

Transvaginal ultrasound evaluation of the pelvis and symptoms after laparoscopic partial cystectomy for bladder endometriosis

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Abstract

Objective: To evaluate transvaginal sonography (TVS) findings after laparoscopic partial cystectomy for bladder endometriosis and to correlate postsurgical ultrasound findings with symptoms.

Material and Methods: A retrospective study including women who underwent laparoscopic partial cystectomy for bladder endometriosis. Within 12 months after surgery, TVS examination was conducted in all patients to evaluate the bladder morphology, and the presence of any postsurgical sonographic findings of the pelvis. Painful symptoms were assessed using a visual analogue scale.

Results: A total of 40 women were included. At the follow-up visit, 25 patients were receiving medical treatment while 15 had declined post-surgical therapy and had tried to conceive. The presence of bladder deep-infiltrating endometriosis (DIE) was found in nine (22.5%), fibrotic thickening of the bladder wall was found in 15 (37.5%), and normal bladder morphology was observed in 16 (40%). There was a correlation between anterior adenomyosis and bladder DIE, and fibrotic thickening of the bladder. Patients with TVS signs of bladder DIE and anterior adenomyosis suffered more dysmenorrhea and dysuria than patients with normal bladder.

Conclusion: Post-operative TVS can detect the alteration of pelvis and could explain the causes of the persistence of symptoms. (J Turk Ger Gynecol Assoc 2022; 23: 145-53)

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Introduction

Bladder involvement is frequent in urinary tract endometriosis, occurring in 70-85% of cases (1,2) and has been reported in 20-53% of women with deep-infiltrating endometriosis (DIE) and in 0.3-12% of all women affected by endometriosis (3). The bladder base and bladder dome are frequently involved and, more rarely, the trigone (4,5).

Bladder DIE can cause dysuria, cramping, painful voiding, urinary frequency, recurrent urinary tract infections, dysmenorrhea, dyspareunia, urinary bleeding (hematuria)

and, in severe cases, ureteral stenosis and occlusion (6,7). Nonetheless, 25-30% of women with bladder DIE are pain-free (8). The symptoms are generally caused by inflammatory factors irritating the bladder wall and by associations with other deep endometriotic lesions and adenomyosis.

The aim of treatment for bladder DIE is to resolve symptoms and improve fertility. Treatment can be expectant, medical, or surgical. Patients who respond to medical management can continue treatment until they achieve optimal quality of life and to reduce the risk of disease progression. Surgery should always be performed in patients with painful



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symptoms or infertility who do not respond to medical treatment (8).

Surgical techniques include shaving the superficial bladder lesions, cystoscopy approaches, and laparoscopic resection of the involved bladder wall (9). Laparoscopic resection of bladder endometriosis is associated with the best results in terms of long-term outcomes compared to other surgical techniques (10). Complications of this surgery include anastomotic stricture, anastomotic leak, utero-vaginal fistula, pelvic ureter injuries, and bladder hemorrhage (1). The complication rate is higher when the trigone or intramural ureter are involved. Surgery may also improve fertility, even when not removing all endometriotic lesions (11). Many studies have evaluated symptoms after partial bladder resection (12-15), but to date none has described bladder wall morphology. In fact, as with all surgical procedures, fibrotic tissues, adhesions, and residual disease can be expected after bladder DIE resection.

Transvaginal sonography (TVS) and magnetic resonance imaging are currently used as preoperative methods to diagnose bladder DIE, with the former being the first-line imaging modality (5,16,17). TVS can accurately evaluate bladder walls and the ureter pelvic segment (5,17). Furthermore, with dynamic TVS examination, it is possible to evaluate the presence of the “sliding sign” between the uterus and other organs of the pelvis, which can be a useful diagnostic tool for evaluating adhesions (18,19).

This retrospective study was performed with patients who had undergone laparoscopic partial bladder resection for DIE, and were subsequently evaluated by TVS for bladder features and ultrasound findings of the pelvis after surgery. Furthermore, the TVS findings were subsequently correlated to specific post-operative symptoms.

Material and Methods

This retrospective observational study included patients with bladder DIE who underwent laparoscopic partial cystectomy in order to remove the endometriotic lesion from 2014 to 2019 and had a TVS scan within 12 months after surgery (2015-2020). The inclusion criteria were: premenopausal women with previous laparoscopic partial bladder resection for DIE and histological confirmation; TVS examination 12 months after surgery; and accurate history, symptoms, and surgical reports. The exclusion criteria were: laparoscopic surgery for endometriosis without bladder resection; menopausal status; reproductive tract cancer; or absence of accurate history, symptoms, and surgical reports.

