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Review Article

SONOGRAPHIC DIFFERENCE BETWEEN PELVIC ARTERIOVENOUS MALFORMATION & RETAINED PRODUCTS OF CONCEPTION (RPOC)- SYSTEMATIC REVIEW

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Abstract:

Introduction: The Retained products of conception (RPOC) refer to intrauterine tissue that develops after conception and persists after medical and surgical pregnancy termination, miscarriage, and vaginal or cesarean delivery. While arteriovenous malformation is an abnormal connection between arteries and veins, bypassing the capillary system, Uterine Arteriovenous malformation (AVM) is a rare condition. Ultrasonography and Color Doppler ultrasound (US) provide a noninvasive and initial method to diagnose both conditions.

Search strategy: We searched google scholar, PubMed, Medline, Medscape and Cochrane

Methods: We searched Google scholar, PubMed, Medline, Medscape, and Chocrane. All words like retained piece of conception, arteriovenous malformation, miscarriage, ultrasonography and color Doppler were used.

Study Selection: We studied more than 30 articles and preferred retrospective study excluding prospective, case reports and case control study. We applied additional filter for paper selection and searched articles published between 2004 to 2020. we selected 14 articles for systematic review.

Conclusion: Diagnostic ultrasonography and Color Doppler rendered initial ample information to spot the pathology.

Key Words: Retained piece of contraception, uterine arteriovenous malformation, ultrasonography and color Doppler.

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INTRODUCTION:

Arteriovenous malformation is an abnormal connection between arteries and veins, bypassing the capillary system, Uterine Arteriovenous malformation (AVM) is a rare condition. Pelvic AVMs are uncommon lesions of unknown cause. Is a potentially life-threatening condition, as patients may present with profuse bleeding. Colour Doppler ultrasound (US) provides a non invasive method for initially diagnosing this rare condition and confirmation can be made using diagnostic angiography, CT and MR imaging scan also use for the conformation of AVM in the diagnosis. To the best of our knowledge the diagnosis of a pelvic AVM is by color flow Doppler ultrasound.

The **Retained products of conception (RPOC)** refer to intrauterine tissue that develops after conception and persists after medical and surgical pregnancy termination, miscarriage, and vaginal or cesarean delivery. Retained products of conception (RPOCs) are uncommon complication of labor and delivery. The retained tissue can cause prolonged postpartum hemorrhage and endometritis On the other hand; retained products of conception (RPOC) may cause prolonged bleeding and sometimes intrauterine adhesions and impairment of future fertility, so the correct selection of patients for surgical evacuation is a desirable goal.

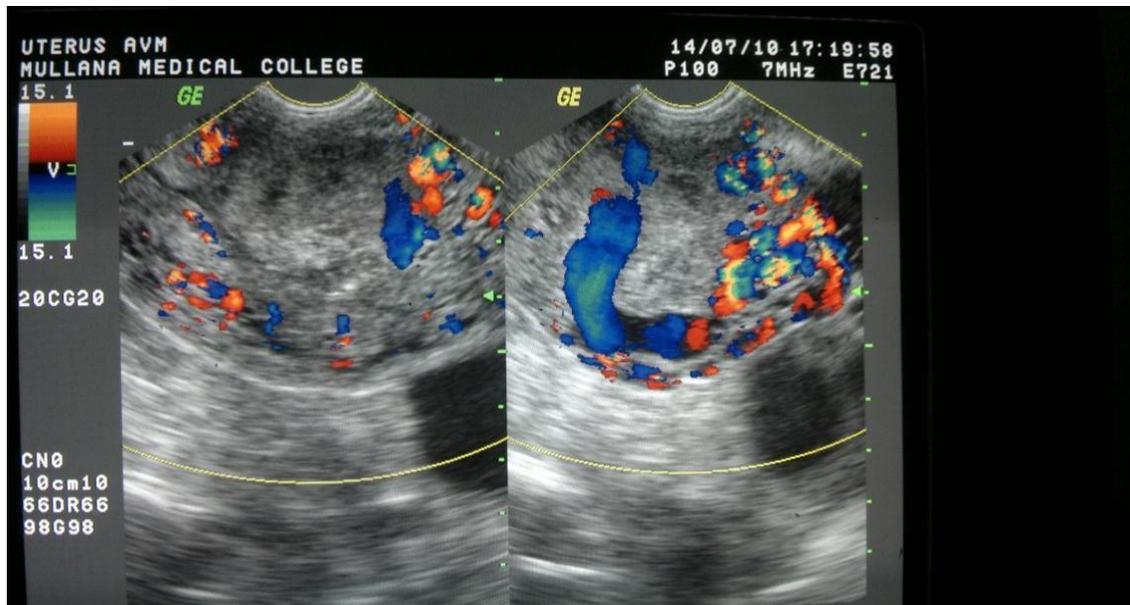


Figure 1.US Color Doppler view showing retained products of conception with AV Malformations.

