Original Research Article

Hysteroscopy versus Three-dimensional Transvaginal ultrasonography for the Detection of Endometrial Cavity Abnormalities

Abstract

Background: Three-dimensional sonographic technology has gained increased acceptance in clinical practise. This technique involves the gathering of a large amount of data and the quick reconstruction of pictures in the coronal, sagittal and transverse planes. The purpose of this work was to compare the diagnostic accuracy of the three-dimensional trans vaginal ultra-sonographic (3-DTVUS) and hysteroscopy in the detection of cavitary lesions in the uterus.

Methods: This study was comparative cross-sectional included 60 patients who had 2D ultrasonography or hysterosalpingography for suspected intrauterine abnormalities. Each patient underwent a thorough history taking, clinical assessment., investigations, imaging [2D transvaginal ultrasound and 3D vaginal ultrasound] and hysteroscopy

Results: 3DTVUS had a (95%) sensitivity in detecting uterine abnormalities compared to hysteroscopic examination. Also, the specificity was (88%) which indicates that only (12%) of the truly negative cases will be missed. The positive predictive values (PPV) of 3D TVUS were (99%) with an accuracy of (94%). The lowest parameter calculated was the negative predictive value (NPV) (58%). 3DTVUS had a specificity and PPV of 100% regarding the detection of all of the mentioned uterine abnormalities. Furthermore, the sensitivity was 100% for all abnormalities except the polyps and adhesions which were 91% and 67% respectively. The NPV were 100% for all abnormalities except for the polys and intrauterine adhesions (IUAs) which recorded 97%. Finally, the accuracy of 3DTVUS in comparison to

hysteroscopy was 100% for all intrauterine abnormalities except the polyps and IUAS which were 98% and 97% respectively.

Conclusions: 3DTVUS can be utilized in diagnosing focal lesions of the uterus with comparable outcomes to hysteroscopy.

Keywords: Hysteroscopy, 3DTVUS, Endometrial Cavity Abnormalities, Three-dimensional sonographic technology, Uterine Anomalies.

Introduction:

The recognition of uterine anomalies has been the attention of gynaecological research. Pathologies of the uterine cavity's structural integrity, as anomalies of the Mullerian duct and lesions within the uterus (fibroids, synechiae, polyps) could play a significant role in infertility, failure of implantation and outcome of pregnancy. As a consequence, screening for uterine anomalies is recognized to be a routine component of clinical investigations of ladies who have struggled with infertility in the past, miscarriages on a regular basis, and preterm labour in its early stages [1].

Three-dimensional transvaginal ultrasound (3DTVUS) is a non-invasive imaging technology that produces precise picture of the uterus and its lining and the uterus's exterior contour. In clinical practise, 3-D sonographic equipment can now be found in greater abundance. This technique involves the gathering of a large amount of data and the quick image reconstruction in the transverse, coronal, and sagittal planes [2].

Hysteroscopy is used to examine or treat the uterine cavity, in females who have experienced uterine bleeding disorders; endocervical canal and tubal ostia, intrauterine contraceptive device kept or more alien bodies, retained conceptional products, anomalies of the Müllerian tract, inclination toward sterilisation, subfertility and miscarriage on a regular basis. It is referred to as diagnostic hysteroscopy when the technique is exclusively for the uterine cavity evaluation, alternatively, the procedure is called an operative hysteroscopy when the pathology found need additional treatment [3].

In benign endometrial disease, hysteroscopy enables a precise diagnosis. Additionally, hysteroscopy enables targeted biopsies of worrisome lesions, which is beneficial in the treatment of endometrial disease which is malignant. Hysteroscopy, both diagnostic and therapeutic, has become a regular procedure in gynaecologic practise due to its safety and

efficacy [4, 5]. The purpose of this study was to compare the diagnostic accuracy of 3D-TVUS and hysteroscopy in detecting intrauterine cavitary lesions.

Patients and Methods:

This cross-sectional comparative research was carried out on 60 patients. Any woman in reproductive age who has a probable intrauterine anomaly on 2D ultrasonography or hysterosalpingography and complains of abnormal uterine bleeding, patients complaining from peri and postmenopausal haemorrhage and Patients who have a history of repeated abortions, lower abdomen pain, infertility, or abnormal vaginal discharge were included.

The study was performed at the Department of Obstetrics and Gynecology in Tanta University Hospitals from the period of February 2020 to November 2020.

An informed written signed consent had been derived from all participants in this research after the research was being accepted by the institutional ethical committee Tanta University.

