REVIEW ARTICLE

Imaging of Acquired Uterine Lesions

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Received on: 21 October 2022; *Accepted on:* 28 October 2022; *Published on:* 26 December 2022

Abstract

In general, the group of acquired uterine lesions consists of enhanced myometrial vascularity (EMV)/arteriovenous malformation (AVM), the isthmocele, intrauterine adhesions (IUAs) (Asherman's syndrome), and nabothian cysts. Uterine AVMs can be congenital or acquired. These vascular lesions can cause severe hemorrhage that can be life-threatening for a woman, so it has been recently suggested that curettage should not be performed in a patient who presents with abnormal uterine bleeding after an abortion or a delivery when there is an ultrasound-detected hypervascular area with turbulent flow within the myometrium. Color Doppler sonography is the preferred method of diagnosing uterine EMV/AVMs. The isthmocele is a myometrial defect resembling a pouch on the anterior wall of the uterine isthmus over a previous cesarean scar. Transvaginal ultrasound (TVUS) is the initial and most usual method described to assess the integrity of the uterus wall in nonpregnant patients. IUAs are also known as intrauterine synechiae or endometrial sclerosis. The most common presentation of Asherman's syndrome is secondary infertility. Two-dimensional (2D)/three-dimensional (3D) TVUS is useful in measuring the thickness of the endometrial lining. Also, together with or without sonohysterography (injection of sterile saline into the uterine cavity) can show the adhesions that characteristically appear as "bridging bands" of tissue that distort the cavity. Nabothian cysts are a common occurrence on the cervix. These are retention cysts of the endocervical glands caused by chronic inflammation. 3D ultrasonography gives an excellent image and the possibility of detecting nabothian cysts.

Keywords: Color Doppler sonography, Enhanced myometrial vascularity/arteriovenous malformation, Intrauterine adhesions (Asherman's syndrome), Nabothian cysts, The isthmocele, Transvaginal ultrasound, Three-dimensional ultrasonography.

Donald School Journal of Ultrasound in Obstetrics and Gynecology (2022): 10.5005/jp-journals-10009-1946

This paper has been previously published as Zorancho Petanovski, Asim Kurjak, Emilija Petanovska Kostova: Imaging of acquired uterine lesions. In: Petanovski Z, Kurjak A. 3D-4D Ultrasound in Gynecology. Jaypee Brothers, New Delhi, 2022, pp 58-64.

EMV/AVM

Introduction

Enhanced myometrial vascularity (EMV)/AVM is a pathologic finding which shows the bloodstream between an organ's arterial and venous supply so-called "short circuit."[1] Uterine AVMs can be congenital or acquired. Acquired lesions are believed to result from pelvic surgery, including diagnostic or therapeutic curettage,[2] after unsuccessful pregnancy, cesarean delivery,[3] cesarean section (SC) scar pregnancy,[4] trophoblastic diseases, neoplasm, or infection.[5] These vascular lesions can cause severe hemorrhage that can be life-threatening for a woman, so it has been recently suggested that curettage should not be performed in a patient who presents with abnormal uterine bleeding after an abortion or a delivery when there is an ultrasound detected hypervascular area with turbulent flow within the myometrium. Some authors, however, believe that this definition should include any detected highly vascularized map of blood vessels, even in cases of placental retention.[6]

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How to cite this article: Petanovski Z, Kurjak A, Kostova EP. Imaging of Acquired Uterine Lesions. Donald School J Ultrasound Obstet Gynecol 2022;16(4):298–303.

Source of support: Nil

Conflict of interest: None

Ultrasonography Characteristics of EMV/AVMs

Two-dimensional (2D) sonography has a limited role in the diagnosis of uterine EMV/AVMs and often shows an ill-defined uterine mass consisting of mildly echogenic tissue that is interspersed with multiple small hypoechoic spaces of varying sizes. Color Doppler sonography is the preferred method of diagnosing uterine EMV/AVMs. On color Doppler ultrasound, a uterine AVM appears as a hypervascular lesion with turbulent flow within the myometrium, so the use of blood velocity blood flow indices is useful to recognize this situation.[6,7] The EMV/AVMs can be distinguished from subsequently enhanced myometrial vascularity (SEMV), pregnancy-related conditions using serum human chorionic gonadotropin measurement (Fig. 1).[7,8]