Pelvic AVMs are uncommon lesions of unknown cause. Congenital AVMs are considered to be undifferentiated vascular structures resulting from arrest of embryonic development at various stages. Acquired AVMs are usually caused by neoplasms or trauma, and procedures such as curettage and uterine surgery have been implicated. These malformations are characterized by their slow growth with a period of latency before becoming symptomatic, including vaginal bleeding, abdominal pain, urinary symptoms, and high-output congestive heart failure. Many methods have been used to diagnose pelvic AVM recommended the use of CT with bolus contrast enhancement to diagnose pelvic AVM and to assess the degree of local organ involvement. Recently, MR imaging has been suggested as a method for evaluating pelvic AVM. The sonographic findings of pelvic AVM were first described by Torres et al. The diagnosis of an AVM was confirmed by a pelvic angiogram. AVM is treated by surgery, embolization, or both. Angiography is essential before treatment, but in cases where AVM is suspected and conservative treatment is anticipated, color flow Doppler alone can establish the diagnosis [1]

Uterine AVM is congenital or acquired. Congenital uterine AVM is rare and seen in syndromes with multiple other AVMs. Acquired AVM develops after uterine trauma, such as dilatation and curettage; it is also reported after cesarean section, vaginal delivery, and medical abortions. Noninvasive studies, such as ultrasound and MRI, may provide the diagnosis. Gray-scale ultrasound may reveal a serpentine hypoechoic area within the myometrium. Color flow Doppler may show rapid, turbulent blood flow with a very high velocity. The vessels can appear tangled, and the blood flow is multidirectional [3]. MRI may demonstrate serpiginous, flow related signal voids. MRI may identify the diagnosis and the extent of involvement [2].

A 35-year-old-woman, presented with intermittent vaginal bleeding for the prior 6 months. She had two children, both alive and healthy with a younger child of 6 years age. Five years prior, she had been diagnosed with hydatidiform mole at 10 weeks of gestation for which suction evacuation was performed. She was on regular monthly follow-up of serum b-hCG levels up to 6 months after normalization and had been asymptomatic since then. Six months before, she had a spontaneous abortion at 12 weeks of gestation. They are vascular fistulas composed of admixed arteries and veins without evidence of an intervening capillary network, involving the myometrium and sometimes the endometrium. Acquired AVM is usually traumatic,

resulting from prior D&C, spontaneous/therapeutic abortion, uterine surgery, direct uterine trauma, endometrial cancer, endometriosis or GTD.³ The imaging features of increased uterine vascularity and arteriovenous shunting on sonography and Doppler may suggest the possibility of AVM but are not pathognomic as they can be seen in rPOC, GTD, placental polyp and vascular endometrial neoplasm.⁴ MR angiography is gold standard in the diagnosis of AVM and helpful in determination of exact size and extent[3]

The purpose of this study was to characterize color Doppler imaging features of retained products of conception (RPOC) with gray scale correlation. Patient data and relevant color Doppler and gray scale features were recorded. Gray Scale Findings are Uterine dimensions were obtained in anteroposterior, transverse, and longitudinal axes. Prior studies have examined the Sonographic features of RPOC but without a clear consensus on the sensitivity and positive predictive value (PPV) of various imaging features of RPOC; Color Doppler imaging has likewise improved and is now part of our standard pelvic sonographic examination. Color Doppler imaging of the uterus opens a new dimension in the evaluation for RPOC, which has only been studied to date in limited detail [4].

