Comparative Study between Hysteroscopy and Three Dimension Ultrasound in Diagnosis of Recurrent Abortion

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Abstract

Background: Congenital uterine anomalies is a common cause of infertility, preterm labor, first trimester abortion. Its estimated percentage varies between 0.1%-3% in the general population and between 3% to 38% in patients with recurrent spontaneous pregnancy loss or with infertility. The use of 3-D ultrasound with image reconstruction in the diagnosis of congenital uterine anomalies has already been described.

Aim of Study: To evaluate and compare the diagnostic validity of 3D ultrasound and hysteroscope in the detection of uterine cavity pathologies in recurrent abortion cases.

Patients and Methods: This study was a prospective cohort study, was carried out on 200 patients at Al-Azhar University Hospitals, Al Hussein and Al Syed Galal, between February 2019 and January 2022.

Results: Using 3D Ultrasound, can discriminate between normal and abnormal biopsy with AUC of 0.793, level of sensitivity 58.6%, specificity 100.0%, PPV 100.0%, NPV 85.5% and accuracy 88%. Using hysteroscopy, it can discriminate between normal and abnormal biopsy with AUC of 0.793, level of sensitivity 75.9%, specificity 100.0%, PPV 100.0%, NPV 91.0% and accuracy 93%.

Conclusion: Three dimensional transvaginal ultrasound is relatively inexpensive, is not time-consuming, and can be performed in settings. 3D sonography has a high level of accuracy for most uterine anomalies. Thus, routine use of three dimensional transvaginal ultrasound is a sensitive method to evaluate the endometrial cavity lesions or abnormalities, before resorting to invasive procedure.

Key Words: *3D ultrasound – Hysteroscopy – Uterine cavity abnormalities.*

Introduction

ABNORMAL uterine bleeding and infertility are two of the most common complaints in gynecologic practice. To properly diagnose and manage both conditions, assessing the uterine cavity for possible abnormalities is essential. Transvaginal ultrasonography is the standard method for screening for possible endometrial or uterine cavity abnormalities. When indicated, saline/gel infusion sonography, hysterosalpingography, or hysteroscopy may also be used to evaluate the uterine cavity lining. Hysteroscopy is widely accepted to be the most accurate method for investigating the uterine cavity [1].

Detection of uterine abnormalities has been the focus of research in gynaecology. Structural pathologies in the uterine cavity such as müllerian duct anomalies (MDAs) and intrauterine lesions (fibroids, polyps, synechiae) may have an important role in infertility, implantation failure and pregnancy outcome. As a result, screening for uterine abnormalities is considered a part of routine clinical investigations of women who have histories of infertility, recurrent miscarriages and early preterm labor [2].

Transvaginal 3DUS is a non-invasive imaging technique with the ability to generate accurate images of the endometrial cavity and of the external contour of the uterus. Three-dimensional sonographic technology has become more widely available in clinical practice this technology entails acquisition of a volume of data and rapid reconstruction of images in the transverse, sagittal, and coronal planes [3].

Hysteroscopy is performed for the evaluation, or for the treatment of the uterine cavity, tubal ostia and endocervical canal in women with uterine bleeding disorders, Müllerian tract anomalies, retained intrauterine contraceptives or other foreign bodies, retained products of conception, desire for sterilisation, recurrent miscarriage and subfertility. If the procedure is done for the purpose of evaluating the uterine cavity only, it is called a diagnostic hysteroscopy. If the observed pathology requires

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further treatment, the procedure is called an operative hysteroscopy [4].

Hysteroscopy allows for an accurate diagnosis in benign endometrial pathology. Hysteroscopy also allows directed biopsies of suspicious lesions, which is useful in malignant endometrial pathology. Given their safety and efficacy, diagnostic and operative hysteroscopy have become standards in gynecologic practice [5].

Three-dimensional ultrasound offers new viewing window by allowing for arbitrary plane evaluation through a volume data set acquired from the pelvis. In addition, by 3D ultrasound more precise anatomical sections for exploring the endometrial cavity; the relations of myomata and their possible encroachment on the cavity, the diagnosis of endometrial polypi and the measurement of endometrial volume rather than thickness in cases of abnormal uterine bleeding [4].