According to The International Society for the Study of Vascular Anomalies classification system, AVMs are clearly demarcated from vasoproliferative lesions of the uterus (uterine hemangioma and placental chorioangioma), which show increased endothelial cell turnover because they are neoplasms. Vascular malformations do not have increased endothelial cell turnover; rather, they are structural abnormalities of the capillary, venous, and arterial system.[9]

Conclusion

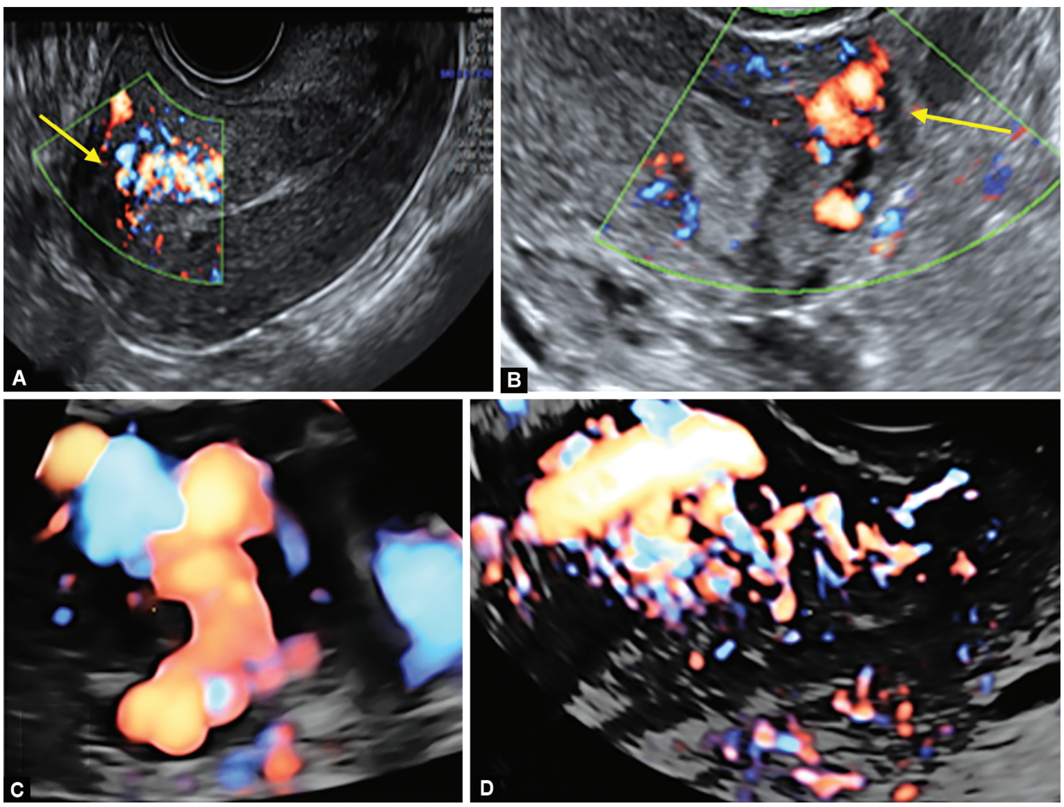
Enhanced myometrial vascularity (EMV)/AVM is a relatively rare pathological situation, and color Doppler is important in detecting this phenomenon.

The Isthmocele

Introduction

The isthmocele is a myometrial defect resembling a pouch on the anterior wall of the uterine isthmus over a previous cesarean scar.[10] The increase in the incidence of isthmocele is the result of an increase in the percentage of births by SC, which has been a trend over the last decades. The prevalence of isthmocele ranges from 24 to 70% in women with one or more previous SC.[11] Several risk factors have been related to the development of the isthmocele; duration of labor (dilatation >5 cm is related to larger isthmoceles), dilatation, stage of the presenting part, a lower position of the cesarean section pregnancy (CSP) hysterotomy, surgical technique, concerning an incomplete closure of the uterine wall,[12] and the single-layer myometrial closure appears to increase the risk of isthmocele development when compared to double-layer closure (Fig. 2).[13] Early adhesion development in the hysterotomy scar with the anterior abdominal wall and patient individual/genetic predisposition to poor hemostasis, inflammation, or adhesion formation.[14]

