

# Evaluation of the Diagnostic Value of TVS (Transvaginal Sonography) in the Diagnosis of Pelvic Endometriosis in Comparison with Laparoscopic Evaluation in Patients Referred to the Imaging Center of Imam Khomeini Hospital and Yas Hospital of Tehran in 2018

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## ABSTRACT

Diagnosis of endometriosis according to TVS may be an appropriate alternative method for laparoscopy. Hence in this study, the role of TVS was investigated compared with laparoscopic assessment in cases with pelvic endometriosis attending to imaging center of Imam-Khomeini and Yas Hospital in Tehran, Iran, in 2018. In this diagnostic study, 69 patients with pelvic endometriosis were assessed. The results of TVS were compared with laparoscopic assessment, and the sensitivity, specificity, and congruence rate were determined. According to the obtained results, it may be concluded that most sensitivity of TVS is related to the torus uterinus and some of the bladder. Also, the most specificity is related to bladder, sigmoid colon, and peritoneal cyst. The most congruence rate between U/S and laparoscopy is at bladder trigon and sigmoid colon.

However, in the end, multicenter studies with more cases and comparisons with the results of other diagnostic methods are recommended to achieve more accurate results.

**Keywords:** Comparison, Endometriosis, Laparoscopy, TVS



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## Introduction

The presence of endometrial tissue, including the stroma and glands outside the uterus, is called endometriosis. Due to the association of the disease with estrogen in the body, endometriosis is mainly observed in women of childbearing age and sometimes in adolescents and postmenopausal women undergoing hormone replacement therapy (1, 2, 3, 4). About 10% of women of childbearing age suffer from endometriosis, which causes dysmenorrhea, dyspareunia, chronic pelvic pain, and infertility (5, 6, 7).

Endometriosis is a benign disease of women that often presents with pelvic pain and infertility (7, 8).

About 17 to 44% of patients with endometriosis have ovarian endometrioma (5, 7, 8). Ovarian endometrioma is one of the most common causes of pelvic pain and one of the most common ovarian cysts that we encounter during surgery (8, 9, 10). There is much speculation about the pathogenesis of endometriosis, but most studies support the theory that the disease is caused by the implantation of endometrial cells

returned from the fallopian tubes into the abdominal cavity (11, 13).

One of the diagnostic methods of endometriosis is to use laparoscopy and see endometriotic areas and finally histological examination of these areas. Surgeons and patients are more inclined to laparoscopic treatment rather than open surgery because it is a faster and less invasive procedure. Laparoscopic treatments include endometrioma aspiration, laparoscopic cystectomy, cyst drainage, and catheterization or laser, and even more radical treatments such as removal of part or all of the ovary and sometimes with uterine appendages (12, 13).

Although laparoscopy is the standard diagnostic method for endometriosis, possible complications in laparoscopic treatment include possible damage to other organs by laparoscopic devices, while the risk of infection, bleeding, postoperative illness, long-term hospitalization, ileus, deep vein thrombosis and other medical problems following laparotomy are common (14, 15, 16). Laparoscopic treatment is also expensive and carries the risk of surgery (17).

Visual examination of the pelvis, as well as limitations such as the diagnosis of posterior pelvic, intestinal, and bladder involvement in endometriosis have led to the significant use of imaging techniques to treat and diagnose the disease. The advantages of using imaging techniques in the diagnosis of endometriosis include greater availability and acceptance for women and quick and cost-effective conclusions compared to surgical procedures. However, imaging methods depend on the skill of the operator and the extent of access to proper radiology facilities (18, 19).

Transvaginal ultrasound and MRI imaging are widely used in the diagnosis of deep lesions and rectosigmoid involvement. Transvaginal ultrasound is useful in the diagnosis of ovarian endometrioma if the diameter is larger than 2 cm (18, 20). MRI and US imaging (including transabdominal, transvaginal, and transrectal) are the most common diagnostic methods for endometriosis (21, 22, 23). Transvaginal ultrasound is more useful in diagnosing endometriosis than other ovarian cysts (24, 25).

MRI imaging is used in the diagnosis of deep endometriosis lesions and is more effective than other methods in the diagnosis of small lesions (18, 20). Due to the importance of pelvic endometriosis, its complications such as pain and infertility (26) and the limited number of studies on this disease in Iran, in this study, we have evaluated the diagnostic value of TVS (Transvaginal sonography) in the diagnosis of pelvic endometriosis compared with laparoscopic evaluation in patients referred to the imaging center of Imam Khomeini Hospital and Yas Hospital of Tehran in 2018.

