Two cases of uterine vascular malformations diagnosed by color doppler ultrasound and managed conservatively by uterine artery embolization*

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ABSTRACT

Vascular malformations of the uterus are rare, but could be a cause of life-threatening profuse abnormal uterine bleeding. Most reported cases in the literature are the arteriovenous malformations (AVM's), arterio-venous (AV) fistulas or pseudoaneurysms. The true incidence is not yet known though they represent about 1-2% of all the genital and intraperitoneal hemorrhages.

AVM is an abnormal connection between uterine arteries and veins while pseudoaneurysm or false aneurysm is an extra-luminal collection of blood with turbulent flow that communicates with the parent vessel through a defect in the arterial wall. Both conditions could cause profuse or torrential abnormal uterine bleeding after uterine surgery, manipulation, or cesarean section or any procedures that could cause injury to the uterus. Treatment options or modalities are similar for both. The treatment of choice whether conservatively or surgically depends on the symptoms, age, desire for future fertility, location and size of the lesion. Pelvic angiography is the gold standard diagnostic modality, though transvaginal ultrasound with color Doppler provides a valuable, non- invasive and readily accessible initial diagnostic procedure. Uterine artery embolization is the treatment of choice in symptomatic patients desirous of future fertility. We report a case of AVM after dilatation and curettage (D&C) for missed abortion and pseodoaneurysm after cesarean section(CS) which were initially diagnosed with transvaginal color Doppler ultrasound – as vascular malformation (AVM versus AV-fistula vs. Pseudoaneurysm), prior to angiography and successfully treated by uterine artery embolization.

Keywords: Vascular Malformations, AV Malformation, Pseudoanuerysm, Abnormal Uterine Bleeding

LEARNING OBJECTIVES:

1. Describe the clinical manifestations of uterine vascular lesions particularly AV malformation and pseudoaneurysm.

2. Identify the role of ultrasound in the diagnosis of uterine AVM's and pseudoaneursym.

3. Explain the significance of uterine artery embolization as treatment modality in cases of uterine vascular malformation.

INTRODUCTION

Vascular malformations of the uterus are rare, though the exact incidence is still unknown. Only 100 cases have been reported since 1926-2005[1]. They represent about 1-2% of all the genital and intraperitoneal hemorrhages[3,4] and could be a cause of life threatening profuse or torrential vaginal bleeding because these abnormal vessels are friable and can easily bleed, leak or rupture. A study by O'Brien showed an incident of AVM of 4.5% in 464 ultrasound examination performed for pelvic bleeding[8]. Most reported cases are the arteriovenous malformations (AVMs) and more rarely pseudoaneursyms. It is uncommon in nulliparous women and has been reported in patient with age group ranging from 18-72 years old[2].

AVMs is an abnormal connection between uterine arteries and veins. It could be Congenital which is very rare or Acquired, which is the more common form. While pseudoaneurysm or false aneurysm, is an extra-luminal collection of blood with turbulent flow that communicates with the parent vessel through a defect in the arterial wall. Acquired AVMs and pseudoaneurysm are caused by uterine trauma or injury, instrumentations or surgeries due to abortion, trophoblastic disease, endometrial cancer, curettage or cesarean section.[4-6] In pseudo-aneurysm, injured blood vessels bleed and blood collects between tunica media and tunica adventitia of an artery[1,7]. Non-recognition or delay in the diagnosis of both vascular abnormalities prior to intrauterine surgical manipulation specifically D&C may result to disruption or further injury

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of these abnormal vessels and may lead to life threatening torrential hemorrhage.

Angiography is the gold standard diagnostic modality of AVM's. While color Doppler ultrasound has been used as a reliable, practical initial diagnostic procedure prior to definitive angiography. It can aid in planning the most appropriate and safest treatment modality for the patient. On transvaginal color Doppler, these abnormal vessels would show bright mosaic pattern color flow from turbulent & multidirectional flow with high velocity or high arterial pulsations[5,6].

We report a case of AVM after D&C for missed abortion and pseudoaneurysm in post CS patient who were successfully treated by uterine artery embolization.

CASE NO. 1

This is a case of a 30 y/o, G2P1 (1011) referred in our Women's Health Care Unit for transvaginal ultrasound examination (TVS) due to persistent vaginal bleeding despite after two dilatation curettage (D&C) procedures. History started 5 weeks prior to referral as prolonged mild vaginal bleeding after D&C for pregnancy failure (blighted ovum vs. missed abortion). However, vaginal bleeding persisted with episodes of moderate to heavy bleeding 3 weeks prior to referral thus prompted consult and TVS was done which showed retained placental fragments. D&C was repeated and patient discharged a day after. However, on and off mild to moderate vaginal bleeding (soaking 1-3 pads/day) persisted thus opted to seek second opinion where TVS in our unit was done which showed normal cervix with intact canal (Figure 1), hyperechoic, thin and intact endometrium at the lower cavity 0.20cm (Figure 2), with a complex mass at mid to upper cavity measuring 2.2 x 1.4 x 1.3 cm (volume of 2.1cc) could be retained secundines/placental polyp (Figure 3). On color Doppler, rich color flow at anterofundal area was seen seemingly extending to anterior endometrial- myometrial junction (Figure 4) with high velocity flow (Figure 5) could be AV malformation. Uterus was normal in size and anteverted (Figure 6), right ovary was normal in size and echotexture with corpus luteum (Figure 7), as well as the left ovary (Figure 8).

