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TRANSPERINEAL ULTRASOUND IN WOMEN WITH RECTAL ENDOMETRIOSIS: COULD SONOGRAPHIC PARAMETERS BE CORRELATED WITH BOWEL SYMPTOMS?

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ABSTRACT

STUDY OBJECTIVE: to compare levator hiatal area and anorectal angle at rest and after maximal contraction, at transperineal 2D/3D/4D ultrasound between patients with rectal endometriosis and asymptomatic healthy women and, secondly, to find any association between sonographic findings and bowel symptoms.

DESIGN: pilot, prospective study conducted between September 2015 and December 2016.

SETTING: tertiary level referral Center of Minimally Invasive Gynecologic Surgery.

PATIENTS: 96 nulliparous patients with symptomatic rectal endometriosis scheduled for laparoscopic surgery (study group) were compared to 88 nulliparous asymptomatic healthy women (control group). Patients had never undergone surgery for deep endometriosis and had not assumed hormonal therapy before the enrollment.

INTERVENTIONS: transperineal ultrasound for evaluation of levator hiatal area and anorectal angle was performed in all patients at rest. Data were analyzed offline with a dedicated software (4DView 14.4; GE Healthcare) by an investigator blinded to clinical data. Bowel symptoms were collected using a validated questionnaire (Knowles-Eccersley-Scott-Symptom Questionnaire). Comparisons of mean values between controls and cases were performed with Student's t-test. Correlations between sonographic parameters and KESS questionnaire's items were analyzed using Spearman's correlation. P values <0.05 were considered significant.

MEASUREMENTS AND MAIN RESULTS: major demographic and anthropometric data were homogeneous for the groups. Compared to the control group, patients with rectal endometriosis

show a significantly narrower levator hiatal area at rest and after maximal contraction; patient with rectal endometriosis show a narrower anorectal angle at rest (109.8±10.8 grade versus 113.7±13.0 grade, p=0.03). Moreover, in the study group we found a significant association between severity of dyschezia at KESS questionnaire and dimension of anorectal angle ($p < 0.001$). In the study group, Patients with constipation had a narrower anorectal angle compared to endometriotic patients without constipation .

CONCLUSION: women with rectal endometriosis had a significantly narrower levator hiatal area and anorectal angle than healthy controls, suggesting pelvic floor hypertone. Pelvic floor dysfunctions in women with rectal endometriosis seem to be associated to bowel complaints, particularly dyschezia and constipation. Transperineal ultrasound may be a useful, inexpensive and non-invasive tool to detect pelvic floor dysfunctions in sympomatic patients affected by deep endometriosis.

INTRODUCTION

Endometriosis is a chronic and recurrent disease defined as the presence and proliferation of endometrial glands and stroma outside the uterine cavity. The ovary is the most common site involved, accounting for 80% of cases of endometriosis, but it can also involve other organs such as rectum, bladder and ureters (1). Rectal endometriosis belongs to a particular clinical condition: deep infiltrating endometriosis (DIE) that is defined as the presence of endometrial-like tissue (glands and stroma) >5 mm under the peritoneum (2). The major clinical problem of endometriosis is the pain syndrome, described as chronic pelvic pain, dysmenorrhea, dyspareunia, dysuria and dyschezia, affecting negatively women's health and quality of life (1) , Noteworthy, deep lesions are associated also to sexual, urinary and rectal dysfunctions (3-6). In particular, sigestive complaints reported by women presenting with deep endometriosis infiltrating the rectum can be partially explained by cyclic micro-hemorrhages and inflammation into the rectal wall, anterior fixation of the rectum to the uterine cervix or vaginal fornix, and rectal stenosis (7). Moreover, recent studies demonstrated that women with DIE have an increased prevalence of pelvic floor muscle (PFM) dysfunctions (8)., which can play an important role in the pathophysiology of dyschezia and rectal symptoms itself (9).

