

# The Value of Transvaginal Sonography Performed before Diagnostic Hysteroscopy for the Evaluation of Uterine Cavity in Infertile Women

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## ABSTRACT:

### BACKGROUND:

Hysteroscopy have gained general acceptance as a method for the investigation of infertility. The main advantage of hysteroscopy is the capability of inspecting the uterine cavity. Transvaginal sonography (TVS) is a noninvasive modality that provide excellent imaging of the uterus and of endometrial abnormalities. The present study was designed to evaluate the use of TVS as the initial diagnostic procedure before hysteroscopy for detecting intrauterine disorders.

### METHODS:

Seventy-eight infertile women were examined by TVS and diagnostic hysteroscopy in the late follicular phase of the menstrual cycle and the results were compared.

### RESULTS:

The uterine cavity abnormalities were present in 19.2% of the infertile females involved in the study. The Transvaginal sonography had 87.5% sensitivity, 100% specificity for detecting endometrial polyps while it had 100% sensitivity and 100% specificity for detecting other intrauterine cavity abnormalities including intrauterine adhesions, uterine septae and submucosal myomas.

### CONCLUSION:

Examination of the uterine cavity is an integral part of any thorough evaluation of an infertile woman. Transvaginal sonography, when performed during the follicular phase, can detect most uterine cavity abnormalities. It was an accurate tool in the identification of intrauterine adhesions, uterine septae and submucosal fibroids.

**KEYWORDS:** Transvaginal sonography, hysteroscopy, uterine cavity, infertility.

## INTRODUCTION:

Mechanical factors account for almost 30% of all cases of infertility<sup>(1)</sup>. One of these is the intrauterine environment. It has been established that the implantation of fertilized eggs during spontaneous cycles or of blastocysts during assisted reproductive treatment is affected by the morphology and thickness of the endometrium and by the shape of the uterine cavity<sup>(2)</sup>. Submucous leiomyomata, congenital uterine abnormalities, endometrial polyps and intrauterine adhesions are all potential causes of infertility<sup>(3)</sup>. Distortion of the uterine cavity by a fibroid or a septum can lead to implantation failure and recurrent early miscarriage<sup>(3)</sup>. Fibroids are estimated to have a detrimental effect on fertility in

up to 10% of cases<sup>(4)</sup>. They are also associated with an increased risk of miscarriage in women who conceive and half the live birth rate in in vitro fertilization cycles<sup>(5)</sup>. Research has shown that 18.2% of patients in whom IVF-ET repeatedly fails have abnormalities of the uterine cavity<sup>(6)</sup>.

Examination of the uterine cavity is an integral part of any thorough evaluation of an infertile couple. The method chosen may vary and should be tailored to the needs of the individual patient. There are several methods for assessing the uterine cavity: transvaginal sonography(TVS),hysteroscopy, hysterosalpingography and hysterosalpingo-contrast sonography. Hysteroscopy permits the inspection of the cervical canal and uterine cavity, and evaluation of the tubal ostium and the proximal intramural segment of the fallopian tube<sup>(7)</sup>. It is considered the gold standard for the assessment of intrauterine

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abnormalities<sup>(8)</sup>. The procedure is accompanied by the risks of such complications as uterine perforation, infection, bleeding, burns, transurethral resection syndrome, and air embolism<sup>(6, 9)</sup>. Transvaginal sonography is a safe noninvasive and relatively inexpensive procedure initially described for ovarian follicle monitoring, now it can be performed routinely in the evaluation of uterine cavity in the infertile female without any special preparation, even without saline contrast, ultrasonography of the endometrium can demonstrate structural abnormalities<sup>(10)</sup>.

The present study was designed to compare the diagnostic accuracy of transvaginal sonography with diagnostic hysteroscopy for the evaluation of uterine cavity in infertile female.

### **MATERIALS AND METHODS:**

The study population included 78 infertile women attending Al-Yarmouk Teaching Hospital in Baghdad, between January 2002 and December 2003. All patients were scheduled to undergo transvaginal sonography followed by diagnostic hysteroscopy for the assessment of uterine factor as a part of diagnostic evaluation of infertile women. All patients gave informed consent to participate in this clinical study and were instructed to refrain from sexual intercourse during the cycle in which the examinations were conducted. A thorough gynaecological and medical history was taken, physical examination was performed and routine investigations were sent. Tubal and ovulatory factors were assessed and treated. All patients had prior investigations for the diagnosis of the cause of infertility ( semen analysis, hormonal profile, transabdominal ultrasound ) some also had laparoscopy and / or hysterosalpingogram.

