Research Article

The Predictive Value of the Sliding Sign in the Evaluation of Deep Infiltrating Endometriosis

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Abstract

Objective: To evaluate preoperative real-time dynamic transvaginal sonography (TVS) in the prediction of pouch of Douglas (POD) obliteration in women undergoing laparoscopy for suspected endometriosis. **Methods:** This prospective controlled study was conducted in the department of Obstetrics and Gynecology, Faculty of Medicine, Minia University. All women with symptoms suggestive of endometriosis who were scheduled for laparoscopy underwent detailed preoperative TVS, in particular to ascertain whether the POD was obliterated. POD obliteration was assessed using a real-time TVS technique called the 'sliding sign'. Preoperative TVS sliding sign findings were then compared to gold standard laparoscopic POD findings. **Results:** Initially, fifty-eight (58) patients in their reproductive age were enrolled into this study, but eight patients (8) were excluded as some of them refuse to do laparoscopy and some get pregnant . Thus, This study included fifty (50) patients aged between 18-40 years (29.2+6.7). The frequency of relevant symptoms include dysmenorrhea (66%), It iliac fossa pain (17%), rt iliac fossa pain (16%), dyschezia (22%), diarrhea (14%), constipation (8%), rectal bleeding (5%), and dyspareunia (28%). The results of TVS include positive sliding sign which means POD is patent in 39 patients (78%), negative sliding sign which means POD is obliterated in 11 patients (22%), endometrioma was present in 9 patients (18%), bowel DIE was present in 3 cases (6%) and adenomyosis was present in 6 patients (12%). The laparoscopic results include patent POD in 35 patients (70%), obliterated POD in 15 patients (30%), endometrioma was present in 9 patients (18%), bowel DIE was present in 5 cases (10%) and adenomyosis was present in 8 cases (16%). The sensitivity, spechficity, PPV and NPV for the use of the sliding sign to predict POD obliteration were 73.3% , 100%, 100% and 89.7%. **Conclusions:** Preoperative real-time dynamic TVS evaluation using the sliding sign seems to establish with a high degree of certainty whether the POD is obliterated. Given the increased risk of deep infiltrating endometriosis in women with POD obliteration, the TVS sliding sign technique may also be useful in the identification of women who may be at a higher risk for bowel endometriosis.
Keywords: transvaginal sonography, Deep Infiltrating Endometriosis

Introduction

Endometriosis is a heterogeneous chronic disease characterised at laparoscopy by typical and atypical peritoneal lesions ranging from a single 1 mm peritoneal implant to > 10 cm ovarian endometrioma and cul de sac obliteration.[1] In women with endometriosis involving the cul de sac, the disease may progress as a deep infiltrating lesion involving the ureter, vagina and/or bowel. In fact, one third of women with endometriosis will have deep infiltrating endometriotic (DIE) disease.[2] Such lesions could result in partial or complete obliteration of the Pouch of Douglas (POD) and may cause debilitating chronic pelvic pain.

Diagnostic delays of up to eight years have been reported with endometriosis. This delay is not only due to suboptimal clinical assessment of patients and the consideration of other differential diagnosis of chronic pelvic pain but also because of the surgicopathologic requirement for a definitive diagnosis of endometriosis. Such delay pervades several aspects of a woman's quality of life and may lead to long-term impairment of organ function, particularly in cases of DIE of the bowel or ureter[3].

In a recent consensus statement following the World Endometriosis Society Montpellier Con-

sortium, there was no mention of the use of transvaginal ultrasound (TVS) in the work up of women with potential endometriosis.[8] In a statement which delineated a consensus on the management of endometriosis, we believe that the omission of ultrasound in the diagnosis of both endometriomata and/or DIE was a serious oversight. Although there is a growing body of evidence for the routine use of pre-operative TVS in the work up of women with chronic pelvic pain,[7,9–22] there seems to be a delay in the uptake of these approaches in day to day clinical practice as demonstrated by the recent consensus statement. High quality ultrasound is critical in the diagnosis and planning of surgical management of women with underlying endo-metriosis.

