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FULL RESEARCH ARTICLE

TVUS soft markers in clinically significant superficial endometriosis: an ultrasonographic, clinical, and laparoscopic correlation

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ABSTRACT

Introduction: *Ultrasonographic soft markers can be useful diagnostic findings in endometriosis. We evaluated women with superficial endometriosis with only soft markers on basal transvaginal ultrasound (TVUS) with bowel preparation and their relationship with chronic pelvic pain and laparoscopy findings.* **Materials and methods:** *This retrospective cohort study included patients with clinical suspicion of endometriosis. They had soft markers on basal TVUS with bowel preparation and underwent laparoscopy for the first time. Symptoms, such as dysmenorrhea, dyschezia, deep dyspareunia, and dysuria, were quantified with a visual analog scale. The ultrasonographic soft markers were ovarian tenderness, adhesions, obliteration of the cul-de-sac (CDS), and obliteration of the vesico-uterine pouch (VUP). Laparoscopic findings were adhesions and superficial endometriotic lesions.* **Results:** *A total of 25 women with superficial endometriosis with only soft markers on basal TVUS with bowel preparation and who underwent therapeutic laparoscopy were included. The mean age was 32.28 ± 5.67 years. The type and intensity (mean ± SD) of chronic pelvic pain were severe dysmenorrhea (7.60 ± 3.08), moderate dyspareunia (4.84 ± 3.51), and mild dyschezia and dysuria (3.44 ± 3.89 and 2.12 ± 2.92, respectively). All had at least one positive ultrasonographic soft marker. Most patients had moderate-to-severe dysmenorrhea and only soft markers on ultrasound examinations. Patients with superficial endometriotic lesions, regardless of size or extension, found at laparoscopy reported severe dysmenorrhea.* **Conclusion:** *TVUS soft markers were associated with clinically significant superficial endometriosis. TVUS soft markers are not usually reported during routine examination. They may improve the diagnostic yield of superficial endometriosis.*

Keywords: *Endometriosis. Superficial endometriosis. Ultrasonographic soft markers. Transvaginal ultrasound. Chronic pelvic pain. Laparoscopic pelvic surgery.*

INTRODUCTION

Endometriosis is endometrial-like tissue found outside the uterine cavity. It is a gynecologic disease that represents one of the greatest gynecologic challenges in diagnosis and treatment today[1]. There are three types of endometriosis: peritoneal, ovarian, and deep infiltrative endometriosis (DIE)[2]. Peritoneal endometriosis, also called superficial endometriosis, is the most common type. It occurs in up to 80% of women with a confirmed diagnosis[3] and is associated with infertility and chronic pelvic pain, such as severe dysmenorrhea and dyspareunia[4]. Early diagnosis of endometriosis can lead to more effective treatment

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and an improved quality of life for affected women. Transvaginal ultrasound (TVUS) is a first-line imaging tool for assessing women with endometriosis[5-7]. A systematic review by the Cochrane group states that TVUS with bowel preparation has high sensitivity and specificity for diagnosing endometriomas and DIE, compared to laparoscopic results[8]. However, no recommendations were made regarding superficial endometriosis or its correlation with ultrasound, clinical, or laparoscopic findings.

The literature on the role of TVUS with bowel preparation for detecting superficial endometriosis is sparse[4]. Okaro et al.[9] first described the concept of soft markers based on the degree of ovarian and uterine mobility and tenderness on ultrasound examination in contrast with a hard marker defined as a structural abnormality (an endometrioma or hydrosalpinx). Soft markers as indirect ultrasound findings have been associated with superficial endometriosis[9], but their diagnostic usefulness is unknown. This study focused on soft markers in basal TVUS with bowel preparation and their relationship to chronic pelvic pain and surgical findings visualized by laparoscopy in women with superficial endometriosis.

MATERIALS AND METHODS

This retrospective cohort study was conducted from January 2018 to December 2019 at the Clinica of Excelencia in Endometriosis in Zapopan, Jalisco, Mexico. Women referred with a clinical suspicion and with only soft markers on basal TVUS with bowel preparation for endometriosis and who underwent therapeutic laparoscopy for the first time were included. Women with ultrasound findings suggestive of DIE or endometriomas, missing clinical and/or laparoscopic data, or conversion to open surgery were excluded. Informed consent was not required for this study of information collected during routine clinical care. The Institutional Ethics and Research Committees approved the protocol.

Developmental study and clinical variables

A search for ultrasound reports and images of women with chronic pelvic pain referred with a clinical suspicion of endometriosis and presenting only soft markers on basal TVUS with bowel preparation with failure of drug treatment, defined as persistence of pain on a visual analog scale over 6, with at least 6 months of progestin use, and who underwent therapeutic laparoscopy for the first time.

The variables were age and chronic pelvic pain lasting at least 6 months, assessed by clinical interview as dysmenorrhea, dyschezia, dyspareunia, and/or dysuria. A visual analog scale was used to classify pain, with 0 being absent, 1-3 mild, 4-7 moderate, and 8-10 severe.

Definition of ultrasonographic soft markers

Ovarian tenderness was categorized by severity as absent, mild, moderate, or severe, according to the patient[1]. A tenderness-guided ultrasound examination was performed with or without an acoustic window between the transvaginal probe and the surrounding vaginal structures, coupled with an 'active' role of the patient, who indicated the site and intensity of any tenderness during the examination[9].

Ovarian adhesions were considered absent, mild (+), or strong (+++) by applying pressure with the transducer and external pressure with the other hand and visualizing in real time if the ovary was fixed to the uterus or the pelvic wall[1]. Direct visualization of adhesions is possible when there is pelvic fluid.

Obliteration of the cul-de-sac (CDS) if there is no sliding between the uterus and the anterior rectal wall when pressure is applied with the transducer and the left hand of the operator.

Obliteration of the vesico-uterine pouch (VUP) if there is no sliding between the bladder dome and the anterior wall of the uterus when pressure is applied to the abdomen with the transducer and the operator's left hand.