Hysteroscopy was one of the very earliest approaches to the direct study of the uterine cavity. The direct or magnified observation of the uterine cavity by hysteroscopy may offer a more precise diagnosis, a better ground for therapy or verification of results as compared to other methods such as hysterography. Although still hysteroscopy could be considered an invasive diagnostic procedure yet in all studies it is considered as the gold standard for evaluation of the uterine cavity [6].

The aim of this study was to evaluate and compare the diagnostic validity of 3D ultrasound and hysteroscope in the detection of uterine cavity pathologies in recurrent abortion cases.

Patients and Methods

This study was a prospective cohort study, was carried out on 200 patients at Al-Azhar University Hospitals (Al Hussein and Al Syed Galal) between February 2019 and January 2022.

All patients was signed a consent form to give permission to use their treatment outcomes confidentially without mentioning the name. All test evaluations was performed free for participants.

Inclusion criteria:

We including all patients, 20 to 40 years of age, who are diagnosed recurrent pregnancy loss (RPL).

Exclusion criteria:

- History of previous surgery and pathology in the uterus, or patients with heterogenic or echogenic endometrium attributed to bleeding.

- The women also had the full routine miscarriage investigations offered by the clinic, which include thrombophilic, endocrine, autoimmune, metabolic and genetic investigations.

Methods:

RPL referred to two or more failed clinical pregnancies as recorded by ultrasonography or histopathologic evaluations in infertile women. During the study period, we were examining 100 patients:

By 3D ultrasound and Hysteroscopy.

And then comparative study between 3D finding and hysteroscopy was done.

Uterine biopsy was performed in cases with abnormal diagnosis according to 3D and/or hysteroscopy. For example, in complex situations like submucous myoma, endometrial polyps and extensive Asherman's syndrome we scheduled several hysteroscopic procedures and performed therapeutic interventions after obtaining informed consent from the patients.

Uterine assessment:

Patients underwent 3D will be done on volson E6 ultrasound in obstetrics and gynecology department in the follicular phase of the menstrual cycle (days 5-13) when the menstrual bleeding stopped and before the diagnostic hysteroscopy evaluation.

All sonographic evaluations were performed by the supervisors on the research. Uterine cavity abnormalities that included polyp lesions, uterine myoma, septate and arcuate uterus, adhesion, and endometrial hypertrophy will be evaluated.

We have define a polyp as a round or oval echogenic lesion with intact endometrial-myometrial junction located in the endometrial cavity. Submucosal fibroma is a benign lesion that originates from the smooth muscle layer and the accompanying connective tissue of the uterus. It is observed in sonography as a mixed or hypoechoic mass lesion that originates from the myometrium and interrupts the endometrial layer.

Septum is a form of congenital malformation that divides the uterine cavity by a longitudinal short or long wall whereas the outside of the uterus has a normal shape.

Abnormal adhesion is detected as an irregular endometrial line in ultrasound and observed as a fibrous band which separates the endometrial cavity. Endometrial hypertrophy is detected as thickening

of the endometrium on sonography which represents excessive proliferation of the endometrium cells.

The supervisors were performing the hysteroscope.

A high-intensity cold light source and fiberoptic cable will to be used to clarify the uterine cavity. Normal saline (0.9%) is applied as the distention medium, with pressure maintained between 100-120mm Hg using a pressure adjustable cuff system to achieve the lowest adequate pressure to distend the uterine cavity.

Bettocchi 5mm elongated hysteroscope-36cm:

Telescope:

Forward oblique 30° and 12° telescope with diameters 2mm, 2.9mm, and 4mm. 30° telescope provides panoramic view best suited for diagnostic procedures, 25-30° and 12-15° are useful for ablation, resection and diagnostic procedures.

Hysteroscope sheath:

Inner and outer sheaths are used according to the size of the telescope: For 2mm telescope, 3.6mm inner and 4.2mm outer sheath; for 2.9mm telescope, 4.3mm inner and 5mm outer sheath; for 4mm telescope, 5.4mm inner and 6mm outer sheath.