In general, most isthmoceles are asymptomatic, being found incidentally on ultrasound. Gynecological complications of ishthmocele include abnormal uterine bleeding, postmenstrual spotting, dysmenorrhea, pelvic



Figs 1A to D: Uterine EMV/AVMs: (A and B) Color and/or 3D-PD is a significant marker for the site of the pathologic blood vessels; (C) Torturous vessel; (D) Sign of "vascular lake" pain, and infertility[15] or obstetric such as placenta accreta, placenta praevia, scar dehiscence, uterine rupture, and ectopic pregnancy in cesarean scar defects.[16] All these say how important it is to detect isthmocele, not only because of the described possible complications but also to provide timely information to the patient on how to manage and carry on the next pregnancy.

Ultrasound Characteristics

Transvaginal ultrasound (TVUS) is the initial and most usual method described to assess the integrity of the uterus wall in nonpregnant patients. The defect has been described on TVUS as an anechoic triangle defect in the myometrium, with the base communicating to the uterine cavity or a deformity (wedge, shape, concavity, or sacculation) on the anterior isthmus (Fig. 3).[17] Some authors classified the findings according to the size of the defect: a large defect is described as a myometrial reduction of >50% of the wall thickness[18] or even >80% by some authors (Fig. 4).[12,19] For management purposes, Marotta et al. adopted the cutoff of RM (remaining myometrial thickness) >3 mm for resectoscope treatment by hysteroscopy (Fig. 5).[3] Diagnosis, when compared to the TVUS, saline infusion sonography (SIS) presented better results by detecting more defects and more often classifying them as larger on average of 1–2 mm.[20] Gel instillation sonography also presents a higher prevalence in detecting the defect when compared to TVUS (49.6% against 64.5%).[15]

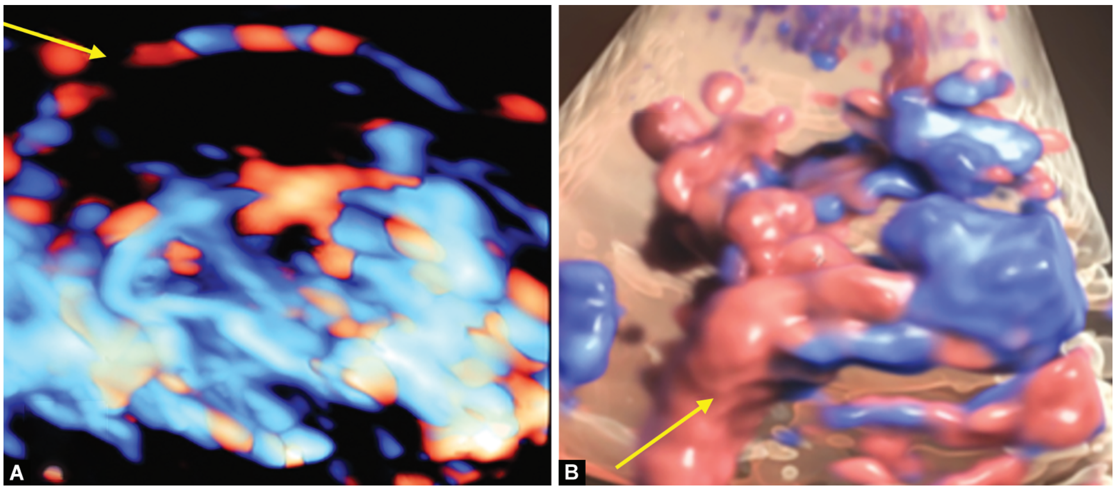
Conclusion

The increased incidence of SC also brings complications such as isthmocele. 2D and especially 3D ultrasonography gives a clear picture of the degree of the extensiveness of the defect itself and certainly in the risk assessment for the next pregnancy and the complications that follow it.