Exclusion criteria: were patients directly affected sexually transmitted diseases, patients with bleeding tendency featuring (failure of liver cell, bleeding problems or coagulation abnormalities, anticoagulant drugs), patients with bleeding of cervices or valves rather than vaginal and whether there are any contraindications to hysteroscopy (uterine bleeding that is excessive, pregnancy, endometrial infection, severe vaginitis or cervicitis, an inflammatory illness of the pelvis in the past and uterine perforation that occurred recently).

All participants were underwent: full history taking (age, gravidity, parity, abortion, history of habitual abortion, diseases, menstrual history, first day of last menstrual period, dysmenorrhea, contraceptive and sexual history, bleeding, pain, recurrent miscarriage, most intracavitary lesions, the presence of IUAS, infertility), clinical examination (general examination, pelvic examination (bimanual examination, speculum vaginal examination), investigations (blood test, biopsy), imaging and hysteroscopy.

Imaging

a- 2D transvaginal ultrasound carried out to detect presence of any focal uterine lesion or adnexal masses.
b- Three-dimensional vaginal ultrasound was done for all the patients with Samsung H60 Korean manufacturer that has a frequency of 5-8 MHz and is an electronic sector transducer.

Steps of image evaluation

1st opening and generating a region of interest box (ROI) on 2D ultrasound image. 2nd detecting contour of target object in (ROI) box. 3rd forming a 3D ultrasound image by displaying volumetric data contained within the identified contour.

Hysteroscopy: A rigid hysteroscope was used to do the hysteroscopic examination (continuous flow; forward-oblique view of 30 degrees, Karl Storz, Germany) assembled in a diagnostic sheath with a diameter of 4 mm. The uterine cavity was illuminated using a cold light source with a high intensity and fiberoptic cable (Karl Storz, Germany).

The following information was recorded on a customised data collection form: the endocervical canal's appearance and form, the endometrium's shape, visualization of both uterine ostia, The uterine cavity's morphology (normal vs. enlarged vs. restricted size; regular vs. irregular contour) additionally to the existence and location of structural anomalies (adhesions, polyps, congenital anomalies, myoma). Moreover, this form featured a section for patient feedback, complications, possible side effects and duration of the procedure.

Statistical analysis

SPSS (Statistical Package for Social Sciences) version 22 for Windows® was utilized for all statistical calculations (SPSS Inc, Chicago, IL, USA). Mean Standard Deviation (SD) and range were applied to characterise the data statistically, or frequencies (numbers) and percentages as necessary. Data were compared among research groups using the McNemar test. The significance level was set at a two-tailed P value of 0.05. The kappa statistic was used to gauge agreement. Sensitivity, specificity, positive predictive value, negative predictive value, and overall accuracy were all terms used to describe accuracy.

Results:

Table 1 shows age in years, body mass index (BMI, kg/m^2), gravidity & parity and compliant of the patients among the study group.

Table 1: Age in years, body mass index (BMI, kg/m^2), gravidity, parity and compliant of the patients among the study group.

Patients (n = 60)	
Age(years)	37 ± 9.57
BMI	29.47 ± 4.24
Gravidity	2.38 ± 2.52
Parity	1.68 ± 2.11
Compliant	
1ry infertility	22(36%)
2ry infertility	9 (15%)
Recurrent pregnancy loss	6 (10%)
2ry amenorrhea	3 (5%)
A.V. B	20(34%)
Menorrhagia	8(12%)
Menometrorrhagia	5(8%)
Metrorrhagia	5 (8%)
Polymenorrhagia	1 (3%)
Postmenopausal bleeding	1 (3%)

Data are presented as mean ± SD or frequency (%). BMI: Body mass index, A.V. B: Abnormal Vaginal Bleeding,

Table 2 shows 3D- TVUS findings and detailed hysteroscopic among all studied group.

Table 2: 3D - TVUS findings among all studied group.

Patients (n = 60)		
	3D Transvaginal Ultrasonography	**Detailed hysteroscopic**
Submucous fibroid	15(25%)	15(25%)
Polyp	12 (20%)	14(23%)
a) endocervical polyp	6(10%)	8(13%)
b) endometrial polyp	6(10%)	6(10%)
IUAS	4 (7%)	5(8%)
Endometrial hyperplasia	6 (10%)	6(10%)
Septate uterus	12 (20%)	12(20%)
Arcuate uterus	4 (7%)	4(7%)
Normal	7 (11%)	4(7%)

Data are presented as frequency (%), Intrauterine adhesions (IUAs).

