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ORIGINAL ARTICLE

The Role of Transabdominal, Transvaginal and Doppler Ultrasound in the Assessment of Endometrial Pathology

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Abstract

Background: ***A major diagnostic problem for the sonographer interpreting physician is endometrial anomalies. Endometrium hemorrhage has several reasons: polyp, hyperplasia, carcinoma of endometrium, carcinoma of the cervical, and leiomyosarcoma of the uterine.***

Aim: ***To assess the role of transabdominal, transvaginal, and Doppler mapping in the detection and characterization of pathologic endometrium.***

Patients and methods: ***Thirty individuals participated in this prospective comparative research. The suspected endometrial pathology had been referred from the Gynecology Outpatient Clinic at Al-Azhar University Hospital to the Department of Radio Diagnosis after the exclusion of certain patient groups.***

Results: ***The biopsy outcomes were statistically significantly connected to ultrasound results (p-value=0.000) with Substantial agreement as kappa co-efficient = 0.689 with 100 % sensitivity, 82.6 % specificity, and 87.7% accuracy within endometrial cancer patients. The mean of endometrial thickness (mm) in biopsy-negative patients was 4.44±1.23 lower than the mean in biopsy-positive patients, 19.64±2.95, which was statistically significant (p-value=0.000). The mean resistive index of the uterine artery in biopsy-negative patients was 0.69±0.10 higher than the mean in biopsy-positive patients, 0.42±0.03, which was statistically significant (p-value=0.000).***

Conclusion: ***Histologic examination is the most efficient technique in the diagnosis of endometrial carcinoma. Also, both endometrial thickness and resistive index of the uterine artery have significant roles in the diagnosis of these tumors. When endometrial thickness and resistance index are considered, ultrasonography can become more sensitive for the direct diagnosis of endometrial pathology.***

Keywords: Doppler Ultrasound; Endometrial Pathology; Transabdominal and Transvaginal Ultrasound

1. Introduction

A major diagnostic problem for the sonographer and interpreting physician is endometrial abnormalities. There are several reasons for endometrial bleeding, including hyperplasia, polyps, endometrial cancer, cervical cancer, and uterine leiomyosarcoma. .[1]

Additionally, women could be directed to fast-track clinics. If a thicker endometrium, fibroids, or entirely asymptomatic polyps are discovered coincidentally (for example, during imaging for other purposes).[2]

Malignant myometrial tumors are quite uncommon, but endometrial carcinoma is by far the most prevalent type. Adenocarcinomas make up the majority of endometrial cancers. By precisely assessing thickness, transvaginal examinations are useful in the early detection of alterations indicative of endometrial hyperplasia or cancer.[3]

Endometrium evaluation is significantly aided by ultrasound, which is non-invasive, inexpensive, and administered in outpatient clinics with minimal patient discomfort. Infertility, postmenopausal hemorrhage, heavy otherwise irregular vaginal bleeding, pelvic pain, & postmenopausal bleeding are all potential indications for pelvic ultrasound.[4]

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Present-day three-dimensional ultrasound (3D U/S) technology possesses the capability to store entire volumes and is suitable for routine clinical use. In addition to surface images, every object recorded in these volumes can also be represented in multiplanar (transverse, coronal, and sagittal) detail.[5]

Transabdominal sonography (TAS) and transvaginal sonography (TVS) are customary diagnostic procedures, occasionally complemented by color Doppler imaging.[6]

The abnormality detected within the endometrial cavity is visualized via transvaginal ultrasound. Endometrial hyperplasia, polyps, and carcinoma are a few examples. Endometrial hyperplasia typically manifests as endometrial thickening and impacts the entire endometrium.[7]

By scanning the lower abdomen, transabdominal ultrasound (TAS) evaluates the female pelvic organs by providing an overall view of the pelvis as opposed to detailed images. Large pelvic masses that extend into the abdomen are especially advantageous to examine with this technique, as they are not consistently visible with TVS.[8]

The objective of this research was to assess the role of transabdominal, transvaginal, and Doppler mapping in the detection and characterization of pathologic endometrium.

2. Patients and methods

This prospective comparative research was carried out on thirty individuals with suspected endometrial pathology had been referred from the Gynecology Outpatient Clinic at Al-Azhar University Hospital to the Department of Radiodiagnosis after exclusion of certain patient groups.