Image acquisition protocol

Grayscale TVUS and power Doppler examinations were performed using a Samsung Accuvix XG system (Samsung Group, Suwon, South Korea) with a 4-9 MHz endocavitary transducer. The patient was in the lithotomy position, and the TVUS bowel preparation protocol for endometriosis was performed according to the International Deep Endometriosis Analysis (IDEA) group[1]. The TVUS technique for detecting superficial endometriosis was performed with detailed scanning of the peritoneum in the right anterior compartment (RAC), the left anterior compartment (LAC), the right posterior compartment (RPC), and the left posterior compartment (LPC) of the pelvis. The surface of the ovaries and the serosa of the rectosigmoid were also evaluated

in detail. All ultrasound examinations were performed by a single radiologist (VGG), who is an expert in endometriosis with 15 years of experience.

Surgical laparoscopic findings

After the ultrasound examination, all women underwent laparoscopic surgery performed by a team of endometriosis experts (MLT and MLZ) who were informed of the ultrasound findings. The presence of adhesions on laparoscopic examination of both ovaries, CDS, VUP, RAC, LAC, RPC, LPC, and RPC was determined as absent, mild (+), moderate (++), or severe (+++), referred to as a qualitative finding by the surgeon[10]. The presence and length of superficial endometriotic lesions directly visualized during laparoscopic examination in the RAC, LAC, RPC, LPC, and RPC were considered absent, < 1 cm, 1-3 cm, or > 3 cm[10].

Statistical analysis

The variables are described as means and standard deviations for numerical data and frequencies and percentages for categorical data. An analysis of variance (ANOVA) was performed between each variable. Pearson's chi-square test was then performed to determine *p*-values. A significance level of $p < 0.05$ was used. The statistical analysis was performed using SPSS version 26 (IBM Corp., Armonk, NY, USA).

RESULTS

A total of 33 women were assessed. Eight patients were excluded: seven due to a lack of clinical and/or laparoscopic data and one who converted to open surgery. We included 25 women with clinically suspected endometriosis and only ultrasonographic soft markers on basal TVUS with bowel preparation who underwent therapeutic laparoscopy for the first time (Table 1). In all patients, the type and intensity (mean ± SD) of chronic pelvic pain found were severe dysmenorrhea (7.60 ± 3.08), moderate dyspareunia (4.84 ± 3.51), and mild dyschezia and dysuria (3.44 ± 3.89 and 2.12 ± 2.92, respectively). Dysmenorrhea was the predominant pain reported by all patients. Patients with dyschezia and dysuria tended to have stronger adhesions, represented by a severity of +++. These results suggest that patients with suspected endometriosis should be thoroughly examined for dyschezia and dysuria, as these symptoms may indicate severe adhesions.

Figure 1, a power Doppler TVUS, shows the presence of adhesions after external mobilization maneuvers without a separation plane between the right ovary (RO) and the abdominal wall. Figure 2, a grayscale TVUS, shows the findings of a patient with severe dysmenorrhea, moderate dyschezia, and dyspareunia. No movement was detected when performing external mobilization maneuvers on the RO and anterior rectal wall, and the patient reported severe pain, concluding adhesions as a soft marker for superficial endometriosis. Figure 3 shows a static laparoscopic image of a patient with CDS obliteration and focal tenderness on TVUS (data not shown), and superficial endometriotic lesions and adhesions on the CDS and pelvic peritoneal defects are seen at the retrocervical level. The laparoscopic findings confirmed the severity and extent of the endometriotic lesions, with many patients having lesions larger than 3 cm. Case 24 presents a woman with moderate dysmenorrhea, dyspareunia, and significant adhesions in multiple compartments (RAC 1-3 cm, LAC 1-3 cm, RPC 1-3 cm, and LPC 1-3 cm).

Association of ultrasonographic soft markers with type and intensity of chronic pelvic pain

The frequency of ultrasonographic soft markers and chronic pelvic pain is shown in Table 2. Patients with moderate tenderness in the RO reported moderate dysmenorrhea (6.62 ± 2.44) and dyspareunia (5.00 ± 3.29). Those with severe tenderness in the RO reported severe dysmenorrhea (8.50 ± 1.73). Moderate tenderness was found in patients with moderate pain (4.81 ± 3.37). In contrast, patients with mild tenderness in the left ovary (LO) had severe dysmenorrhea (9.00 ± 1.67). Those with moderate tenderness reported severe dysmenorrhea (8.27 ± 1.42), and those with severe tenderness had moderate dysmenorrhea (5.00 ± 4.54). Figure 4 shows a grayscale TVUS of a patient with severe dysmenorrhea and dyspareunia, in which the LO is shown without a separation plane of the uterus and abdominal wall. No movement was seen, and the patient reported severe pain with external mobilization maneuvers, concluding adhesions as a soft marker of superficial endometriosis. Figure 5 shows a grayscale TVUS of a patient with severe dysmenorrhea, moderate dyschezia, and dyspareunia, in which CDS obliteration and focal tenderness were found. There is no separation plane, and adhesions were seen during dynamic maneuvers.

Table 1. Pain characteristics, ultrasonographic soft markers, and laparoscopic findings in 25 patients with clinically significant superficial endometriosis