Patient then had serum B-HCG with a value of 87.20mIU/ml ruling out the possibility of Gestational Trophoblastic Tumor. Patient was admitted for pelvic angiography and proceeded with uterine artery embolization in the same setting.

Past Medical History: Patient had no known co-morbidities. No other history of surgery aside from NSD and two D&C's.

She is a non-smoker & occasional alcoholic beverage drinker with known family history of thyroid cancer.

Gynecologic History: Menarche was at 13-years-old, of 7 days duration consuming 2-3 pads/day moderately soaked; LMP-Oct 24, 2017, PMP-September 2017. Used OCP's since 2013 but intermittently only; Pap smear done (2014 & 2015) - negative results

Obstetric History: G2P1 (1011) G1-2013, NSVD, Full term, no complications; G2-2017, Blighted ovum (vs. Missed abortion) S/P D&C twice done.

On admission, patient was conscious, coherent, not in respiratory distress. BP-110/70 mmHg, HR-77bpm, RR-19cpm. Anicteric sclera, pinkish palpebral conjunctiva. Symmetrical chest expansion & clear breath sounds. Dynamic precordium, normal rate & regular rhythm. Abdomen is soft with no tenderness. Full pulses & no edema. IE: introitus: parous cervix: closed uterus: small, non- palpable adnexa: (-) tenderness; (+) bloody discharge.

Admitting Diagnosis: AUB consider uterine AV malformation, S/P: D&C(2x) for Blighted Ovum and Retained Products of Conception.

Laboratory Tests: CBC and Prothombin time were normal.

She was referred to the Interventional Radiology Section for pelvic angiogram and possible embolization if proven with AVM. Pelvic angiography showed localized confluence of prominent and tortuous vessels with dense staining lesion, representing arteriovenous malformation, at the left mid to superior uterine segment, supplied by the ascending branch of the left uterine artery (Figure 9). The lower abdominal aorta and its branches, the rest of the bilateral common iliac, the bilateral hypogastric, and the right uterine vasculatures showed normal intimal outline and branching pattern. Hence, super-selective catheterization of the left uterine artery and its ascending branch under fluoroscopic guidance was done. Patient tolerated the procedure well and discharged a day after.

A repeat TVS with color Doppler was done in our unit two months after embolization showed the following results: Cervix was normal and intact (Figure 12), Endometrium thin and intact with no color flow on previous AVM site (Figure 13), Uterus normal in size, anteverted with no myometrial lesions. (Figure 14) and no color flow on color flow mapping (Figure 13), Right ovary normal in size and echotexture (Figure 15), Left ovary normal in size and echo texture with corpus luteum (Figure 16). Patient claimed to have normal resumption of normal menses one month after the procedure with no recurrence of abnormal uterine bleeding.

CASE NO. 2

This is a case of a 33 y/o G2P2 who was brought at emergency room of our institution for loss of consciousness. Three weeks PTA, patient noted episodes of profuse vaginal

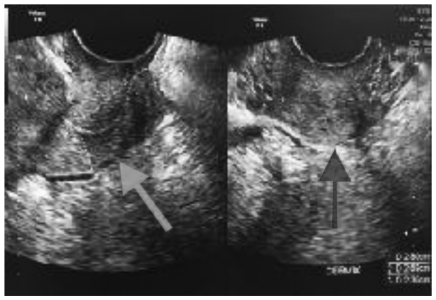

Figure 1. Cervix on sagittal (blue arrow) and transverse view (red arrow) measures 2.8 x 2.7 x 2.3 cm with intact canal

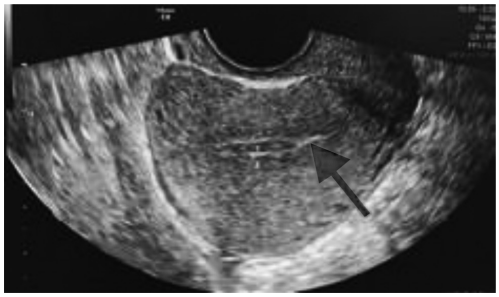

Figure 2. Endometrium at the lower cavity is hyperechoic and intact (blue arrow).

Figure 3. Complex mass (blue arrow) at the mid to upper cavity measuring 2.2 x 1.4 x 1.3 cm (volume 2.1cc) could be retained secundines.

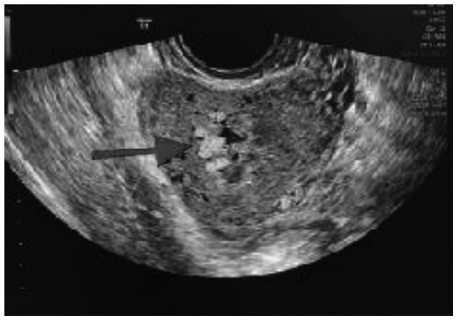

Figure 4. I l l - defined hypoechoic myometrial mass with rich color flow at the anterofundal area seemingly extending to anterior endometrial-myometrial junction could be AV malformation.