Inclusion Criteria: Patients with suspected endometrial pathology.

Exclusion Criteria: Pregnant females and virgins.

Methods

Patients were subjected to Complete history taking and laboratory investigation.

Ultrasonography:

Transabdominal technique, Transvaginal technique

Transabdominal scanning was performed utilizing real-time scanners equipped with a low-frequency probe (3/3.5 MHz) while the bladder was distended. After this, the individual was instructed to discharge urine, and a high-frequency (5/7.5 MHz) transvaginal probe was utilized to perform transvaginal sonography with a real-time sector scanner.

The individual was provided with a comprehensive explanation of the technique, and informed consent was obtained. Prior to insertion, the transvaginal transducer was enveloped in a sterile condom that had been lubricated with lubricant.

The individual was positioned in the lithotomy position with a Trendelenburg inclination that was slightly inverted. 6 to 8 centimeters were inserted into the vagina to position the transducer.

An examination was conducted in the sagittal & coronal planes. The manipulations employed to acquire images in diverse planes &depths involved the adjustment of the shaft's handle to a tilt or angle. A push-pull rotation is utilised to bring an organ in a closer proximity or deeper into the focal zone. Additionally, a rotation of the handle along the longitudinal axis of the probe rotates the scanning plane, enabling sections to be taken along the entire 360° of the pelvis.

Doppler Mapping

Each individual underwent transvaginal sonography utilizing a Toshiba SSA-370 A machine (Toshiba Medical Systems, Tokyo, Japan) outfitted with a transvaginal instrument operating at a frequency range of 5–7.5 MHz and 5-MHz color, power, and pulsed Doppler capabilities. Transverse and longitudinal sections of the uterus were initially acquired via conventional grayscale sonography. Longitudinal endometrial thickness at its maximum (double-layer) was determined. Following this, the power Doppler gate was engaged to map the blood flow through the endometrium and myometrium. Maximum sensitivity was achieved in determining low-velocity flow devoid of noise by configuring the Power Doppler parameters as follows: frequency of 5 MHz; power Doppler gain of 20 (range: 1–30 dB); the dynamic range of 20–40 dB; edge, 1; persistence, 2; color map, 1; gate, 2; filter, 3). After the identification of the vessels, the pulsed Doppler sample volume was triggered to acquire a flow velocity waveform. From 3 consecutive FVWs, the resistance index, pulsatility index, and peak systolic velocity (PSV, cm/s) were computed automatically. Doppler for conventional colors was not utilized. When more than one vessel was identified, the analysis utilized the vessel with the lowest RI and PI, as well as the highest PSV. Only the detected endometrial vessels were assessed using pulsed Doppler.

Biopsy confirmatory for endometrial cancer

The initial portion of the process is not sanitary. Before proceeding, the individual is initially positioned in the lithotomy position, and a bimanual examination is performed to ascertain the dimensions and location of the uterus. The speculum was introduced in order to facilitate the visualization of the cervical region. The cervix was anesthetized and cleansed following visualization with a twenty percent benzocaine spray for five seconds, followed by the application of an iodine solution. It was acceptable to wash hands and

apply sterile gloves at this time.

Utilizing a uterine sound, the profundity of the uterus was subsequently ascertained. In the first stage, the cervix was stabilized. By applying a tenaculum to the anterior border of the cervix, the practitioner is able to erect the uterocervical angle. Subsequently, the uterine sound was introduced into the uterus to an average depth ranging from six to ten cm. The smallest dilator was introduced first, and subsequently, progressively larger dilators were inserted until the sound could penetrate the fundus. After attaining sufficient oestrus dilation and ascertaining the depth of the uterus, the sampling pipette was introduced. Pipelle's advancement continued until resistance was encountered. The resistance experienced was equivalent in intensity to the uterine sound. As soon as the pipette entered the uterine cavity, the internal piston was completely withdrawn from the catheter, generating a vacuum at the catheter tip. This vacuum, in conjunction with the inward and outward motion of the tip, enabled the collection of samples. By culminating in a 360-degree winding motion, this process ensured that every quadrant of the endometrium was reached. Following the removal of the pipette, the gathered tissue sample was added to a formalin solution. A subsequent incision was made within the uterus to guarantee the acquisition of sufficient tissue.