Case	Age, years	Chronic pelvic pain[a]				Ultrasonographic soft markers				Laparoscopic findings		
		Dysmenorrhea	Dyspareunia	Dyschezia	Dysuria	Tenderness RO/LO	Adhesions[b] RO/LO	CDS Obliteration	VUP Obliteration	Adhesions[b] RO/LO	Adhesions[b] CDS/VUP	Localization and length of endometriotic lesions
1	19	10	0	8	7	RO mild LO mild	No/no	No	No	No/no	No/no	RAC: < 1cm RPC: 1-3 cm
2	23	10	0	5	3	RO absent LO mild	No/+++	No	No	No/no	No/no	RAC: < 1 cm RPC: 1-3 cm
3	27	8	6	0	0	RO moderate LO mild	No/no	No	No	No/+	No/no	LAC: < 1 cm RPC: < 1 cm LPC: < 1 cm
4	26	10	0	0	0	RO mild LO absent	No/no	No	No	+++/++	No/+	RPC: > 3 cm LPC: > 3 cm
5	29	10	0	0	0	RO absent LO moderate	No/+	No	No	++/+++	No/+++	RPC: > 3 cm LPC: > 3 cm
6	31	9	8	8	0	RO mild LO moderate	+/+	Yes	No	No/+++	+++/+++	RPC: > 3 cm LPC: > 3 cm
7	35	8	9	7	6	RO moderate LO moderate	No/+	No	No	No/no	No/no	RPC: 1-3 cm LPC: 1-3 cm
8	43	0	9	4	4	RO absent LO severe	+/+++	No	No	No/+	No/++	LPC: 1-3 cm
9	32	10	3	6	0	RO mild LO mild	+/+	No	No	No/no	++/no	LAC: > 3 cm RPC: 1-3 cm LPC: < 1 cm
10	40	10	5	0	0	RO severe LO moderate	+++/no	No	No	+++/no	No/no	RPC: > 3 cm LPC: > 3 cm
11	25	7	0	0	6	RO moderate LO moderate	No/no	No	No	No/no	No/no	RPC: 1-3 cm LPC: 1-3 cm
12	36	7	5	0	0	RO moderate LO moderate	+++/+++	Yes	No	No/no	No/no	RPC: < 1 cm LPC: < 1 cm
13	32	10	5	0	0	RO mild LO moderate	+++/+++	Yes	No	+++/+++	No/no	RPC: > 3 cm LPC: > 3 cm
14	29	10	10	10	5	RO mild LO severe	No/+++	Yes	No	++/+++	No/++	RPC: > 3 cm LPC: > 3 cm
15	34	1	7	6	0	RO moderate LO severe	No/no	No	No	No/no	No/no	LPC: 1-3 cm
16	38	10	5	8	6	RO absent LO mild	No/+	Yes	No	No/+++	No/+++	RAC: < 1 cm LAC: < 1 cm
17	33	8	6	5	0	RO absent LO moderate	No/+	No	No	No/no	No/no	LAC: > 3 cm RPC: > 3 cm
18	34	9	9	9	9	RO severe LO severe	+/+	No	No	++/++	No/++	RPC: 1-3 cm LPC: 1-3 cm
19	32	0	9	0	0	RO absent LO severe	No/+++	No	No	No/+++	+/no	RAC: 1-3 cm LAC: 1-3 cm RPC: > 3 cm LPC: > 3 cm
20	29	9	7	0	0	RO moderate LO moderate	+/no	No	No	++/no	No/no	RPC: 1-3 cm LPC: 1-3 cm
21	36	9	4	10	5	RO severe LO severe	No/+++	No	No	No/no	++/no	None
22	35	6	0	0	0	RO severe LO severe	+++/+++	No	No	No/no	No/no	RAC: < 1 cm LAC: < 1 cm RPC: 1-3 cm LPC: < 1 cm
23	37	7	0	0	2	RO moderate LO moderate	+++/+++	Yes	No	+++/+++	No/+++	RPC: > 3 cm LPC: > 3 cm
24	31	6	6	0	0	RO moderate LO mild	++++/++	No	No	+++/+++	No/+++	RAC: 1-3 LAC: 1-3 cm RPC: 1-3 cm LPC: 1-3 cm
25	41	6	8	0	0	RO mild LO moderate	+/+	No	No	+++/+++	No/+++	None

[a]Visual analogue scale; [b]Adhesion severity represented by +, ++ or +++ as mild, moderate, and strong; RO: right ovary; LO: left ovary; CDS: Cul-De-Sac; VUP: vesico-uterine pouch; RAC: right anterior compartment; LAC: left anterior compartment; RPC: right posterior compartment; LPC: left posterior compartment.

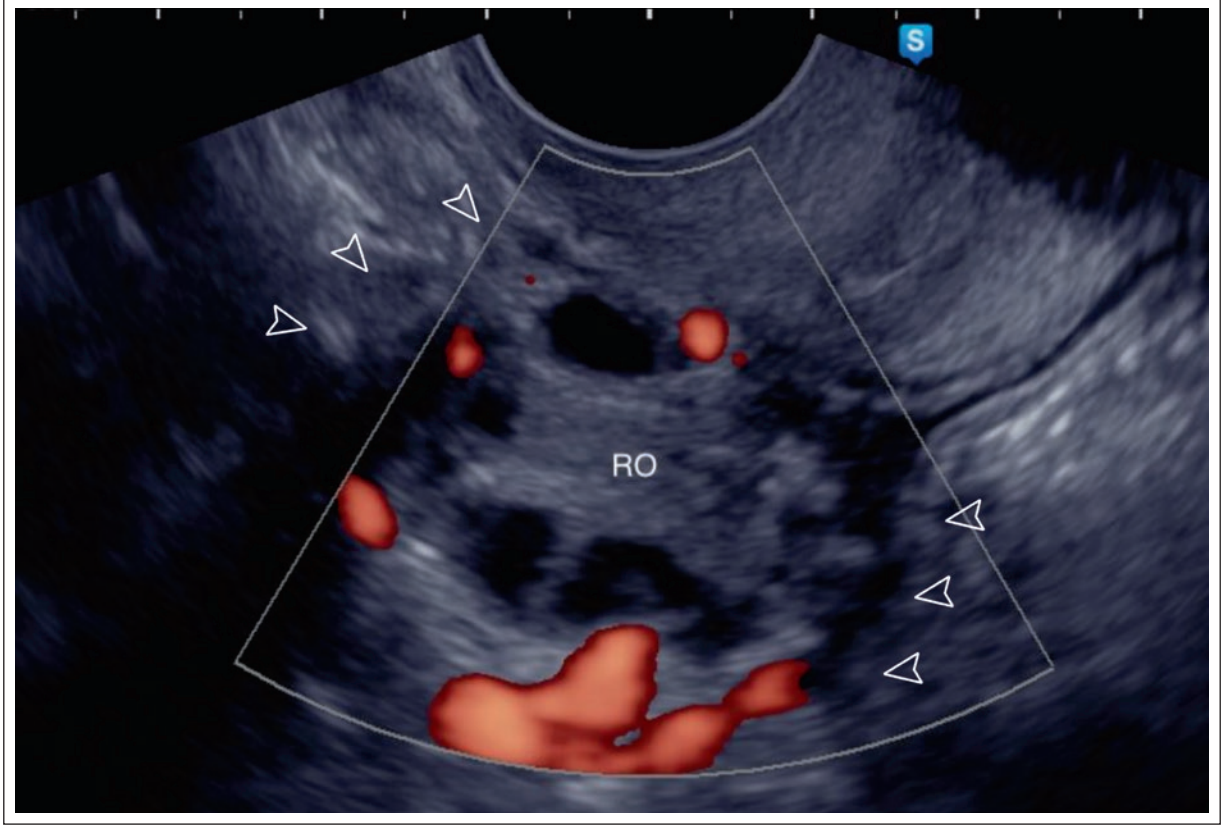

Figure 1. Power Doppler TVUS, of a woman with severe dysmenorrhea. The image shows the RO without any separation plane from the abdominal wall (arrowheads). When performing external mobilization maneuvers, no movement was seen, and the patient reported moderate pain, suggesting adhesions as a soft marker for superficial endometriosis.
TVUS: transvaginal ultrasound; RO: right ovary.