Table 3 shows comparison between negative (normal cases) and positive (diseased cases) finding of 3D - TVUS and hysteroscopy.

Table 3: Comparison between negative (normal cases) and positive (diseased cases) finding of 3D - TVUS and hysteroscopy

Patients (n = 60)		
	3D Transvaginal Ultrasonography	**hysteroscopy**
Normal cases	7(11%)	4(6%)
Diseased cases	53(89%)	56(94%)

Data are presented as frequency (%).

Table 4 showed that 3D TVUS had a (95%) sensitivity in detecting uterine abnormalities compared to hysteroscopic examination. Also, the specificity was (88%) which indicates that only (12%) of the truly negative cases will be missed. The positive predictive values of 3D TVUS was (99%) with an accuracy of (94%). The lowest parameter calculated was the negative predictive value (58%).

Table 4: Sensitivity, specificity, predictive values, and total accuracy of 3D - TVUS in relation to hysteroscopy.

	Sensitivity	**Specificity**	**PPV**	**NPV**	**Accuracy**
3D US	95%	88%	99%	58%	94%

Data are presented as frequency (%), US: ultrasonography

Table 5 shows that 3DTVUS had a specificity and PPV of 100% regarding the detection of all of the mentioned uterine abnormalities. Furthermore, the sensitivity was 100% for all abnormalities except the polyps and adhesions which were 91% and 67% respectively. The negative predictive values were 100% for all abnormalities except for the polys and IUAS which recorded 97%. Finally, the accuracy of 3D TVUS in comparison to hysteroscopy was 100% for all intrauterine abnormalities except the polyps and IUAS which were 98% and 97% respectively.

Table 5: Sensitivity, specificity, PPV, NPV, and accuracy of 3D - TVUS for different findings compared to hysteroscopic investigations.

Abnormalities	**Sensitivity**	**Specificity**	**(+) ve PV**	**(-) ve PV**	**Accuracy**
Submucous fibroid	100%	100%	100%	100%	100%
Polyp	91%	100%	100%	97%	98%
IUAS	67%	100%	100%	97%	97%
End. Hyperplasia	100%	100%	100%	100%	100%
Septate uterus	100%	100%	100%	100%	100%
Arcuate uterus	100%	100%	100%	100%	100%

Discussion

US technology is a convenient way to diagnose uterine diseases. With the help of 3D- TVUS, non-invasive images of the endometrial cavity and the uterine exterior can be captured, which allows for the quick image reconstruction in the transverse, coronal and sagittal planes.[6]

Hysteroscopy provides direct access to the uterine cavity and the cervical canal. Intrauterine anomalies can be accurately diagnosed via diagnostic hysteroscopy. As diagnostic tool, outpatient clinics are the primary location for hysteroscopy, so for the sake of avoiding unnecessary surgery, a correct diagnosis is essential. Even in patients with normal TVUS, it is considered a critical step in the infertility workup before to ICSI [6].

In this study, by comparing 3D -TVUS results in relation to results of hysteroscopy, we observed that: the sensitivity, specificity, PPV, NPV values and total accuracy of 3D-TVUS in relation to hysteroscopy for individual uterine anomalies were for myomas (submucous myomas) 100%. For endometrial polyps were 91%, 100%, 100%, 97%, 98% respectively. For IUAS were 67%, 100%, 100%, 97% &97% respectively.

For endometrial hyperplasia were 100%. The sensitivity, specificity, PPV value, NPV, and total overall accuracy of 3D-TVUS to hysteroscopy for total abnormal findings were 95%, 88%, 99%, 58% and 94% respectively.

Several studies have compared the outcomes of 3D-TVUS with those of hysteroscopy, with some finding similar results to ours and others finding them to be different. For myomas (submucous myomas) evaluation, 3D-TVUS we noticed 15 cases only (25%) to have submucous myomas, finally hysteroscopy diagnosed 15 cases (25%) to have submucous myomas. For myomas (submucous myomas), 3D-TVUS had 100% sensitivity, specificity, PPV, NPV, and overall accuracy.

These results were in agreement with the results of Stamenovet al.[7] who discovered that 3D-TVUS and hysteroscopy have the same ability to detect submucous myoma., They were meticulously documented with 100% sensitivity and specificity.

For the evaluation of intrauterine polyps, 3D-TVUS results was 12 patients (20 %) had polyps, but 14 cases (23 %) had polyps after hysteroscopy. There was a 91% specificity, a 100% PPV, a 100% NPV and a 98% accuracy for 3D-TVUS.