3. Results

Table 1 showed that the patients` age ranged from 34 to 71 and the mean of age was 52.37 ± 9.63 years and the BMI ranged from 20 to 36 and BMI mean was 28.83±4.88 kg/m2

Table 1. Demographic data of individuals

	MINIMUM	MAXIMUM	MEAN	STD. DEVIATION
AGE(N=30)	34	71	52.37	9.63
BMI(N=30)	20	36	28.83	4.88

Table 2 showed that all patients had vaginal bleeding and high endometrial vascularity, 13(43.3%) patients had lower abdominal pain, 5(16.7%) had purulent foul-smelling discharge, and 4(13.3%) had dysmenorrhea.

Table 2. Distribution of the studied cases according to clinical symptoms

CLINICAL SYMPTOMS	NO.	%
VAGINAL BLEEDING	30	100.0
HIGH ENDOMETRIAL VASCULARITY	30	100.0
LOWER ABDOMINAL PAIN	13	43.3
PURULENT FOUL-SMELLING DISCHARGE	5	16.7
DYSMENORRHEA	4	13.3
TOTAL	30	100.0

Table 3 showed that the individuals were distributed according to diagnosis into 11 (36.7%) patients had endometrial polyp, 6(20%) had endometrial hyperplasia, 7 (23.3%) patients had endometrial carcinoma, 5(16.7%) had endometritis and only one patient had Asherman's syndrome.

Table 3. Distribution of the studied cases according to diagnosis

DIAGNOSIS	NO.	%
ENDOMETRIAL POLYP	11	36.7
ENDOMETRIAL HYPERPLASIA	6	20.0
ENDOMETRIAL CARCINOMA	7	23.3
ENDOMETRITIS	5	16.7
ASHERMAN'S SYNDROME	1	3.3
TOTAL	30	100.0

Table 4 showed that the mean of endometrial thickness (mm) in biopsy negative patients was 4.44±1.23 lower than the mean in biopsy positive patients 19.64±2.95 which was statistically significant (p-value=0.000)

Table 4. Comparison amongst patients' biopsy results as regards Endometrial thickness (mm)

ENDOMETRIAL THICKNESS (MM)	BIOPSY						T-TEST	
	Negative (n = 23)			Positive (n= 7)			t	P-value
RANGE	2.50	-	7.30	16.50	-	24.00	20.18	0.000**
MEAN ±SD	4.44	±	1.23	19.64	±	2.95		

** p-value < 0.001 highly statistically significant

Table 5 showed that the mean of resistive index of the uterine artery in biopsy negative patients was 0.69±0.10 higher than the mean in biopsy positive patients 0.42±0.03 which was statistically significant (p-value=0.000)

Table 5. comparison amongst patients' biopsy results as regards resistive index of the uterine artery

RESISTIVE INDEX OF THE UTERINE ARTERY	BIOPSY						T-TEST	
	Negative (n = 23)			Positive (n= 7)			t	P-value
RANGE	0.39	-	0.79	0.37	-	0.46	-7.23	0.000**
MEAN ±SD	0.69	±	0.10	0.42	±	0.03		

**p-value < 0.001 highly statistically significant

Table 6 shows that the biopsy outcomes were statistically significantly related to ultrasound results (p-value=0.000) with Substantial agreement as kappa co-efficient = 0.689 with 100 % sensitivity, 82.6 % specificity and 87.7% accuracy within endometrial cancer patients

Table 6. Agreement (sensitivity, specificity & accuracy) for ultrasound

ULTRASOUND	BIOPSY				SENSITIVITY	SPECIFICITY	PPV	NPV	ACCURACY
	Negative (n = 23)		Positive (n= 7)						
	No.	%	No.	%					
NEGATIVE (N = 19)	19	82.6	0	0.0	100	82.6	63.6	100	87.7
POSITIVE (N= 11)	4	17.4	7	100					
K(P)	0.689 (0.000**)								
LEVEL OF AGREEMENT	Substantial agreement								

K: Kappa test PPV: Positive predictive value NPV: Negative predictive value *Statistically significant p ≤ 0.05

CASES PRESENTATION

Case 1:Clinical history:

Female patient aged 40 years old with abnormal

vaginal bleeding.