An association was found between patients with mild and strong right-side adhesions and severe dysmenorrhea (7.16 ± 3.76 and 7.66 ± 1.86, respectively). Women with mild adhesions reported severe dyspareunia (7.33 ± 2.25). Figure 6 shows a laparoscopic static image of a woman with severe dysmenorrhea and moderate dyspareunia with superficial endometriotic lesions at the RAC. Grayscale TVUS demonstrated RO adhesions and focal tenderness (data not shown). Patients with mild adhesions on the left side reported severe dysmenorrhea (8.75 ± 1.38) and moderate dyschezia and dyspareunia (5.37 ± 3.54 and 6.00 ± 3.20, respectively). Those with severe adhesions reported moderate dysmenorrhea (6.50 ± 3.77). Figure 7 shows a laparoscopic static image of superficial endometriotic lesions and adhesions in the LAC in a patient with severe dysmenorrhea and focal LO tenderness on TVUS (data not shown).

The CDS was obliterated in women with severe dysmenorrhea (8.83 ± 1.47) and moderate dyschezia and dyspareunia (4.33 ± 4.80 and 5.50 ± 3.39, respectively).

Association between the severity of adhesions visualized during laparoscopy and the type and intensity of chronic pelvic pain

Laparoscopic findings are shown in Table 3, and there were no complications. Patients with moderate or severe right-sided adhesions reported severe dysmenorrhea (9.50 ± 9.57 and 8.16 ± 2.04, respectively). Patients with moderate right-sided adhesions had moderate dyschezia and dyspareunia (4.00 ± 3.28 and 6.50 ± 4.50, respectively). Patients with severe right-sided adhesions reported moderate dyspareunia (4.00 ± 3.28). Severe dysmenorrhea (9.50 ± 0.70) was found in women with moderate left-sided and severe adhesions (7.55 ± 3.32). Patients with moderate left-sided adhesions reported moderate dyschezia, dyspareunia, and dysuria (4.50 ± 6.36). Patients with severe left-sided adhesions reported moderate dyspareunia (5.66 ± 3.64).

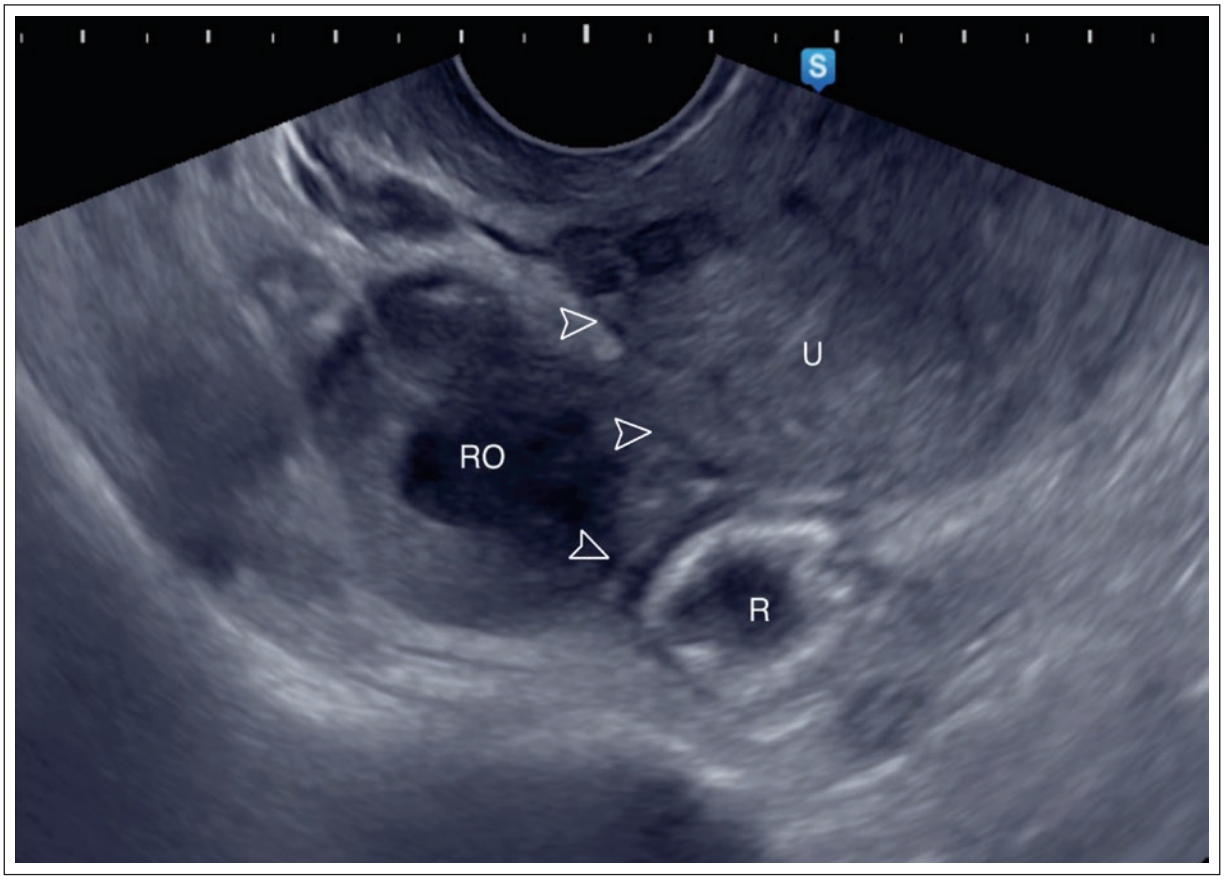

Figure 2. Grayscale TVUS of a woman with severe dysmenorrhea, moderate dyschezia, and dyspareunia. The image shows the RO without any separation plane from the uterus or anterior rectal wall. When performing external mobilization maneuvers, no movement was seen, and the patient reported severe pain, concluding adhesions as a soft marker for superficial endometriosis (arrowheads).