Having said that, none of the governing bodies for ultrasound including ASUM, COGU, ISUOG, AIUM or WFUMB have published practice guidelines on the use of ultrasound in women with endometriosis[4].

In an attempt to reduce the diagnostic delays associated with endometriosis, studies have investigated the diagnostic accuracy of several non-invasive imaging modalities such as magnetic resonance imaging (MRI), computed tomography, transrectal and TVS in the pre-operative assessment of women with endome-triosis. These studies have established the value of TVS as a first line preoperative imaging modality for endometriosis.7 While traditional TVS evaluation of the pelvis is an excellent diagnostic tool for unilateral or bilateral endometriomata,[9,10] its role in the pre-operative diagnosis of extra-ovarian endometriosis has continued to evolve[5].

Patients and Methods
This prospective controlled study was condu-cted in the department of Obstetrics and Gynecology, Faculty of Medicine, Minia University.

Fifty-eight (54) patients were recruited for this study. Eight patients were excluded from the final analysis because of refusal to do laparo-scopy or getting pregnancy. The aim and technique of the study were simply explained to the patients, and a formal consent was taken, confirming their free approval.

Inclusion Criteria:
1- Their ages range from 18-40 years old (reproductive age).
2- Had a history of chronic pelvic pain
3- Have a history suggesting of endometriosis or confirmed before by any diagnostic procedure
4- Were scheduled for operative laparoscopy.

Exclusion Criteria:
1- Refusal to participate.
2- Current Pregnancy.
3- Current gynecological Malignanc (ovarian, endometrial and cervical)
4- Premenarche.
5- Menopause.
6- Previous surgeryin douglas pouch.

- The recruited women were subjected to:

1) Detailed history taking involving (personal history, menstrual history, medical history, surgical history, and obstetrical history). with a special stress on menstrual pattern, fertility status, any previous investigations or treatment given to the patient.

2) General examination : to detect the;
- Height , weight, BMI.
- Pulse, blood pressure, temperature.
- Chest and cardiac examination.

3) Abdominal and pelvic examination were done involving speculum, bimanual exami-nation to evaluate size of the uterus and prese-nce of any cervical, or pelvic pathology.

4) A power vision 6000 Toshiba, Tokyo, Japan ultrasound machine equipped with a 5 MHZ trans vaginal probe was used to perform the ultrasound examination.

5) Trans – vaginal ultrasound examination: All scans were done at post menstrual period. The patients were instructed to evacuate the bladder before the procedure, patient lied at lithotomy position. The probe was covered with a thin layer of gel and loaded in a disposable glove and inserted slowly into the vagina.

The vaginal cavity, cervix, bladder and then the uterus were identified.
In order to assess the sliding sign, gentle pressure was placed against the cervix with the transvaginal probe to establish whether the anterior rectum glided freely across the posterior aspect of the cervix (posterior cervical

region) and posterior vaginal wall. If the anterior rectal wall glided smoothly over the posterior cervix and posterior vaginal wall the sliding sign was considered positive for this location.

The examiner then placed the left hand over the patient's lower anterior abdominal wall in order to ballot the uterus between the palpating hand and transvaginal probe (being held in the right hand) to determine whether the rectosigmoid glided freely over the posterior aspect of the upper uterus/fundus.

If the anterior rectosigmoid wall glided smoothly over the posterior upper uterus/fundus during TVS, the sliding sign in this region was also considered positive.

As long as the sliding sign was considered positive in both of these anatomical regions (posterior cervix and posterior upper uterus), the POD was recorded as 'not obliterated.

If either of these anatomical regions demonstrated that the anterior rectal wall or rectosigmoid did not glide smoothly over the posterior cervix or posterior uterine fundus, the sliding sign was considered negative, and the POD was recorded as 'obliterated.

The examined patients were divided into two groups:
Group [A]; Positive sliding sign which means that the ant rectal wall gliding smoothly over the post cervix and post vaginal wall during TVS Which means no POD obliteration.

