CASE REPORT

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Intra-uterine use of a Foley balloon catheter to tamponade an actively bleeding post-traumatic uterine arteriovenous shunt

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ABSTRACT

Arteriovenous shunts (AV-shunts) whilst rare, can complicate intrauterine surgical procedures leading to severe vaginal bleeding. We present the case of a 29-year-old woman who experienced sudden, torrential vaginal bleeding 10 days following a hysteroscopic resection and curettage of a placental remnant after vaginal delivery. Ultrasonographic evaluation with power doppler demonstrated a post-traumatic AV-shunt. Tamponading the shunt for 36 hours utilising an intra-uterine inflated Foley catheter successfully controlled the bleeding and led to complete resolution of the AV-shunt. Accurately differentiating an AV-shunt from other hyper vascular entities, such as enhanced myometrial vascularity or arteriovenous malformations, is essential, due to the important differences in therapeutic management strategies.

Keywords: Arteriovenous malformations, surgical arteriovenous shunt, enhanced myometrial vascularity, uterine artery embolisation

Introduction

Uterine hypervascularity can be present in different physiological and pathological entities such as enhanced myometrial vascularity (EMV), post-traumatic arteriovenous shunts (AV-shunts), gestational trophoblastic disease, uterine malignancy, uterine ectopic pregnancies or rare congenital uterine arteriovenous malformations (AVM).[1-3]

Post-traumatic AV-shunt has been reported following various obstetric and gynaecologic procedures such as dilation and curettage (D&C), caesarean section, hysteroscopy, myomectomy and manual removal of the placenta.[4-6] It is a rare condition. Abnormal uterine bleeding is the most common presenting symptom of post-traumatic AV-shunts.[4,6] Differentiating acquired AV-shunts from other hyper vascular entities is important to provide optimal treatment.[1,2] We report a case of a post traumatic AV-shunt, where the use of an intra-uterine Foley catheter controlled the uterine haemorrhage and resulted in a complete disappearance of the AV-shunt. Written informed consent was obtained from the patient after approving the final version of the manuscript.

Case Report

A 29-year-old woman, G1P1, with an unremarkable medical history was diagnosed with an asymptomatic hematometra and placental remnant of 22x19x7mm located on the anterior uterine wall 8 weeks after a vaginal delivery. Three months postnatally, the shared

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decision was made to perform a cold loop hysteroscopic resection of the retained placental tissue. Complete resection could not be achieved hysteroscopically, necessitating conversion to ultrasound-guided curettage during the same procedure. Intraoperative ultrasonography and hysteroscopy confirmed complete evacuation of the retained placental tissue. The patient was discharged from hospital the same day without any adverse events. Histopathological review of the tissue confirmed placental remnants with associated chronic endometritis.

Ten days following hysteroscopy and curettage, the patient presented to the emergency department with acute onset of severe vaginal bleeding. Clinical examination confirmed active bleeding originating from the cervical ostium. The patient was haemodynamically stable. There were no clinical nor biochemical signs of infection: white blood cell count was 6300/µL, C-reactive protein 2.6 mg/L and haemoglobin 10.6 g/dL. Transvaginal ultrasound demonstrated a hematometra without persistent retained placental tissue. Within the posterior myometrium an anechoic structure was detected (Figure 1). Power Doppler imaging revealed a high velocity (30 cm/s) and low resistance blood flow exhibiting a whirlpool flow-pattern within the anechoic lumen, suggestive of an AV-shunt (Figure 2).