RO: right ovary; TVUS: transvaginal ultrasound; U: uterus; R: rectum.

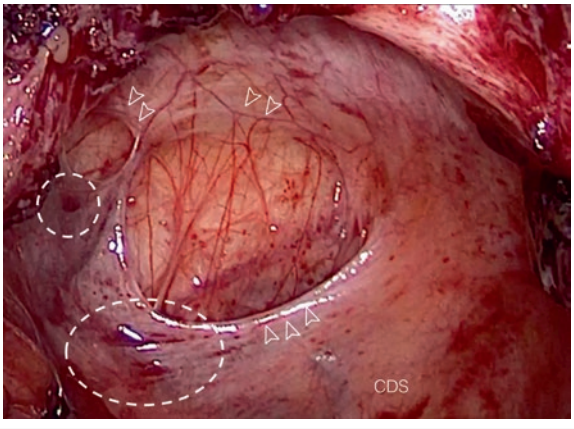

Figure 3. Static laparoscopic image of a woman with severe dysmenorrhea and dyspareunia, with CDS obliteration on TVUS (data not shown). The image shows superficial endometriotic lesions (dotted circles) and pelvic peritoneal defects (arrowheads) causally related to endometriosis, as this patient had neither pregnancy nor previous surgical procedures.

CDS: *Cul de Sac*; TVUS: transvaginal ultrasound.

Patients with mild adhesions in the CDS had severe dysmenorrhea. Women with moderate adhesions at this level had moderate dysmenorrhea and dysuria (6.33 ± 5.50 and 6.00 ± 2.64, respectively) and severe dyschezia and dyspareunia (7.66 ± 3.21 and 9.33 ± 0.57, respectively). Patients with severe adhesions reported severe dysmenorrhea (8.00 ± 1.89) and moderate dyspareunia (4.50 ± 3.67). Patients with moderate adhesions of the VUP reported severe dysmenorrhea and dyschezia (9.50 ± 0.70 and 8.00 ± 2.82, respectively). Patients with severe adhesions at this level reported severe dysmenorrhea, dyschezia, and dyspareunia (9.00 ± 0, 8.00 ± 0, and 8.00 ± 0, respectively). Ultrasonographic RO and LO adhesions were associated with surgical RO adhesions ($p = 0.02$) and LO adhesions ($p = 0.04$), respectively. There were no significant differences compared with other parameters.

Table 2. Association between ultrasonographic soft markers and type and intensity of chronic pelvic pain[a] in 25 patients with clinically significant superficial endometriosis

Description	n (%)	Dysmenorrhea Mean ± SD	Dyschezia Mean ± SD	Dyspareunia Mean ± SD	Dysuria Mean ± SD
RO tenderness					
Absent	6 (24.0)	6.33 ± 4.96	3.66 ± 3.14	4.83 ± 4.07	2.16 ± 2.56
Mild	7 (28.0)	9.28 ± 1.49	4.57 ± 4.42	4.85 ± 4.01	1.71 ± 2.98
Moderate	8 (32.0)	6.62 ± 2.44	1.62 ± 3.02	5.00 ± 3.29	1.75 ± 2.71
Severe	4 (16.0)	8.50 ± 1.73	4.75 ± 5.50	4.50 ± 3.69	3.50 ± 4.35
LO tenderness					
Absent	1 (4.0)	10.00 ± 0	-	-	-
Mild	6 (24.0)	9.00 ± 1.67	4.50 ± 3.67	3.33 ± 2.80	2.66 ± 3.20
Moderate	11(44.0)	8.27 ± 1.42	1.81 ± 3.18	4.81 ± 3.37	1.27 ± 2.41
Severe	7 (28.0)	5.00 ± 4.54	5.57 ± 4.39	6.85 ± 3.62	3.28 ± 3.45
RO adhesions[b]					
Absent	13 (52.0)	7.76 ± 3.39	4.53 ± 4.03	4.30 ± 3.90	2.92 ± 2.95
Mild	6 (24.0)	7.16 ± 3.76	4.50 ± 3.88	7.33 ± 2.25	2.16 ± 3.71
Strong	6 (24.0)	7.66 ± 1.86	-	3.50 ± 2.73	0.33 ± 0.81
LO adhesions					
Absent	7 (28.0)	7.85 ± 3.23	2.00 ± 3.46	3.57 ± 3.40	1.85 ± 3.18
Mild	8 (32.0)	8.75 ± 1.38	5.37 ± 3.54	6.00 ± 3.20	2.62 ± 3.73
Strong	10 (40.0)	6.50 ± 3.77	2.90 ± 4.17	4.80 ± 3.85	1.90 ± 3.73
CDS					
Normal	6 (24.0)	7.21 ± 3.37	3.15 ± 3.67	4.63 ± 3.62	2.10 ± 3.05
Obliterated	19 (76.0)	8.83 ± 1.47	4.33 ± 4.80	5.50 ± 3.39	2.16 ± 2.71
VUP[c]					
Normal	25 (100)	7.60 ± 3.08	3.44 ± 3.89	4.84 ± 3.51	2.12 ± 2.92

[a]Visual analogue scale; [b]Adhesion severity represented by +, ++ or +++ as mild, moderate, or severe/strong. [c]No case with obliterated VUP; RO: right ovary; LO: left ovary; CDS: Cul-De-Sac; VUP: vesico-uterine pouch.

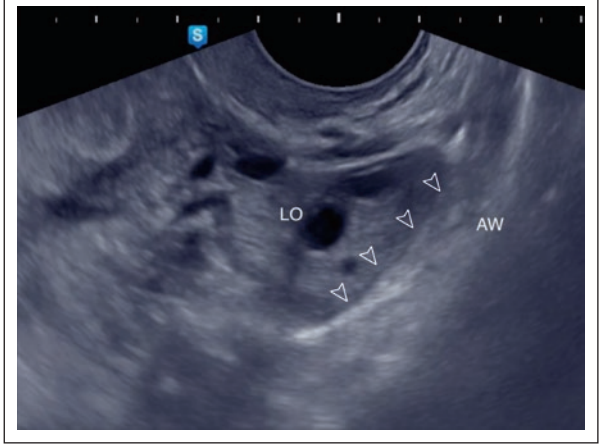

Figure 4. Grayscale TVUS of a woman with severe dysmenorrhea and dyspareunia. The image shows the LO without any separation plane between the uterus and AW. When performing external mobilization maneuvers, no movement was seen, and the patient reported severe pain, concluding adhesions as a soft marker for superficial endometriosis (arrowheads).