Retained products of conception (RPOC) are a common and treatable complication after delivery or termination of pregnancy. However, gray-scale US findings alone are inadequate for accurate diagnosis. Detection of vascularity in a thickened EEC or an endometrial mass at color or power Doppler US increases the positive predictive value for the diagnosis of RPOC. Computed tomography or magnetic resonance imaging may be helpful when US findings are equivocal and typically demonstrates an enhancing intracavitary mass in patients with RPOC. Combined gray-scale-color Doppler US is the first-line imaging modality for the diagnosis of suspected RPOC and allows real-time assessment of the uterine structures and blood flow, whereas magnetic resonance (MR) imaging can be a useful adjunct imaging modality in complicated cases. The sensitivity and specificity of US for the diagnosis of RPOC varies widely based on the diagnostic criteria and the clinical setting. However, more recent studies have defined more robust gray-scale and color Doppler US criteria with a high sensitivity and specificity for RPOC. Gray-Scale US Findings of RPOC We have found that the most sensitive finding of RPOC at gray-scale US is a thickened endometrial echo complex (EEC). Because the findings of RPOC at MR imaging in particular overlap entirely with

those of gestational trophoblastic disease (28), clinical context is essential. Specifically, the serum b-hCG level is usually normal or low in patients with

RPOC and considerably elevated in those with gestational trophoblastic disease [5]

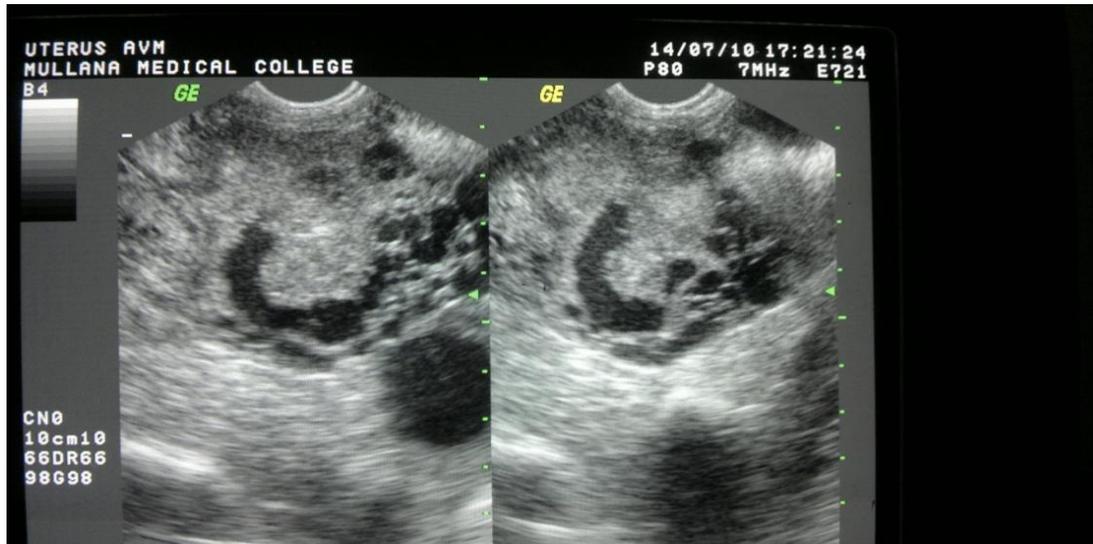


Figure 2: Ultrasound Transverse view showing retained products of conception with AV Malformations.

The advent of color Doppler imaging, an increasing number of cases with areas of hypervascularity, marked turbulence, and low-impedance, high-velocity flow within the myometrium are being reported. true arteriovenous malformations are rare entities, and most older published cases had been treated by either hysterectomy or uterine artery embolization. In a cross-sectional study of 385 women presenting In a prospective study of the puerperium including 93 consecutive women after an uncomplicated term vaginal delivery, 5 areas of enhanced myometrial vascularity were visualized in 51% of patients on day 3 versus 4% at 6 weeks. Results the mean age of the patients was 31 years (range, 22–37 years). Two women were asymptomatic at presentation, and 15 had bleeding, of whom 7 also had lower abdominal pain. The ultrasound diagnosis of retained tissue was scored as certain in 17 and possible in 1 case [6].