At the entrance of uterine cavity, a systematic observation is performed that included the uterine cornea, tubal ostia, uterine fundus, lateral, anterior, and posterior uterine walls. The uterine cavity and endocervical canal are re-evaluated during withdrawal of the instrument. A video system was used for patient observation and to document the procedure for future reference. The patients will be under observation for a minimum of 30 minutes to assess for possible side effects and complications.

Hysteroscopy was recorded on a special data form that included the following items:

1- Appearance and figure of the endocervical canal (endocervicitis-determined by congestion and hypertrophy of the mucosal lining; mucous polyp-associated with contact bleeding and excessive discharge).

2- Endometrial appearance (endometritis - congestion, hyperemia, hemorrhages, and adhesions; hyperplastic endometrium-thickened and easily indented by pressure, with or without multiple polyps).

Statistical analysis:

Data were fed to the computer and analyzed using IBM SPSS software package version 20.0.

(Armonk, NY: IBM Corp) Qualitative data were described using number and percent. The Kolmogorov-Smirnov test was used to verify the normality of distribution Quantitative data were described using range (minimum and maximum), mean, standard deviation, median and interquartile range (IQR). Significance of the obtained results was judged at the 5% level. Chi-square test for categorical variables, to compare between different groups. Student t-test for normally distributed quantitative variables, to compare between two studied groups. Mann-Whitney test for non-parametric variables, to compare between two studied groups. p-value <0.05 was considered significant.

Results

Table (1) shows that there was no statistically significant difference between the studied groups as regard history.

Table (2) shows that there was no statistically significant difference between the studied groups as regard diagnosis.

Table (3) shows that there was no statistically significant difference between the studied groups as regard biopsy.

Table (4) shows that there was no statistically significant difference between the studied groups as regard anatomical configuration.

Table (5) shows showed strong substantial agreement regarding Diagnosis with kappa (κ) 0.846.

Table (6) shows showed strong substantial agreement regarding Diagnosis with kappa (κ) 0.846.

Table (7) shows showed strong substantial agreement regarding Diagnosis with kappa (κ) 0.912.

Using 3D Ultrasound it was shown that it can discriminate between normal and abnormal biopsy with AUC of 0.793, level of sensitivity 58.6%, specificity 100.0%, PPV 100.0%, NPV 85.5% and accuracy 88%. Using hysteroscopy it was shown that it can discriminate between normal and abnormal biopsy with AUC of 0.793, level of sensitivity 75.9%, specificity 100.0%, PPV 100.0%, NPV 91.0% and accuracy 93% (Table 8).

Table (1): Comparison between the studied groups as regard History.

	3D Ultrasound group (n=100)	Hysteroscopy group (n=100)	Test	p
Age:				
Range	26-35	26-36	t=0.079	0.937
Mean ± SD	31.12±2.71	31.15±2.61		
Parity:				
Range	3-8	3-8	U=4698.5	0.451
Median (IQR)	5 (4-6)	5 (4-6)		
Abortion:				
Range	3-6	3-6	U=4822.0	0.649
Median (IQR)	4 (3-5)	4 (3-5)		

t: Student t-test.
p: p-value for comparing between different categories.
*: Statistically significant at $p \le 0.05$.

Table (2): Comparison between the studied groups as regard diagnosis.

	3D Ultrasound group (n=100)		Hysteroscopy group (n=100)		Test	p
	No.	%	No.	%		
Submucousmyoma	33	33.0	27	27.0	χ^2=2.971	0.812
Endometrial thickness	23	23.0	21	21.0		
Endometrial Polyp	12	12.0	14	14.0		
IUA (by sono-ultrasonography)	11	11.0	9	9.0		
Arcuate uterus	2	2.0	5	5.0		
Septate uterus	2	2.0	2	2.0		
Normal	17	17.0	22	22.0		

χ^2: Chi-square test.
p: p-value for comparing between different categories.
*: Statistically significant at $p \le 0.05$.

