

Diagnostic accuracy of sonovaginography for deep infiltrating endometriosis

Sonovaginografia na avaliação da endometriose profunda

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Abstract

Objective: The aim of this study was to assess the performance and accuracy of sonovaginography (SVG) for preoperative diagnosis and characterization of deep infiltrating endometriosis (DIE) lesions.

Study Design: A prospective study was conducted between January 2014 and January 2016, including all premenopausal women with clinical and/or imaging suspicion of DIE that underwent laparoscopic surgery. We performed consecutive evaluation with transvaginal ultrasound complemented by SVG of all women with clinical suspicion of DIE and assessed for suspected lesions in the anterior compartment (bladder and vesicouterine pouch), rectovaginal septum (RVS), pouch of Douglas (POD), uterosacral ligaments, vagina and rectosigmoid colon. Accuracy of SVG to identify lesions of DIE was assessed for the different sites of DIE, relative to laparoscopic and histological findings. The sensitivity, specificity, positive likelihood ratio (LR+) and negative likelihood ratio (LR-) were determined.

Results: Fifty nine women were evaluated by SVG and 19 (32%) underwent laparoscopic surgery. Median age was 35 years (range 26-42 years), nine women (47.4%) were nulliparous and five (26.3%) had infertility. Most common symptoms were dysmenorrhea (14/19) and deep dyspareunia (14/19). DIE was confirmed in all patients, 18/19 (94.7%) had involvement of the posterior and 3/19 (8.9%) of the anterior compartments. We found high sensitivity for the diagnosis of lesions involving the POD (92%) and RVS (90%). Our diagnostic sensitivity was lower for DIE lesions involving the anterior compartment (67%), rectosigmoid colon (50%), vagina (50%) and uterosacral ligaments (23%).

Conclusions: SVG is a simple, non-invasive method with good diagnostic sensitivity for DIE lesions involving particularly RVS and POD. This technique has a relatively short learning curve for experienced operators and provides an effective alternative to other more invasive and expensive imaging techniques.

Keywords: Ultrasound; Sonography; Deep infiltrating endometriosis; Endometriosis

INTRODUCTION

Endometriosis is a chronic gynecologic disorder defined as the presence of functional endometrial-like

tissue outside the uterine cavity and myometrium¹⁻⁴. It affects mainly women of reproductive age and its prevalence in the general female population is about 10-15%⁵⁻⁷. Deep Infiltrating Endometriosis (DIE) is defined as endometriosis which infiltrates the surface of the affected structures more than 5 mm^{1,2,5}. This aggressive presentation affects 15-30% of women with endometriosis. The most common locations are the rectovaginal septum (RVS), the pouch of Douglas (POD), the uterosacral ligaments (USLs), the vagina, the rectosigmoid (RS) colon and, less frequently, the bladder and the ureter^{8,9}.

DIE is a progressive disorder causing severe pelvic pain (dysmenorrhea, deep dyspareunia, non-menstrual

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pain), heavy menstrual bleeding and other organ-specific symptoms (dysuria, hematuria, dyschezia, constipations, diarrhea). It strongly affects the quality of life of the patients and a radical surgical treatment is often required¹⁰.

Accurate site-specific diagnosis is essential to define the optimal therapeutic strategy for patients suffering from endometriosis. Imaging techniques emerge as non-invasive and accurate methods for diagnosing and precisely mapping lesions, as well as in evaluating the extension of DIE lesions to plan surgery and adequately counsel patients regarding the treatment⁸.

Transvaginal sonography (TVS) is considered the first-line imaging technique in the evaluation of women with suspected pelvic endometriosis, with great sensitivity (64-89%) and specificity (89-100%) for the diagnosis of endometriomas¹². However, its accuracy for lesions involving the posterior compartment (RVS, POD, posterior vaginal fornix, USLs and RS) is much lower, less consistent and highly operator-dependent. Sonovaginography (SVG) is an adapted TVS technique that uses a saline solution to increase the acoustic window between the probe and surrounding structures, allowing a better evaluation of DIE lesions.