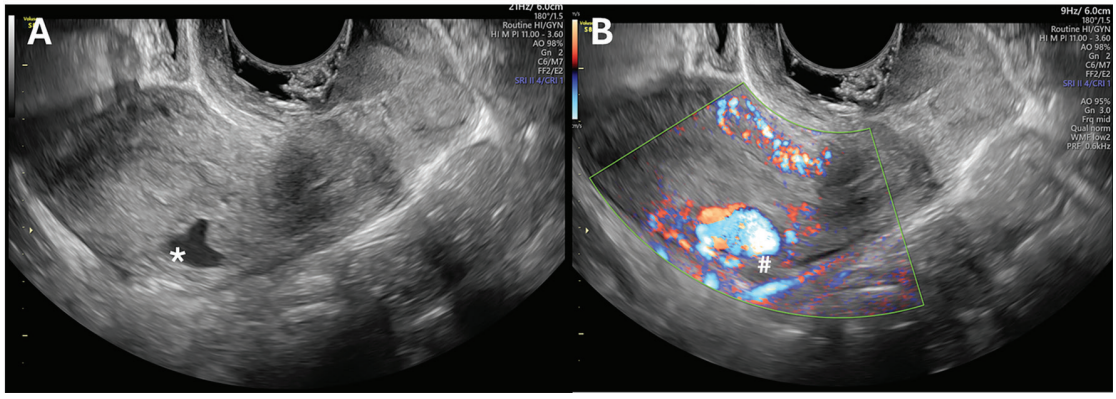

Figure 1. A) Grey scale ultrasound image of an anechoic area in the posterior myometrium (*), corresponding with an AV-shunt. (B) Power Doppler Image of this same image. Pulse Repetition Frequency 0.6 kHz. AV: Arteriovenous.

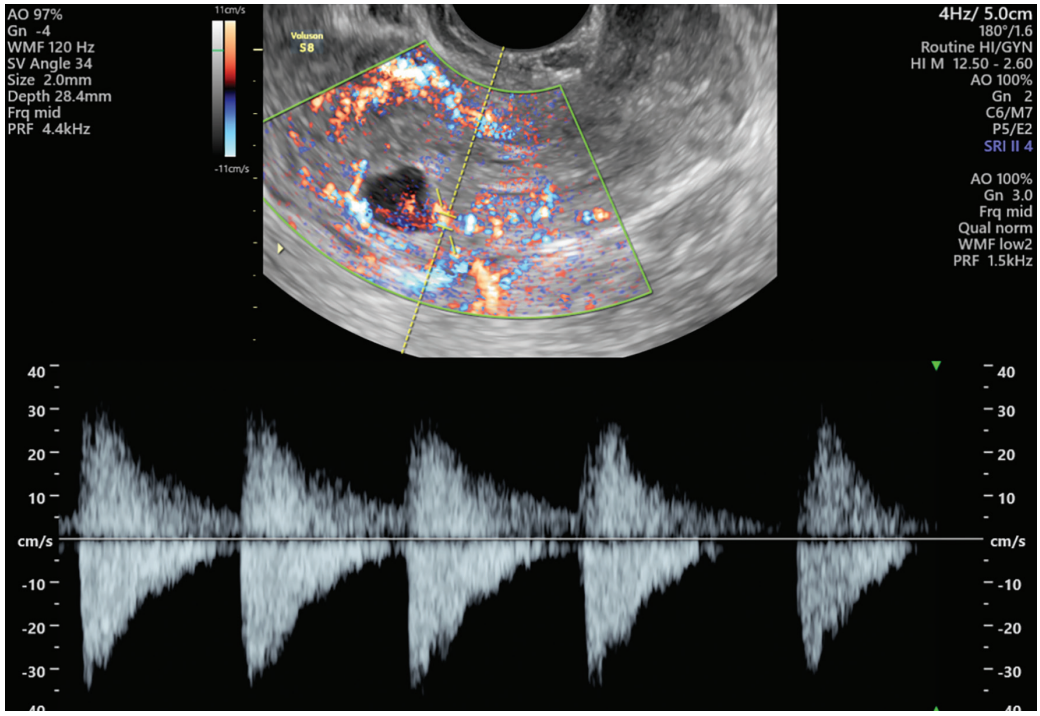

Figure 2. Spectral Doppler demonstrating high velocity arterial flow into the cavity. Pulse repetition frequency 1.5 kHz. peak systolic velocity 30 cm/s.

Given the clinical context and availability of recent pre-operative imaging without the presence of a vascular lesion, other types of hypervascularity such as congenital AVM could be excluded. An EMV with retained placental tissue was also less likely given hysteroscopy confirmed complete resection after the D&C.