Group [B]; Negative sliding sign which means that ant rectal wall not gliding over the recto-cervix during TVS which prove the prescence of POD obliteration.
5) Laboratory assay: Blood samples were obtained from all patients. To assess the fitness of the patients for laparoscopy.
6) All patients were submitted to operative laparoscopy to confirm the site and degree of endometriotic disease using karl storz endo-scope.

POD obliteration is diagnosed when the peritoneum of the POD is no longer visible during surgery, and it occurs as a result of adhesion formation between the posterior aspect of the uterus/cervix and surrounding structures such as the anterior rectum, rectosigmoid bowel, rectovaginal septum, vagina or utero-sacral ligaments.

Results
Initially, fifty-eight (58) patients in their reproductive age were enrolled into this study, but eight patients (8) were excluded as some of them refuse to do laparoscopy, and some get pregnant. Thus, This study included fifty (50) patients aged between 18-40 years (29.2+6.7).

Complete TVS sliding sign and laparoscopic data were available for this patients, patients characteristics as age, mode of delivery and history of infirmity are displayed in table 1 as follow:

Table 1: Demographic and obstetric data

		Descriptive statistics N=50
Age	*Range*	(18-40)
	Mean±SD	29.2±6.7
Delivery	*SVD*	8(16%)
	CS	11(22%)
	Infertile	31(62%)

The frequency of relevant symptoms is shown in table 2 dyssmenorrhea (66%), lt iliac fossa pain (17%), rt iliac fossa pain (16%), dyschezia (22%), diarrhea (14%), constipation (8%), rectal bleeding (5%), and dyspareunia (28%) .

Table 2: Clinical data

Clinical data		Descriptive statistics N=50
History of endometriosis	*-Ve*	15(30%)
	+Ve	35(70%)
Dysmenorrhea	*Absent*	17(34%)
	Present	33(66%)
LT Iliac fossa pain	*Absent*	33(66%)
	Present	17(34%)
RT Iliac fossa pain	*Absent*	34(68%)
	Present	16(32%)
Dyschezia	*Absent*	28(56%)
	Present	22(44%)
Diarrhea	*Absent*	36(72%)
	Present	14(28%)
Constipation	*Absent*	42(84%)
	Present	8(16%)
rectal bleeding	*Absent*	45(90%)
	Present	5(10%)
Dyspareunia	*Absent*	22(44%)
	Present	28(56%)

The results of TVS were shown in table 3 which include positive sliding sign which means POD is patent in 39 patients (78%), negative sliding sign which means POD is obliterated in 11 patients (22%), endometrioma was present in 9 patients (18%), bowel DIE was present in 3 cases (6%) and adenomyosis was present in 6 patients (12%).

Table 3: Transvaginal US data

Transvaginal US data		Descriptive statistics N=50
Sliding sign	*-Ve*	11(22%)
	+Ve	39(78%)
Endometrioma	*-Ve*	41(82%)
	+Ve	9(18%)
Bowel DIE	*-Ve*	47(94%)
	+Ve	3(6%)
Adenomyosis	*-Ve*	44(88%)
	+Ve	6(12%)

The laparoscopic results was shown in table 4 which include patent POD in 35 patients (70%), obliterated POD in 15 patients (30%), endometrioma was present in 9 patients (18%), bowel DIE was present in 5 cases (10%) and adenomyosis was present in 8 cases (16%).