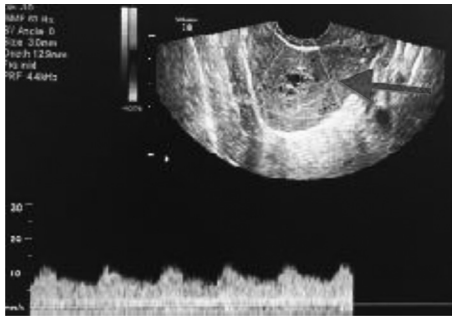

Figure 5. High velocity flow within highly vascular area. Peak systolic velocity (PSV) = 43cm/min.

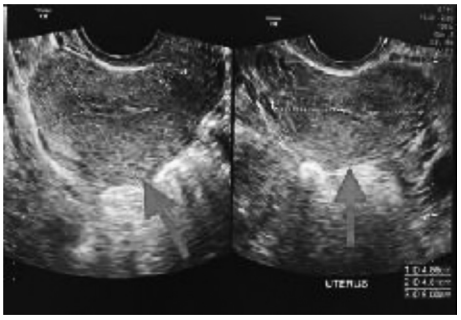

Figure 6. Uterus on sagittal (blue arrow) and transverse view (red arrow) measures 4.9 x 4.8 5.0 cm normal in size and anteverted.

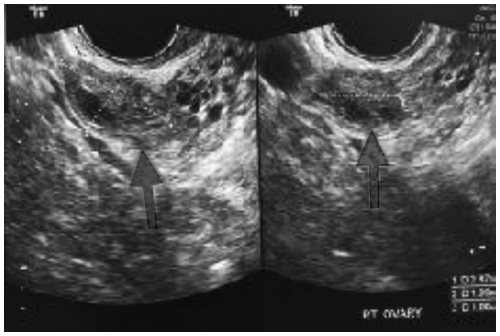

Figure 7. Right ovary on sagittal (blue arrow) and transverse view (red arrow) measures 2.9 x 2.0 x 1.7 cm, normal in size and echotexture with corpus luteum.

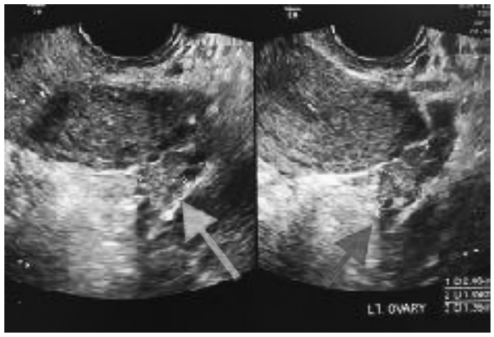

Figure 8. Left ovary on sagittal (blue arrow) and transverse view (red arrow) measures 2.1 x 1.1 x 1.3 cm, normal in size and echotexture.

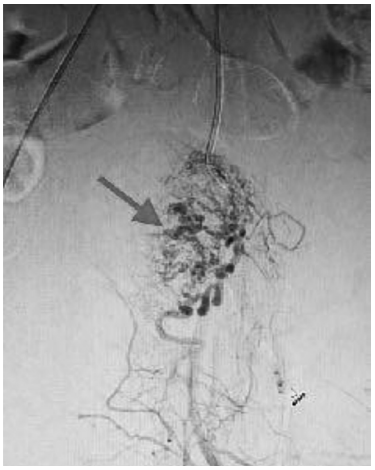

Figure 9. Pre-embolization of the AVMs at the left mid- superior uterine segment supplied by the ascending branch of the left uterine artery

Figure 10. Post embolization of the uterine AVMs.

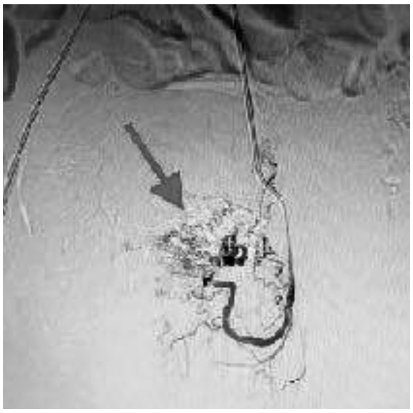

Figure 11. Post embolization of the part of the ascending branch of the left uterine artery.

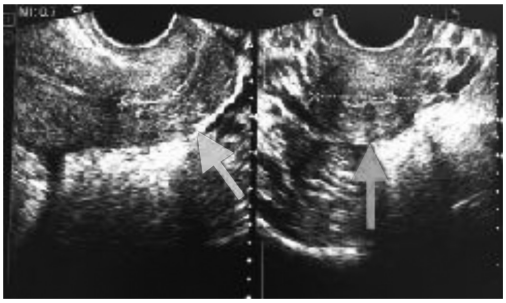

Figure 12. Cervix on sagittal (blue arrow) and transverse view (red arrow) measures 3.1 x 3.1 x 3.6 cm, normal and intact.