This study has shown that the presence of hyperechoic material on ultrasound examination is highly predictive of RPOC after spontaneous first-trimester miscarriage (sensitivity 78%, specificity 100%). No patient with decidua had hyperechoic material (positive predictive value 100%). 5 reported a false positive rate of 29% in the diagnostic use of hyperechoic material, and suggested a more conservative approach for the treatment of RPOC. This might have been because of the inclusion of a wide range of ultrasound appearances of the uterus in

their study. Forty-three of the 55 women with RPOC showed hyperechoic material on ultrasound examination but no women with decidua tissue had such a finding ($P < 0.001$). The ultrasound finding of hyperechoic material had a sensitivity of 78% and specificity of 100% in predicting RPOC [7].

Retained products of conception are rare complications of labor and delivery, leading to postpartum bleeding and infection if left untreated. However, this study also reported a high- false positive rate of 17%. More recent studies confirm this early study that the false-positive diagnosis of retained products on sonography is high, in the range of 17% to 51%. Results there were 163 patients identified for our study, ranging in age from 14 to 44 years (mean, 31 years). The indication for sonography included abnormal vaginal bleeding in 82 (50%), pelvic pain in 77 (47%), and fever in 55 (34%) cases. Some patients had more than 1 symptom. Delivery had been transvaginal in 122 cases, cesarean in 39 cases, and unknown in 2 cases. Retained products were found in 17% (28 of 163) of all study patients and 78% (28 of 36) of patients who had surgical intervention [8].

Pelvic sonography plays an important role in determining the source of abnormal bleeding and is the first-line imaging modality in evaluation for RPOC Results Demographics Thirty-five sonograms in 35 patients were analyzed. Twenty-six patients underwent transvaginal and Transabdominal

sonography of the pelvis. Nine patients underwent only Transabdominal sonography of the pelvis. The average age of the imaged patients was 29.8 years (range, 15–46 years). Three patients were post vaginal delivery at term; 1 was post cesarean delivery at term; 1 was postpartum at 24 weeks; 3 were post therapeutic abortion; and 27 were post miscarriage. Gray Scale Findings Uterine dimensions were obtained in anteroposterior, transverse, and longitudinal axes [9].

Arora R. *et al* reported three cases of uterine AV malformations with recurrent vaginal bleeding. One case presented with bleeding three weeks after MTP. Repeat D&C was done with the diagnosis of incomplete abortion which landed up in massive torrential bleeding for which she was transfused three units of blood. With the suspicion of AV malformation color Doppler study done which confirmed the diagnosis.

Uterine Arterio-venous malformations are rare lesions with a considerable risk potential. Recurrent or massive life-threatening vaginal bleeding may occur [10]

One hundred sixty-three cases were identified. Indications for pelvic sonography included vaginal bleeding in 82 (50%), pelvic pain in 77 (47%), and fever in 55 (34%). Gestational age at delivery ranged from 14 to 43 weeks (mean, 37 weeks), and the sonographic examination was performed from 0 to 95 days postpartum (mean, 21 days). Thirty-six patients underwent surgical intervention, and 28 of these had RPOCs. The remaining 127 patients were followed clinically. An endometrial mass was the most sensitive (79%) and specific (89%) sonographic feature for RPOCs. Color Doppler flow was detected in the endometrium somewhat more often when RPOCs were present than in the absence of RPOCs (75% versus 40%) [11]

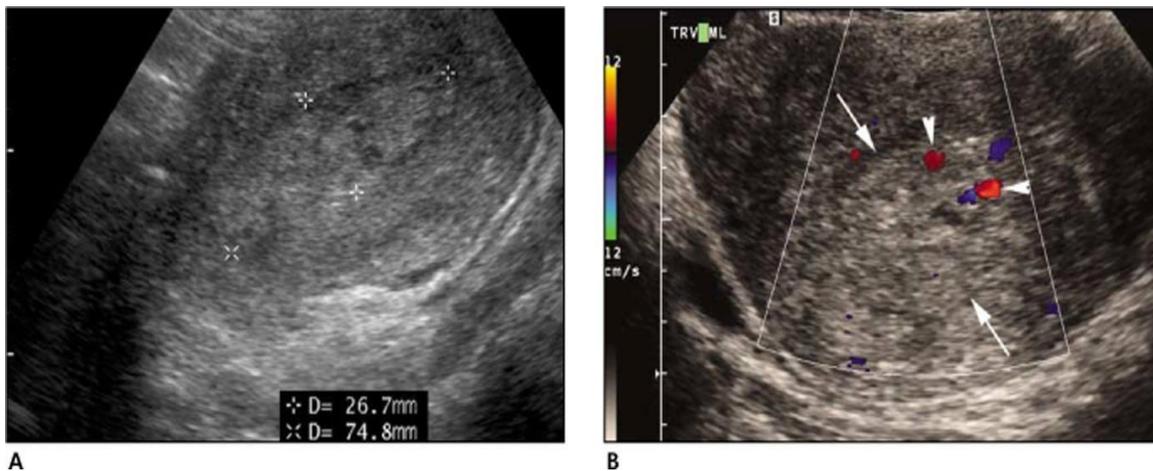


Figure3.The Sonographic and Color Doppler Features of Retained Products of Conception.