Table 4: Laparoscopic data

Laparoscopic data		Descriptive statistics N=50
POD	*Patent*	35(70%)
	Obliterated	15(30%)
Endometrioma	*Absent*	41(82%)
	Present	9(18%)
Bowel DIE	*Absent*	45(90%)
	Present	5(10%)
Adenomyosis	*Absent*	42(84%)
	Present	8(16%)

Table 5: The Relation of demographic, obstetric and clinical data with POD

		POD		P value
		Patent (N=35)	**Obliterated (N=15)**	
Age	*Range*	(18-40)	(18-40)	*0.180*
	Mean±SD	2^.3±6.7	31.1±6.5	
Delivery	*SVD*	7(20%)	1(6.7%)	*0.338*
	CS	6(17.1%)	5(33.3%)	
	Infertile	22(62.9%)	9(60%)	
History of endometriosis	*-Ve*	8(22.9%)	7(46.7%)	*0.107*
	+Ve	27(77.1%)	8(53.3%)	
Dysmenorrhea	*Absent*	12(34.3%)	5(33.3%)	*0.948*
	Present	23(65.7%)	10(66.7%)	
LT Iliac fossa pain	*Absent*	21(60%)	12(80%)	*0.171*
	Present	14(40%)	3(20%)	
RT Iliac fossa pain	*Absent*	25(71.4%)	9(60%)	*0.514*
	Present	10(28.6%)	6(40%)	
Dyschezia	*Absent*	19(54.3%)	9(60%)	*0.709*
	Present	16(45.7%)	6(40%)	
Diarrhea	*Absent*	24(68.6%)	12(80%)	*0.507*
	Present	11(31.4%)	3(20%)	
Constipation	*Absent*	30(85.7%)	12(80%)	*0.683*
	Present	5(14.3%)	3(20%)	
rectal bleeding	*Absent*	30(85.7%)	15(100%)	*0.305*
	Present	5(14.3%)	0(0%)	
Dyspareunia	*Absent*	13(37.1%)	9(60%)	*0.136*
	Present	22(62.9%)	6(40%)	

- *Independnet samples T test for parametric quantitative data between the two groups*
- *Chi square test (if < 20% of cells have expected count less than 5) or Fisher exact test (if >20% of cells have expected count less than 5)*
- *Significant level at P value < 0.05*

Table 6: Agreement between Laparoscope and Transvaginal US as regarding Adhesions

		Laparoscope	Transvaginal US	Test of agreement	
				Kappa	**P value**
Adhesions	*Absent*	35(70%)	39(78%)	*0.794*	*<0.001**
	Present	15(30%)	11(22%)		

- *Kappa test*   **: Significant level at P value < 0.05*

Table 7:- Relation between Laparoscope and Transvaginal US as regarding Adhesions

Adhesions		Laparoscope	
		Absent	Present
Transvaginal US	Absent	35 (TN)	4 (FN)
	Present	0 (FP)	11 (TP)

Table 8: ROC curve analysis of Transvaginal US for prediction of Adhesions (Laparoscope is the reference test) as follow:
The sensitivity, spechficity, PPV and NPV for the use of the sliding sign to predict POD obliteration were 73.3% , 100% , 100% and 89.7%.

	Transvaginal US
AUC	0.867
95% CI	0.728-1
P value	*<0.001**
Sensitivity	73.3
Specificity	100
PPV	100
NPV	89.7
Accuracy	92

- *AUC: Area Under Curve*
- *CI: Confidence Interval*
- *PPV: Positive Predective Value*
- *NPV: Negative Predictive Value*
- **: Significant level at P value < 0.05*

Discussion

This prospective controlled study was condu-cted in the department of Obstetrics and Gynecology, Faculty of Medicine, Minia University.

Fifty-eight (54) patients were recruited for this study. Eight patients were excluded from the final analysis because of refusal to do laparo-scopy or getting pregnancy. The aim and technique of the study were simply explained to the patients, and a formal consent was taken, confirming their free approval.
The age of our studied women ranged from 18 to 40 years old with an average of 30.45 years. Endometriosis can be identified in women from premenarche to postmenopause, and diagnoses have been made in women ranging from 12 to 80 years of age.

Regardless, endometriosis is foremost a disease of reproductive-age women, which may be explained by the estrogenic milieu strongly implicated in its pathogenesis, and it carries an average age of diagnosis of 28 years[9]. A positive correlation between age and risk of the disease has been noted, particularly at ages above 30 and peaking in the early-to-mid 40s [10].