In this study, the authors assess the performance and accuracy of SVG for preoperative diagnosis and characterization of DIE lesions.

MATERIAL AND METHODS

We conducted a prospective observational study at a tertiary-care university hospital, between January 2014 and January 2016. All pre-menopausal women with clinical and/or imaging suspicion of DIE, submitted to laparoscopic surgery were included. Patients gave oral informed consent. Institutional Ethics Committee consent was not requested since SVG was performed as a complement to TVS, performed routinely to all our patients with gynecological complaints, and therapeutic strategy, medical versus surgical, was not based on SVG findings alone.

TVS and SVG

During the study period, all pre-menopausal women attending our Gynecology Department with clinical suspicion of endometriosis were evaluated by TVS complemented with SVG. The sonographic exams were performed by the same operator (J.F.), an Assis-

tant in Gynecology with 16 years of experience in gynecologic ultrasound, using a Voluson™ 730 (General Electric, USA) transvaginal 5-9 MHz probe. The investigator was informed about the patient's clinical history, but blinded to the results of physical examination or previous imaging techniques. No bowel preparation was used before sonography.

The sonographic protocol consists of a routine evaluation of uterus and adnexa, including evaluation of uterus and ovaries mobility, sonographic signs of adenomyosis and adnexal masses. Endometriomas and other adnexal masses were described according to the International Ovarian Tumor Analysis (IOTA) terminology¹². Obliteration of the POD was assessed by the degree of sliding of the posterior aspect of the cervix over the anterior rectum wall (*sliding sign*) by gently pressing the uterus with the probe.

SVG acoustic window was obtained by placing 50 ml of ultrasound-gel in the vagina. Endometriosis was defined as irregular hypoechoic lesions and characterized as: 1) nodules – well-circumscribed projected lesions; 2) thickening – infiltrative lesions; 3) *indian head-like* lesions – mixed lesions with both nodular and infiltrative components. Lesions were mapped by location: 1) anterior compartment (urinary bladder, vesicouterine pouch and distal ureter); 2) ureter; 3) vagina (including posterior vaginal fornix); 4) RVS; 5) POD; 6) USLs and 6) RS colon.

Surgical and Pathologic Findings

All women included in this study underwent laparoscopic surgery by clinical and imagological suspicion of DIE. Surgeries were performed by a Gynecologist Consultant with experience in advanced laparoscopic gynecologic surgery (M.M.). A Consultant in General Surgery with experience in advanced laparoscopic surgery performed interventions involving the excision of RS lesions. Location of all suspicious lesions was recorded and removed or biopsied for histological confirmation.

Diagnosis of DIE was made if at least one structure (bladder, ureter, vagina, RVS, USLs or RS colon) was involved. Histological confirmation included one of the following: 1) endometrial tissue in at least one resected/biopsied lesion¹³; 2) direct visualization of lesion suggestive of DIE and histological findings of fibrosis and/or smooth muscle cells hypertrophy¹⁴. Total obliteration of the POD that could not be surgically clarified (*frozen pelvis*)¹⁵ was also considered a surgical finding of DIE.

Statistical Analysis

We performed a descriptive statistical analysis using SPSS 23.0 (SPSS Inc., Chicago, USA). The accuracy of SVG to identify lesions of DIE was assessed for the different sites of DIE, relative to laparoscopic and histological findings. The sensitivity, specificity, positive likelihood ratio (LR+) and negative likelihood ratio (LR-) were determined with 95% confidence intervals (95% CI).

RESULTS

During the 25-month study period, 59 women were evaluated by TVS complemented with SVG because of clinical suspicion of endometriosis. Of those, only 19 underwent laparoscopic surgery.

