellow and white, suggesting focal high velocities.³ Spectral Doppler demonstrates low-resistance and high-peak systolic velocities with continuous high flow throughout systole and diastole.^{2,3}

MRI provides accurate definition of uterine AVMs and effectively delineates invasion of adjacent organs. Characteristic features include a bulky uterus with a focal mass, disruption of the junctional zones, multiple serpiginous flow-related signal voids within the lesion, and prominent parametrial vessels.^{2,3} Gadolinium-enhanced MRI demonstrates hypervascular arterial dominant flow.

Prior to embolotherapy, hysterectomy or uni/bilateral uterine artery ligation were the therapies of choice. Since the first reported case of transcatheter uterine artery embolization for a uterine AV fistula in 1982, embolotherapy has become a well-recognized alternative to surgical intervention for uterine AVMs, with the major advantage of maintaining childbearing capacity.

Ghai et al recently reported a retrospective review of all patients who underwent pelvic arterial embolization for traumatic uterine AVMs at their institution during a 10-year span.¹ A total of 25 embolization procedures were performed in 15 patients. Embolization agents used depended on operator preference and expertise and included polyvinyl alcohol particles, absorbable gelatin sponge, metallic coils, and glue. The technical success rate was 100%. The clinical success rate was 93%. The authors did not believe the type of embolization agent influenced the outcome. Four of 15 patients had a total of five uneventful intrauterine pregnancies carried to term. The authors concluded that selective uterine artery embolization is a safe and effective

tive treatment for traumatic uterine AVMs while preserving the possibility of future pregnancy.

The transcatheter embolization technique we used is typical of that described in most cases in the literature. For our embolization material, we used absorbable gelatin sponge pledgets without complications. Gelfoam offers 3 to 5 weeks of occlusion that is sufficient to occlude the AVM while still permitting slow development of collateral vessels, allowing for the preservation of fertility and resumption of menstruation.⁵ Furthermore, an increasing number of pregnancies following transcatheter embolization of uterine AVMs are being reported.

This case supports the current literature, which suggests that transcatheter uterine artery embolization of traumatic uterine AVMs is a safe and effective alternative to surgical therapy while offering the major advantage of preserving childbearing capacity.

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