The uterine cavity was assessed by transvaginal sonography and diagnostic hysteroscopy. Transvaginal ultrasound was performed before diagnostic hysteroscopy (on the morning of the hysteroscopy ), during the follicular phase ( days 9-13 / 28 ) of the menstrual cycle. All ultrasound examinations were performed using a Kretz ( 5-7.5 MHz) transvaginal transducer. Patients had an empty bladder during scanning. For every woman an assessment of the genital tract was conducted with special emphasis on the uterus. The uterus was examined in both longitudinal and transverse sections to visualize the whole endometrium and the

endometrial cavity. The sonographic findings were categorized as: normal findings or abnormal findings including the presence of polyps, fibroids, intrauterine adhesions and congenital malformations of the uterus. A contour defect was considered present when an echogenic structure was seen in a hypoechoic endometrium. A contour defect was considered a polyp when it was completely surrounded by endometrium and a submucosal fibroid when myometrium was present on one side and endometrium on the other side and the endometrial cavity was distorted. Intrauterine adhesions appeared as an irregular central line in the endometrium. During midcycle, uterine synechiae were visualized much better as a hyperechoic, irregular, sometimes cordlike features that could be delineated better in the echo-free space between the basalis layer, interrupting the integrity of the uterine cavity. They were small, irregular structures that varied in size and location. The appearances of the septate uterus on TVS included a convex, flat, and minimally indented fundal contour with an echogenic mass dividing the cavity, the proximal part of which possesses an echographic texture indicative of myometrium merging into hypoechoic fibrous tissue distally. Each scanning examination time was between 5-10 minutes. Pictures were taken for documentation.

Diagnostic hysteroscopy was performed after TVS. Hysteroscopy was performed under general anaesthesia with a rigid 30 – degree, 4mm hysteroscope and a diagnostic sheath with a diameter of 5mm ( Karl Storz Endoscopy, Tuttlingen, Germany ). After brief explanation of the procedure, hysteroscopy was performed in the low dorsilithotomic position. Full aseptic and antiseptic precautions were observed, the cervix and vagina were swabbed with chlorhexidine in water solution. A bimanual examination was performed to determine position and mobility of the uterus. The cervix was grasped with a tenaculum and gently dilated with a size 5 Hegar dilator, if necessary, and a 5 – mm hysteroscope was inserted. Normal saline solution was used to distend the uterine cavity for optimal visualization. Five to eight minutes were sufficient for good visualization of the uterine cavity, including the tubal ostia. Once in the cavity the scope was positioned in the center with the distal tip being held at a distance of 1.5-2mm close to the fundus. By holding the light cable and fixing the position of the

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camera, the scope was rotated 180° clockwise and 180° counter-clockwise. Due to the 30° direction of view the entire cavity can be observed. The hysteroscopic findings were categorized as normal or abnormal and any abnormality ( polyps, fibroids, intrauterine adhesions or congenital uterine malformations ) were recorded.

All women stayed in the hospital for twenty-four hours after the procedure for observation of any side effects.

### Statistical analysis:

The results were presented as number, percent and mean  $\pm$  SD. The data were analyzed by using chi-square ( $X^2$ ) test for difference between percentages, taking ( $P < 0.05$ ) as the lowest limit of significance. Sensitivity, specificity, positive predictive value, negative predictive value, and accuracy rate were calculated.

### RESULTS:

Seventy-eight infertile women were assessed in this clinical study. The characteristics of the women involved are shown in table 1. The mean age of patients was ( $28.4 \pm 4.7$ ) years with range of 17-37 years. The duration of their infertility ranged from 2-14 years with mean of ( $5.1 \pm 3.3$ ) years, and their parity ranged from (0-7). Regarding the type of infertility, thirty women (38.5%) had primary infertility while forty-eight (61.5%) had secondary infertility (Table 2).

