Comparative study between Diagnostic Value of 3D Ultrasound Versus Hysteroscopic Finding in Patients with Perimenopausal Bleeding

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Received *for publication May 06, 2022;* ***Accepted*** *October 23, 2022;* ***Published online*** *October 23, 2022.*

doi: *10.21608/aimj.2022.137057.1933*

Citation: *Ahmed S. , Abdel Moneim M. and Ahmed M. Comparative study between Diagnostic Value of 3D Ultrasound Versus Hysteroscopic Finding in Patients with Perimenopausal Bleeding. AIMJ. 2022; Vol.3-Issue10 : 85-90.*

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ABSTRACT

Background: Hysteroscopy is the most accurate method for diagnosing intrauterine pathologies related to abnormal bleeding and infertility. The accuracy of three-dimensional (3D) ultrasonography and hysteroscopy were compared in identifying uterine cavity abnormalities.

Aim of the work: To compare the sensitivity of three-dimensional ultrasonography to a gold standard in detecting uterine abnormalities (hysteroscopy).

Patients and methods: This wasprospective comparative study, was carried out on 100patients at Obstetrics and Gynecology department, at Al-Hussein University Hospital From December 2020 to Jun 2021.

Results: As regard fibroid diagnosis, there were 35 patients (35%) true positive, 57 patients (57%) true negative, 5 patients (5%) false positive and 3 patients (3%) false negative. Thus 3D-U/S had the sensitivity of 92.1%, specificity of 91.9%, PPV of 87.5%, NPV of 95% and accuracy of 92% in diagnosis of fibroid cases.

Conclusion: Before resorting to invasive treatments like diagnostic hysteroscopy, three-dimensional transvaginal ultrasonography is a sensitive approach for examining endometrial cavity lesions or anomalies. Hysteroscopy, on the other hand, allows for direct visualization of the uterine cavity and may identify minor intrauterine lesions that may be missed by vaginal ultrasonography.

Keywords: *Three-D ultrasound;Hysteroscopy; Uterine lesions; Premenopausal bleeding.*

INTRODUCTION

Uterine abnormal bleeding is a common gynecologic complaint that can affect women of any age. Abnormal bleeding affects 33% of women referred to gynecologic clinics, rising to 69 percent in perimenopausal and postmenopausal women.[1] Endometrial polyps, hyperplasia, cancer, and submucosal myoma are all organic and functional causes of abnormal uterine bleeding that necessitate medical and/or surgical treatment. A differential diagnosis of these causes is essential to detect and treat intrauterine lesions in irregular uterine bleeding.[2]

Transabdominal sonography (TAS), transvaginal sonography (TVS), sonohysterography (SHG), diagnostic hysteroscopy, computed tomography (CT), and magnetic resonance imaging(MRI) are being employed to identify intrauterine disorders . [2]

The endometrial cavity is commonly examined using transvaginal ultrasonography. 2-DHS is a B-mode transvaginal ultrasonographic method that involves injecting a sterile saline solution into the endometrial cavity, is commonly used. 2-DHS, on the other hand, does not allow for a comprehensive examination of the uterine cavity and any lesions that may be present. [3]

A small number of studies have demonstrated that 3-DHS is more accurate than 2-DHS and may minimize false-positive results4, although these studies were confined to postmenopausal individuals measuring endometrial thickness and polyps. [3,4] Direct visualisation of the cervical canal and uterine cavity is possible with hysteroscopy, which aids in the detection of intrauterine abnormalities. A correct diagnosis may lead to surgical or medical treatment aimed at the specific pathology, avoiding the need for major surgery. The gold standard for evaluating the uterine cavity is hysteroscopy. However, hysteroscopy is an invasive and potentially painful procedure. Its sensitivity is lower than that of a histological examination because it is operator–dependent. [5]

Hysteroscopy enables the precise diagnosis of benign endometrial pathology.Targeted biopsies of suspicious lesions are also possible with hysteroscopy, which aids in the identification of malignant endometrial pathology Diagnostic and operative hysteroscopy have become standards in gynecologic practise due to their safety and efficacy. [6] The endometrial cavity and the exterior shape of the uterus are imaged precisely using transvaginal 3DUS, a non-invasive imaging approach. In clinical practice, three-dimensional sonographic equipment is becoming more commonly accessible. This method gathers a lot of data and reconstructs pictures in the transverse, sagittal, and coronal planes quickly. [7] The goal of this study was to compare three-dimensional ultrasonography's accuracy in diagnosing uterine abnormalities to a gold standard (hysteroscopy).