Table (3): Comparison between the studied groups as regard biopsy.

	3D Ultrasound group (n=59)		Hysteroscopy group (n=58)		Test	p
	No.	%	No.	%		
Submucousmyoma	33	33.0	27	27.0	χ^2=3.462	0.725
Endometrial thickness	20	20.0	20	20.0		
Endometrial Polyp	6	6.0	11	11.0		

χ^2: Chi-square test.
p: p-value for comparing between different categories.
*: Statistically significant at $p \le 0.05$.

Table (4): Comparison between the studied groups as regard anatomical configuration.

	3D Ultrasound group (n=41)		Hysteroscopy group (n=42)		Test	p
	No.	%	No.	%		
IUA (by sono-ultrasonography)	8	8.0	6	6.0	χ^2=3.642	0.725
Arcuate uterus	2	2.0	5	5.0		
Septate uterus	2	2.0	2	2.0		
Normal	29	29.0	29	29.0		

χ^2: Chi-square test.
p: p-value for comparing between different categories.
*: Statistically significant at $p \le 0.05$.

Table (5): Agreement between 3D Ultrasound and Biopsy in 3D Ultrasound group.

Diagnosis	Biopsy						
	Submucou-smyoma	Endometrial thickness	Endometrial Polyp	IUA	Arcuate uterus	Septate uterus	Normal

Diagnosis	Submucou-smyoma	Endometrial thickness	Endometrial polyp	IUA	Arcuate uterus	Septate uterus	Normal	
IUA	0	0	0	8	0	0	3	κ=0.846
Arcuate uterus	0	0	0	0	2	0	0	
Septate uterus	0	0	0	0	0	2	0	
Normal	0	0	0	0	0	0	17	

χ^2: Chi-square test.
p: p-value for comparing between different categories.
*: Statistically significant at $p \le 0.05$.

Table (7): Agreement between hysteroscopy and Biopsy in hysteroscopy group.

		Biopsy			Anatomical configuration				
		Submucou-smyoma	Endometrial thickness	Endometrial polyp	IUA	Arcuate uterus	Septate uterus	Normal	
Diagnosis	Submucousmyoma	27	0	0	0	0	0	0	x=0.912
	Endometrial thickness	0	20	0	0	0	0	1	
	Endometrial Polyp	0	0	11	0	0	0	3	
Anatomical configuration	IUA	0	0	0	6	0	0	3	
	Arcuate uterus	0	0	0	0	5	0	0	
	Septate uterus	0	0	0	0	0	2	0	
	Normal	0	0	0	0	0	0	22	

χ^2: Chi-square test.
p: *p*-value for comparing between different categories.
*: Statistically significant at $p \leq 0.05$.

Table (8): Roc curve analysis for the use of 3D Ultrasound and hysteroscopy to discriminate between normal and abnormal biopsy.

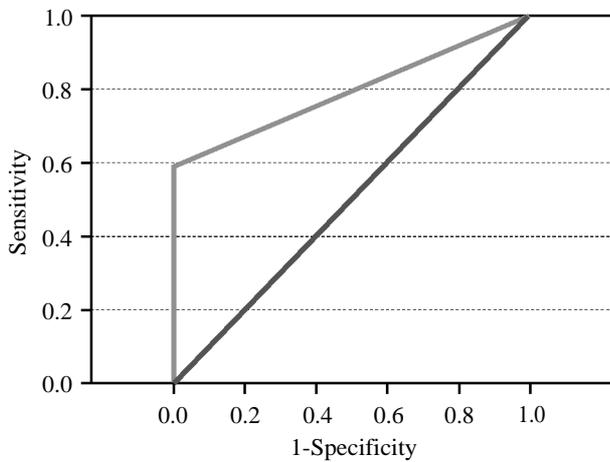|	AUC	Sens%	Spec%	PPV%	NPV%	Accuracy %
3D US	0.793	58.6	100.0	100.0	85.5	88.0
Hysteroscopy	0.879	75.9	100.0	100.0	91.0	93.0