Transperineal ultrasound 2D, 3D and 4D imaging was demonstrated as valid, inexpensive, reliable and non-invasive tool for assessing of pelvic floor function (10-13). Our group investigated PFM tone and strength through transperineal ultrasound in women with deep endometriosis and demonstrated in these patients a hyper-tone of PFM (represented by lower levator hiatal area) and a low strength of contraction (smaller changes in levator hiatal aerea narrowing during PFM contraction) (14).

Anorectal angle dimensions have been associated with evacuation difficulty revealed with defecography findings (16) and measurements of anorectal angle's excursions have been used widely as a proxy of PFM strength in women with incontinence and pelvic organ prolapsed (17).

The aim of our study is to evaluate, static and dynamic amplitude of levator hiatal area and anorectal angle in women affected by rectal endometriosis, in comparison to asymptomatic healthy women using 2D-3D-4D transperineal ultrasound. Furthermore, we analyze any correlation between sonographic data (anorectal angle and levator hiatal area at transperineal ultrasound) and digestive symptoms reported by the patients of study group through a validated questionnaire (18).

MATERIALS AND METHODS

Participants

This pilot prospective study was conducted between September 2015 and December 2016 at our tertiary level referral Center of Minimally Invasive Gynecologic Surgery. Ninety-six consecutive nulliparous women with diagnosis of rectal endometriosis were recruited in the study group. Diagnosis of rectal endometriosis is based on clinical and transvaginal/transabdominal ultrasound examinations and, when necessary, magnetic resonance All patients did not show a significant narrowing of rectal lumen (narrowing < 50%). All patients in the study group were scheduled for laparoscopic surgery and diagnosis of rectal endometriosis was confirmed by histological examination. Eighty-eight nulliparous asymptomatic healthy volunteers were enrolled in control group. Women in control group did not show any clinical or ultrasonographic signs of endometriosis and had to report no history of recurrent abdominal pain. For each women demographic and anthropometric data (age, body mass index, pain symptoms using a numerical rating scale from 0 to 10, previous surgery) were collected. In study group, surgical data and histological findings were also collected and KESS questionnaire was handed over to the subjects. The questionnaire includes eleven questions about bowel symptoms, in particular constipation, with a total scores ranging from 0 (no symptoms) to 39 (high symptoms severity). A cut-off score of ≥

11 indicates constipation (18, 19).

Exclusion criteria included: age less than 18 years or greater than 45 years, current or previous pregnancy, post-menopausal status, rectal endometriosis with more than 50% stenosis of bowel lumen, other cause of pelvic pain or pelvic floor dysfunctions (acute or chronic pelvic inflammatory disease, irritable bowel disease, vulvodynia, active urinary tract infection, congenital or acquired abnormalities of the pelvis or pelvic floor, diagnosis of genital malignancy, pelvic organ prolapse) and hormonal therapy within 3 months before the enrollment .

Patients gave informed written consent to participate to our study. The study protocol obtained approval from the local ethics committee.

Procedure

Information about pelvic floor anatomy and physiology was given to each participant. Transperineal ultrasound examinations were performed in both groups as previously described (14). In particular, levator hiatal area, antero-posterior diameter (AP diameter), left-right transverse diameter (LR diameter) and anorectal angle were evaluated at rest and at maximum pelvic floor contraction. (Figure 1, Figure 2, Figure 3)

The anorectal angle was defined as the angle between the posterior wall of the rectal ampulla and the anal canal. During PFM contraction, the anorectal angle becomes more acute and it moves cranially. (10).

All scans from both groups were obtained by the same experienced operator using a Voluson E6 system (GE Healthcare, Zipf, Austria) with RAB 8-4-MHz volume transducer for all acquisitions. Measurements were evaluated offline with a dedicated software (4DView 14.4; GE Healthcare, Zipf, Austria) by an experienced investigator blinded to clinical data. These measured parameters have already been studied for their properties demonstrating good test-retest, intra-observer and inter-observer reliability (17, 20-23).

All groups completed Knowles-Eccersley-Scott-Symptom Questionnaire (KESS) questionnaire. The questionnaire includes eleven questions about bowel symptoms, in particular constipation, with a total scores ranging from 0 (no symptoms) to 39 (high symptoms severity). A cut-off score of ≥ 11 indicates constipation (18, 19).