The uterine cavity was clearly seen in all patients by transvaginal sonography. A three-layer endometrium during the late follicular phase (Fig 1) enabled precise visualization of the intrauterine abnormalities. In table 3 the findings on transvaginal sonographic assessment of uterine cavity were demonstrated. Sixty-four patients (82%) were found to have a normal uterine cavity by transvaginal sonography, only fourteen patients (18%) had uterine cavity abnormalities: 7 patients (9%) had uterine polyps, 3 (3.8%) had intrauterine adhesions, 2 patients (2.6%) were found to have uterine septum and another 2 patients (2.6%) with submucous fibroid. The sonographic appearance of uterine polyp, intrauterine adhesions, uterine septum and submucous fibroid were shown in figure 2 (A-D), respectively.

Hysteroscopic examination was satisfactory in all patients. Visualization of the uterine cavity revealed

that the cavity was normal in sixty-three patients (80.8%). Only fifteen patients (19.2%) were discovered to have mechanical uterine cavity abnormalities at hysteroscopy. Uterine polyps were diagnosed in 8 patients (10.2%). Intrauterine adhesions (Fig 3) were detected in three patients (3.8%). Two patients (2.6%) had a uterine septum, and submucous fibroid was found also in two patients (2.6%) by hysteroscopy, as shown in table 4. In all cases in which endometrial abnormalities were detected at hysteroscopy, the corresponding sonographic images were carefully compared, only one patient had cornual polyp visualized by hysteroscopy was missed by transvaginal sonography, as shown in table 5. In table 6 the findings discovered later at hysteroscopy were compared with TVS findings. Transvaginal sonography had a sensitivity, specificity, a positive predictive value, and a negative predictive value of 87.5%, 100%, 100% and 98.4%, respectively for detecting uterine polyps with accuracy of 98.6 % and a sensitivity of 100%, specificity of 100% for detecting the rest of uterine cavity abnormalities.

Table 7 demonstrated the relation of age of 78 infertile females with uterine cavity abnormalities, such abnormalities were increased with increasing age of females. Uterine cavity abnormalities were found in 30.6% of females in the age group of 30-34 years and in 66.7% of females aged 35 years and over, while only 11.1% of females in the age group <25 years had such abnormalities and no abnormalities were found in the age group between 25-29 years. This relation was found to be significant ( $p < 0.005$ ). Table 8 showed the relation of uterine cavity abnormalities with the type of infertility regarding primary and secondary infertility. Only 4 patients (13.3%) with primary infertility had uterine cavity abnormalities: two patients (6.7%) had uterine polyp, one (3.3%) had uterine septum and other one (3.3%) had submucous fibroid, while 11 patients (22.9%) with secondary infertility had uterine cavity abnormalities: six patients (12.5%) had uterine polyp, three (6.2%) had intrauterine adhesions, only one patient (2.1%) had uterine septum and another one patient (2.1%) had submucous fibroid.

Transvaginal sonography also yielded information that could not be obtained by diagnostic hysteroscopy, it was able to detect other pelvic pathology such as intramural myoma (n=1) and complex ovarian cyst (n=1).

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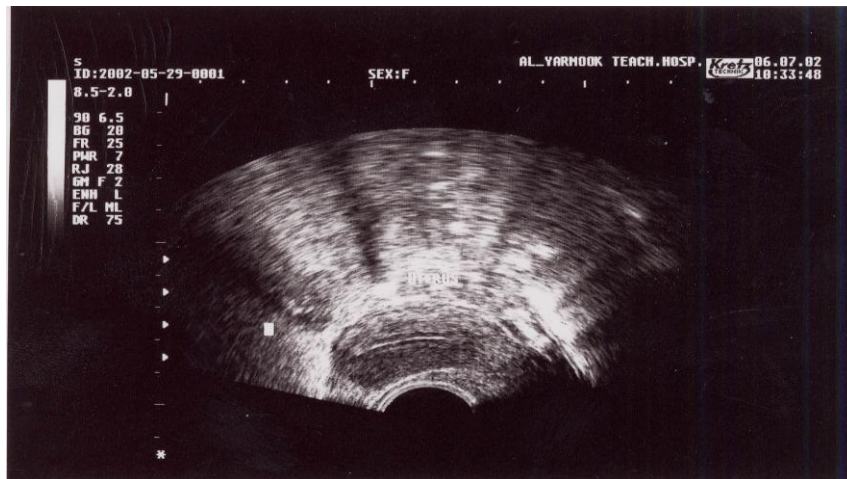
All patients tolerated the sonographic examination well, four patients complained of mild abdominal pain medication. No infections or complications occurred after TVS or hysteroscopy. cramps after hysteroscopy procedure, no patient took