Fig. (1): Roc curve analysis for the use of 3D Ultrasound to discriminate between normal and abnormal biopsy.
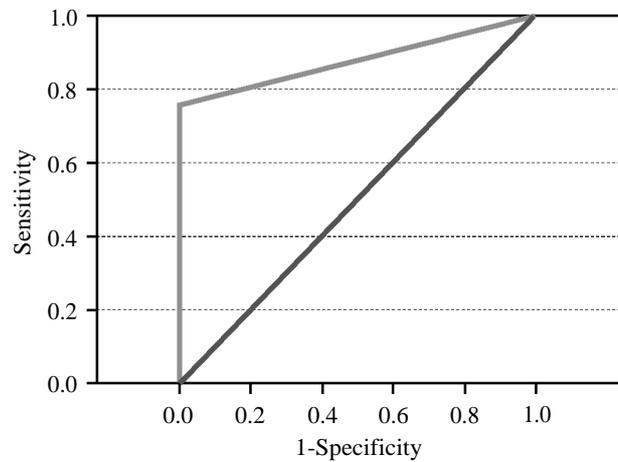

Fig. (2): Roc curve analysis for the use of hysteroscopy to discriminate between normal and abnormal biopsy.

Discussion

In this study we demonstrated that there was no statistically significant difference between the studied groups as regard history.

Haemila et al., [7] found that in a comparative study of Hysteroscopy and 3D Ultrasound for Diagnosing uterine cavity Abnormalities, there were insignificant difference between both studied groups as regards age, parity, and fertility.

Mohammad et al., [8] found that in a Comparative Study between Three-Dimensional Transvaginal Ultrasonography and Hysteroscopy in the Diagnosis of Uterine Cavity Abnormalities, there were insignificant difference between both studied groups as regards age, parity, and abortion.

In a Comparative Study between Hysteroscopy versus transvaginal ultrasound in infertile women prior to intracytoplasmic sperm injection by Kandeel et al., [9], he found that there was insignificant difference between both studied groups as regards age, parity, and fertility.

In this study we found that there was no statistically significant difference between the studied groups as regard examinations.

Haemila et al., [7] found that no statistically significant difference between the studied groups

as regard type of bleeding. In which the most common bleeding pattern was menorrhagia (40%) followed by menometrorrhagia (22.8%) then metrorrhagia (34.2%) then polymenorrhoea (2.8%).

Grigore et al., [10] found that there was no statistically significant difference between the studied groups as regard Abnormal uterine bleeding included cases of menorrhagia, metrorrhagia, hypomenorrhea, and postmenopausal bleeding.

In this study we found that that there was no statistically significant difference between the studied groups as regard diagnosis.

Abd-Elaziz et al., [11] found that there was insignificant difference between both studied groups, as regards diagnosis, in which the vaginal ultrasonography detected abnormal findings in 28 (93.3%) cases, whereas two (6.7%) cases were free as represented in Table (8). Moreover, we found that the abnormalities detected by vaginal ultrasonography were intrauterine adhesions, which were detected in nine (30%) cases, fibroid was found in seven (23.3%) cases, intrauterine polyps were found in six (20%) cases, irregular endometrium in four (13.3%) cases, endometritis was seen in one (3.3%) case, and septum was detected in one (3.3%) case. By hysteroscopy, which is the gold standard in investigating the uterine cavity in our study, we found abnormal findings in 27 cases, representing 90% of cases, whereas three (10%) cases were free. Moreover, he found that the abnormalities detected by hysteroscopy were intrauterine adhesions, which were detected in 11 (36.7%) cases, intrauterine polyps were found in seven (23.3%) cases, fibroid was found in five (16.7%) cases, endometritis was seen in two (6.7%) cases, and septum was detected in two (6.7%) cases.

Mohammad et al., [8] found that the differences between diagnostic capabilities of 3D-TVUS and hysteroscopy in our study were: 10 cases of endometrial polyps diagnosed by hysteroscopy that differ from 3D US, 2 of them were missed by 3D ultrasonography. He diagnosed 7 cases of intrauterine adhesions which were confirmed by hysteroscopy as intrauterine adhesions, 3 of them were missed by 3D ultrasonography. Overall, there was insignificant difference between both studied groups, as regards diagnosis.