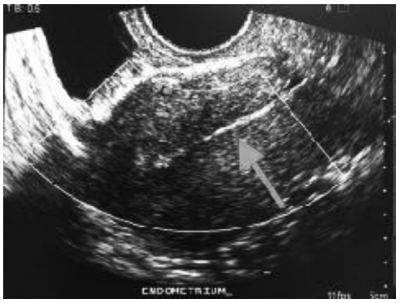

Figure 13. Endometrium measures 0.26 cm, hyperechogenic, endome trial midline defined, regular endometrial-myometrial

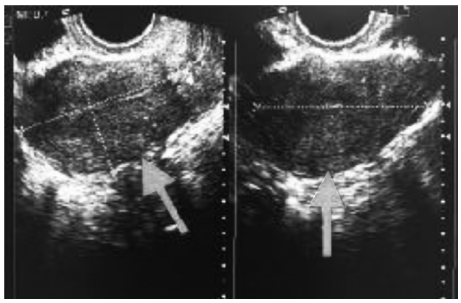

Figure 14. Uterus on sagittal (blue arrow) and transverse view (red arrow) measures 5.1 x 5.3 x 4.0 cm, normal in size and anteverted with no myometrial lesions.

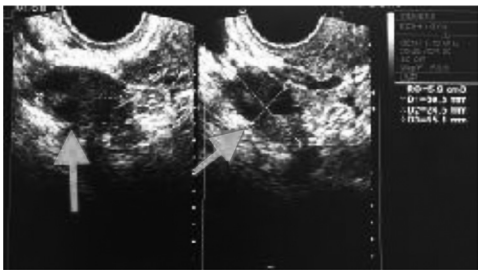

Figure 15. Right ovary on sagittal (blue arrow) and transverse view (red arrow) measures 3.0 x2.5 x 1.5 cm, normal in size and echotexture.

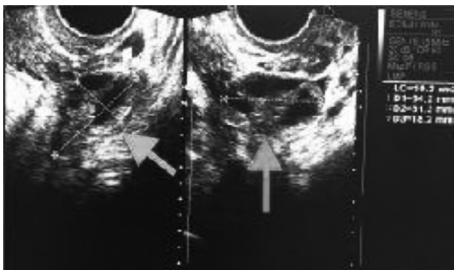

Figure 16. Left ovary on sagittal (blue arrow) and transverse view (red arrow) measures 3.6 x 3.1 x 1.8 cm, normal in size and echotexture with corpus luteum.

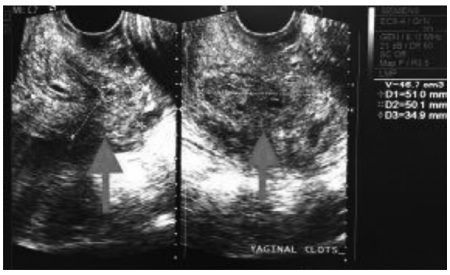

Figure 17. Heterogenous echoes at vaginal vault 5.1 x 5.0 x 3.4 cm=46.7cc could be blood/blood clots.

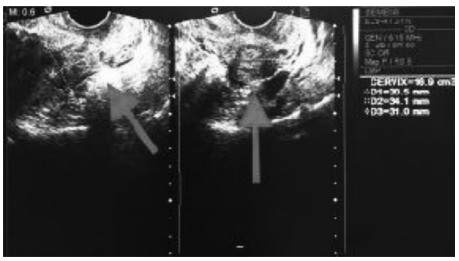

Figure 18. Cervix on sagittal (blue arrow) and transverse view (red arrow) measures 3.1 x 3.4 x 3.1 cm with intact canal.

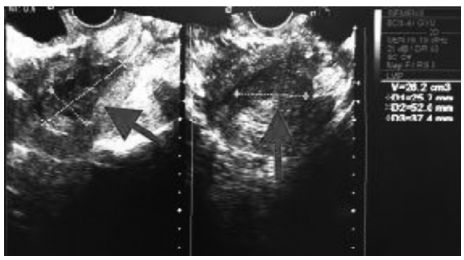

Figure 19. Endometrium with hetero genous echoes measuring 2.6 x 5.2 x 3.7 cm compatible with blood clots.

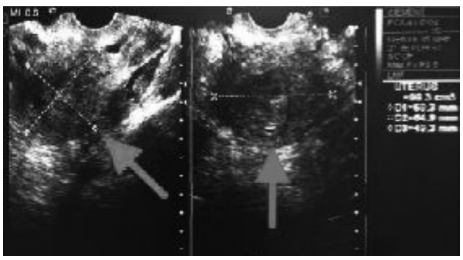

Figure 20. Uterus on sagittal (blue arrow) and transverse view (red arrow) measures 5.9 x 6.5 x 4.9 cm, slightly globular in size and anteverted with no myometrial lesions (such as myoma).

Figure 21. Vascular lesion pulsating at the anterior left lower uterine segment above the internal os encroaching the lining 1 . 0 x 1 . 0 x 1 . 8 cm=1.0 cm3 could be AV malformation vs AV fistula vs pseudoaneurysm.