In contrast to our findings, Shivaet al. [8] assessed 2D and 3D- US imaging. Standard 2D- US was shown to have a low specificity (69.5%). With a sensitivity of 88%, 3D US performed almost as well diagnosing the presence of polyps.

For IUAs evaluation: Four cases (7 %) were found to have IUAs by 3DTVUS, but by hysteroscopy 5cases (8%) found to have IUAS, 3D-TVUS missed one case, it demonstrates the excellent sensitivity of hysteroscopy in the diagnosis of IUAs. 3DTVUSshowed 67% sensitivity, 100% specificity, 100%PPV, 97%NPV and 97% accuracy.

These results disagree with study of Doroftei et al.[9] which reported that in all cases, IUAscould be seen on 3D -US and HSG, and verified by hysteroscopy. However, 3D -Us had 100% sensitivity. It's possible that their selection of suspected IUAs patients is to criticize for this discrepancy.

For the evaluation of endometrial hyperplasia: we discovered endometrial hyperplasia in six patients (ten %) with 3DTVUS, and six more patients (ten %) were identified with endometrial hyperplasia through hysteroscopy. 3D US has 100% sensitivity, 100% specificity, 100% positive predictive value, 100% negative predictive value, and 100% accuracy.

By Wanderleyet al. [10] ultrasonography, and hysteroscopy were used to examine 255 women who had experienced abnormal uterine bleeding. TVUS had a sensitivity, specificity, PPV, NPV, and diagnostic accuracy of 77 %, 94.6 %, 84.4 %, 91.6 %, and an 89.8 % diagnostic

accuracy for endometrial hyperplasia in 70 of the patients examined histopathologically. and son hysterography showed 95.7% sensitivity, 96.8% specificity, 91.8% PPV, 98.35% NPV and 96.5% diagnostic accuracy and 75.7%, 97.3%, 91.4%, 91.45 ,91.4% for hysteroscopy.

Yu et al. [11] conducted research on the uterine malformations found in the hysteroscopic and/or laparoscopic examinations of 62 patients. The cases underwent 2D- TVUS and 3D-TVUS. The two methods were compared in terms of accuracy. The 3D-TVUS accuracy rate was (98.38%, 61/62), higher than that of 2D-TVUS (80.65%, 50/62).

Prior to hysteroscopic uterine septum removal, Arya et al. [12] compared 2D-US, transvaginal colour Doppler, 2D sonohysterography, and 3D US. According to our findings, the sensitivity and specificity of 3D US were both 100%.

When compared to hysteroscopy, 3D-US had 100% sensitivity, specificity, PPV, NPV, and accuracy in identifying congenital uterine abnormalities. That stated by Kougioumtsidou et al. [13], Graupera et al. [14], Ludwin et al. [15] and Dewan et al. [16] All four investigations, which looked at a wide range of septal birth defects, came to the same conclusion that we did. In the four investigations comparing the diagnostic accuracy of 3D US in the examination of the uterine cavity to hysteroscopy, 3D gives 100% specificity for the exclusion of uterine anomalies. According to our findings, these are also in agreement.

In our research, the overall 3DTVUS had a sensitivity of 95%, a specificity of 8%, a PPV of 99%, an NPV of 58%, and a total accuracy of 94% for all abnormal findings.

For the diagnosis of endometrial abnormalities in patients with abnormal uterine bleeding, Mohamed et al. [6] found that TVS had 77.8% sensitivity, 93.3% specificity, 88.9%, PPV and 98.3% NPV whereas Khalaf et al. [17] found that TVS had a sensitivity, specificity, PPV, and NPV of 33.3%, 88.6%, 25% and 92.1% respectively.

Dreisler et al. [18] examined 134 infertile ladies by both US and hysteroscopy. In 58 of the 134 cases in which uterine lesions were diagnosed during hysteroscopy (44 %), hysteroscopy

results from the US were in agreement with 50 of the 58 diagnoses made by hysteroscopy. 84.5 % (49/58) sensitivity and 98.0 % (74/75) specificity, 98.0 % (49/50) PPV were achieved by US in contrast to hysteroscopy. and our findings are in line with theirs.

Limitations: The sample size was relatively small, and the study was done in a single center.

Conclusions:

This study concluded that the 3D-TVUS can be used in diagnosing uterine focal lesions with results comparable to hysteroscopy.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that no competing interests exist. The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

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