In Table I we report the demographic characteristics, medical history and clinical findings from the 19 women included in our final analysis. Patients median age was 35 years (range 26-42 years), nine women (47.4%) were nulliparous and five (26.3%) had criteria of infertility. Most common symptoms were dysmenorrhea (14 cases) and profound dyspareunia (14 cases). Physical examination revealed suspicious in 13 women, either nodules or tightness at bimanual touch (13 cases) or by direct visualization of macroscopic vaginal lesions (11 cases).

At the time of surgery 17 women (89.5%) were receiving hormonal treatment with oral estroprogestins (13/17 cases), dianogest (4/17 cases) or levonorgestrel intrauterine system (2/17 cases) and three women (13.6%) had already undergone surgical treatment for endometriosis.

DIE was confirmed in all cases and specific lesion location is summarized in Table II. Posterior and anterior DIE was documented in 18/19 (94.7%) and 3/19 (8.9%) patients, respectively. Ovarian lesion (endometrioma) was found in two patients.

Table III shows pre-operative SVG accuracy for the diagnoses of DIE according to anatomical locations. Sensitivity was higher for the diagnosis of lesions involving POD (92%) and RVS (90%), with LR+ of 0.1 for both locations. Our diagnosis sensitivity was lower for DIE lesions involving the anterior compartment (67%), RS colon (50%), vagina (50%) and USLs (23%).

We found in five patients *frozen pelvis* in laparoscopy. The sensitivity and specificity of *sliding sign* was 40% (95% CI: 5.3 – 85.34) and 64% (95% CI: 35.1 – 87.2), respectively, with a LR+ of 1.12 (95% CI: 0.31 – 4.04) and a LR- of 0.93 (95% CI: 0.41 – 2.11).

TABLE I. DEMOGRAPHIC CHARACTERISTICS, CLINICAL FINDINGS AND PREVIOUS TREATMENTS

Patient characteristics	Median (range)	
Age (years)	35 (26-42)	
BMI (Kg/m ²)	23.8 (19.5-21.25)	
Menarche (years)	11 (9-15)	
Gravidity	0.5 (0-2)	
Parity	0.5 (0-2)	
	N	%
Previous abdominal surgery *	13	68.4
Previous surgery for endometriosis	3	15.8
Infertility	5	26.3
Chronic pelvic pain		
Dysmenorrhea	14	73.7
Deep dyspareunia	14	73.7
Non menstrual pain	1	5.3
Abnormal uterine bleeding	3	15.8
Gastrointestinal symptoms		
Constipation	2	10.5
Rectorrhagia	2	10.5
Urinary symptoms		
Dysuria	1	5.3
Haematuria	1	5.3
Pelvic exam findings		
Speculum lesions	11	57.9
Bimanual exam lesions	13	68.4
Bimanual exam pain	8	42.1
Previous treatments		
Oral estroprogestins	13	76.5
Oral dienogest	4	23.5
Levonorgestrel uterine system	2	11.8

*Including caesarian section, appendectomy or other abdominal surgeries

COMMENT

Endometriosis is a chronic disease with a broad expression, regarding both the organs it affects as well as the severity of symptoms. Laparoscopic excision of endometriosis lesions is the gold standard treatment, but it is a difficult procedure and requires differentiated technical skills and sometimes long operating time. Accurate preoperative lesion mapping helps to predict the extent of the disease and to define the best therapeutic and surgical strategy. Different imaging techniques have been suggested for this purpose, including magnetic resonance imaging (MRI) and barium enema, but TVS is now considered the first-line imaging

TABLE II. ANATOMICAL LOCATIONS OF DIE DOCUMENTED SURGICALLY AND HISTOLOGICALLY

DIE locations	N (%)
Anterior compartment	3 (15.8)
RVS	10 (52.6)
POD	13 (68.4)
RS colon	8 (42.1)
USLs	13 (68.4)
Vagina	8 (42.1)
Total	55

tool for the diagnosis of endometriosis, with the advantages of being inexpensive, easily accessible, patient acceptable and an innocuous technique¹⁶.

