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Tangled: A Pictorial Review of Ultrasound and Angiography of Postpartum Hemorrhage due to Uterine Arteriovenous Malformations and Sub-Involution of the Placental Bed

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Background

Post-partum hemorrhage (PPH) can occur in up to 6% of deliveries and is a major cause of maternal mortality. First line conservative management includes uterotonic agents (oxytocin/misoprostol), and extra and/or intrauterine compression. Failure of conservative management in PPH progresses to uterine artery embolization (UAE) or surgical management.

UAE is preferred for PPH after failure of conservative treatment, as UAE can be performed in an emergent manner and can be repeated if necessary. Multiple studies have shown fertility is usually preserved after UAE, while surgical management is more aggressive utilizing either UA ligation or hysterectomy. UAE is effective for multiple types of PPH, and 24 hours after delivery, arteriovenous malformations (AVM) are one of the most common type to require UAE. Embolization with gelatin foam is preferred but in refractory or severe bleeding, N-butyl cyanoacrylate or microparticles can be used. Coils are generally reserved for pseudoaneurysm.

Sub-involution of the placental bed (SIPB) as an etiology for PPH is a relatively underrecognized etiology in both diagnostic and interventional radiology as it is a diagnosis of exclusion. SIPB describes a failure of regression of large placental vessels within the myometrium, with PPH occurring greatest at 2-weeks post-partum. Generally, they can be thought of as focal uterine atony and can respond to uterotonic agents. However, embolization may be required in severe bleeding and, as shown in our imaging, they can recur and cause re-bleeding.

Clinical Findings

The appearance of uterine AVM and SIPB in the setting of PPH is indistinguishable on ultrasound. Both manifest as a vascular myometrial based focus with high flow and low-resistance on spectral Doppler. However, uterine vessel angiography can clearly diagnose a uterine AVM with tortuous and hypertrophied uterine arteries and an early draining vein.

We present several cases of PPH with uterine AVM diagnosed on ultrasound that were confirmed with angiography and embolized successfully. We contrast those cases to patients with PPH and features that were consistent with AVM on ultrasound, whom had no evidence of AVM on angiography, thus suggestive of SIPB. Despite the lack of AVM found on angiography, these cases were embolized via gelatin foam or microparticles with successful hemostasis of the PPH.

In our cases, the PSV of both AVM and SIPB are in the 30-60 cm/s range with a low RI. AVMs are more likely to be after instrumentation and will show a focal tangle of vessels with a early draining vein on angiography. SIPB, in contrast, will show only a normal post-partum uterine vascularity on angiography without focal vascular lesion or early draining vein. In our cases of SIPB one was after surgical abortion, one was after medical abortion and one was after a C-section with the other two after NSVD. All AVM and SIPB cases had negative beta-hCG at time of ultrasound and UAE.

SIPB

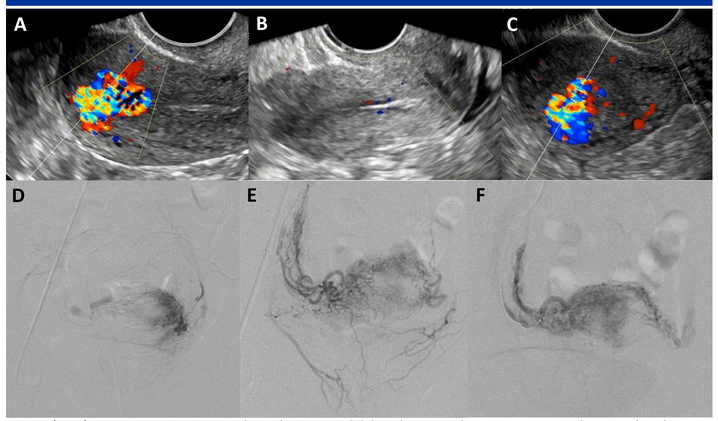

Fig 1(A-F): *21 yo F presented with vaginal bleeding with a myometrial vascular lesion on U/S (A). Vaginal bleeding ceased after treatment with misoprostol and packing and 24 hr follow-up ultrasound (B) did not show the vascular lesion. Patient then presented 8 days later with no further intervention with vaginal bleeding with recurrence of the vascular lesion on U/S (C). Patient presented for pelvic angiogram/UAE (D-F) which did not demonstrate a vascular lesion/AVM suggestive of SIPB. UAE was performed with gelatin foam and 5-700 nm and 7-900 nm microparticles with adequate hemostasis.*