PATIENTS AND METHODS

Prospective comparative study conducted at Obstetrics and Gynecology department, at EL Hussein University hospital.From December 2020 to Jun 2021,100 patients from Al-Hussein University Hospital's Obstetric and Gynecology outpatient clinic were included in the study. Full history is taken for all patients, with special attention paid to the perimenopausal condition in terms of onset, course, duration, possible aetiology, and complications. Complete a general and local examination to determine the size and mobility of the uterus, as well as the presence of any cervical or adnexal masses.

Inclusion criteria:Perimenopausal age (40-55), abnormal uterine bleeding, uterus less than 12 weeks, and heamodynamically stable.

Exclusion criteria: Patients with bleeding tendency, patient with liver cell failure, acute pelvic infection, vaginal or cervical cause of bleeding, patient taking anticoagulant drugs as warfarin or heparin, and uterus large than 12 week.

All patients were subjected to:

Full history taking, including age, parity,menstrual history and contraceptive history.

Before hysteroscopy was scheduled, transvaginal 2D and 3D ultrasoundexaminations were performed for each patient. For both examinations A single operator used a Voluson s6 3D system with a RIC5-9-RS volume 3D transvaginal probe to perform three-dimensional transvaginal ultrasound.

Sonographic technique was standardized according to the following criteria:•The frequency of the probe is set to 7 mHz. A midsagittal view of the uterus occupies 75% of the screen. The uterine fundus and cervix are contained within a three-dimensional box. The sweep angle is set to 120 degrees. An automated system was used to obtain a 3D volume through the uterus. After that, The image is shown in a multiplanar format, with three perpendicular planes running through it: sagittal, transverse, and reconstructed coronal views. Using the reconstructed coronal view, the sonographer obtains multiple images through the anteroposterior thickness of the endometrium. Cavity configuration is examined in the endometrium and surrounding myometrium, masses, and mass relationships to the endometrial cavity. The sonographer carefully evaluates the perpendicular planes to obtain a true midcoronal view of the uterus in order to accurately assess uterine contour and endometrial cavity shape

Intervention:Hysteroscopy was also carried out. A single operator performed hysteroscopy.

Hysteroscopic procedure:

We used a 25 cm long, 4 mm diameter rigid continuous flow panoramic hysteroscopy with a 5.5 mm outer sheath and a 30 degree fibro optic lens. A Circon Acmi G71A/Germany metal halide automatic light source with a 150 Watt lamp was used in this study. A fibro optic cable connects the light source and the hysteroscope. As a distention medium, a normal saline solution is used, and hamou hysteromate is instilled under pressure.

The hysteroscope is gently inserted into the cervical canal, internal os, and the uterine cavity to examine the uterine cornu, tubal ostia, uterine fundus, as well as the lateral, anterior, and posterior uterine walls Surgery is performed if a hysteroscope finding is positive. The results of the hysteroscopy were recorded on a case record form. There is documentation of the presence, size, and location of structural anomalies, as well as the appearance of the cervical canal and endometrium. 3D-sensitivity, TVS's specificity, diagnostic accuracy, positive predictive value, negative predictive value, positive likelihood ratio, and negative likelihood ratio were calculated and compared to the gold standard for uterine cavity evaluation. , hysteroscopic diagnosis. The proportion of true results in the study population (both true-positive and true-negative) was calculated as (number of truepositive + number of truenegative)/total study population.