Abd Elkhalek et al., [12] found that 3D-US detected normal uterine cavity in 24 patients (48%), submucous fibroids in 12 patients (24%) and endometrial polyps in 14 patients (28%) with diag-

nostic performance accuracy of 88% and sensitivity about 81.25% with 100% specificity. Hysteroscopy detected normal uterine cavity in 22 patients (44%), submucous fibroids in 10 patients (20%) and endometrial polyps in 18 patients (36%) with diagnostic performance accuracy of 92% and sensitivity about 87.5% with 100% specificity. There was agreement between 3D-US and hysteroscopy in 40 cases (18 true negative and 22 true positive) and disagreement between both methods in 10 cases.

In study in our hands, we found that there was strong substantial agreement between hysteroscopy and 3D-US regarding Diagnosis with kappa (ic) 0.846.

Abd-Elaziz et al., [11] found that the intermethod agreement between hysteroscopy and ultrasonography according to diagnosis was as follows: kappa (ic)=0.484, representing perfect agreement for participant females, with p-value 0.027, being significant.

Haemila et al., [7] found that there was a good overall agreement between diagnostic hysteroscopy and 3D transvaginal ultrasound in the diagnosis of uterine abnormalities. 3D US detected, 8 polyps (11.43%) and an endometrial mass. it was able to differentiate these myomas as 10 interstitial (14.29%) and 4 submucous (5.71%). Hysteroscopy detected 6 submucous myomas (8.57%), 11 polyps (15.71%) which by pathology had been differentiated to 9 adenomatous polyps and 2 fibroid polyps.

In this study we illustrated that using 3D Ultrasound it was shown that it can discriminate between normal and abnormal biopsy with AUC of 0.793, level of sensitivity 58.6%, specificity 100.0%, PPV 100.0%, NPV 85.5% and accuracy 88%. While using hysteroscopy it was shown that it can discriminate between normal and abnormal biopsy with AUC of 0.793, level of sensitivity 75.9%, specificity 100.0%, PPV 100.0%, NPV 91.0% and accuracy 93%.

El Tabbakh and Slamka [13] who studied 255 patients with abnormal uterine bleeding by ultrasound and operative hysteroscopy. Histological examination revealed endometrial hyperplasia in 70 patients where sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy were 77%, 94.6%, 84.4%, 91.6% and 89.8% for transvaginal ultrasound and 75.7%, 97.3%, 91.4%, 91.45,91.4% for hysteroscopy.

For total abnormal findings, Mohammad et al., [8] found that the overall 3D- TVUS had sensitivity 89.13%, specificity 100%, PPV 100.00%, NPV 44.44% and total accuracy 90%.

Haemila et al., [7] found that while comparing 3D US results against hysteroscopy on 70 patients complaining of abnormal uterine bleeding found that 3DUS has a sensitivity of 63.16% specificity of 80.77%, positive predictive value of 54.55% and negative predictive value of 85.71%, accuracy of 76.1 % these results are quite different with our results.

Souse et al., [14] reported a sensitivity of 77.8%, specificity of 93.3%, positive predictive value of 88.9% and negative predictive value of 98.3% for TVS in diagnosing endometrial abnormalities in patients with abnormal uterine bleeding while Krampl et al., [15] reveals sensitivity, specificity, positive predictive value, negative predictive value of 33.3%, 88.6%, 25% and 92.1% respectively.

Loverro et al., [16] investigated 134 infertile women by both US and hysteroscopy. Hysteroscopy detected uterine lesions in 58 out of 134 cases (44%), while the US was in agreement with 50 out 58 of the findings diagnosed by hysteroscopy, US in comparison to hysteroscopy had 84.5% (49/58) sensitivity and 98.7% (74/75) specificity, 98.0% (49/50) positive predictive value and these results agree with our results.