Statistical analysis

Continuous data were expressed in terms of mean ± SD or median (range). Categorical variables were expressed as numbers and percentages. Student's t-test was used to compare continuous parametric variables. The comparison of KESS items and anorectal angle was performed using Spearman's correlation because Kolmogorov – Smirnov test failed to show normal distribution ($p < 0.001$) for KESS items and for KESS total score. A correlation of 0.10 to 0.29 was considered slight, 0.30 to 0.49 modest, and 0.50 to 1.0 as good. A P-value of <0.05 was considered significant for all tests. Statistical analysis was carried out using the Statistical Package for the Social Sciences (SPSS) software version 24.0 (IBM Corp., Armonk, NY, USA).

RESULTS

Baseline characteristics of the control and study groups did not differ significantly and are reported in Table 1. Pain symptoms and endometriotic localizations of the study group are reported in Table 2. Transperineal ultrasound was successfully performed in all women, and no patients were removed from the study as a result of discomfort. The Outcomes of hiatal area (cm^2) for DIE group and for control group respectively are: at rest 10.90 $\pm$ 2.69 and 13.02 $\pm$ 2.58, $p<0.0001$; after maximal contraction 8.55 $\pm$ 1.85 and 9.45 $\pm$ 2.11, $p=0.002$. The delta of hiatal area between contraction and rest for DIE group and for control group respectively are: 2.34 + 2.02 and 3.56 + 1.84, $p<0.0001$. The AP diameter of hiatal area (cm) for DIE group and for control group respectively are: at rest 4.67 $\pm$ 0.69 and 4.92 $\pm$ 0.63, $p= 0.01$; after maximal contraction 3.82 $\pm$ 0.59 and 3.99 $\pm$ 0.56, $p= 0.04$. The LR diameter of hiatal area (cm) for DIE group and for control group respectively are: at rest 3.29 $\pm$ 0.46 and 3.63 $\pm$ 0.53, $p<0.0001$; after maximal contraction 3.03 $\pm$

0.39 and 3.20 ± 0.48, p= 0.007. Compared to the control group, patients with rectal endometriosis showed a significantly narrower anorectal angle at rest (109.8±10.8 grade versus 113.7±13.0 grade, p=0.03); anorectal angle after contraction did not significantly differ between the two groups (Table 3).

In the study group we found a significant association between severity of dyschezia at KESS questionnaire and grade of anorectal angle ($p < 0.001$). No further associations were detected concerning the other items of the KESS questionnaire and sonographic parameters.

In the study group 35 women (36.5%) reported constipation according to the results of KESS questionnaire. In this particular group, anorectal angle was significantly narrower than women with rectal endometriosis without constipation (106,6±10,9 grade versus 111,6±10,5 grade p=0,03). Results are shown in Table 4 and Table 5.

DISCUSSION

Women presenting with pelvic endometriosis frequently report gastrointestinal complaints of increased intensity during menstruation (24).

This is the first study evaluating the correlations between pelvic floor muscle sonographic findings at transperineal ultrasound and bowel symptoms in women with deep endometriosis.

Our analysis of the PFM morphometry showed a narrower levator hiatal area and anorectal angle at rest and after maximal PFM contraction in patients with DIE rather than control women, suggesting a higher PFM tone. This result is consistent with our previous publications (14; MABROUK ET AL.). Like other visceral pain syndromes responsible for chronic pelvic pain, DIE may be the cause of PFM hypertone through central and peripheral sensitization and lowering of nociceptive thresholds, resulting in neuropathic upregulation, hypersensitivity and allodynia (25).

Noteworthy, it has been shown that floor hypertonic dysfunctions can be an additional causal factor of a patient's pelvic pain, determining pelvic dysfunctions and worsening chronic pelvic pain (26).

In accordance with this opinion, in the study group, we found a correlations between anorectal angle at rest and dyschezia and constipation.