Statistical analysis:

The Statistical Program for Social Science (SPSS) version 24 was used to analyse the data. The data was statistically presented as a range, The mean, standard deviation (SD), and percentages are all used. To compare parametric data, the Student's t test was used. The Chi Square (X2) test was used to compare non parametric data. Sensitivity, specificity, positive predictive value, negative predictive value, and overall accuracy were used to describe accuracy. Version 7 of Microsoft Excel (Microsoft Corporation) was used to perform all statistical calculations., New York, USA) and Arcus quickstat version I. Sensitivity: When the disease is present, The probability of a positive test result rises. Specificity is the likelihood that a test result will be negative when the disease is absent. Positive predictive value (PPV): the likelihood that a disease exists when test results are positive. When the test is negative, the negative predictive value is the probability that the disease does not exist (NPV). Accuracy is the overall likelihood that a patient will be correctly classified. A P value of 0.05 was deemed significant.

RESULTS

		Studied patients(N = 100)
Age(years)	Mean ±SD	48.2± 7.3
	Min - Max	40 – 55
Parity	Mean ±SD	3.8± 1.9
	Min - Max	1 – 4

Table 1: Description of age and parity in all studied patients.

The mean age of all studied patients was 48.2 ± 7.3 years with minimum age of 40 years and maximum age of 55 years.The mean parity of all studied patients was 3.8 ± 1.9 with minimum parity of 1 and maximum age of 4 (Table 1).

		Studied patients(N = 100)	
Bleeding pattern	Menorrhagia	35	35%
	Metrorrhagia	25	25%
	Meno-metrorrhagia	40	40%

Table 2: Description of bleeding pattern in all studied patients.

There was menorrhagia in 35 patients (35%), metrorrhagia in 25 patients (25%) and meno-metrorrhagia in 40 patients (40%)(Table 2).

		Studied patients(N = 100)	
Uterine Lesions detected by 3D-ultrasound	Normal	20	20%
	Fibroid	40	40%
	Endometrial thickness	20	20%
	Polyp	20	20%

Table 3: Description of uterine lesions detected by 3D-Ultrasoundin all studied patients.

There was fibroid in 40 patients (40%), endometrial thickness in 20 patients (20%) and polyp in 20 patients (20%) while there were 20 patients (20%) revealed no uterine lesions (normal)(Table 3).

		Fibroid types patients(N = 40)	
Fibroid types	Sub-mucus	20	50%
	Intra-mural	13	32.5%
	Sub-serous	7	17.5%

Table 4: Description of fibroid types in all studied patients.

Fibroid was of sub-mucus type in 20 patients (50%), intra-mural type in 13 patients (32.5%) and sub-serous type in 7 patients (17.5%) (Table 4).

		Studied patients(N = 100)	
Uterine Lesions detected by hysteroscopy	Normal	15	15%
	Fibroid	35	35%
	Endometrial thickness	20	20%
	Polyp	30	30%

Table 5: Description of uterine Lesions detected by hysteroscopyin all studied patients.

There was fibroid in 35 patients (35%), endometrial thickness in 20 patients (20%) and polyp in 30 patients (30%) while there were 15 patients (15%) revealed no uterine lesions (normal) (Table 5).

(n = 100)	Polyp		End. Thickness		Fibroid	
True positive	16	16%	12	12%	35	35%
True negative	72	72%	72	72%	57	57%
False positive	4	4%	8	8%	5	5%
False negative	8	8%	8	8%	3	3%
Sensitivity	66.7%		60%		92.1%	
Specificity	94.7%		90%		91.9%	
PPV	80%		60%		87.5%	
NPV	90%		90%		95%	
Accuracy	88%		84%		92%	

Table 6: Diagnostic performance of 3D-U/S in relation to hysteroscopy in diagnosis of causes of premenopausal bleeding.

This table shows the Diagnostic performance of 3D-U/S in relation to hysteroscopy in diagnosis of causes of premenopausal bleeding. Total studied patients were 100 patients.As regard polyp diagnosis, there were 16 patients (16%) true positive, 72 patients (72%) true negative, 4 patients (4%) false positive and 8 patients (8%) false negative. Thus 3D-U/S had the sensitivity of 66.7%, specificity of 94.7%, PPV of 80%, NPV of 90% and accuracy of 88% in diagnosis of polyp.As regard endometrial thickness diagnosis, there were 12 patients (12%) true positive, 72 patients (72%) true negative, 8 patients (8%) false positive and 8 patients (8%) false negative. Thus 3D-U/S had the sensitivity of 60%, specificity of 90%, PPV of 60%, NPV of 90% and accuracy of 84% in diagnosis of endometrial hyperplasia.As regard fibroid diagnosis, there were 35 patients (35%) true positive, 57 patients (57%) true negative, 5 patients (5%) false positive and 3 patients (3%) false negative. Thus 3D-U/S had the sensitivity of 92.1%, specificity of 91.9%, PPV of 87.5%, NPV of 95% and accuracy of 92% in diagnosis of fibroid cases (Table 6).