Ultrasound finding:

TAS shows prominent endometrial thickening with hetrogenous echogenicity. TVS shows ET= 3.5 cm, RI=0.73 with increased endometrial vascularity.

Radiological diagnosis: Regular endometrial thickening of benign behavior.

Pathological finding: Simple endometrial hyperplasia without atypia.

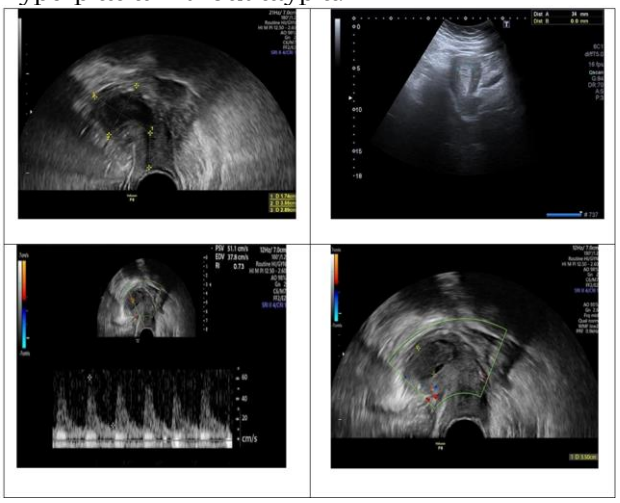

Figure 1. Endometrial hyperplasia.

Case 2:Clinical history: 62 years old post-menopausal female with abnormal vaginal bleeding.

Ultrasound finding:

TAS shows homogenous echogenic endometrial lesion with increased endometrial thickening.

TVS shows solitary homogenous echogenic broad based lesion measuring (1.23*0.73) cm interrupt mucosal contour, ET= 0.64 cm, RI=0.75 with increased endometrial vascularity.

Radiological diagnosis:

Regular endometrial thickening of benign behavior.

Pathological finding: Endometrial polyp with no malignant cells.

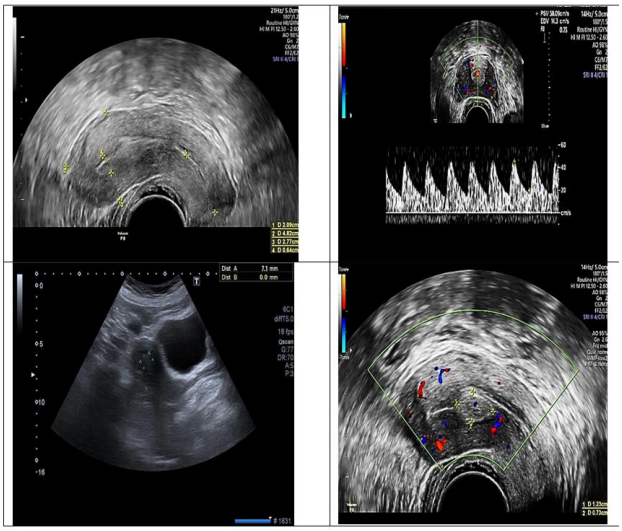

Figure 2. Endometrial polyp.

4. Discussion

In this research the thirty patients` age ranged from 34 to 71 and the mean of age was 52.37 ± 9.63 years and the highest percentages of women were in age group 40-58 years (54%), also the BMI ranged from 20 to 36 and BMI mean was 28.83±4.88 kg/m2 indicating overweight.

In the research of Mohammed et al.,[8] reported that the mean age of the studied hundred women presented with abnormal uterine bleeding was 47 ±8.57 years, and the highest percentages of women were in the age group 40-59 years (73%).

Also, in the study by Wankhade et al.,[9] The sample population had a mean age of 41.7 ± 7.82 years, with the largest proportion of individuals, or 45 percent, falling within the age range of 41-50 years.

In the present research the patients were distributed according to histological diagnosis into 11(36.7%) individuals had endometrial polyp, 6(20%) had endometrial hyperplasia, 7 (23.3%) patients had endometrial carcinoma, 5(16.7%) had endometritis and only one patient had Asherman's syndrome.

Alcazar et al.,[10] The following histological diagnoses were identified: 33 (36%), 37 (41%), 14 (15%), and seven (8 percent) cases, respectively, of endometrial carcinoma, endometrial polyp, endometrial hyperplasia, and endometrial cystic atrophy, with higher prevalence of endometrial cancer than our study.