AW: abdomino-pelvic; LO: left ovary; TVUS: transvaginal ultrasound; U: uterus.

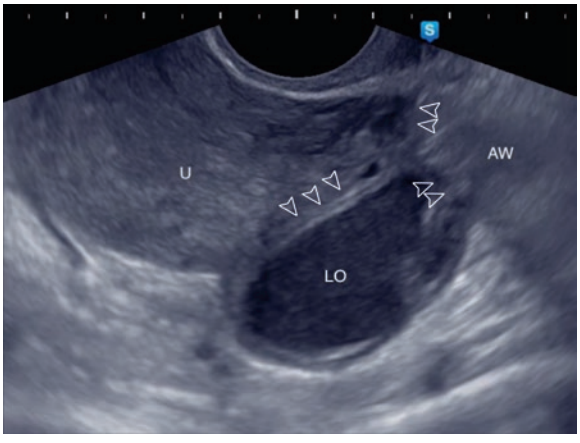

Figure 5. Grayscale TVUS of a woman with severe dysmenorrhea, moderate dyschezia, and dyspareunia. CDS obliteration and focal tenderness. There is no separation plane (arrowheads) and adhesions were seen during dynamic maneuvers.

AW: abdomino-pelvic wall; CDS: Cul de Sac; LO: left ovary; TVUS: transvaginal ultrasound; U: uterus.

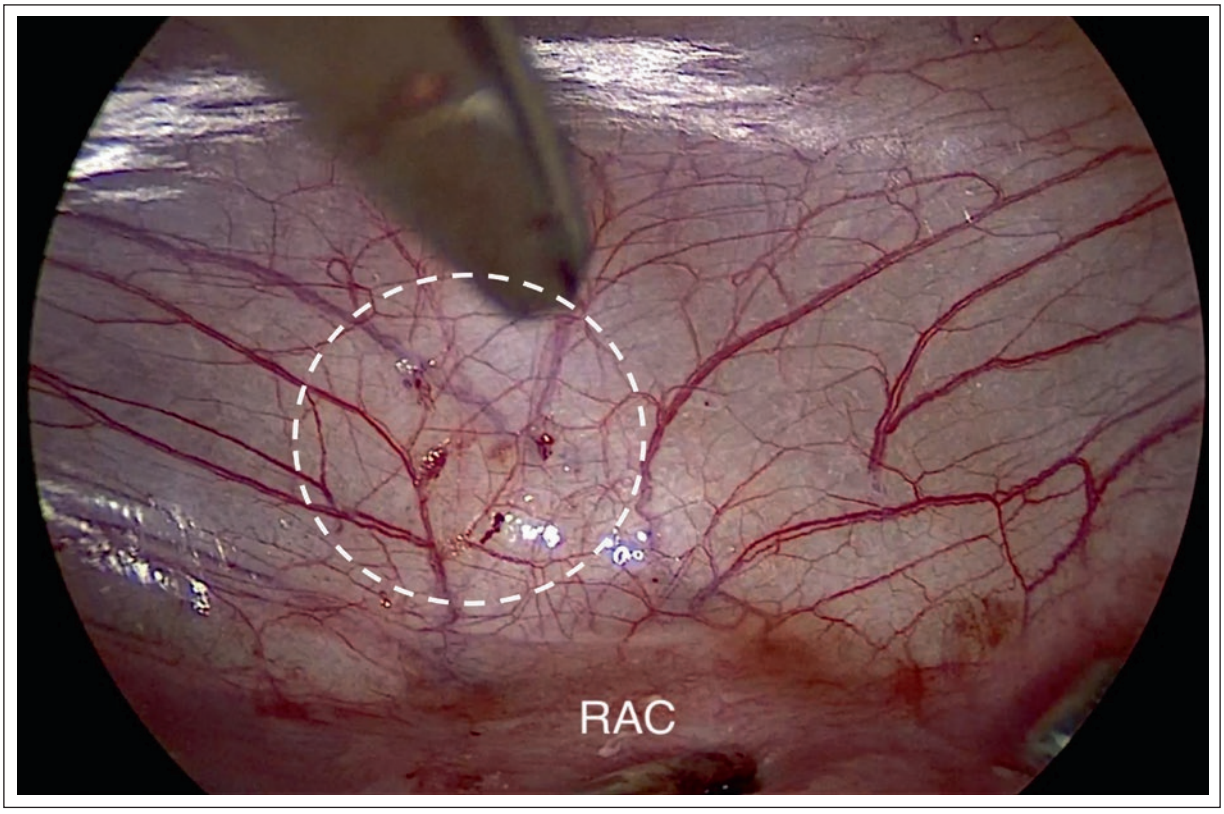

Figure 6. Laparoscopic static image showing superficial endometriotic lesions at the RAC (dotted circle) of a woman with severe dysmenorrhea and moderate dyspareunia. In grayscale TVUS, RO had adhesion and focal tenderness (data not shown).

RAC: right anterior compartment; RO: right ovary; TVUS: transvaginal ultrasound.

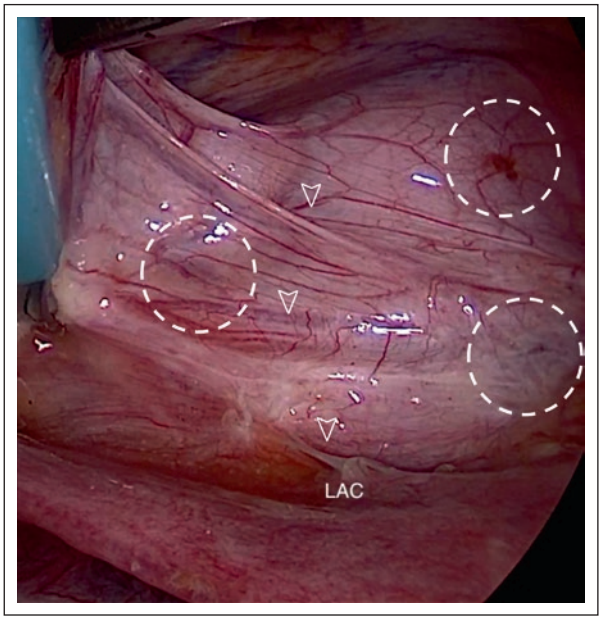

Figure 7. Laparoscopic static image shows superficial endometriotic lesions (dotted circles) and adhesions at the LAC (arrowheads) of a patient with severe dysmenorrhea and focal tenderness at the LO documented by TVUS (data not shown).