#### Sampling Method and Sample Size

The study population was patients with pelvic endometriosis who were referred to the Imaging Center

of Imam Khomeini Hospital and Yas Hospital of Tehran in 2018. The patients were suspected of endometriosis because of dysmenorrhea, dyspareunia, infertility, chronic pelvic pain, stable cyst or endometrioma, etc., and at the initial examination did not have a definitive diagnosis other than endometriosis to justify their symptoms. Exclusion criteria were dissatisfaction with the plan and patients with incomplete information.

In this diagnostic observational study, 69 patients with pelvic endometriosis who were referred to the Imaging Center of Imam Khomeini Hospital and Yas Hospital of Tehran in 2018 were randomly selected and entered into the study. All the obtained results were stored as typed ultrasound reports in patients' files to be used both for follow-up and clinical laparoscopic surgery (in the form of surgical description) and for study data. For each patient, the necessary information was collected and recorded from the TVS report in the patient file

The random selection method of data collection in this study was to review the records of patients, transvaginal ultrasound reports, and description of laparoscopic surgery and compare them in patients with endometriosis who underwent laparoscopic surgery. The mentioned information was extracted without mentioning the names of the patients and in a confidential manner, using an alternative numeric code for each patient and their results were evaluated as a group. TVS findings were gathered with the Siemens device and were compared with laparoscopic evaluation in the diagnosis of pelvic endometriosis and the sensitivity and specificity of TVS and the degree of agreement with laparoscopic results were determined.

The present article is part of the dissertation on "Evaluation of the diagnostic value of TVS (Transvaginal sonography) in the diagnosis of pelvic endometriosis in comparison with laparoscopic evaluation in patients referred to the Imaging Center of Imam Khomeini Hospital and Yas Hospital of Tehran in 2018" in the specialized doctoral program in 2019 with ethics code 9511282001, which has been implemented with the support of Tehran University of Medical Sciences and Health Services.

#### Findings

The age of the patients in 29 cases (42%) was less than 35 years and in 40 cases (58%) was over 35 years. The pain was observed in 97.1%, infertility in 18.8% and uterine size above 80 mm in 59.4% of cases. Uterine myometrium echo pattern was homogeneous in 36.2%, heterogeneous in 63.8%, suggestive for adenomyosis in 34.8% and fibromatosis in 13% of cases. The position of the uterus on ultrasound was 88.4% anteverted and 7.2% retroverted. The remaining 4.4% had no uterus and underwent a hysterectomy, which did not fit into the above two categories.

In sonography, 34.8% had unilateral endometrium, 53.6% had bilateral endometrium, and 11.6% had no endometrium. In laparoscopy, 44.9% had unilateral

endometrium, 43.5% had bilateral endometrium, and 11.6% had no endometrium.

In sonography, 36.2% of patients had a single DIE and 63.8% had multiple DIE. In laparoscopy, 33.3% of patients had single DIE and 50.7% had multiple DIE.

16% of cases were reported in laparoscopy without DIE nodules.

Frequency distribution of the site of involvement as DIE nodules in sonography was seen in 71% of patients, the distribution of which is as follows ([Table 1](#)).

**Table 1.** Comparison of the frequency of DIE based on the location of ultrasound and laparoscopy in patients

Laparoscopy		Sonography		
Negative	Positive	Negative	Positive	
25 (36.2%)	44 (63.8%)	20 (29%)	49 (71%)	Nodule DIE
23 (33.3%)			25 (36.2%)	Single DIE
35 (50.7%)			44 (63.8%)	Multiple DIE
				Anterior compartment
67 (97.1%)	2 (2.9%)	69 (100%)	0	Bladder trigone
55 (79.7%)	14 (20.3%)	58 (84.1%)	11 (15.9%)	Bladder base
61 (88.4%)	8 (11.6%)	68 (98.6%)	1 (1.4%)	Bladder dome
69 (100%)	0	69 (100%)	0	Extra peritoneal part of bladder
59 (85.5%)	10 (14.5%)	67 (97.1%)	2 (2.9%)	Distal ureter
				Posterior compartment
62 (89.9%)	7 (10.1%)	63 (91.3%)	6 (8.7%)	Rectovaginal septum
36 (52.2%)	33 (47.8%)	40 (58%)	29 (42%)	Uterosacral ligament
65 (94.2%)	4 (5.8%)	66 (95.7%)	3 (4.3%)	Posterior vaginal fornix
52 (75.4%)	17 (24.6%)	49 (71%)	20 (29%)	Torus uterinus
69 (100%)	0	69 (100%)	0	Posterior vaginal wall
63 (91.3%)	6 (8.7%)	63 (91.3%)	6 (8.7%)	Lower rectum
61 (88.4%)	8 (11.6%)	56 (81.2%)	13 (18.8%)	Upper rectum
29 (42%)	40 (58%)	51 (73.9%)	18 (26.1%)	Rectosigmoid
68 (98.6%)	1 (1.4%)	69 (100%)	0	Sigmoid colon
				Other findings
56 (81.2%)	13 (18.8%)	66 (95.7%)	3 (4.3%)	Peritoneal cyst