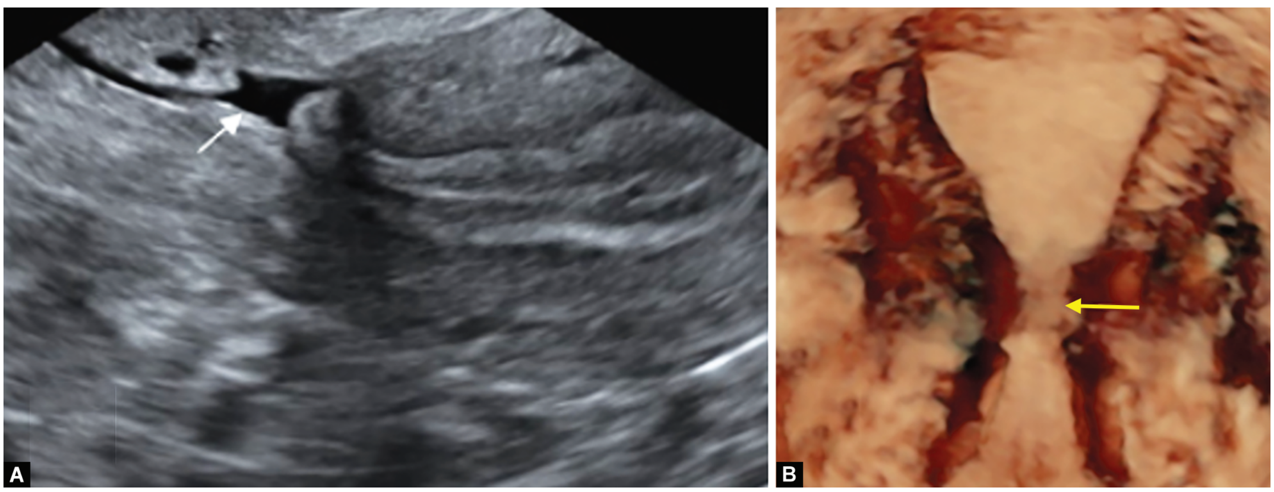
IUAS "Asherman's Syndrome"

Introduction

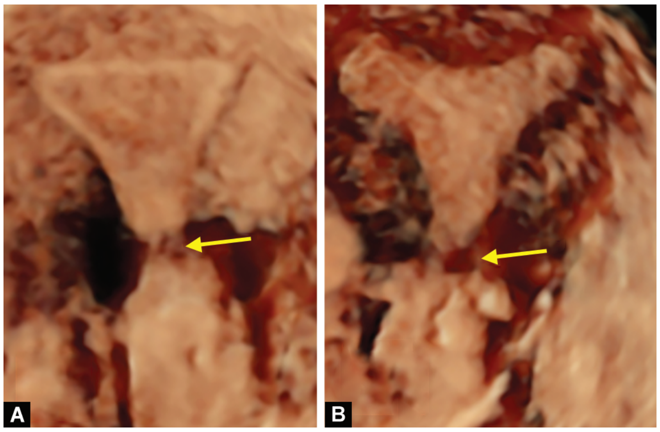
Intrauterine adhesions (IUAs) are also known as intrauterine synechiae or endometrial sclerosis, as should be defined by the presence of adhesions inside the uterine cavity and/or endocervix leading to clinical manifestations such



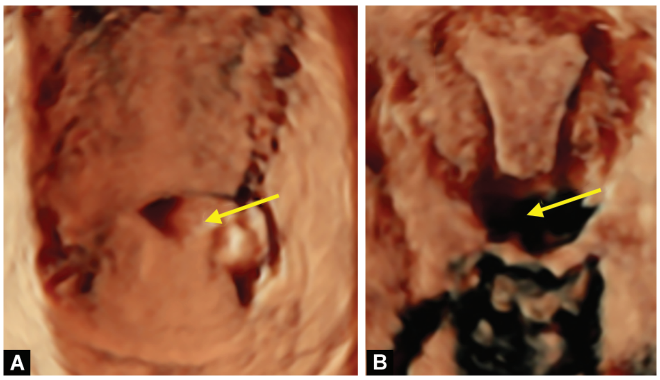
Figs 2A and B: Two-dimensional (2D)/three-dimensional (3D)/color Doppler ultarsonograhy of uterine hemagioma