LAC: left anterior compartment; LO: left ovary; TVUS: transvaginal ultrasound.

Association between the severity of endometriotic lesions and the type and intensity of chronic pelvic pain

Patients with moderate and severe pelvic pain had endometriotic lesions. There was no association between lesion length and pain severity (Table 4). Patients with lesions less than 1 cm in length in the RAC reported severe dysmenorrhea (8.66 ± 2.30), moderate dyschezia (4.33 ± 4.04), mild dyspareunia (1.66 ± 2.88), and dysuria (3.00 ± 3.00). Patients with lesions 1-3 cm in length at this level reported severe dyspareunia (7.5 ± 2.12).

Patients with lesions less than 1 cm in length in the LAC reported severe dysmenorrhea (8.00 ± 2.00). Those with lesions 1-3 cm in length reported moderate dysmenorrhea (5.00 ± 4.58) and severe dyspareunia (8.00 ± 1.73). Patients with lesions larger than 3 cm reported severe dysmenorrhea (9.00 ± 1.41) and moderate dyschezia (5.50 ± 0.70).

Patients reported severe dysmenorrhea with endometriotic lesions in the RPC smaller than 1 cm (7.50 ± 0.70), 1-3 cm (8.12 ± 1.64), and larger than 3 cm

Table 3. Association between adhesion severity visualized at laparoscopy and the type and intensity of chronic pelvic pain[a] in 25 patients with clinically significant superficial endometriosis

Description	n (%)	Dysmenorrhea Mean ± SD	Dyschezia Mean ± SD	Dyspareunia Mean ± SD	Dysuria Mean ± SD
RO adhesions[b,c]					
Absent	15 (60.0)	6.86 ± 3.60	4.46 ± 3.58	4.73 ± 3.45	2.16 ± 2.56
Moderate	4 (16.0)	9.50 ± 9.57	04.75 ± 5.50	6.50 ± 4.50	3.50 ± 4.35
Severe	6 (24.0)	8.16 ± 2.04	-	4.00 ± 3.28	0.33 ± 0.81
LO adhesions					
Absent	12 (48.8)	7.91 ± 2.57	3.91 ± 3.70	3.83 ± 3.21	2.25 ± 2.92
Mild	2 (8.0)	4.00 ± 5.65	2.00 ± 2.82	7.50 ± 2.12	2.00 ± 2.82
Moderate	2 (8.0)	9.50 ± 0.70	4.50 ± 6.36	4.50 ± 6.36	4.50 ± 6.36
Severe	9 (36.0)	7.55 ± 3.32	2.88 ± 4.37	5.66 ± 3.64	1.44 ± 2.40
CDS adhesions					
Absent	15 (60.0)	7.53 ± 3.13	3.13 ± 3.66	4.40 ± 3.18	1.80 ± 2.75
Mild	1 (4.0)	10 ± 0	-	-	-
Moderate	3 (12.0)	6.33 ± 5.50	7.66 ± 3.21	9.33 ± 0.57	6.00 ± 2.64
Severe	6 (24.0)	8.00 ± 1.89	2.66 ± 4.13	4.50 ± 3.67	1.33 ± 2.42
VUP adhesions					
Absent	21 (84.0)	7.71 ± 2.83	2.95 ± 3.72	4.61 ± 3.63	2.28 ± 3.01
Mild	1	4.0	-	-	-
Moderate	2 (8.0)	9.50 ± 0.70	8.00 ± 2.82	3.50 ± 0.70	2.50 ± 3.53
Severe	1 (4.0)	9.00 ± 0	8.00 ± 0	8.00 ± 0	-

[a]Visual analogue scale; [b]Adhesion severity represented by +, ++ or +++ as mild, moderate, or severe. [b]None case with mild adhesions in RO; RO: right ovary; LO: left ovary; CDS: Cul-De-Sac; VUP: vesico-uterine pouch.

Table 4. Association between endometriotic lesion length found at laparoscopy and type and intensity of chronic pelvic pain[a] in 25 patients with clinically significant superficial endometriosis

Description	n (%)	Dysmenorrhea Mean ± SD	Dyschezia Mean ± SD	Dyspareunia Mean ± SD	Dysuria Mean ± SD
Endometriotic lesion length in the RAC[b]					
Absent	20 (80.0)	7.90 ± 2.82	3.65 ± 4.00	5.05 ± 3.48	2.20 ± 3.03
< 1 cm	3 (12.0)	8.66 ± 2.30	4.33 ± 4.04	1.66 ± 2.88	3.00 ± 3.00
1-3 cm	2 (8.0)	3.00 ± 4.24	-	7.5 ± 2.12	-
Endometriotic lesion length in the LAC					
Absent	17 (68.0)	7.82 ± 3.06	3.41 ± 4.00	4.52 ± 3.79	2.23 ± 2.68
< 1 cm	3 (12.0)	8.00 ± 2.00	2.66 ± 4.61	3.66 ± 3.21	2.00 ± 3.46
1-3 cm	3 (12.0)	5.00 ± 4.58	3.00 ± 5.19	8.00 ± 1.73	3.00 ± 5.19
> 3 cm	2 (8.8)	9.00 ± 1.41	5.50 ± 0.70	4.50 ± 2.12	-
Endometriotic lesion length in the RPC					
Absent	6 (24.4)	6.00 ± 4.51	6.00 ± 3.57	5.50 ± 3.27	3.66 ± 3.01
< 1 cm	2 (8.8)	7.50 ± 0.70	-	5.50 ± 0.70	-
1-3 cm	8 (32.0)	8.12 ± 1.64	3.37 ± 3.77	4.25 ± 3.99	3.00 ± 3.5
> 3 cm	9 (36.0)	8.22 ± 3.27	2.55 ± 4.03	4.77 ± 3.96	0.77 ± 1.71
Endometriotic lesion length in the LPC					
Absent	6 (24.0)	8.83 ± 1.60	6.00 ± 3.52	3.83 ± 3.25	3.50 ± 3.01
< 1 cm	4 (16.0)	7.75 ± 1.70	1.50 ± 3.00	3.50 ± 2.64	-
1-3 cm	7 (7.0)	5.71 ± 3.72	3.71 ± 3.77	6.71 ± 3.19	3.57 ± 3.64
> 3 cm	8 (32.0)	8.25 ± 3.49	2.25 ± 4.20	4.62 ± 4.20	0.87 ± 1.80

[a]Visual analogue scale; [b]No case with length of endometriotic lesions > 3 cm in the RAC; RAC: right anterior compartment; LAC: left anterior compartment; RPC: right posterior compartment; LPC: left posterior compartment.