Intervention

During the emergency assessment 1 g of intravenous tranexamic acid was administered. To achieve source control of the active bleeding, a Foley catheter was inserted in the uterine cavity under ultrasound guidance and positioned at the level of the AV-shunt. The balloon was gradually inflated with a normal saline solution until the sonographic image confirmed complete compression of the lesion with the disappearance of the anechoic area and resolution of the Power Doppler signal (Figure 3). In total 10 cc was inserted. This intervention successfully controlled the haemorrhage. Post-procedurally the patient was admitted and intravenous tranexamic acid 1 g three times per day was continued and prophylactic doxycycline initiated.

Outcome

After 36 hours, sonographic assessment confirmed a sustained tamponade of the AV-shunt and the Foley catheter was gradually deflated by 5 cc, followed by an additional 5 cc four hours later. Minimal bleeding was observed throughout the process and patient remained haemodynamically stable. Catheter removal under sonographic guidance confirmed complete resolution of the AV-shunt. Haemoglobin level was 9.6 g/dL.

The patient was subsequently discharged with oral tranexamic acid 1 gram 3 times daily and doxycycline 100 mg twice a day. Follow-up ultrasound examination at 3 weeks confirmed persistent resolution of the AV-shunt. There was some residual hematometra (Figure 4A). Vaginal bleeding remained minimal and Desogestrel 75 mcg once a day was reinitiated for contraceptive purposes. Ultrasounds 6-months after the procedure demonstrated a normal endometrial lining and homogeneous myometrium (Figure 4B).

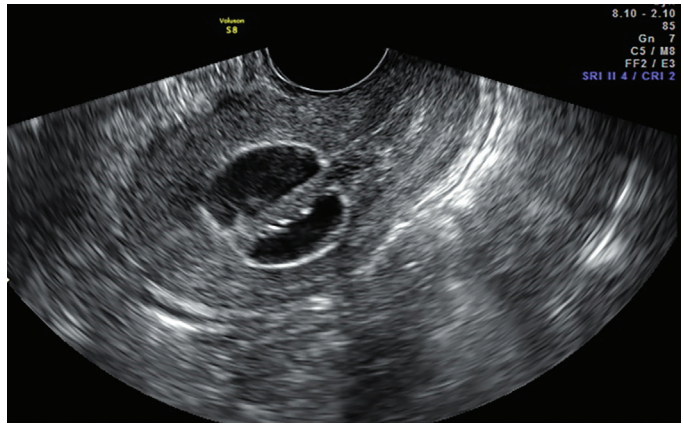

Figure 3. Complete compression of the lesion with disappearance of the anechoic area after Foley catheter insertion.

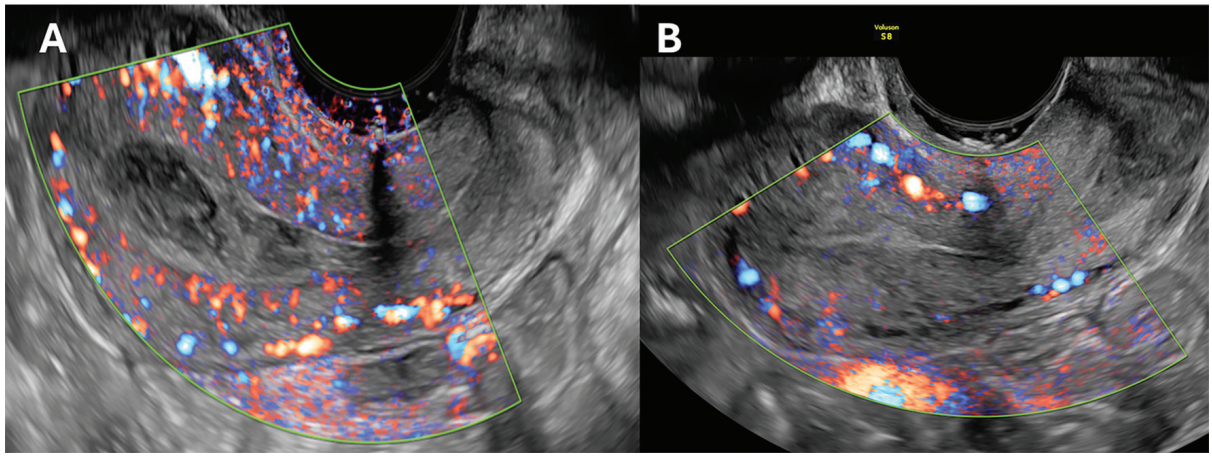

Figure 4. A) Follow-up Doppler ultrasound 3 weeks postoperatively confirmed sustained and complete resolution of the arteriovenous shunt but with a residual hematometra. Pulse repetition frequency 0.3 kHz. (B) Ultrasound 6 months postoperatively demonstrates absence of the hematometra and a sustained resolution of the arteriovenous shunt. Pulse Repetition Frequency 0.3 kHz.