**Table 1: The characteristics of seventy-eight infertile women included in the study**

Characteristics		
Age ( years)	Mean $\pm$ SD	28.4 $\pm$ 4.7
	Range	(17-37)
Duration of infertility (years)	Mean $\pm$ SD	5.1 $\pm$ 3.3
	Range	(2-14)
Parity	Range	(0-7)

**Table 2: The type of infertility in seventy-eight infertile women included in the study**

Type of infertility	No.	%
Primary infertility	30	38.5
Secondary infertility	48	61.5
Total	78	100%

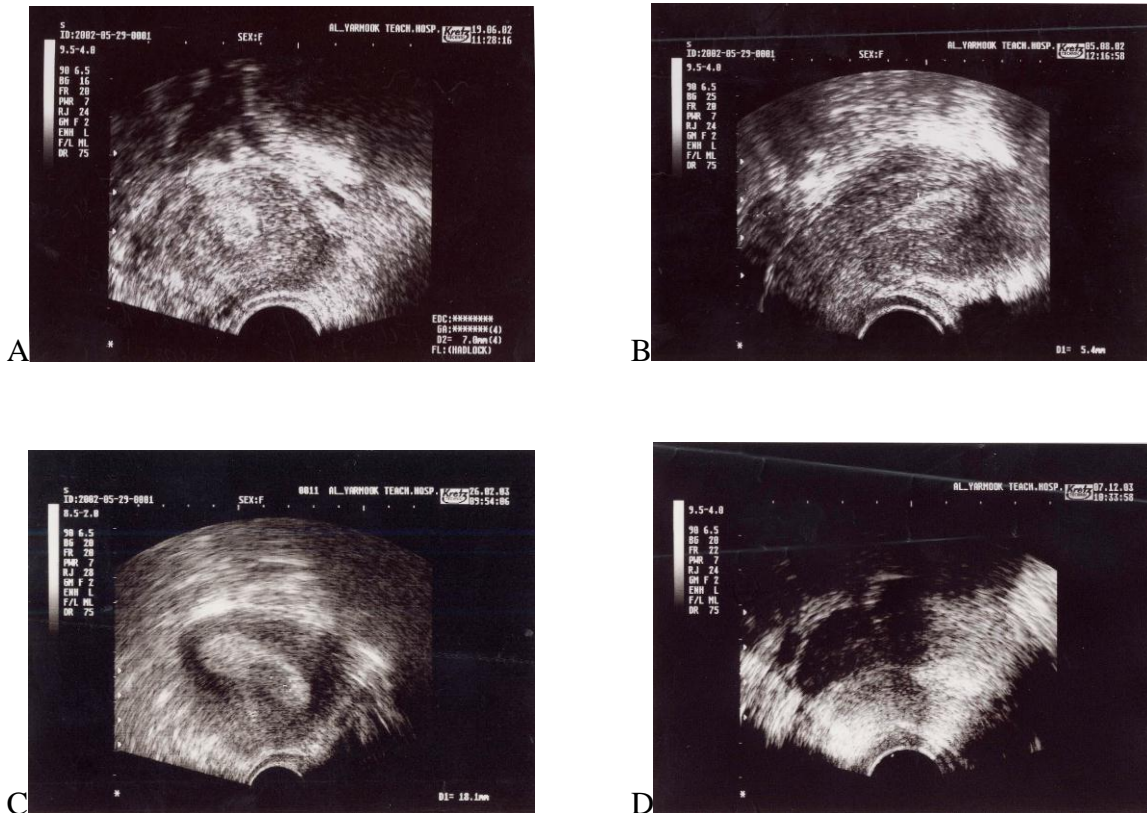


**Figure 1: The Transvaginal sonographic appearance of normal endometrial cavity (a three-layers endometrial line) during the late follicular phase of the menstrual cycle: Day (10/28).**

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**Table 3: The assessment of uterine cavity by transvaginal ultrasound in seventy-eight infertile women.**

Finding	No.	%
Normal	64	82
Abnormal	14	18
Polyps	7	9
Adhesions	3	3.8
Congenital abnormality	2	2.6
Fibroid	2	2.6
Total	78	100



**Figure 2: Abnormal TVS scan. The transvaginal sonographic appearance of endometrial polyp (A), uterine adhesions (B), uterine septum (C), and uterine fibroid (D).**



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Figure 3: The Hysteroscopic appearance of intrauterine adhesions.