The prevalence of gastrointestinal symptoms, expecially constipation, is higher in patients with endometriosis (27); this symptom could be related to PFM hypertone. Patients with posterior DIE often experience dyschezia associated to constipation (28).

CONCLUSION

The use of transperineal ultrasound could represent a pain free methodology for assessing the PFM function in women with DIE, In particular assessing anorectal angle can represent an important method to recognize symptomatic patients with DIE in order to start properly rehabilitative therapy.

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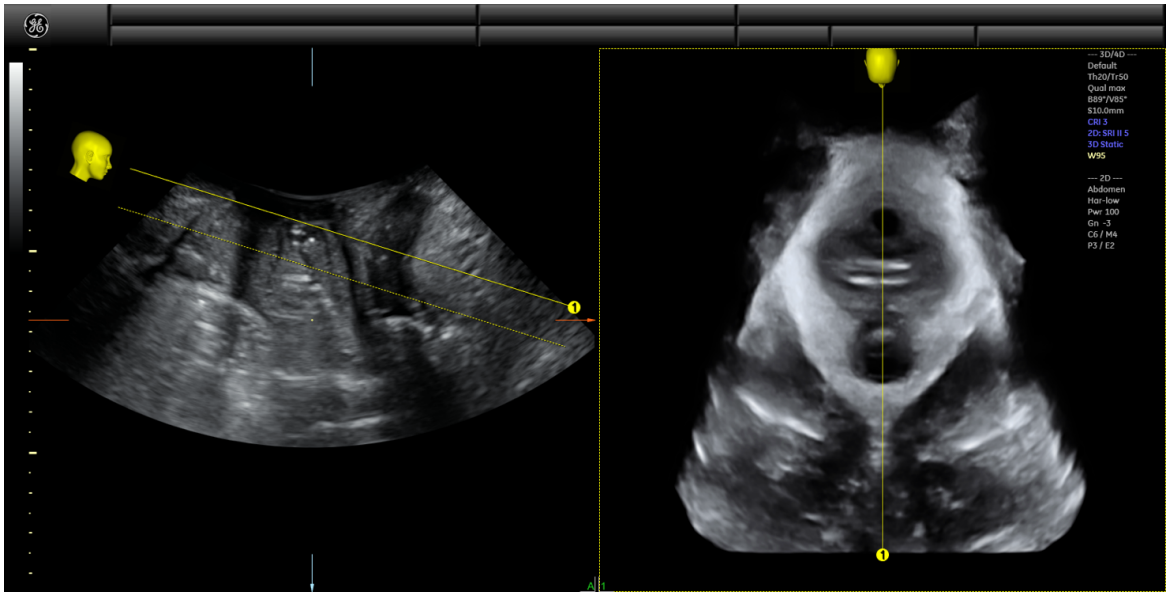
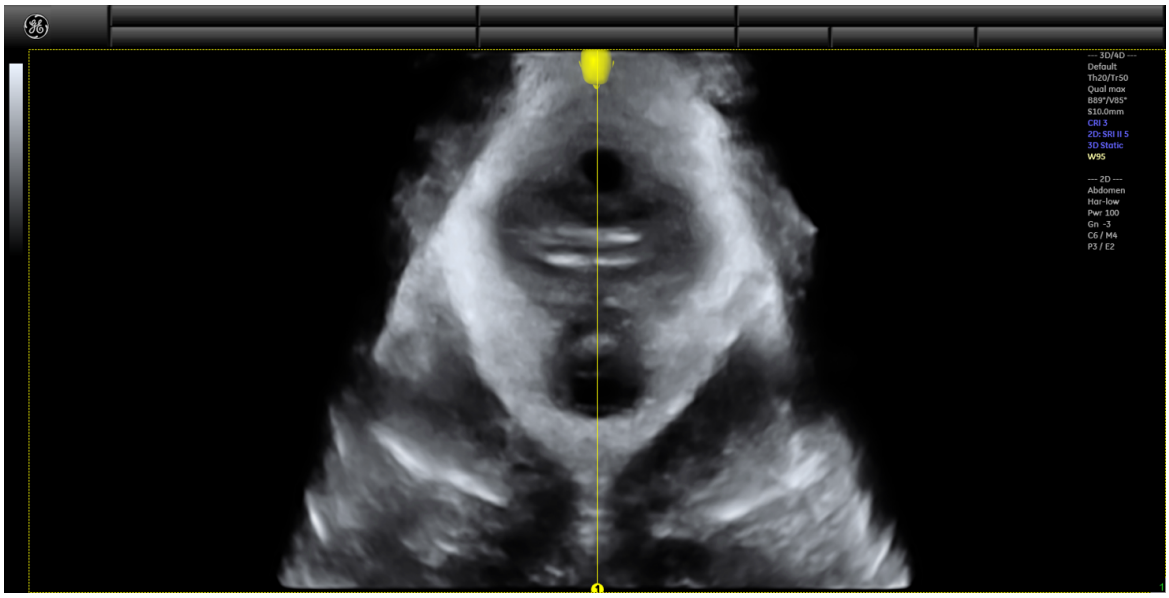
Figure 1