DISCUSSION

In the present research, the average age of all patients was 48.27.3 years, with a minimum age of 40 and a maximum age of 55. The present research was supported by a grant.by theprospective cohort study by Dedhia et al.[8] The purpose of this study was to compare the diagnostic effectiveness of Transvaginal Sonography (TVS) and Saline Infusion Sonohysterography (SIS) versus diagnostic hysteroscopy in assessing endometrial pathology in premenopausal and postmenopausal women, as well as to determine the cause of irregular uterine bleeding in these women. A total of 40 women with atypical premenopausal uterine hemorrhage were enrolled in the research. The average age of the participants was 38.1 8.8 years, with a range of 25 to 71 years.

Also, the study by Mohammad et al.[7] The researchers wanted to see how sensitive three-dimensional transvaginal ultrasonography and hysteroscopy were at detecting intrauterine cavitary lesions. The study included 50 women of reproductive age, perimenopausal women, and postmenopausal women with irregular uterine hemorrhage. The median age was 36.59.57 years.

As well, Tsonis et al.[9] The goal of this research was to see how well TVS compared to office hysteroscopy (OHSC) in detecting endometrial abnormalities. A total of 2675 patients were included in the research. The majority (76.7 percent) were of reproductive age, whereas 23.2 percent were postmenopausal. Abnormal uterine bleeding (AUB) was the most prevalent reason for hysteroscopy, accounting for 29.7% of the cases. The average age of women with AUB was 45.4 (95 percent confidence interval: 44.6–46.2 percent), accounting for 30.6 percent of the entire group under investigation.

The average parity of all patients in this research was 3.8±1.9, with a minimum parity of 1 and a maximum parity of 4.

However, the study by Mohammad et al. 7The patients' parity ranged from zero to eight births, with a median parity of 1.68 2.11.

Also, Gowri and Nair10 revealed thatthe parity of the patients ranged from nullipara to para 9 with maximum number of cases being para 2(43%).

Regarding the bleeding pattern in all studied patients. There was menorrhagia in 35 patients (35%), Metrorrhagia in 25 patients (25%) and Meno-metrorrhagia in 40 patients (40%).

All the studies agree with our results as they showed that the most prevalent bleeding pattern was menorrhagia, the study by Grigore et al.[11] reported that There was metrorrhagia in 8 patients (17.3%), menorrhagia in 20 patients (43.5%) and Meno-metrorrhagia in 9 patients (19.6%) and Postmenopausal bleeding in 9 patients (19.6%).

Also, the study by Mohammad et al.[7] revealed that 22 women (44 percent) had abnormal uterine bleeding, menorrhagia (8 cases (16 percent), metrorrhagia (4 cases (8 percent), menometrorrhagia (5 cases (10 percent), polymenorrhea (2 cases) (4 percent), and postmenopausal bleeding (3 cases) among the bleeding cases (6 percent). additionally, Maiti et al.[12] discovered that The most prevalent bleeding pattern was menorrhagia (56 percent), followed by postmenopausal bleeding (15.5%), metrorrhagia (10.5%), polymenorrhagia (10%), and polymenorrhea (10%). (8 percent).

In our study regarding the description of uterine Lesions detected by 3D-Ultrasound in all studied patients. There was Fibroid in 40 patients (40%), endometrial thickness in 20 patients (20%) and polyp in 20 patients (20%) while there were 20 patients (20%) revealed no uterinelesions (normal).Fibroid was of sub-mucus type in 20 patients (50%), intra-mural type in 13 patients (32.5%) and sub-serous type in 7 patients (17.5%).