Figs 3A and B: Isthmocele: triangular-shaped defect detected by 2D and 3D ultrasound: (A) Sagittal 2D myometrial defects are present; (B) 3D rendering of isthmocele, small defect as amenorrhea, hypomenorrhea, recurrent pregnancy loss, infertility, and a history of abnormal placentation.[21] The most common presentation of Asherman's syndrome is secondary infertility. These patients have a higher risk of recurrent miscarriages, second-trimester loss, preterm delivery, incompetent cervix, uterine rupture, and placenta accreta.[22]



Figs 4A and B: Isthmocele: triangular-shaped defect on 3D ultrasound: Different depth of defects



Figs 5A and B: Isthmocele: (A) Huge defects; (B) Cervical amputation in situation of cervical carcinoma *in situ*

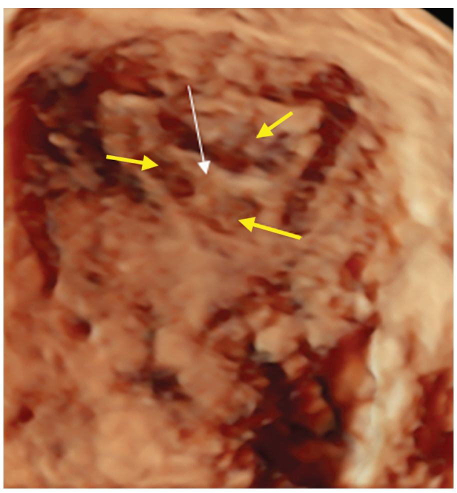


Fig. 6: Three-dimensional (3D) ultrasonography of IUAs: hypoechoic areas (yellow arrow) with interruptions of the endometrial layer and hyperechoic bands–IUAs (white arrow)

Ultrasound Characteristics

Two-dimensional (2D)/three-dimensional (3D) TVUS is useful in measuring the thickness of the endometrial lining. Also, together with or without sonohysterography (injection of sterile saline into the uterine cavity) can show the adhesions that characteristically appear as "bridging bands" of tissue that distort the cavity. The bands may vary in thickness, but their echogenicity is usually the same as the echogenicity of the adjacent myometrium. According to the International Endometrial Tumor Analysis group scoring system, IUAs on ultrasound is seen as bands of myometrium tissue traversing the endometrial cavity and adjoining the opposing uterine walls. The bands may vary in thickness, but their echogenicity is usually the same as that of the adjacent myometrium.[23] One of the typical ultrasound finding is the presence of hypoechoic areas with interruptions of the endometrial layer (skip lesions representing entrapped menstrual blood or secretions from preserved functioning endometrium) and obliteration of the uterine cavity can be focal, partial, or complete (Figs 6 to 8).[24]

Three-dimensional ultrasound scanning can provide images for clinicians that are detailed and self-explanatory with information regarding the location and extent of cavity obliteration and obstruction.[24] In addition, the extent of uterine cavity damage should be quantified by measuring the size of the obliterated area in the coronal plane and comparing it with the total surface area of the uterine cavity. This could be expressed as an obliteration ratio: obliterated area (O)/total cavity area (C) × 100 (%), where O is the obliterated area and C is the total cavity area (Fig. 5). The areas of obstruction could be described in a similar fashion, stating the level of obstruction and percentage of the uterine cavity involved. The same approach should be used for both preoperative assessments and following

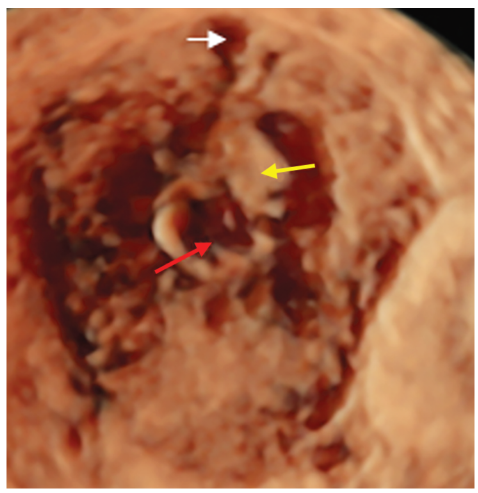


Fig. 7: Three-dimensional (3D) SIS of Asherman's syndrome: 3D ultrasound image of the uterine cavity: balloon (red arrow). IUC (yellow arrow). Defect myometrium until serosa (white arrow). The severity of adhesions could be expressed as an obliteration ratio (%) = O/C × 100