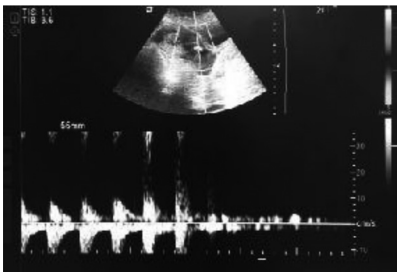

Figure 22. Doppler wave form of the pulsating artery

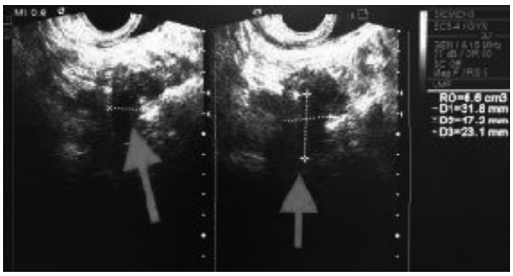

Figure 23. Right ovary on sagittal (blue arrow) and transverse view (red arrow) measures 3.2 x 1.7 x 2.3 cm, normal in size and echo texture.

bleeding with chunks of blood clots, 10 days after her discharge for an apparently uneventful primary Cesarean Section in another institution. She consulted her attending physician and noted to have contracted uterus. She was given methylergometrine maleate, tranexamic acid & folic acid which gave minimal and temporary alleviation of the bleeding. Two days PTA, patient claimed to have more profuse vaginal bleeding associated with vomiting. Patient was advised by her doctor to continue her medications. Few hours PTA, patient had apparently 3 minute episode of seemingly continuous painless profuse vaginal flow and subsequently had loss of consciousness, thus brought to the emergency room of this institution.

Past Medical History: She was treated for Pulmonary Tuberculosis in 2014 for 6 months; had apparently Rubella infection in her first pregnancy (2014) - baby turned out to be healthy; non-hypertensive, non-diabetic. Non-smoker and non- alcoholic beverage drinker.

She had her menarche at 16 years old, monthly interval, lasting for 5-7 days, consuming 5-7 pads/day fully soaked, (+) dysmenorrhea. Her first pregnancy was delivered by NSVD (2014) without complications and second pregnancy by CS (2018) for dystocia.

Upon examination patient was noted to be drowsy but with responses to stimuli, GCS (14), BP-70/40mmHG, HR-99 bpm, RR-20/min. T= 36.8C. Anicteric sclera, pale palpebral conjunctiva, symmetrical chest expansion, clear breath sounds, adynamic precordium, normal rate & regular rhythm. Abdomen was flabby, soft with vertical midline incision scar, non-tender. Big blood clots were noted within the vaginal vault. On speculum examination, approximately 600cc of blood & blood clots were evacuated; no vaginal lacerations noted, cervix was parous with no lesions. Internal examination done revealed cervix admits tip, smooth, medium consistency, uterus enlarged to 12-14 weeks size; no adnexal masses or tenderness noted. Digital rectal examination showed tight sphincteric tone and no masses. Patient was stabilized at the ER and referred to OB service. CBC showed hemoglobin of 7.7g/dl and hematocrit of 23.4% thus 3 units of PRBC were transfused. Stat TVS was done which showed heterogenous echoes within the vaginal vault could be blood/blood clots (Figure 17); normal and intact cervix (Figure 18); endometrial mass with heterogenous echoes compatible with blood clots (Figure 19); uterus slightly globular with no significant myometrial lesions on 2D grayscale (Figure 20); however, color Doppler showed a well circumscribed vascular lesion pulsating at the anterior left lower uterine segment above the internal os encroaching the lining (Figure 21) could be AV malformation vs. AV fistula vs. pseudo aneurysm with high resistance or pulsating arterial spectral or Doppler waveforms (Figure 22). Right ovary (Figure 23) and left ovary (Figure 24) were normal.

After TVS, approximately 400cc of blood/blood clots per vagina was still evacuated. Patient was then referred to Interventional Radiology for emergency pelvic angiography and uterine artery embolization.

Pelvic angiography showed a brisk contrast extravasation and contrast pooling noted at the transverse segment of the left uterine artery, suggestive of pseudoaneursym. (Figure 25). Patient then, underwent super-selective coil embolization. The active bleeding stopped immediately after the procedure and patient gradually recovered. A total of 5 units of packed RBC was given and patient discharged on the 4th hospital day, apparently well.