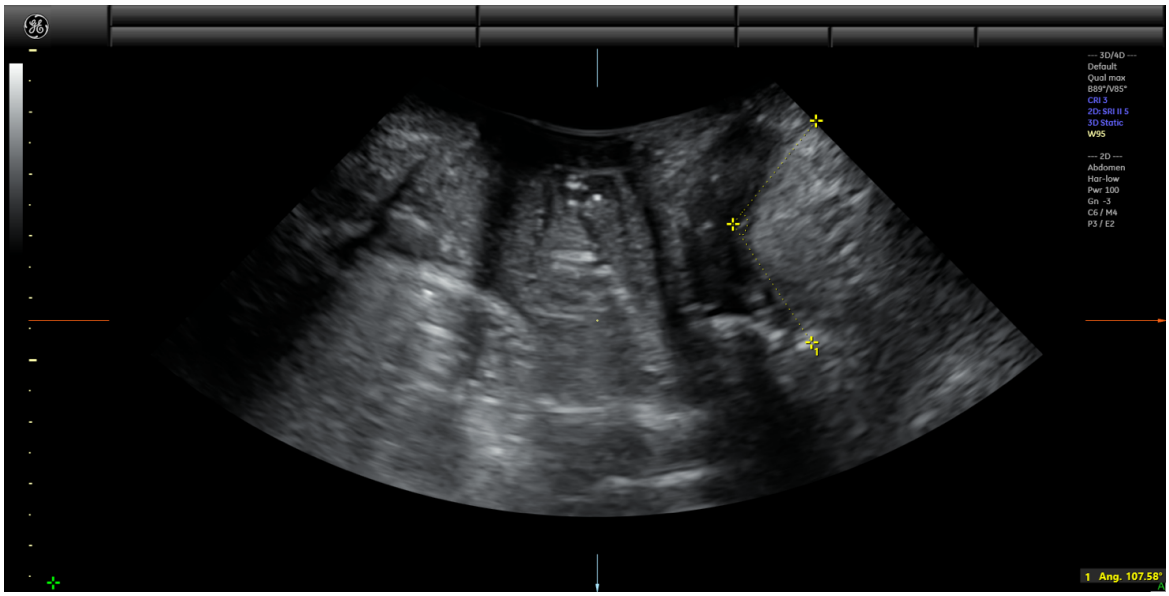
3D image of levator hiatal area

Figure 2



3D image of levator hiatal area

Figure 3



Ano-rectal angle

TABLE 1 Baseline characteristic of study and control group.

	STUDY group (n.96)	**CONTROL group (n. 88)**	**p value**
Age (years), mean+/- DS	33,6 ± 7,2	35,7 ± 6,9	NS[a]
Body Mass Index (kg/m2), mean +/- DS	21,8 ± 3,1	22,6 ± 3,9	NS[a]
Smoke, number (%)	10 (10,4%)	10 (11,4%)	NS[b]

[a] Student's t-test

[b] Chi Square Test

TABLE 2 Pain symptoms and endometriotic localizations (confirmed after laparoscopic excision) of the study group (96 women).