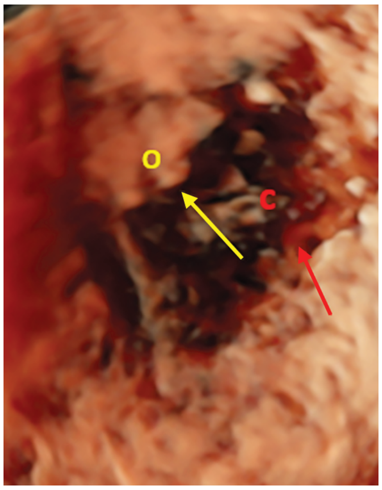
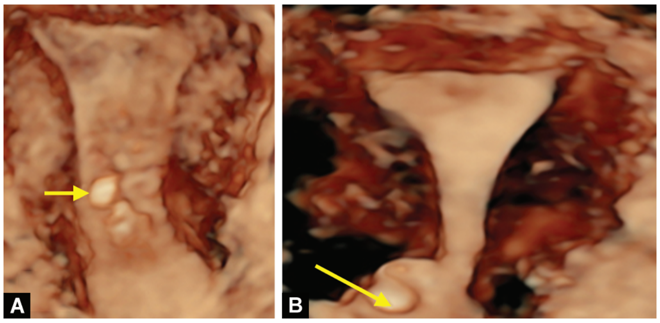
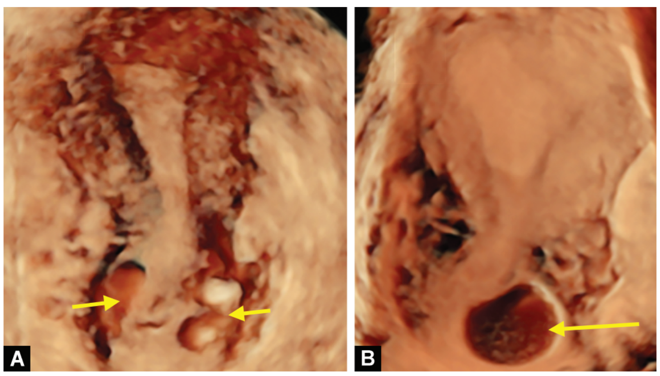


Fig. 8: Three-dimensional (3D) SIS of Asherman's syndrome: severity of adhesions could be expressed as an obliteration ratio (%) = O (yellow arrow)/C (red arrow) × 100



Figs 9A and B: Three-dimensional (3D) ultrasound of ovule nabothian cyst



Figs 10A and B: (A) Three-dimensional (3D) ultrasound of ovule nabothian cysts; (B) Huge ovule nabothian cyst (7 cm, diameter)

surgical division of IUAs adopted.[23] A 3D-SIS has recently been proposed for the diagnosis of intrauterine lesions. 3D-SIS, carried out in combination with 3D power Doppler (3D-PD), was found to have sensitivity and specificity of 91.1 and 98.8%, respectively, for all kinds of intrauterine lesions, including synechiae.[25]

Even the experience of 3D ultrasound for the detection and evaluation of IUAs is limited, but some studies have suggested that it may be superior to hysterosalpingogram (HSG) for the detection of uterine intracavitary pathology.[26]

As for other classification scoring systems that use HSG and/or hysteroscopy as a method, there are several: The American Fertility Society devised a classification system that, for the first time, took into consideration the menstrual pattern as a prognostic marker.[27] More recently, the classification scoring system included not only the menstrual symptoms but also the obstetric history of the woman.[28]

Nabothian Cysts

Introduction

Nabothian cysts are a common occurrence on the cervix. These are retention cysts of the endocervical glands caused by chronic inflammation. They are generally small in diameter and completely asymptomatic, but large cysts may be misdiagnosed with other cervical pathology and even malignant neoplasms. Multilocular cervical cysts must be clearly differentiated, whether they are benign or malignant, because each glandular proliferation gives a multilocular picture.[29,30]