While the uterine lesions detected by hysteroscopy in studied patients. There was Fibroid in 35 patients (35%), endometrial thickness in 20 patients (20%) and polyp in 30 patients (30%) while there were 15 patients (15%) revealed no uterine lesions (normal).

The study by Dedhia et al.[8] revealed that 27 (67.5 percent) of the 40 3D-transvaginal ultrasounds performed prior to Saline Infusion Sonohysterography (SIS) showed Normal Cavity, 7 (17.5 percent) submucosal fibroids, and 6 (15 percent) endometrial polyps. However, the Diagnostic Hysteroscopy revealed that 6 (15%) Normal Cavity, 21 (52.2%) submucosal fibroids, 8 (20%) endometrial polyps and 6 (15%)Synechiae.

In addition, Gowri and Nair[10] reported that in TVS Hyperplasia was found in (54%), Normal (37%), Fibroid (4%), Fibroid +hyperplasia (2%), Polyp +hyperplasia in (1%) and Malignancy (2%). And in Hysteroscopy Normal cases accounts (24%), Hyperplastic (54%), Polyp (8%), fibroid (6%), Atrophic (6%), Carcinoma (1%) and Adhesions in (1%).

Furthermore, the study by Jindal and Gupta[13] on100 patients with AUB most common bleeding pattern was menorrhagia (54%), followed by polymenorrhagia (18%). The study revealed that TVS findings were normal TVS 42 cases, thick endometrium 28 cases, Polyp 10 cases, fibroid with or without thick endo 10 cases, thickened endometrium with polyp 4 cases, hypoplastic Uterus 2 cases and thin endometrium 4 cases. However, the hysteroscopic findings were normal 20 cases, polypoidal endometrium 32 cases, endometrial polyp 20 cases, polyp +fibroid 4 cases, Adhesions 4 cases, endocervical polyp 6 cases, atrophic 6 cases, atrophic with focal hyperplasia 4 cases, polyp with focal adhesions 2 cases and polyp with hyperplasic endometrium 2 cases.

Regarding the Diagnostic performance of 3D-U/S in relation to hysteroscopy in diagnosis of causes of peri-menopausal bleeding, our analysis showed that:

As regard polyp diagnosis, there were 16 patients (16%) true positive, 72 patients (72%) true negative, 4 patients (4%) false positive and 8 patients (8%) false negative. Thus 3D-U/S had the sensitivity of 66.7%, specificity of 94.7%, PPV of 80%, NPV of 90% and accuracy of 88% in diagnosis of polyp.

As regard endometrial thickness diagnosis, there were 12 patients (12%) true positive, 72 patients (72%) true negative, 8 patients (8%) false positive and 8 patients (8%) false negative. Thus 3D-U/S had the sensitivity of 60%, specificity of 90%, PPV of 60%, NPV of 90% and accuracy of 84% in diagnosis of endometrial hyperplasia.

As regard fibroid diagnosis, there were 35 patients (35%) true positive, 57 patients (57%) true negative, 5 patients (5%) false positive and 3 patients (3%) false negative. Thus 3D-U/S had the sensitivity of 92.1%, specificity of 91.9%, PPV of 87.5%, NPV of 95% and accuracy of 92% in diagnosis of fibroid cases.

Our findings were consistent with those of Fang et al.[14], who discovered that using a combination of endometrial echogenicity, endometrial thickness, and endometrial volume, 3D-TVS exhibited a sensitivity of 65.6 percent and a specificity of 89 percent in diagnosing endometrial polyps.

Our result showed high sensitivity 92.1%,specificity 91.9% and accuracy of 92% in diagnosis of fibroid cases 3DUS provides a more accurate visualization and The extent of cavity destruction, the degree of intramural involvement of leiomyoma, and the precise location and size of polyps. This preoperative information reduces the number of complications and the length of the operation.