SYSTEMATIC REVIEW

In 2004 Sadan et al conducted a retrospective study on 156 patients admitted for retained products of conception to evaluate the Role of Sonography in the Diagnosis of Retained Products of Conception. 121 women (77.6%) were admitted after dilation and curettage for abortion, and 35 (22.4%) were postpartum cases. Clinical presentation of the patients were abdominal pain or bleeding or fever or combination of these. bimanual examination was performed to know the status of the cervix. Criteria for The diagnosis of retained products of conception was presence sonographic finding hypoechoic material in any part of the uterine cavity or the presence of a thickened endometrial stripe greater than 8 mm and irregular interface between endometrium and myometrium. Diagnosis was confirmed by Histopathologic reports which revealed retained products of conception in 86 (71%) of 121 women in the post abortion group and in 17 (48.5%) of 35 women in the postpartum group. The overall false-positive rate for sonographic diagnosis was 34%. For post abortion cases it was 28.9% and 51.5% for post- delivery.

In 2005 Durfees M studied One hundred sixty-three cases for the assessment of sonographic and color Doppler features of retained products of conception between September 1994 and July 2001. 82 Cases presented with vaginal bleeding (50%), 77 with pelvic pain (47%), while fever was in 55 patients (34%). 14 to 43 weeks (mean, 37 weeks) was Gestational age at delivery, from 0 to 95 days postpartum (mean 21 days) the sonographic examination was done. Thirty-six patients underwent surgical intervention, and 28 of these had RPOCs. The remaining 127 patients were followed clinically. For RPOCs the most sensitive (79%) and specific (89%) sonographic feature was an endometrial mass. The isolated finding of either complex fluid in the endometrial canal or a thick endometrium measuring greater than 10 mm had low sensitivity, specificity. Normal sonographic findings were found in none of patient with RPOC. The absence of an endometrial mass or complex fluid and an endometrial thickness of less than 10 mm were considered normal findings. Color Doppler flow was detected in the endometrium somewhat more often when RPOCs were present (75%) than in the absence of RPOC (40%). Study concluded that an endometrial mass is the most sensitive finding for RPOCs. If the endometrial thickness is less than 10 mm but no mass or endometrial fluid is seen, then RPOCs are extremely unlikely. The absence of blood flow does not exclude the diagnosis of RPOCs.

In 2008 a retrospective study was conducted by Abbasi et al to specify the Role of clinical and ultrasound findings in the diagnosis of retained products of conception. 91 patients were admitted for suspected RPOC who were evacuated surgically after spontaneous first trimester miscarriage. Confirmation of RPOCs was done on Histopathological analysis by the presence of chorionic villi in 55 women (60%) and decidua in 36 (40%). Vaginal bleeding was more frequent in women having RPOC ($P < 0.001$), whilst lower abdominal pain was a more frequent symptom in those with decidua ($P = 0.019$). The ultrasound finding of hyperechoic material had a sensitivity of 78%, specificity of 100% and positive and negative predictive values of 100% and 75%, respectively, in predicting RPOC. The combination of hyperechoic material and/or vaginal bleeding increased the sensitivity to 98% and negative predictive value to 95%. There was no significant difference in endometrial thickness (more than 8 mm) between the two groups.