Table 4: The assessment of uterine cavity by hysteroscopy in seventy-eight infertile women

Finding	No.	%
Normal	63	80.8
Abnormal	15	19.2
Polyps	8	10.2
Adhesions	3	3.8
Congenital abnormality	2	2.6
Fibroid	2	2.6
Total	78	100

Table 5: The comparison of the findings in seventy-eight infertile women undergoing transvaginal sonography followed by diagnostic hysteroscopy

Hysteroscopy	TVS					Total
	Normal	Polyps	Adhesions	Congenital abnormality	Submucosal fibroid	
Normal	63	-	-	-	-	63
Polyps	1	7	-	-	-	8
Adhesions	-	-	3	-	-	3
Congenital abnormality	-	-	-	2	-	2
Submucosal fibroid	-	-	-	-	2	2
Total	64	7	3	2	2	78

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**Table 6: The sensitivity, specificity, positive and negative predictive value, and accuracy rate of TVS in detecting uterine cavity abnormalities in seventy-eight women.**

TVS	Sensitivity	Specificity	Positive predictive value	Negative predictive value	Accuracy rate
Polyps	87.5%	100%	100%	98.4%	98.6%
Adhesions	100%	100%	100%	100%	100%
Congenital abnormality	100%	100%	100%	100%	100%
Submucosal fibroid	100%	100%	100%	100%	100%

**Table 7: The age characteristics of seventy-eight infertile women included in the study according to abnormal uterine findings**

Age group (year)				
	Total number of patients	Patients with abnormal uterine findings		
		No.	%	
<25	18	2	11.1	
25-29	21	-	-	
30-34	36	11	30.6	
≥35	3	2	66.7	
Total	78	15	19.2	

P value < 0.005

**Table 8: The percentage of abnormal intrauterine cavity findings in relation to the type of infertility.**

Causes	Infertility			
	Primary		Secondary	
	No.	%	No.	%
Normal	26	86.7	37	77.1
Polyps	2	6.7	6	12.5
Adhesions	-	-	3	6.2
Congenital abnormality	1	3.3	1	2.1
Fibroid	1	3.3	1	2.1
Total	30	100	48	100

### DISCUSSION:

Transvaginal sonography is a noninvasive modality that provides excellent imaging of the uterus and of endometrial abnormalities. It is relatively painless, is well accepted by patients, and can be performed in either the office or the hospital at relatively low cost<sup>(9)</sup> while hysteroscopy complements the procedures particularly when abnormal transvaginal sonography have been obtained and plays an important role as both a diagnostic and therapeutic tool in the infertility treatment centers<sup>(11)</sup>.

In our clinical study, uterine cavity abnormalities were diagnosed by hysteroscopy in fifteen infertile women (19.2%). This observation was in concordance with the results of Hucke et al<sup>(12)</sup>, who identified some grade of intrauterine abnormalities in about 20% of hysteroscopic examinations in infertile patients whereas in the study of Bartkowiak et al, intrauterine pathologies were diagnosed in 25% of patients<sup>(13)</sup>.

Nasri et al<sup>(14)</sup>, studied the uterine cavity in the luteal phase of the menstrual cycle, because he believes that thick endometrium provide better diagnosis of endometrial abnormalities while Stadtmayer et al<sup>(10)</sup>, and Grunfeld et al<sup>(15)</sup>, studied the uterine cavity in the follicular phase. Regarding our study we select the follicular phase particularly the late follicular phase for better ultrasound imaging of the endometrium because the hypoechoic lumen between the endometrium functionalis and outer echogenic layer of the basalis provides greater contrast with echogenic structures (a three layer endometrium). Endometrial polyps were common finding in our study (10.2%). Rogerson et al<sup>(8)</sup> recorded that endometrial polyps were common incidental findings in all investigations of the uterus, sonographic or hysteroscopic. De Geyter et al<sup>(16)</sup> found that endometrial polyps were present in between (3.8 – 5.8%) of infertile women. Trans- vaginal sonography had 87.5% sensitivity and 100% specificity for detecting polyps. These results were in agreement to Stadtmayer's results who found that TVS had 90% sensitivity and 100% specificity for detecting polyps<sup>(10)</sup>.