In our study the frequency of relevant symp-toms include dysmenorrhea (66%), lt iliac fossa pain (17%), rt iliac fossa pain (16%), dyschezia (22%), diarrhea (14%), constipation (8%), rectal bleeding (5%), and dyspareunia (28%).

In our study, the results of TVS include positive sliding sign which means POD is patent in 39 patients (78%), negative sliding sign which means POD is obliterated in 11 patients (22%), endometrioma was present in 9 patients (18%), bowel DIE was present in 3 cases (6%) and adenomyosis was present in 6 patients (12%).

In our study the use of Transvaginal US for prediction of Adhesions in comparison with laparoscopy demonstrates that The sensitivity, spechficity, PPV and NPV for the use of the sliding sign to predict POD obliteration were 73.3% , 100% , 100% and 89.7% .

In our study the use of transvaginal US for prediction of endometrioma in comparison with laparoscopy demonstrates that the sensitivity, specificity, PPV and NPV were 88.9%, 97.6%, 88.9% and 97.6%.

In our study the use of transvaginal US for prediction of bowel DIE in comparison with laparoscopy demonstrates that the sensitivity, specificity. PPV and NPV were 60%, 100%, 100% and 95.7%.

In our study the use of transvaginal US for prediction of adenomyosis in comparison of laparoscopy demonstrates that the sensitivity, specificity, PPV and NPV were 62.5%, 97.6%, 83.3% and 93.2%.

This study demonstrates the merit of careful preoperative evaluation of the posterior compartment and, in particular, evaluation for POD obliteration.
We demonstrated a sensitivity and specificity of 73.3% and 100%, respectively, for prediction of POD obliteration using real-time preoperative dynamic TVS.

Use of the sliding sign technique is simple, outpatient-based and well tolerated by women with chronic pelvic pain who are undergoing preoperative ultrasound evaluation.
We believe that the sliding sign technique gives important additional information that in turn is helpful in planning laparoscopic surgery.

More importantly, the high NPV of this simple technique means that one can confidently expect the POD to be non-obliterated when the sliding sign is positive.
Due to high diagnostic accuracy, low level of patient discomfort and low cost, TVS is currently recommended as the first-line preoperative tool for assessment of women with suspected endometriosis.

Our study further supports the use of TVS as not only the first-line preoperative investigation of choice in women with chronic pelvic pain, but also for the diagnosis of POD obliteration using the real-time dynamic sliding sign technique.

The high NPV (89.7%) means that women with a positive sliding sign are indeed unlikely to have an obliterated POD, which in turn means that the general gynecologist need not refer to a tertiary advanced laparoscopic unit. In the case of women with a history of endometriosis and an obliterated POD that has been cleared by previous surgery, a positive sliding sign during TVS may also be used to reassure a patient that endometriotic bowel disease has not recurred.

This study further supports the role of TVS in preoperative assessment of women with suspected endometriosis; in particular, use of the sliding sign technique during real-time dynamic ultrasound examination can provide accurate information which is essential in the planning of endometriosis surgery.
Our findings suggest that all women with suspected endometriosis, or with a history of endometriosis, should undergo TVS preoperatively to establish whether the POD is obliterated.

Given the increased risk of DIE in women with POD obliteration, the TVS sliding sign technique may be useful in the identification of women at increased risk for bowel endometriosis.
Preoperative assessment for the sliding sign may ensure appropriate referral of women to an advanced laparoscopic surgeon .

This new ultrasound procedure not only has the potential to eliminate the need for two laparoscopies, but also allows for appropriate preoperative counseling and planning, including involvement of a colorectal surgeon if POD obliteration is suspected.

Conclusion
TVS is currently recommended as the first-line preoperative tool for assessment of women with suspected endometriosis. Our study further supports the use of TVS as not only the first-line preoperative investigation of choice in women with chronic pelvic pain, but also for the diagnosis of POD obliteration using the real-time dynamic sliding sign technique this is due to high diagnostic accuracy, low level of patient discomfort and low cost.

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