In the anterior compartment, 15.9% of the bladder base, 1.4% of the bladder dome, 2.9% of the distal ureter; In the posterior compartment, 8.7% of the rectovaginal septum, 42% of the uterosacral ligament, 4.3% of the posterior vaginal fornix, 29% of the torus uterinus, 8.7% of the lower rectum, 18.8% of the upper rectum, 26.1% of the rectosigmoid; in 4.3% of cases peritoneal cysts were seen. The frequency distribution of the site of involvement as DIE nodules in laparoscopy was reported in 63.8% of patients, which are as follows; In the anterior compartment 2.9% of the bladder trigone, 20.9% of the bladder base, 11.6% of the bladder dome, 14.5% of the distal ureter; In the posterior compartment 10.1% rectovaginal septal involvement, 47.8% uterosacral ligament, 5.8% posterior vaginal fornix, 24.6% torus uterinus, 8.7% lower rectum, 11.6% upper rectum, 58% rectosigmoid, 1.4% of the sigmoid colon and 18.8% of peritoneal cysts were reported.

The mean size of endometriotic nodules varied from 12.7 to 25.6 mm in the patients examined based on ultrasound.

Regarding various findings ([Table 2](#)) in patients, the sensitivity and specificity of ultrasound in the diagnosis of adhesion based on the sliding sign were: in the anterior compartment 33.3% and 53%, and in the posterior compartment 7.1% and 92.7% (including 71.4% and 65.5% in retro cervix And 60% and 86.4% in posterior fundus). Also, the sensitivity and specificity of sonography in diagnosing unilateral endometrium was 83.3% and 90.2%, bilateral endometrium 93.3% and 76.9%, decreased left ovarian mobility 50% and 92.3%, fixed left ovarian mobility 88.5% and 74.4%, decreased right ovarian mobility 100% and 89.6%, fixed right ovarian mobility 84% and 72.7%, diffuse pelvic adhesion 90.2% and 55.6%, and Kissing ovaries 81.8% and 74.5%.

**Table 2. Comparison of ultrasound and laparoscopic results of patients**

Findings	Sensitivity	Specificity	Compatibility rate
Adhesion in the anterior compartment	33.3	53	<b>52.2</b>
Adhesion in the posterior compartment	7.1	92.7	<b>75.4</b>
Adhesion of the recto cervix	71.4	65.5	<b>66.7</b>
Fundus adhesion	60	86.4	<b>82.6</b>
Unilateral endometrium	83.3	90.2	<b>82.6</b>
Bilateral endometrium	93.3	76.9	<b>84.1</b>
Decreased left ovarian mobility	50	92.3	<b>89.6</b>
Fixed mobility of left ovary	88.5	74.4	<b>79.7</b>
Decreased right ovarian mobility	100	89.6	<b>89.6</b>
Fixed mobility of right ovary	84	72.7	<b>76.8</b>
Pelvic adhesions) frozen pelvis(	90.2	55.6	<b>81.2</b>
Kissing ovary	81.8	74.5	<b>76.8</b>

Ultrasonic and laparoscopic consistency in the diagnosis of adhesions is as follows, in the anterior compartment 52.2%, in the posterior compartment 75.4% (including 66.7% in the retro cervix, 82.6% in posterior fundus), unilateral endometrium 82.6%, bilateral endometrium 84.1%, decreased left ovarian mobility 89.6%, fixed left ovarian mobility 79.7%, decreased right ovarian mobility 89.6%, fixed right ovarian mobility 76.8%, diffuse pelvic adhesion 81.2% and 76.8% was related to kissing ovaries.