CASE DISCUSSION

Vascular lesions of the uterus are rare. O'Brien et al[8] showed an incidence of AVM of 4.5% in 464 pelvic sonographic examinations performed for pelvic bleeding. It could be a cause of profuse vaginal bleeding that may be life threatening to the patient. The International Society for Study of Vascular Anomalies Classification System divides the uterine vascular lesions into two: 1. Vasoproliferative or Vascluar neoplasm (hemangioma and placental chorioangioma)[2]. Vascular malformations which includes AV Malformation, AV fistula and pseudoaneuryms[9]. Mostly reported are the arteriovenous malformations (AVMs) but the true incidence is not yet known. AVMs has been described in patients between 18 and 72 years of age that could be congenital or acquired[2]. Until 2005, 100 cases have been reported[1]. Most international reports in the literature consist of single case histories. In the Philippines, there is no reported incidence rate of these vascular abnormalities except for individual case reports. However, data in our institution showed that for the past 6 years there were 18 sonographic diagnoses of AV malformation in our ultrasound unit, 8 of them confirmed by angiography and subsequently treated with super selective uterine artery embolization; 2 had hysterectomy & confirmed on histopathology; and the remaining 8 patients had no confirmatory procedures prior to expectant and medical management. With the advent of color Doppler ultrasound there is lately increasing awareness of clinicians as well as sonologists that AVM's or vascular malformations could be a common cause of abnormal uterine bleeding. Lately, it is always suspected particularly after uterine manipulation and color Doppler routinely done in the investigation of women with intractable vaginal hemorrhage.

Uterine AVMs result from formation of multiple arteriovenous fistulous communications within the uterus without an intervening capillary network. The size of these vessels can vary considerably and they are classified as congenital or acquired[3]. **Congenital** AVM - is more rare and

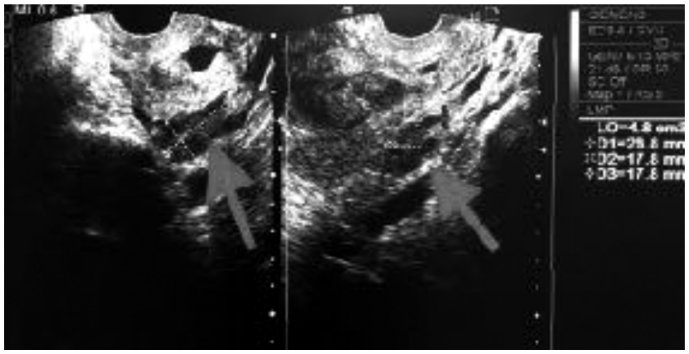

Figure 24. Left ovary on sagittal (blue arrow) and transverse view (red arrow) measures 2.9 x 1.8 x 1.8 cm, normal in size and echo texture.

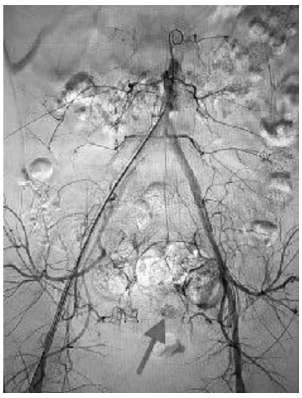

Figure 25. Aortoiliac angiography showing contrast pooling suggestive of pseudoaneurysm.

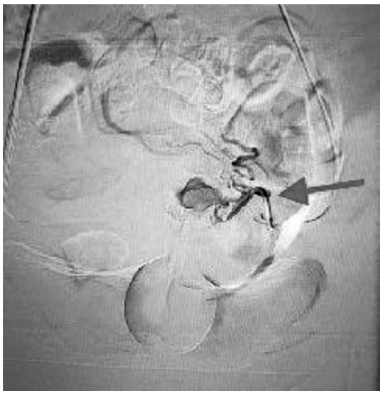

Figure 26. Close-up view of the transverse segment of the left uterine artery with pseudoaneurysm.

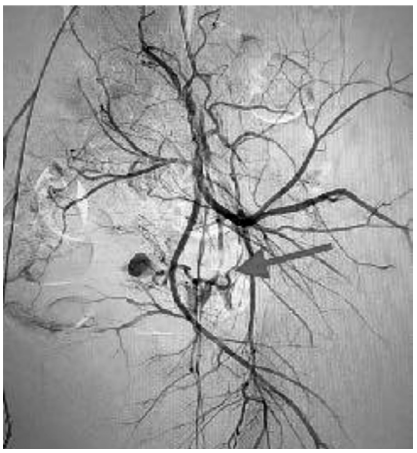

Figure 27. Superselective catheterization of the transverse segment of the left uterine artery.

Figure 28. Post embolization of the transeverse segment of the left uterine artery.

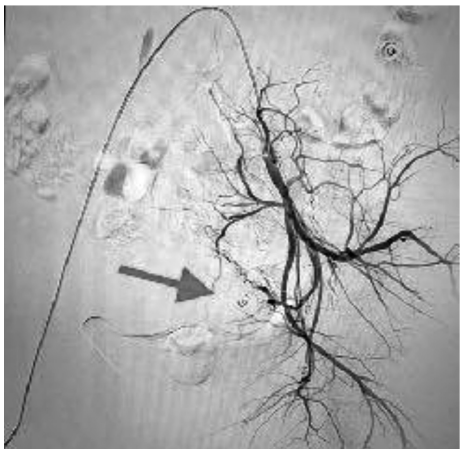

Figure 29. Disappearance of contrast pooling previously seen in the transverse segment of the left uterine artery after embolization.