Discussion

In this case we describe the successful minimal invasive haemostatic control of a symptomatic post-traumatic uterine AV-shunt with the intra-uterine placement of a Foley catheter. This intervention led to the complete regression of this rare but potential life-threatening vascular lesion highlighting its potential use as minimal invasive low-cost intervention. We hypothesize that the regression of the traumatic AV-shunt can be explained by the local compression of a non-physiological cavity, allowing for secondary haemostasis with resolution of the traumatic arterio-venous connection. The use of tamponade with a Foley catheter balloon is well-established in the management of postpartum haemorrhage and has demonstrated its efficacy in procedures such as myomectomies, caesarean sections for placenta accreta spectrum and caesarean scar pregnancies.[7-9] To our knowledge, the therapeutic application of a Foley catheter for AV-shunts has not been extensively described. Three case reports describe the use of a Foley catheter to control torrential bleeding in case of a uterine hypervascularity. The case reports describe a uterine AVM or 'uterine artery pseudoaneurysm', but the manuscripts do not allow to differentiate between a true AV-shunt, EMV or congenital AVM.[10-12]

The diagnosis of a post-traumatic AV-shunt can be challenging, as imaging findings alone may be insufficient to reliably distinguish it from an EMV or a rare congenital AVM.[4] Besides ultrasound findings, clinical context is indispensable for accurate diagnosis (Figure 5). Based on the available literature, the diagnostic process is further complicated by the historically inconsistent and interchangeable use of the terms post-traumatic AV-shunts, AVM (both congenital and acquired) and EMV.[1,13] However, they represent separate entities that require different management approaches.

A post-traumatic AV-shunt, is characterised by a single arteriovenous communication between one or more branches of the uterine artery and the myometrial venous plexus.[4] In the literature, post-traumatic AV-shunts have interchangeably been referred to as "arteriovenous fistulas", "traumatic uterine arteriovenous malformations"