In this study, the sensitivity and specificity of ultrasound in the case of DIE detection (Table 3) as nodules were 88.6% and 60%, single involvement 52.2% and 71.7%, multiple involvement 54.3% and 76.5%,

anterior compartment involvement including bladder base 64.3% and 96.4%, bladder dome 87.5% and 100%, distal ureter 10% and 98.3% and posterior compartment involvement including rectovaginal septum 42.9% and 95.2%, uterosacral ligament 75.8% and 88.9%, posterior vaginal fornix 25% and 96.9%, Torus uterinus 94.1% and 92.3%, Lower rectum 50% and 95.2%, Upper rectum 62.5% and 86.9%, Rectosigmoid 42.5% and 96.6%, accompanying findings such as peritoneal cyst 23.1% and 100% and tubal involvement were 43.8% and 67.6%. Ultrasound has indefinite sensitivity in the diagnosis of bladder trigone and sigmoid colon involvement but has 100% specificity.

**Table 3. Comparison of involvement site in ultrasound and laparoscopy of patients**

Site of involvement	Sensitivity	Specificity	Compatibility rate
Presence of DIE nodule	88.6	60	<b>78.3</b>
Single DIE nodule	52.2	71.7	<b>65.2</b>
Multiple DIE nodules	54.3	76.5	<b>65.2</b>
Bladder trigone	---	100	<b>97.1</b>
Bladder base	64.3	96.4	<b>89.9</b>
Bladder dome	87.5	100	<b>89.9</b>
Distal ureter	10	98.3	<b>85.5</b>
Rectovaginal septum	42.9	95.2	<b>89.9</b>
Uterosacral ligament	75.8	88.9	<b>82.6</b>
Posterior vaginal fornix	25	96.9	<b>92.7</b>
Torus uterinus	94.1	92.3	<b>92.7</b>
Lower rectum	50	95.2	<b>91.3</b>
Upper rectum	62.5	86.9	<b>84.1</b>
Rectosigmoid	42.5	96.6	<b>65.2</b>
Sigmoid colon	---	100	<b>98.6</b>
Peritoneal cyst	23.1	100	<b>85.5</b>
Tubal involvement	43.8	67.6	<b>56.5</b>

Ultrasonic and laparoscopic compatibility of DIE detection as nodules were 78.3%, single involvement 65.2%, multiple involvement 65.2%, anterior compartment involvement including bladder trigone 97.1%, bladder base 89.9%, bladder dome 89.9%, distal ureter 85.5 %, Posterior compartment involvement including rectovaginal septum 89.9%, uterosacral ligament 82.6%, posterior vaginal fornix 92.7%, torus uterinus 92.7%, lower rectum 91.3%, upper rectum 84.1%, rectosigmoid 65.2%, sigmoid colon 98.6%. Accompanying findings such as peritoneal cyst was 85.5% and tubular involvement was 56.5%.

## Results

Endometriosis is an important cause of pelvic pain and infertility in women. Ultrasound imaging and MRI are the most common diagnostic methods for endometriosis. Ultrasound is a suitable modality for assessing the extent and spread of involvement in endometriosis patients due to its high accuracy, low cost and availability. Transvaginal ultrasound is useful in diagnosing ovarian endometrioma if it is larger than 2 cm in diameter and is more useful in diagnosing endometriosis than other ovarian cysts. Therefore, in this study, we investigated the diagnostic value of TVS in the diagnosis of pelvic endometriosis in comparison with laparoscopic evaluation in patients who were referred to the Imaging Center of Imam Khomeini Hospital and Yas Hospital of Tehran in 2018.

In this study, the sensitivity and specificity of sonography in the case of DIE detection as nodules were 88.6% and 60%, single involvement detection 52.2% and 71.7%, multiple involvement detection 54.3% and 76.5%, anterior compartment involvement including bladder base 64.3% and 96.4%, bladder dome 87.5% and 100%, distal ureter 10% and 98.3% and posterior compartment involvement including rectovaginal septum 42.9% and 95.2%, uterosacral ligament 75.8% and 88.9%, posterior vaginal fornix 25% and 96.9%, Torus uterinus 94.1% and 92.3%, lower rectum 50% and 95.2%, upper rectum 62.5% and 86.9%, rectosigmoid 42.5% and 96.6% and associated findings such as peritoneal cysts were 23.1% and 100% and tubal involvement 43.8% and 67.6%, respectively. Ultrasound is indeterminate in the diagnosis of bladder trigone and sigmoid colon involvement but has 100% specificity.