Uterine structural anomalies are a quite common etiology for uterine factor of infertility, and usually found during invasive procedures as laparoscopy and hysteroscopy. Thus, providing a non-invasive technique which has a comparable sensitivity, specificity and accuracy to invasive maneuvers would certainly reduce the complications resulting from the anesthesia and surgery. Moreover, 3D doesn't indicate hospital admission and it is widely accepted as a diagnostic technique. Limitations could be that 3D ultrasound is only diagnostic method, whereas laparoscopy and hysteroscopy are both diagnostic and therapeutic. In addition, three-dimensional ultrasound is not available in all hospitals and it may be done with a relatively high cost. Further research will show whether this increased diagnostic capability of 3D ultrasound may be translated into a more meaningful system of classification of submucous fibroids, which could predict the success of hysteroscopic fibroid resection with a high degree of accuracy.

Conclusion:

- From our study we could conclude that three dimensional Transvaginal ultrasound can be used in diagnosing uterine focal lesions with results comparable to hysteroscopy.

- In addition, three dimensional Transvaginal ultrasound is relatively inexpensive, is not time-consuming, and can be performed in settings. 3D sonography has a high level of accuracy for most uterine anomalies. Thus, routine use of three dimensional Transvaginal ultrasound is a sensitive method to evaluate the endometrial cavity lesions or abnormalities, before resorting to invasive procedure.

Recommendations:

We recommend that 3D TVUS, if available, to be performed routinely for: All cases of uterine cavity anomalies. Prior to laparoscopy and hysteroscopy as by reaching a correct and accurate diagnosis it may spare the patient from performing those procedures hence exempting patients from risks of anesthesia and surgery.

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دراسة مقارنة بين المنظار الرحمى وسونار ثلاثى الابعاد فى تشخيص حالات الاجهاض المتكرر

خلفية الدراسة : تعتبر تشوهات الرحم الخلقية هى مجموعة غير متجانسة من الشنوذ مع مجموعة واسعة من الأعراض. إن التطور المعيب فى مجرى مولرى سواء أثناء التكوين أو أثناء ارتشاف الحاجز ينتج عنه تشوهات فى الرحم. قد يتم العثور عليها بالمصادفة، أو أثناء العمل بسبب العقم وفقد الحمل المتكرر. نسبة الانتشار المقدرة هى ٤.٠٪ (٠.١–٣٪) فى عموم السكان، و ١٣.٣٪ فى المرضى الذين يعانون من العقم، وبين ٣٪ و ٣٨٪ فى المرضى الذين يعانون من حالات الإجهاض التلقائى المتكرر.

الهدف من الدراسة : هو تقييم و مقارنة الصلاحية التشخيصية للموجات فوق الصوتية ثلاثية الأبعاد ومنظار الرحم فى الكشف عن أمراض تجويف الرحم فى حالات الإجهاض المتكرر.

المريضات وطرق الدراسة : كانت هذه الدراسة عبارة عن دراسة جماعية مستقبلية، أجريت على ٢٠٠ مريض فى مستشفيات جا معة الأزهر (الحسين والسيد جلال) بين فبراير ٢٠١٩ ويناير ٢٠٢٢.

نتائج الدراسة : باستخدام الموجات فوق الصوتية ثلاثية الأبعاد، يمكنه التمييز بين الخزعة العادية وغير الطبيعية باستخدام منطقة تحت المنحنى ٠.٧٩٣، ومستوى الحساسية ٥٨.٦٪، والنوعية ١٠٠.٠٪، و ١٠٠.٠٪ PPV، و ٨٥.٥٪ NPV والدقة ٨٨٪. باستخدام تنظير الرحم، يمكنه التمييز بين الخزعة العادية وغير الطبيعية باستخدام منطقة تحت المنحنى ٠.٧٩٣، ومستوى الحساسية ٧٥.٩٪، والنوعية ١٠٠.٠٪، و ١٠٠.٠٪ PPV، و ٩١.٠٪ NPV والدقة ٩٣٪.

بناءً على نتائجنا، نوصى بإجراء مزيد من الدراسات على المرضى الأكبر حجماً وفترة المتابعة الأطول للتأكيد على استنتاجنا.