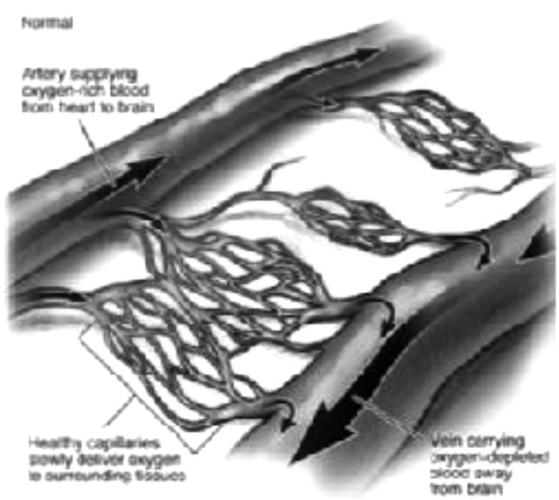

Figure 30. Normal arterio- venous capillary network.

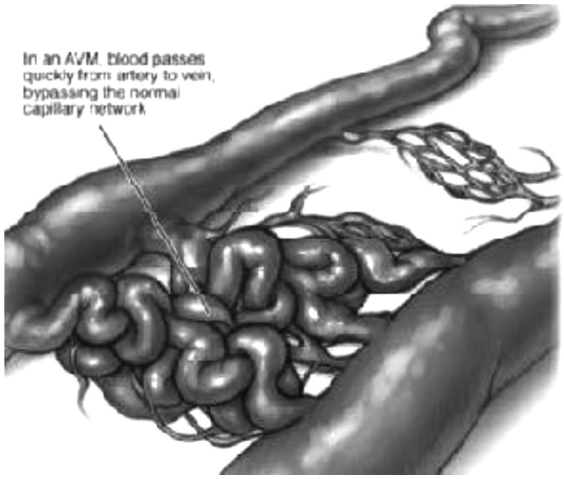

Figure 31. Capillary network of AVMs.

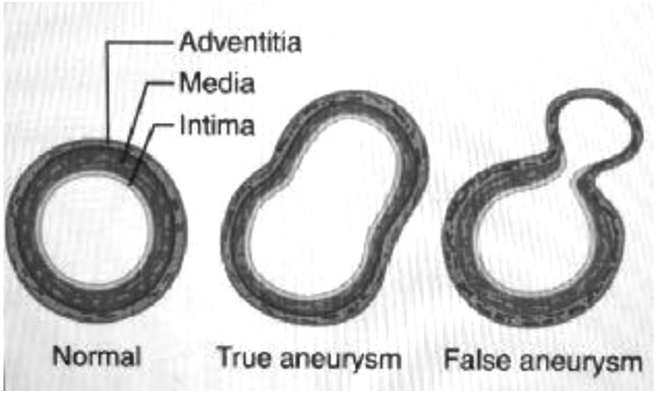

Figure 32. Comparison of normal arterial wall from true & pseudo aneurysm.

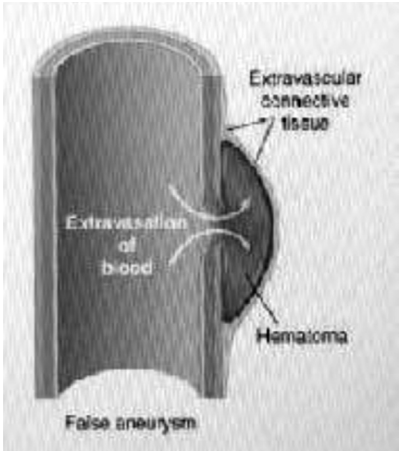

Figure 33. Formation of Pseudoaneurysm

tend to have multiple feeding arteries, a central nidus and numerous large draining veins. The Acquired or traumatic uterine AVM - is more common than the congenital and tend to have multiple small arteriovenous fistulas between intramural arterial branches and the myometrial venous plexus. They typically represent a single artery joining a single vein[6]. It is usually associated with multiple pregnancies, miscarriage, previous surgeries such as D&C (medical & therapeutic), cesarean section, pathologic processes like infection, GTD and malignancies.[2,7-9] In our 1st case the AV malformation was acquired from previous D&C's.

Patients usually presents with scanty to profuse vaginal bleeding, vague pelvic discomfort, incontinence and dyspareunia[8,9]. Our two patients presented with on & off vaginal spotting to profuse bleeding after a history of curettages and cesarean section.

Initial diagnostic modality is currently by transvaginal ultrasound (grayscale) with color Doppler or MRI for equivocal findings and the gold standard is angiography.[8,10,11]