## Discussion

Ultrasonic and laparoscopic compatibility of DIE detection as nodules was 78.3%, follows by single involvement detection 65.2%, multiple involvement detection 65.2%, anterior compartment involvement, including bladder trigone 97.1%, bladder base 89.9%, bladder dome 89.9%, distal ureter 85.5 %, posterior compartment involvement including rectovaginal septum 89.9%, uterosacral ligament 82.6%, posterior vaginal fornix 92.7%, torus uterinus 92.7%, lower

rectum 91.3%, upper rectum 84.1%, rectosigmoid 65.2%, peritoneal cyst 85.5% and tubular involvement 56.5%.

In a study by Tadros *et al.* (2016), the role of transvaginal ultrasound in the study of superficial and deep endometriosis was investigated. Sensitivity, specificity and overall accuracy of transvaginal ultrasound were calculated to be 88%, 33% and 76%, respectively. Therefore, MRI imaging was a very useful method in determining the rate of endometriosis, which is in line with the results of our research. In a study, Said *et al.* (2014) evaluated the possibility of predicting endometriosis by transvaginal ultrasound in 125 women with normal ovarian size and mean age of 29 (19 to 46 years) and the sensitivity, specificity, NPV, PPV and diagnostic accuracy of endometriosis diagnosis were 85.3%, 80.7%, 84.1%, 82.1% and 83.2%, respectively. They stated that transvaginal ultrasound is a useful method in predicting endometriosis, which is consistent with the findings of our study. In the study by Abrao *et al.* (2007), they compared the results of transvaginal ultrasound and MRI imaging (T1 and T2) in 104 patients for the diagnosis of endometriosis (rectosigmoid). Sensitivity, specificity and accuracy of the test in the diagnosis of endometriosis on transvaginal ultrasound were 98.1%, 100% and 99%, respectively. Also, the sensitivity, specificity and accuracy of the test in the diagnosis of rectosigmoid on transvaginal ultrasound were 95.1%, 98.4% and 97%. Compared to MRI, transvaginal ultrasound was slightly better in the diagnosis of endometriosis, thus it confirms our findings. Ghezzi *et al.* (2005) examined 722 premenopausal women suspected of having pelvic endometriosis. Ultrasound was performed before surgery and the diagnostic value of ultrasound in the diagnosis of ovarian cysts and endometriosis was evaluated. According to the results of the ultrasound, which showed endometriosis, 309 patients underwent laparoscopy. The results showed that the diagnosis of ovarian cyst on ultrasound was directly and significantly related to endometriosis and is one of the symptoms of this disease that is consistent with the results of our study. In a study conducted by Holland *et al.* in the UK and published in 2013, 198 women underwent TVS ultrasound and it was determined that the sensitivity and specificity for endometriosis lesions of the bladder was 100% , for ovaries 84% and 95.6% and the rectum is 33% and 98.9%, which is in line with the results of our research.

Therefore, due to the fact that laparoscopy is a surgery and imaging methods have high accuracy for diagnosing endometriosis, the need for laparoscopy to diagnose the disease is eliminated in a high percentage of patients.

## Conclusion

In general, it is inferred that the highest diagnostic sensitivity of TVS in cases of pelvic endometriosis is related to the involvement of the torus uterinus and bladder dome, and its highest specificity is related to the involvement of the bladder, sigmoid colon and

peritoneal cyst, and in case of bladder trigone and sigmoid colon involvement there is the most consistency of TVS with laparoscopic evaluation. Based on laparoscopic findings, involvement of some parts of the abdomen, including the diaphragm, appendix, and serosal surfaces of the intestine, is frequently reported which ultrasound sensitivity is not optimal for their diagnosis and multi-modal examination and integration of MRI and ultrasound findings is needed to increase sensitivity and specificity of Imaging.

However, in the end, multicenter studies with higher sample sizes and comparison with the results of other diagnostic methods are recommended to achieve more documented results.

## Acknowledgments

The present article is part of the dissertation on "Evaluation of the diagnostic value of TVS (Transvaginal sonography) in the diagnosis of pelvic endometriosis in comparison with laparoscopic evaluation in patients referred to the Imaging Center of Imam Khomeini Hospital and Yas Hospital of Tehran in 2018" In the specialized doctoral program in 2019 with ethics code 9511282001, which has been implemented with the support of Tehran University of Medical Sciences and Health Services.

## Conflict of Interest

The authors declared no conflict of interest.

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