Pain symptoms, NRS score (mean ± SD)	
-Dyspareunia	5.80 ± 3.35
-Chronic Pelvic Pain	5.47 ± 3.55
-Dysuria	2.21 ± 3.21
-Dyschezia	6.67 ± 2.81
Endometriosis localization n (%)	
-Rectum	96 (100%)
-Ovary	33 (34.4 %)
-Peritoneum	8 (8.3%)
-Vagina	2 (2.1%)
-Recto vaginal septum	27 (28.1%)
-Sigmoid	11 (11.5%)
-Parametrium	18 (18.8%)
-Utero-sacral ligaments	11 (11.5%)
-Bladder	4 (4.2%)

NRS: numerical rating scale

Table 3 Static (at rest) and dynamic (during contraction and during Valsalva manoeuvre) anorectal angle at transperineal ultrasound in study and control group. Values are expressed as mean (± standard deviation).

		Study group (n.96)	***Control group (n. 88)***	***P value***
At rest	Anorectal angle (grade)	109.8±10.8	113.7±13.0	0.03*
During PFM contraction	Anorectal angle (grade)	102.5±12.2	103.4±12.8	NS

* student's T- test

Table 4 Static (at rest) and dynamic (during contraction and during Valsalva manoeuvre) anorectal angle at transperineal ultrasound in women belonging to study group with or without constipation according to KESS results. Values are expressed as mean (± standard deviation).

		Constipation (n.35)	***No constipation (n. 61)***	***P value***
At rest	Anorectal angle (grade)	106,6±10,9	111,6±10,5	0.03*
During PFM contraction	Anorectal angle (grade)	100,7±16,7	103,5±8,6	Ns

* Student's T- test

KESS ITEM	0 pt	1 pt	2 pt	3 pt	4 pt	Results of study group mean (±SD)	Spearman correlation values between results and anorectal angle at rest	p
Duration of constipation	0 – 18 months	18 months – 5 years	5 – 10 years	10 – 20 years	> 20 years (or all life)	1.17 ± 1.14	- 0.160	Ns
Laxative use	None	Laxatives prn or for short duration	Laxatives regular, long duration	Laxatives long duration, ineffective		1.17 ± 1.05	0.044	Ns
Frequency of bowel movement	1-2 times / 1-2 days	2 or less times / week	Less than once per week	Less than once per 2 weeks		1.11 ± 1.23	- 0.003	Ns
Unsuccessful evacuatory attempts	Never / rarely	Occasionally	Usually	Always = manual evacuation		0.91 ± 1.05	- 0.005	Ns
Feeling incomplete evacuation	Never	Rarely	Occasionally	Usually	Always	1.02 ± 1.09	- 0.021	Ns
Abdominal pain	Never	Rarely	Occasionally	Usually	Always	1.29 ± 1.42	0.005	Ns
Bloating	Never	Perceived by patient only	Visible to others	Severe causing satiety or nausea	Severe with vomiting	1.52 ± 1.20	- 0.070	Ns
Enemas / Digitation	None	Enemata / suppositories occasionally	Enemata/suppositories regular	Manual evacuation occasionally	Manual evacuation always	1.13 ± 0.87	- 0.167	Ns
Time taken in lavatory/attempt	< 5 minutes	5-10 minutes	10-30 minutes	> 30 minutes		0.98 ± 0.88	- 0.107	Ns
Difficulty evacuating causing a painful evacuation effort	Never	Rarely	Occasionally	Usually	Always	1.57 ± 1.26	- 0.433	**< 0.001**
Stool consistency (without laxatives)	Soft / loose / normal	Occasionally hard	Always hard	Always hard, usually pellet-like		1.27 ± 1.05	- 0.190	Ns
Total KESS						13.20 ± 7.34	- 0.155	Ns

Table 5 KESS Questionnaire results for study group (96 women)