In 2009 Kamaya et al reviewed 269 clinically suspected cases of RPOC between January 2005 and February 2008 to find out Spectrum of Color Doppler Findings in Retained Products of Conception. Thirty-five patients were confirmed on pathologic evidence including of 28 having RPOC. In those with RPOC, avascular (type 0) were 5 (18%), minimal vascularity (type 1) were 6 (21%); moderate vascularity (type 2) were 12 (43%); and 5 (18%) had marked vascularity (type 3). Peak systolic velocities ranged from 10 to 108 cm/s (average, 36.1 cm/s). Resistive indices in arterial waveforms ranged from 0.33 to 0.7 (average, 0.5). 5 of the patients (45%) with type 0 vascularity had RPOC; 6 of those (86%) with type 1 had RPOC; and 17 (100%) of those with types 2 and 3 had RPOC. An echogenic mass had a moderate positive predictive value (80%) but low sensitivity (29%) for RPOC. Color Doppler evaluation of the endometrium is helpful in determining the presence of RPOC. Endometrial vascularity is highly correlated with RPOC, whereas in both intrauterine clots and avascular RPOC the lack of vascularity can be seen.

In 2009 Ratko Matijevic audited a predefined data of sonographic diagnosis of RPOC for 3 years by comparing with histopathologic reports after dilatation and curettage to evaluate the diagnostic accuracy of sonographic and clinical parameters in prediction of RPOC and those were confirmed on HP reports, study perceived Sonography alone or combined with color Doppler imaging has better

diagnostic accuracy than the usual clinical parameters used for the prediction of RPOC.

2009 S. Degani et al conducted a study to evaluate benefit of expectant management in AVM. He chose twelve patients diagnosed with AVMs after abortion and were followed-up until resolution of the lesions. Out of them 9 asymptomatic patients were such as Trans catheter arterial embolization, and 6 had uncomplicated pregnancies after resolution of the lesions. So Expectant management is an option in many women with pregnancy-related uterine AVM. Can be managed expectantly 4to10 weeks without further complications.No one required aggressive interventions.

In 2013 Hiroyuki Yazawa et al evaluated the Incidence of Uterine Vascular Malformations Developing after Abortion or Delivery. He selected six patients with a UVM including 1 with an AVM. Transvaginal color Doppler ultrasonography was performed between April 2010 and March 2012 for clinical screening. Transvaginal color Doppler ultrasonography was the criteria to find out the incidence of UVM developing after abortion or delivery or in outpatients. Out of 959 patients, 6 (0.63%) were identified with UVMs, including 1 (0.10%) with a uterine AVM.

Specifically, UVMs was in 4 of 77 patients (5.2%) after abortion, 1 of 458 patients (0.22%) after delivery, and 1 of 424 outpatients (0.24%). Four patients after abortion and 1 after delivery reported mild symptoms, which were treated conservatively; however, the outpatient had a severe uterine AVM, which was confirmed via 3-dimensional computed tomography angiography.

In 2015 Van den Bosch et al conducted a study of 18 consecutive women with a diagnosis of retained products of conception and enhanced myometrial vascularity, with a peak systolic velocity (PSV) higher than 60 cm/s. All underwent ultrasound guided surgical removal of the retained products under general anesthesia. After surgery, the PSV in the myometrium dropped dramatically (≤ 30 cm/s in all except of 1.

In 2016 Aya Kamaya conducted a retrospective study to find Clinical and imaging predictors of management in retained products of conception. He evaluated 334 patients sonographically for RPOC. with Mean patient age of 29.6 years and mean gestational age of 17.4 weeks. Mean endometrial stripe thickness was found 21.3 mm. vascularity score was noted as that 47 women (26.7%) had score of 0; 50 (28.4%) had score 1; 52

(29.6%) had score 2; and 27 (15.3%) had score 3. He presumed that US vascularity score ($p < 0.005$) was one of the statistically significant predictors for final management.

In 2016 Ilan e Timur Tritsch conducted a retrospective study upon 27 patients (18-42 years' age) to assess the presentation, treatment, and clinical pictures of patients with uterine Enhanced myometrial vascularity or arteriovenous malformations that were diagnosed with transvaginal ultrasound scanning. 10 patients were of incomplete abortions, 6 of missed abortions, 5 of spontaneous complete abortions, 5 of cesarean scar pregnancies, and 1 of molar pregnancy the average peak systolic velocity of the 16 patients with spontaneous resolution was 58.5 cm/sec (range, 23-90 cm/sec).

In 2017 Stefano Calzolari conducted a retrospective study between March 2012 and December 2015 in Regional Center of Excellence in Hysteroscopy, University of Florence to specify Hysteroscopic Management of Uterine Arteriovenous Malformation. A diagnosis criterion of AVM was established by transvaginal ultrasonography with high definition flow in patients with mild to moderate symptoms. He concluded Hysteroscopy is a feasible and safe alternative treatment modality for AVM with high fertility outcome.