Several single international case reports supports 2D transvaginal ultrasound with color Doppler as the initial imaging modality of choice to diagnose these vascular anomalies because it is readily available, low cost and non-invasive. Color Doppler should be incorporated in the examination since 2D grayscale sonologic features of uterine vascular lesions are non-specific, and could simulate molar pregnancy, adenomyosis or dilated uterine vessels.[12-15] Gray scale sonographic appearances may only be subtle myometrial inhomogeneity or tubular cystic spaces within the myometrium. O'Brien et al.[8] in their study of 21 AVMs cases concluded that uterine AVM diagnosis cannot be made based on gray-scale findings alone and color and spectral Doppler studies should be done to confirm abnormal vascularization. In a study of Timor-Tritsch et al.[16] of 27 patients with enhanced myometrial vascularities/ AVMs, Doppler ultrasound evaluation is emerging as the simplest, best, and most cost-effective diagnostic imaging modality. Their study helps in the triage of patients for either conservative follow- up or treatment with uterine artery embolization (UAE) based on their clinical picture supplemented by objective measurement of blood velocity in the area of the AVMs or enhanced myometrial activity. Color Doppler scan shows bright mosaic color from turbulent & multidirectional flow and high arterial pulsations. There are low resistance indices (RI&PI) and high peak velocities. Our 1st patient also had non-specific heterogeneous complex mass at the upper endometrial cavity with rich color flow and low resistance indices (RI&PI) and high peak velocities. AV malformation was highly considered, considering patient had already 2 previous D&C for missed abortion. The possibility of GTD or GTT such as invasive mole was eventually ruled out due to low B-HCG value. The quantitative measurements of blood velocities are important for the clinical treatment of patients. In a study by Timmerman et al.[10], PSV values appear to be useful in distinguishing between low and high risk patients. A PSV >/= 0.83cm/sec has a higher probability of further treatment like uterine artery embolization, a PSV of <0.39cm/sec requires no embolization or intervention. In the first case, patient's PSV was high (43cm/sec) and successfully treated with embolization. This emphasizes the importance of color Doppler sonography in the initial diagnosis of AVMs as well as planning the most appropriate management .

The use of 3D power doppler can additionally increased the diagnostic accuracy because it depicts clearly the exact site, size and extent of vascular lesions in the uterus.[17,18]

Pelvic angiography is the gold standard for diagnosis of AVM's and depicts complex serpentine abnormal vessels that enhance as intensely as normal vessels and show early venous return[6,9,19] and was also found in our patient.

It is expensive, invasive and not readily available but can be diagnostic as well as therapeutic in single setting. It is the most appropriate diagnostic and treatment modality if patient has profuse bleeding and desirous to preserve her uterus.

Pseudoaneurysm on the other hand is an extraluminal collection of blood with turbulent flow. It is likewise secondary to a local trauma producing vascular injury where the artery does not seal completely and blood escapes and diffuses through the surrounding tissues but rarer than AVM. Vaginal bleeding results from high arterial pressure resulting in extravasation of blood through the surrounding connective tissues which eventually ruptures[5,7,20]. Risk factors just like AVMs includes obstetrical & gynecologic procedures like vaginal deliveries, CS, D&C, hysterectomy, myomectomy, cervical conization and oocyte retrieval after IVF, of all CS is the most common cause[21,22]. In our patient, pseudoaneurysm probably developed as a result of trauma to the uterine vasculatures after cesarean section. Clinically patients also present with postpartum hemorrhage, abdominal and suprapubic pain, as seen in our patient who also presented with vaginal bleeding more than a month after cesarean section. 2D ultrasound provides a quick & less invasive initial diagnostic tool where it appears as a anechoic or hypo echoic structure connected to the parent artery by a thin vascular neck which maybe similar to AVM or AV fistula on 2D grayscale. On color Doppler, a swirling blood flow with a "yin-yang" pattern will be observed & on Doppler presents turbulent arterial blood flow with a "to and fro" pattern[11]. However this is not seen all the time because in some cases the caliber of the feeder vessel is too small[23]. Study of Zimon et al[20] showed the sensitivity and specificity of color Doppler ultrasound for the detection of pseudoaneurysm has been estimated to be at 94% and 95% respectively. In the second case the hypervascularity seen at the anterior lower left uterine segment coupled with a pulsating artery on Doppler is highly suspicious of abnormal vascular lesion. On pelvic angiography where it appears as focal outpouching of contrast that fills from a communication with the parent vessel & there is persistent contrast staining that washes out slowly[20,24]. These were seen in the pelvic angiography of our patient.

Clinically it is not so important to specifically identify if the uterine vascular malformation is AVM , AV-fistula or pseudoaneurysm – for these have similar etiopathogenesis and can be resolved with similar treatment modalities.

Management of these type vascular lesion just like AVM depends on hemodynamic stability of the patient, size and site of the lesion, degree of bleeding, age and desire for future fertility. Hysterectomy is the surgical treatment of choice if family size is completed, patients who are less likely to follow-up, failure of uterine artery embolization and inaccessibility to medical facilities. However if patient desires preservation of fertility function just like our case, uterine artery embolization is the best option. Intrauterine instrumentation, manipulation or curettage can inadvertently disrupt or further injure the abnormal vessels encroaching the endometrium and cause life-threatening torrential bleeding or lead to hysterectomy. Other treatment options includes medical therapy with OCP, coagulation of AVM under hysteroscopy, laparoscopic bipolar coagulation, surgical removal of AVM, ligation of uterine arteries and observation for asymptomatic patients.[1, 6, 8,9, 25]

CONCLUSION

AV malformation including pseudoaneurysm should be suspected and evaluated with transvaginal color Doppler ultrasound particularly in patients with intractable or profuse vaginal bleeding and history of previous surgeries, deliveries, miscarriages or trauma to the uterus. Transvaginal color Doppler ultrasound can also be a good initial diagnostic procedure to determine the most appropriate management, such as uterine artery embolization to preserve fertility function. ■

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