As regards symptoms at admission, this study showed that all patients had vaginal bleeding and high endometrial vascularity, 13(43.3%) patients had lower abdominal pain, 5(16.7%) had purulent foul-smelling discharge, and 4(13.3%) had dysmenorrhea.

These results are concomitant with those of Showkat et al.,[11] who investigated the role of transvaginal sonography in the detection of endometrial carcinoma in forty individuals who had clinically suspected thickened endometrium. The research revealed that abnormal uterine bleeding was the most prevalent sign related to endometrial pathology, occurring in all forty cases (100%). A total of 18 individuals (45.0%) reported experiencing lower abdominal discomfort. Ten of the instances were infertile (25.0%). Dysmenorrhea was observed in five individuals, accounting for 12.5 percent of the total.

In this study, a comparison between the two groups showed that the mean of endometrial thickness (mm) in biopsy-negative patients was 4.44±1.23 lower than the mean in biopsy-positive patients 19.64±2.95 which was statistically significant (P<0.01), also, the mean of resistive index of the uterine artery in biopsy negative patients was 0.69±0.10 higher than the mean in biopsy positive patients 0.42±0.03 which was statistically significant (P<0.01).

In concomitant to our findings, Alcazar et al.,[10] found that The mean endometrial thickness was notably higher in individuals diagnosed with endometrial cancer (13.8 mm; SD, 6.5 mm) compared to those with cystic atrophy (8.3 mm; SD, 2.2) (P = 0.04). However, this difference was not statistically significant when compared to endometrial hyperplasia (11.9 mm; SD, 3.7) or endometrial polyps (11.4 mm; SD, 3.8). However, contrary to our outcomes, a substantial overlap in RI values was observed, which restricts the clinical application of this method.

Beeresh et al.,[12] discoverd that the Mean endometrial thickness in atrophic endometrium was 3.86mm. The Mean endometrium in carcinoma endometrium was 21.29mm. Taking 4mm as the cut-off to define abnormal endometrium, this had a sensitivity of 85.71%, specificity of 62.50%, PPV of 66.66%, NPV of 83.33%

In our research, the mean of the resistive index of the uterine artery in biopsy-negative patients was 0.69±0.10 higher than the mean in biopsy-positive patients, 0.42±0.03 which was statistically significant (p-value=0.000)

In our research, the biopsy outcomes were statistically significantly related to ultrasound results (p-value=0.000**) with Substantial agreement as kappa co-efficient = 0.689 with 100 % sensitivity, 82.6 % specificity, and 87.7% accuracy within endometrial cancer patients.

The study of Mohammed et al.[8] also showed that the sensitivity and specificity of TAS were 100% and 68.4%, respectively (P<0.001). The sensitivity and specificity of TVS were 100% and 94.7%, respectively (P<0.001)

In the study of Showkat et al.,[11] The correlation between the histological diagnosis and the TVS diagnosis of endometrial cancer among individuals was established after the relevant case reports were gathered. According to TVS results, out of 40 patients, 2 (5.0%) had endometrial carcinoma, and 38 (95.0%) did not have endometrial carcinoma.

Research by Kaur et al.,[13] found that 5.71% of endometrial cancer cases were reported. There was not a single diagnosis of an aberrant high-risk kind of endometrium with a thickness of less than 4 mm. Transvaginal sonography was found to be a 100 percent sensitive and 72.73 percent specific screening technique. The use of transvaginal sonography as a screening method for individuals experiencing postmenopausal hemorrhage was concluded and validated by the research.

4. Conclusion

This study showed that histologic examination is the most efficient technique in the diagnosis of endometrial carcinoma. There was statistically significantly substantial agreement between biopsy outcomes and ultrasound outcomes with 100 % sensitivity, 82.6 % specificity, and 87.7% accuracy within endometrial cancer patients. Also, both endometrial thickness and resistive index of the uterine artery have a significant role in the diagnosis of these tumors. When endometrial thickness and resistance index are considered, ultrasonography can become more sensitive for the direct diagnosis of endometrial pathology.

Disclosure

The authors have no financial interest to declare in relation to the content of this article.

Authorship

All authors have a substantial contribution to the article

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Conflicts of interest

There are no conflicts of interest.

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