Ultrasound Characteristics

Three-dimensional (3D) ultrasonography gives an excellent image and the possibility of detecting nabothian cysts. Generally, these are cystic formations up to 4 cm that has hypoechoic density. In addition, detection of changes in intracystic space by this method is possible, and color Doppler will detect neoangiogenesis if it is present (Figs 9 and 10).[31]

References

1. Timor-Tritsch IE, Haynes MC, Monteagudo A, et al. Ultrasound diagnosis and management of acquired uterine enhanced myometrial vascularity/arteriovenous malformations. Am J Obstet Gynecol 2016;214(6):731.e1–731.e10. DOI: 10.1016/j.ajog.2015.12.024
2. Peitsidis P, Manolakos E, Tsekoura V, et al. Uterine arteriovenous malformations induced after diagnostic curettage: a systematic review. Arch Gynecol Obstet 2011;284(5):1137–1151. DOI: 10.1007/s00404-011-2067-7
3. Takeda A, Koike W, Imoto S, et al. Conservative management of uterine artery pseudoaneurysm after laparoscopic-assisted myomectomy and subsequent pregnancy outcome: case series and review of the literature. Eur J Obstet Gynecol Reprod Biol 2014;182:146–153. DOI: 10.1016/j.ejogrb.2014.09.020
4. Timor-Tritsch IE, Monteagudo A, Santos R, et al. The diagnosis, treatment, and follow-up of cesarean scar pregnancy. Am J Obstet Gynecol 2012;207(1):44.e1–44.e13. DOI: 10.1016/j.ajog.2012.04.018
5. Polat P, Suma S, Kantarcy M, et al. Color Doppler US in the evaluation of uterine vascular abnormalities. Radiographics 2002;22(1):47–53. DOI: 10.1148/radiographics.22.1.g02ja0947
6. Van den Bosch T, Van Schoubroeck D, Timmerman D. Maximum Peak systolic velocity and management of highly vascularized retained products of conception. J Ultrasound Med 2015;34(9):1577–1582. DOI: 10.7863/ultra.15.14.10050
7. Capmas P, Levaillant JM, Teig B, et al. Uterine arteriovenous malformation involving the whole myometrium. Ultrasound Obstet Gynecol 2013;41(6):715–717. DOI: 10.1002/uog.12432