(8.22 ± 3.27). Patients with lesions at this level reported moderate dyspareunia (5.50 ± 0.70) for lesions smaller than 1 cm, lesions 1-3 cm (4.25 ± 3.99), and lesions larger than 3 cm (4.77 ± 3.96). Patients with lesions smaller than 1 cm in the LPC reported severe dysmenorrhea (7.75 ± 1.70). Those with lesions between 1 and 3 cm reported moderate dysmenorrhea (5.71 ± 3.72) and severe dyspareunia (6.71 ± 3.19). Patients with lesions larger than 3 cm in this area reported severe dysmenorrhea (8.25 ± 3.49). A one-way ANOVA showed a significant association between dyspareunia intensity and VUP adhesions ($p = 0.010$).

Ultrasonographic CDS obliteration was significantly associated with LO adhesions and CDS adhesions found at laparoscopy ($p = 0.01$ and $p < 0.02$, respectively). No significant differences were found compared with other parameters.

DISCUSSION

This study demonstrates the association between soft markers on basal TVUS with bowel preparation in patients with clinically significant superficial endometriosis and laparoscopy findings. Our study sheds light on the complexity of endometriosis. It emphasizes the need for comprehensive assessment, including an evaluation of the ultrasound-based soft markers.

Superficial endometriosis has been diagnosed with a median delay of 5 years[11]. The detection of ultrasound-based soft markers may be helpful for an early diagnosis. Okaro et al.[9], in a study of 120 women, demonstrated only ultrasonographic soft markers in 51 (53.1%) of 96 patients. Pelvic adhesions and peritoneal endometriotic lesions were found in 37 (72.5%) of 51 patients. On the other hand, Reid et al.[12] studied the accuracy of ultrasound in predicting the site of endometriotic involvement during laparoscopy. They found that ovarian immobility on TVUS was significantly associated with ipsilateral pelvic pain, uterosacral ligamentous lesions, pelvic wall adhesions, endometriomas, and CDS obliteration. The authors suggested that a patient with mobile ovaries is unlikely to have superficial endometriosis without endometriomas, which is consistent with our findings. In summary, ultrasonographic soft markers are defined as focalized tenderness, adhesions, absence of uterine and ovarian mobility, and obliteration of VUP or CDS[9]. Site-specific tenderness and ovarian mobility as indirect ultrasound-based markers of pelvic pathology improved the ability to predict or rule out diagnosis in women with chronic pelvic pain[9]. Soft markers on TVUS with bowel preparation may be sufficient to indicate clinically significant superficial endometriosis.

The severity of symptoms is not directly related to the severity of the disease and should be considered along with the soft markers in the TVUS to determine the presence and extent of clinically significant superficial endometriosis. Menakaya et al.[13] showed an overall accuracy of 84.9% in predicting the exact level of laparoscopic findings with an excellent correlation (0.82). However, the authors did not consider symptom severity, which was addressed in our study. Most of the patients in our study suffered moderate to severe dysmenorrhea and had only soft markers on their ultrasound examination, all of whom had at least one positive ultrasonographic soft marker. Dyspareunia, dyschezia, and dysuria can also be present without DIE. This finding is consistent with a previous study[12] that found a significant association between ovarian tenderness on ultrasound and CDS adhesions and a strong association between right-sided adhesions on ultrasound and laparoscopy findings. Patients with severe dyschezia in our study had adhesions in the CDS and VUP at laparoscopy. Women with severe dyspareunia also had right-sided adhesions on ultrasound and at surgery, adhesions in the LO, CDS, and VUP, and endometriotic lesions in the RAC and LAC. The relevance of the diagnosis of clinically significant superficial endometriosis lies in its significant impact on the health of women, especially those suffering from chronic pelvic pain. Soft markers found in TVUS are often classified as mild disease but may indicate clinically significant superficial endometriosis, so laparoscopic examination and timely treatment are recommended.

This study has several strengths. All patients were referred with a clinical suspicion of endometriosis and underwent surgery performed by experienced laparoscopic gynecologists. One of the main limitations is the sample size, which was reduced for various reasons. A very specific patient selection was conducted, excluding those who had DIE, ovarian involvement, or other surgical procedures. Patients who previously underwent surgery may have adhesions due to their surgical history, making assessment more difficult. An analysis of the excluded patients revealed that most patients undergo multiple surgeries at a young age to relieve chronic pelvic pain, leaving us with only younger patients (mean age, 32.28 years) with a shorter duration of disease. Ovarian mobility assessment and site-specific tenderness are subjective and require experience in the use of TVUS in assessing pelvic pain.

CONCLUSION

Our study showed that soft markers on a well-performed ultrasound examination were the only findings that indicated clinically significant superficial endometriosis. These subjective ultrasound findings are not usually reported during routine examinations. TVUS-based soft markers can triage appropriate patients for further investigation. Our results must be confirmed in prospective studies with a larger and more diverse patient population.

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Conflicts of interest

The authors declare no conflicts of interest.

Ethical disclosures

Protection of individuals. This study complied with the Declaration of Helsinki (1964) and its amendments.

Confidentiality of data. The authors declare they followed their center's protocol for sharing patient data.

Right to privacy and informed consent. Informed consent was not required for this observational study of information collected during routine clinical care.

Use of artificial intelligence. The authors state that they did not use generative artificial intelligence to prepare this manuscript and/or create tables, figures, or figure legends.

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