Our results were supported by Grigore et al.[11] as they reported that Three-dimensional ultrasound had a sensitivity of 88%, specificity of 94%, a PPVof 96%, NPVof 84%, likely ratio of 5,5, and accuracy of 90% in identifying uterine cavity anomalies. Three-dimensional ultrasound had anexcellent sensitivity and specificity for polyps (97% and 97%, respectively), congenital uterine malformations (100% and 99%, respectively) and submucous myoma (87% and 100%, respectively), but a low sensitivity and high specificity for uterine synechia (41% and 99%, respectively) but our study show low sensitivity for polyp,

The echogenicity of the endometrium and the day of the menstrual cycle are two variables that may impact these results. In these false-negative instances (8 percent), endometrium ultrasonography features indicated mixed echogenicity, which may make diagnosis of tiny endometrial polyps challenging. Endometrium thickening during the late proliferative phase may enhance false-positive or false-negative results when compared to the early to mid-proliferative phase. The sample size in our research, on the other hand, was chosen to show the diagnostic accuracy of 3D-TVS in identifying any abnormalities inside the uterine cavity. The sample size was inadequate to determine the diagnostic accuracy of endometrial polyps, myomas, and endometrial thickness

. Furthermore, according to Mohammad et al. [7], For endometrial polyps, the sensitivity, specificity, PPV, NPV, and overall accuracy of 3D-TVUS were 80 percent, 100 percent, 100 percent, 95.24 percent, and 96 percent, respectively. The sensitivity, specificity, PPV, NPV, and overall accuracy of 3D-TVUS for intrauterine adhesions were 57.14 percent, 100 percent, 100 percent, 93.48 percent, and 94 percent, respectively. For endometrial hyperplasia, 3D-TVUS exhibited 100 percent sensitivity, PPV, NPV, and overall accuracy. The sensitivity, specificity, and PPVare all greater in comparison to hysteroscopy. The sensitivity, specificity, and NPVare all higher in comparison to hysteroscopy., and 3D-TVS ultrasonography's total overall accuracy was 89.13 percent for total abnormal findings, 100 percent, 100 percent, 44.44 percent, and 90 percent, respectively.

In addition, Dedhia et al.[8] TVS's overall sensitivity, specificity, PPV, NPV, and diagnostic accuracy were reported to be 38.2 percent, 100 percent, 100 percent, 22.2 percent, and 47.5 percent, respectively. TVS had a 75.0 percent sensitivity, specificity, PPV, and NPV in the identifying of endometrial polyps. , 100%, 100%, and 94.0 percent, respectively.

The sensitivity of TVUS for identifying endometrial polyps is 57.57 percent, the specificity is 100 percent, the positive predictive value is 100 percent, and the negative predictive value is 92.26 percent, according to Maiti et al.[12]. Hysteroscopy has a sensitivity of 93.93 percent, a specificity of 100 percent, a positive predictive value of 100 percent, and a negative predictive value of 98.80 percent for identifying endometrial polyps. Furthermore, Gowri and Nair10 found that TVS had 67.1 percent sensitivity, 72.2 percent specificity, 91.1 percent positive predictive value, and 34.2 percent negative predictive value in detecting endometrial pathology, whereas hysteroscopy had 85.5 percent, 77.8%, 94.2 percent, and 56 percent sensitivity, specificity, positive predictive value, and negative predictive value in detecting endometrial pathology, respectively.

Furthermore, our results were in line with Tsonis et al.[9] as they reported that The TVS sensitivity, specificity, positive prognosis value (PPV), and negative prognostic value (NPV) for identifying endometrial disease were 84.0, 86.8, 95.3, and 63.0%, respectively. Hysteroscopy had equivalent results of 98.9, 95.1, 98.4, and 93.9 percent, respectively.

CONCLUSION

Abnormal uterine hemorrhage is a prevalent condition affecting women at all ages and affects women’s social, physical and emotional life adversely. It is important to reach correct clinical diagnosis and identify the etiology. TVS may be safe and non-invasive initial investigation, but hysteroscopy is the gold standard for visualization of inside of endometrial cavity.

Hysteroscopy has high sensitivity and specificity in diagnosing intrauterine pathology as uterine cavity can be directly visualized.Before resorting to invasive treatments like diagnostic hysteroscopy, three-dimensional transvaginal ultrasonography is a sensitive approach for examining endometrial cavity lesions or anomalies. Hysteroscopy, on the other hand, allows for direct visualization of the uterine cavity and may identify minor intrauterine lesions that may be missed by vaginal ultrasonography.

Conflict of interest : none

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