8. Timmerman D, Van den Bosch T, Peeraer K, et al. Vascular malformations in the uterus: ultrasonographic diagnosis and conservative management. Euro J Obstet Gynaecol Reprod Biol 2000;92(1):171–178. DOI: 10.1016/s0301-2115(00)00443-7
9. Vijayakumar A, Srinivas A, Chandrashekar BM, et al. Uterine vascular lesions. Rev Obstet Gynecol 2013;6(2):69–79. PMID: 24340126; PMCID: PMC3848669.
10. Florio P, Filippeschi M, Moncini I, et al. Hysteroscopic treatment of the cesarean-induced isthmocele in restoring infertility. Curr Opin Obstet Gynecol 2012;24(3):180–186. DOI: 10.1097/GCO.0b013e3283521202
11. Bij de Vaate AJ, Van der Voet LF, Naji O, et al. Prevalence, potential risk factors for development and symptoms related to the presence of uterine niches following cesarean section: systematic review. Ultrasound Obstet Gynecol 2014;43(4):372–382. DOI: 10.1002/uog.13199
12. Tulandi T, Cohen A. Emerging manifestations of cesarean scar defect in reproductive-aged women. J Minim Invasive Gynecol 2016;23(6):893–902. DOI: 10.1016/j.jmig.2016.06.020
13. Hayakawa H, Itakura A, Mitsui T, et al. Methods for myometrium closure and other factors impacting effects on cesarean section scars of the uterine segment detected by the ultrasonography. Acta Obstet Gynecol Scand 2006;85(4):429–434. DOI: 10.1080/00016340500430436
14. Vervoort AJ, Uittenbogaard LB, Hehenkamp WJ, et al. Why do niches develop in Cesarean uterine scars? Hypotheses on the aetiology of niche development. Hum Reprod. 2015;30(12):2695–2702. DOI: 10.1093/humrep/dev240
15. Van der Voet LF, Bij de Vaate AM, Veersema S, et al. Long-term complications of cesarean section. The niche in the scar: a prospective cohort study on niche prevalence and its relation to abnormal uterine bleeding. BJOG 2014;121(2):236–244. DOI: 10.1111/1471-0528.12542
16. Monteagudo A, Carreno C, Timor-Tritsch IE. Saline Infusion sonohysterography in nonpregnant women with previous cesarean delivery: the “niche” in the scar. J Ultrasound Med 2001;20(10):1105–1115. DOI: 10.7863/jum.2001.20.10.1105
17. Futyma K, Gałczyński K, Romanek K, et al. When and how should we treat cesarean scar defect - isthmocoele? Ginekol Pol 2016;87(9):664–668. DOI: 10.5603/GP.2016.0063
18. Ofili-Yebovi D, Ben-Nagi J, Sawyer E, et al. Deficient lower-segment cesarean section scars: prevalence and risk factors. Ultrasound Obstet Gynecol 2008;31(1):72–77. DOI: 10.1002/uog.5200
19. Marotta ML, Donnez J, Squifflet J, et al. Laparoscopic repair of post-cesarean section uterine scar defects diagnosed in nonpregnant women. J Minim Invasive Gynecol 2013;20(3):386–391. DOI: 10.1016/j.jmig.2012.12.006
20. Osser OV, Jokubkiene L, Valentin L. Cesarean section scar defects: agreement between transvaginal sonographic findings with and without saline contrast enhancement. Ultrasound Obstet Gynecol 2010;35(1):75–83. DOI: 10.1002/uog.7496
21. Conforti A, Alviggi C, Mollo A, et al. The management of Asherman syndrome: a review of literature. Reprod Biol Endocrinol 2013;11(1):118. DOI: 10.1186/1477-7827-11-118
22. Yu D, Wong YM, Cheong Y, et al. Asherman syndrome–one century later. Fertil Steril 2008;89(4):759–779. DOI: 10.1016/j.fertnstert.2008.02.096
23. Leone, FPG, Timmerman, D, Bourne, T, et al. Terms, definitions and measurements to describe the sonographic features of the endometrium and intrauterine lesions: a consensus opinion from the International Endometrial Tumor Analysis (IETA) group. Ultrasound Obstet Gynecol 2010;35(1):103–112. DOI: 10.1002/uog.7487
24. Amin TN, Saridogan E, Jurkovic D. Ultrasound and intrauterine adhesions: a novel structured approach to diagnosis and management. Ultrasound Obstet Gynecol 2015;46(2):131–139. DOI: 10.1002/uog.14927
25. Makris N, Kalmantis K, Skartados N, et al. Three-dimensional hysterosonography versus hysteroscopy for the detection of intracavitary uterine abnormalities. Int J Gynaecol Obstet 2007;97(1):6–9. DOI: 10.1016/j.ijgo.2006.10.012
26. Knopman J, Copperman AB. Value of 3D ultrasound in the management of suspected Asherman’s syndrome. J Reprod Med 2007; 52(11):1016–1022. PMID: 18161399.
27. The American Fertility Society. The American Fertility Society classifications of adnexal adhesions, distal tubal occlusion, tubal occlusion secondary to tubal ligation, tubal pregnancies, müllerian anomalies and intrauterine adhesions. Fertil Steril 1988;49(6):944–955. DOI: 10.1016/s0015-0282(16)59942-7
28. Nasr AL, Al-Inany HG, Thabet SM, et al. A clinicohysteroscopic scoring system of intrauterine adhesions. Gynecol Obstet Invest 2000;50(3):178–181. DOI: 10.1159/000010305
29. El-Agwany AS. Large multilocular cystic lesions in the uterine cervix: differential diagnosis and significance. J Med Ultrasound 2018;26(3):153–156. DOI: 10.4103/JMU.JMU_38_18
30. Bin Park S, Lee JH, Lee YH, et al. Multilocular cystic lesions in the uterine cervix: broad spectrum of imaging features and pathologic correlation. Am J Roentgenol 2010 195(2):517–523. DOI: 10.2214/AJR.09.3619
31. Oguri H, Maeda N, Izumiya C, et al. MRI of endocervical glandular disorders: three cases of a deep nabothian cyst and three cases of a minimal-deviation adenocarcinoma. Magn Reson Imaging 2004;22(9):1333–1337. DOI: 10.1016/j.mri.2004.08.013