The use of SVG in the evaluation of DIE lesions is relatively new and only recently there has been consensus regarding nomenclature and standardization of the technique¹⁷. In 2014 we introduced SVG technique in our Department, initial protocol was slightly modified over the two years, as a result of updating the scientific knowledge and *feed-back* between our surgeon and sonographer, in order to optimize our diagnostic accuracy.

The main objective of this study was to understand if we could rely on TVU complemented with SVG whenever DIE is suspected to identify, describe and characterize DIE lesions for initial imaging evaluation and select patients that should be referred to MRI, avoiding unnecessary costs.

During these 25 months period a total of 59 TVS complemented with SVG were performed, but only 19 patients underwent surgery based on clinical and imaging findings. Despite our sample size, our preliminary results are quite appealing and point out an ac-

ceptable acuity and potential utility of extended TVU for posterior compartment's evaluation, especially for the diagnosis of lesions involving the RVS and POD. Regarding the diagnosis of lesions involving RVS, our accuracy was surprisingly high (sensitivity 90% and specificity 89%) and even superior from the one reported in a recent meta-analysis from *Guerriero et al*, where sensitivity and specificity for this location was from 49% and 98%, respectively¹⁸. Our detection rate for lesions involving the anterior compartment, vagina and RS was very similar to that described in this same meta-analysis.

Regarding lesions involving the USLs we achieved a lower sensitivity compared to data from published literature¹⁸ (23% versus 53%) and this finding is probably related to the examiner's experience and learning curve. Our ability to identify POD obliteration using the *sliding signal* was also significantly lower (sensitivity: 40%, specificity: 64%) than expected (sensitivity: 83%, specificity: 97%)¹⁹.

We are aware of our study limitations, particularly the small sample size. For this purpose, the inclusion of patients without DIE criteria, particularly those with endometrioma findings alone, could have been an advantage to increase our overall diagnostic sensitivity and specificity. An intestinal preparation would have been a plus in the diagnosis of intestinal endometriosis, however it was not used mainly due to the fact that the exam was performed preferably on the day of first appointment. All sonographic exams were performed by the same operator, which proved to be extremely useful and of advantageous for his learning curve and technique improvement, but limits the assessment of interobserver variability. Finally, we acknowledge our patient selection bias, since we only include women with DIE, probably overestimating our results.

In conclusion, our data suggest that SVG is a simple,

TABLE III. SVG PRE-OPERATIVE ACCURACY FOR DIE ACCORDING TO ANATOMICAL LOCATIONS

Lesion location	Sensitivity (%) (95% CI)	Specificity (%) (95% CI)	LR+ (95% CI)	LR- (95% CI)
Anterior compartment N=3	67 (9.4-99.2)	100 (78.2-100)	inf.	0.3 (0.07-1.7)
RVS N=10	90 (55.5-99.8)	89 (51.8-99.7)	8.1 (1.3-52)	0.1 (0.02-0.7)
POD N=13	92 (64-99.8)	83 (35.9-99.6)	5.5 (0.9-33.4)	0.1 (0.01-0.6)
RS colon N=8	50 (15.7-84.3)	82 (44.2-97.7)	2.75 (0.66-11.52)	0.61 (0.29-1.29)
USLs N=13	23 (5-53.8)	100 (54.1-100)	inf.	0.77 (0.6-1)
Vagina N=8	50 (15.7-84.3)	100 (71.5-100)	inf.	0.5 (0.25-1)

non-invasive method with good diagnostic sensitive for DIE lesions particularly those involving posterior compartment (RVS and POD). This technique, used as a routine TVS complement, has a relatively short learning curve for experienced operators and may provide an effective technique for initial imaging evaluation and selection of patients that should be referred to other more invasive and expansive imaging techniques.

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