Loverro et al<sup>(17)</sup> showed also a sensitivity of 84.5% and a specificity of 98.7% in identifying polyps, septum and submucous fibroids.

Intrauterine adhesions were detected in 3.8% of women involved in our study. This was in agreement

to the study done by Hucke et al<sup>(12)</sup> who found that intrauterine adhesions were detected in 4% of infertile females. Three patients with secondary infertility had intrauterine adhesions, one of them had never had a curettage or intrauterine contraceptive device. It was assumed that adhesions were related to some type of intrauterine infection, although the history for infection was negative. Mendelson et al<sup>(18)</sup>, found that transvaginal sonography had an 80% sensitivity and 100% specificity for detecting intrauterine adhesions. In the study of Sohail<sup>(19)</sup>, the sensitivity of TVS in diagnosing intrauterine adhesions was 92% with specificity of 100%. Fedele et al<sup>(20)</sup> found that transvaginal sonography had a sensitivity of 91% with specificity of 100% for detecting adhesions. In our study TVS had 100% sensitivity and 100% specificity for detecting intrauterine adhesions.

Transvaginal sonography was able to diagnose submucous fibroid with high sensitivity and specificity (100% sensitivity and 100% specificity), whereas in the study of Dueholm et al<sup>(21)</sup> transvaginal sonography had 83% sensitivity and 90% specificity for identification of submucous myomas. Submucous fibroid was found in two patients (2.6%) one with primary infertility and the other one with secondary infertility. In our series submucous fibroid was found in 3.3% of primary infertility patients, this was comparable to that of Hucke et al<sup>(12)</sup> who found that Submucous fibroid was detected in 3% of primary infertility patients.

This study showed that congenital uterine malformations were found in 2.6% of infertile women, whereas Hucke et al<sup>(12)</sup> found that congenital malformations were found in 14% of infertile women. This finding in his study may have been influenced by a selection bias as some of the patients had been referred to his center. Our study demonstrate that TVS was able to detect uterine septum with quite significant accuracy (100% sensitivity and 100% specificity). This observation was in concordance with the results of Pellerito et al<sup>(22)</sup> who found that TVS had a 100% sensitivity but only 80% specificity in identifying septate uterus.

Many studies recommended a transvaginal sonography as a primary investigation of uterine cavity abnormalities while hysteroscopy was indicated for their confirmation<sup>(23,24,25)</sup>.



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Hysteroscopy is an available tool for direct visualization of uterus especially in the diagnosis of small lesions that are missed by TVS as suggested by Malhotra et al <sup>(26)</sup> while Golan et al <sup>(27)</sup> found that normal findings of the uterus by transvaginal sonography do not need further diagnostic work-up of hysteroscopy or may proceed directly to operative hysteroscopy when abnormalities were detected by TVS.

Malhotra et al <sup>(26)</sup> considered hysteroscopy as a gold standard for diagnosis of morphological abnormalities of the uterus, while Corson et al <sup>(28)</sup> found that hysteroscopy may give a false negative diagnosis of bicornuate uterus, if the hysteroscope was inserted into one side only.

The presence of intrauterine abnormalities like fibroid or endometrial polyp were increased with age. This observation was also noted by Nagele et al <sup>(23)</sup> who found that intrauterine factors had a significant impact on age-related infertility.

Transvaginal sonography appears to have a definite advantage over hysteroscopy in that it provides the diagnosis with more information about genital tract where it allows detection of other possible concomitant pelvic pathology. It is a simple accurate procedure, with a high patient acceptance rate, avoiding invasive and expensive diagnostic hysteroscopy.

### CONCLUSION:

Examination of the uterine cavity is an integral part of any thorough evaluation of infertile women. Transvaginal sonography, when performed during the follicular phase, can detect most uterine cavity abnormalities. It was an accurate tool in identification of intrauterine adhesions, uterine septae and submucous fibroids.

Transvaginal sonography may be used as the initial diagnostic procedure to select patients for hysteroscopy.

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