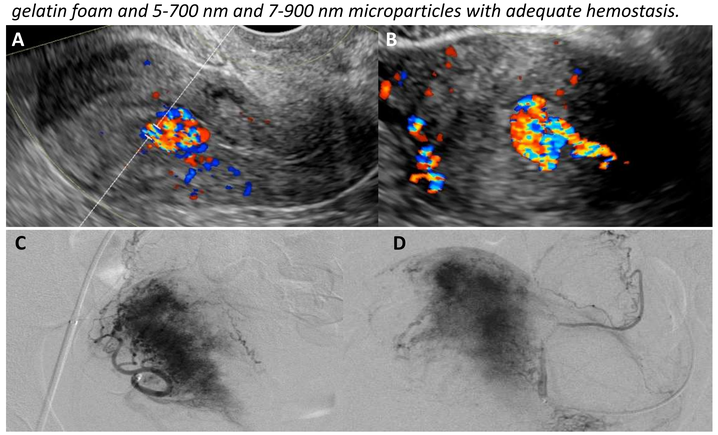

Fig 2(A-D): *20 yo F presented with vaginal bleeding after medical abortion. Ultrasound (A, B) showed myometrial vascular lesion "concerning for AVM or retained products". Beta-hCG was zero. Uterine artery angiogram (C,D) did not show vascular lesion consistent with SIPB. Bilateral UAE was performed with 500-700 nm microparticles with adequate hemostasis.*

AVM

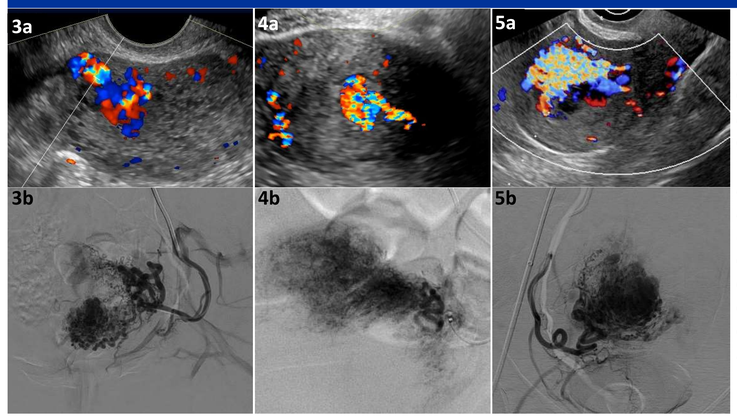

Fig 3-5: *Three selected cases of secondary post-partum hemorrhage refractory to conservative management with a hypervascular myometrial focus on ultrasound (3a-5a). UAE of these lesions demonstrated a hypervascular focus and hypertrophied and/or torturous uterine artery (3b-5b). Early draining vein confirms the diagnosis of AVM on angiography. These cases were embolized either by gelatin foam, microparticles or combination.*

	SIPB	AVM
Case #	5	5
PSV/RI on EV U/S	40-60 cm/s. Low RI.	30-65 cm/s. Low RI.
Uterine Artery Angiography Findings	Post-partum uterus without vascular focus.	Vascular focus, tortuous and hypertrophied uterine artery, and early draining vein.
Embolization Material	Microparticles (500-900 nm range). One case employed both gelatin foam and particles.	Gelatin foam, microparticles (500-1200 nm range) or combination.
Re-bleeding after UAE	None	None

Conclusion

Both SIPB and AVM are a cause of secondary-PPH which are indistinguishable on doppler and spectral ultrasound but can be differentiated on pelvic angiography. Both entities can be successfully embolized, in our experience with different sizes of microparticles +/- gelatin foam. SIPB treated with conservative management can regress and recur that then may require embolization for refractory bleeding.

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