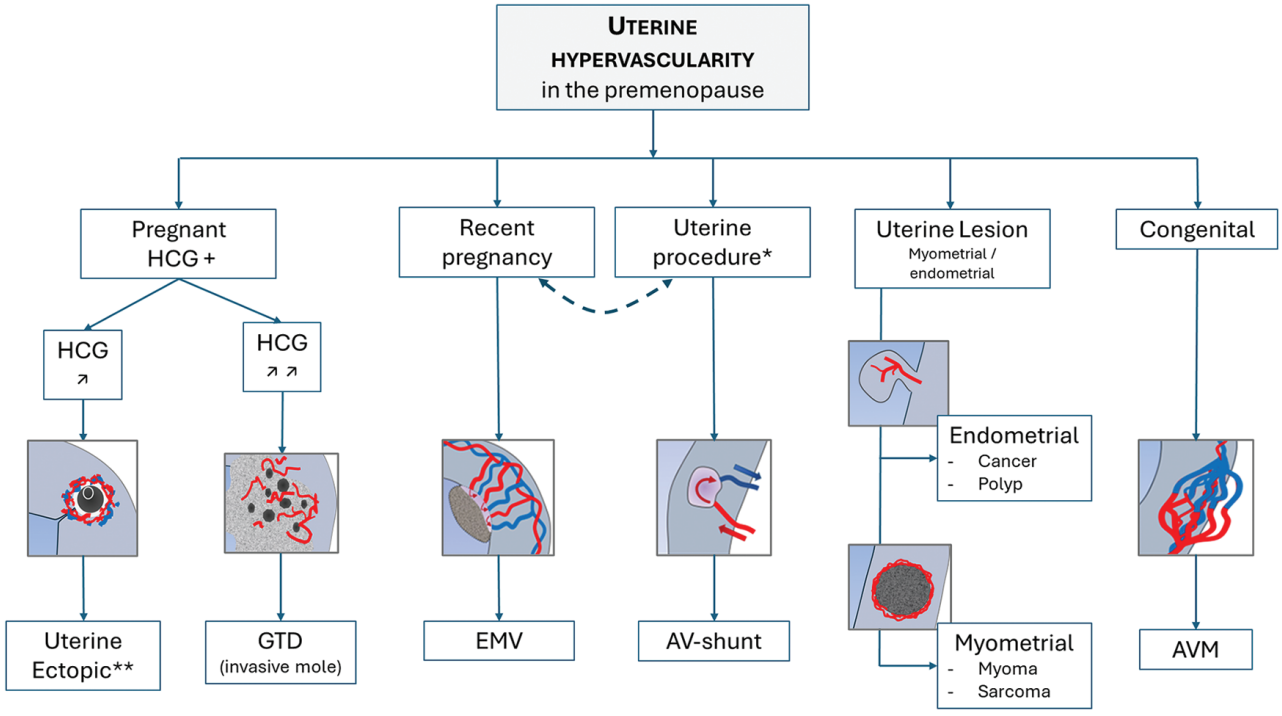

Figure 5. Differential diagnosis of uterine hypervascularity in premenopausal women.

*Uterine procedures with a risk of a myometrial trauma such as (but not limited to) uterine sounding, intra-uterine device placement, curettage, hysteroscopy, myometrial resection for fibroid, adenomyosis, caesarean section.

**Uterine ectopic such as an intra-mural pregnancy, caesarean scar pregnancy, interstitial pregnancy, cervical pregnancy.

HCG: Human chorionic gonadotropin, GTD: Gestational trophoblastic disease, EMV: Enhanced myometrial vascularity, AV-shunt: Arteriovenous shunt, AVM: Arterio-venous malformation.

or "acquired uterine arteriovenous malformations".[1] In contrast to acquired AV-shunts, congenital AVMs result from embryological maldevelopment and arise from defects in the differentiation of the primitive capillary plexus during foetal angiogenesis. They are characterized by multiple feeding arteries, a central nidus consisting of vessels with characteristics of both arteries and veins and multiple large draining veins.[6,14,15] A congenital AVM and an acquired (post-traumatic) AV-shunt represent a non-pregnancy related shortcut between an artery and a vein, which does not resolve spontaneously.[2] EMV is distinct from an AV-shunt because it represents an incomplete regression of physiological vascular changes within the myometrium due to retained pregnancy tissue. It typically resolves once the retained tissue is expelled or surgically removed.[1,16-18]

Integrating clinical context in the diagnostic process is essential, particularly given the significant differences in management strategies.[2] Historically, hysterectomy was the standard treatment for post-traumatic AV-shunts.[4] In recent years, selective uterine artery embolisation (UAE) has become the preferred treatment, being less invasive and fertility-preserving.[5,6] Although other surgical techniques including laparoscopic occlusion of the internal iliac or uterine artery, hysteroscopic coagulation or surgical removal have been described, UAE remains the most commonly used intervention.[4,19] However, this radiological treatment may not be available in all hospital settings and alternative management approaches such as the one described in this case report should considered. Moreover, whilst generally safe, UAE can be associated with pelvic pain and rare complications such as thromboembolic events, puncture site hematoma, non-target embolization, ovarian function disruption, intrauterine adhesions and an increased risk for placental abnormalities (placenta accreta and/or placental insufficiency) in future pregnancies.[4,16,20-23]

In contrast to treatment of symptomatic AV-shunts, expectant management of EMV is appropriate when symptoms are minimal, as spontaneous resolution usually occurs.[1] Intervention with removal of the retained pregnancy tissue can be indicated in case of heavy or persistent bleeding or if conception is deemed hindered by the retained tissue. Misdiagnosing EMV as a shunt or rare congenital AVM may lead to overtreatment with unnecessary morbidity from interventions such as UAE or hysterectomy. On the other hand, misdiagnosing an AV shunt as EMV may lead to endometrial curettage, which may exacerbate bleeding.[4,17]

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Transparency: The authors affirm that the manuscript is an honest, accurate, and transparent account of the reported case. No important aspects have been omitted.

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