In 2018 Lamiaa A. Abd ElGawad et al observed twenty patients. Who were referred to the radio diagnosis and imaging department, faculty of medicine, Tanta University from obstetrics and gynecology department? They were suspected clinically to have uterine arteriovenous malformations and were subjected to history taking regarding clinical state, laboratory investigation and color Doppler ultrasonography and multidetector computed tomography angiography of the pelvis. He concluded that Color Doppler ultrasound sensitivity was 100% in detecting a uterine hyper vascular lesion and highly suggesting the diagnosis of uterine AVM.

In 2018 a study was conducted by Hina Iqbal to evaluate 193 patients to determine the diagnostic accuracy of ultrasound in the detection of the retained products of conception in relation with the histopathological findings at the Department of Radiology, Aga Khan University Hospital (AKUH), Karachi in the period from October 2014 to October 2015. Her study revealed that ultrasound has a sensitivity of 75.22%, specificity of 72.50%, a positive predictive value (PPV) of 79.44%, a negative predictive value (NPV) of 67.44%, and a

diagnostic accuracy of 74.09%. it gave strong impression that Transvaginal ultrasound is a modality that can be used for early diagnosis of the retained products of conception including fetal parts and could prove to be lifesaving.

In 2019 Fabinsky Thangarajah conducted a retrospective study on 32 patients underwent surgery due to suspected postpartum RPOC were analyzed for potential predictive clinical and sonographic parameters. His perception was that endometrial hyper echogenic mass and clinical parameters such as pain, fever and bleedings were not predictive for RPOC.

DISCUSSION:

After delivery, there may be partial or complete retention of parts of the placenta or other decidual tissues within the uterus. Or there will be incomplete abortion or some part of conception remained after surgical evacuation of uterus. This condition is termed “retained products of conception” (RPOC). RPOC is suspected when there is prolonged or sustained vaginal bleeding after delivery. Ultrasound and MRI are perhaps the safest method of evaluating the postpartum uterus for RPOC, but sonography is the safest and most inexpensive imaging modality for identifying retained products. Following spontaneous first-trimester complete miscarriage, endovaginal ultrasonography has been found to be 81% sensitive and 94% specific in detection of retained products of conception. Ultrasound indicators of retained products of conception may include a thickened endometrial echo complex (EEC). The clinical threshold for a thickened EEC ranges from 8 to 13 mm. signs of any endometrial masses on ultrasound can be found and vascularity through color Doppler is preferable to compare endometrial vascularity with the myometrial vascularity in the same image section. Color Doppler imaging shows the presence of or absence of flow within the uterine cavity. Absent flow is more suggestive of hemorrhagic material or clots in the uterus. However, nonviable placental tissue within the uterus can also show absent flow within the RPOC. Finding of blood flow in the intervillous space in cases of first-trimester miscarriage using color Doppler ultrasonography as useful in the prediction of successful expectant management.

In contrast Uterine arteriovenous malformation (AVM) is a rare condition, Gray scale ultrasound (US) can detect the presence of multiple tubular or “spongy” anechoic or hypoechoic areas within the myometrium of a normal endometrium however it can be confused with presentation of similar

appearance, such as retained products of conception, hemangioma, gestational trophoblastic disease, multilocular ovarian cysts, or hydro salpinx. Color Doppler ultrasound (US) provides a noninvasive method for initially diagnosing this rare condition. A normal myometrial signal will show normal flow in addition, uterine AVM will exhibit intensely vascular and multidirectional flow. Spectral Doppler US will show high velocity (mean PSV: 136 cm/s), low resistance (mean RI: 0.3) flow, low pulsatility of the arterial waveform, and pulsatile high-velocity venous waveform (4–5) finally confirmation can be made using diagnostic angiography and eventually embolization.

CONCLUSION:

Being a first line investigation in both condition whether RPOC or UVAM ultrasonography and color Doppler provides adequate information about the pathology with the benefit of easy availability cost effectiveness inexpensive and noninvasive technique. However, sensitivity and specificity of the modality is variable.

CONFLICT OF INTEREST:

The authors confirm that there is no conflict of interests regarding this literature study.

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