Ethical approval

All enrolled patients gave their informed consent before the TVS examination to allow the use of their data. The study

was approved by Ethics Committee of University of Rome Tor Vergata (approval number: 194/21, date: 22.09.2021).

Clinical examination

Full patient histories and symptom evaluation, utilizing a visual analogue scale (VAS) system, were recorded before the scan. The complete medical, surgical, and obstetrical history included the patients' age, body mass index [(BMI) in kg/m²], age at menarche, gravidity, parity (that is, the total number of all prior pregnancies, spontaneous pregnancy loss, and/or live births), and the mode of delivery were recorded. Previous uterine surgery (myomectomy or caesarean section) was recorded. Infertility was defined as no pregnancy after 12 months of unprotected intercourse. Patients were also asked about any medication that they were taking, including the use of analgesics for painful periods. Hormonal treatments were recorded according to type, for example, progestin, estrogen, and gonadotropin releasing hormone analogs, and mode of use (continuous or cyclic). The presence of the following post-surgical painful symptoms was evaluated before performing the follow-up scan: dysmenorrhea, dyspareunia, dysuria, dyschezia, recurrent cystitis, and hematuria. Symptom intensity was evaluated through the VAS system, using a 10 cm line with the extreme points 0 and 10 corresponding to “no pain” and “maximum pain”, respectively. The presence of heavy menstrual bleeding (HMB) was also investigated. Patients were asked about the frequency and duration of menstrual periods and any episodes of intermenstrual bleeding. HMB was determined by subjective evaluation of the patient; this evaluation has been reported in the literature as reliable and comparable to the pictorial blood-loss analysis chart score (20,21).

Ultrasound examination

All TVS examinations and interpretation were performed by the same experienced sonographer, using a 4-9 MHz probe, with a three-dimensional (3D) facility (Voluson E6, GE Medical Systems, Zipf, Austria). Briefly, a conventional 2D ultrasound with greyscale and power Doppler for assessment of the pelvis was performed. Bladder was always evaluated with medium fullness and patients were therefore asked not to completely empty their bladder before the TVS scan as this made it possible to evaluate the structure of the walls and the presence of lesions or irregularities of the wall layers. The TVS probe was positioned in the anterior vaginal fornix and gently swung from side-to-side, visualizing the mucosa and muscularis for focal thickening and for hypoechoic linear or nodular lesions. Suspected bladder adhesions of the vesico-uterine pouch were evaluated by the presence or absence of the “sliding sign” between the uterus and the bladder.

In the TVS bladder assessment after surgery, lesions were described in terms of their size and location according to the following three zones (5,22):

- 1) The bladder base, which also included the trigone;
- 2) The bladder dome, which lay superior to the trigone/base and was intra-abdominal, with the demarcation point between the base and the dome of the bladder being the vesico-uterine pouch;
- 3) And the bladder anterior retro-peritoneal portion, which corresponded to the part of the bladder in the Retzius space.

The trigone was observed by TVS as lighting thicker bladder wall within 3 cm of the urethral opening, delimited by the two ureteral orifices laterally. The intramural and pelvic segment of the ureter was examined by moving the TVS probe from the midline toward the pelvic sidewall.

Bladder lesions after surgical resection of bladder endometriosis were defined as follow:

- Bladder endometriosis was defined as the presence of a nodule or a lesion that infiltrated the muscular layer of the bladder wall and did not include cases of adhesions or the presence of limited thickening or irregularities of the bladder internal wall (mucosa) or serosa. Bladder nodules or residual

DIE appeared as hypo- or hyper-echoic linear or spherical thickening of the bladder wall, with or without cystic areas and regular/irregular margins, bulging towards the lumen, involving mostly the muscularis and serosa (Figure 1).

- Fibrotic thickening was identified as a hyperechoic bladder wall, which was thicker than the normal adjacent wall, without a well-defined lesion or nodule (Figure 2);

- Irregularities of the bladder wall were defined as small hypo- or hyper-echoic lines or interruptions or invaginations of the bladder wall (Figure 2).

The dimensions of the bladder DIE (measured in three orthogonal planes), as well as irregularities of the bladder wall, were recorded in addition to the distance between the lesion and the trigone and the meatus and intramural part of the ureter.

The uterus, myometrium, and endometrium were also scanned. The 2D examination was followed by the acquisition of the 3D volume of the uterus with and without power Doppler. This was important for evaluating the uterine cavity morphology and the myometrium to detect typical ultrasound signs of adenomyosis in the outer myometrium and the junctional zone, as previously described (23-25).

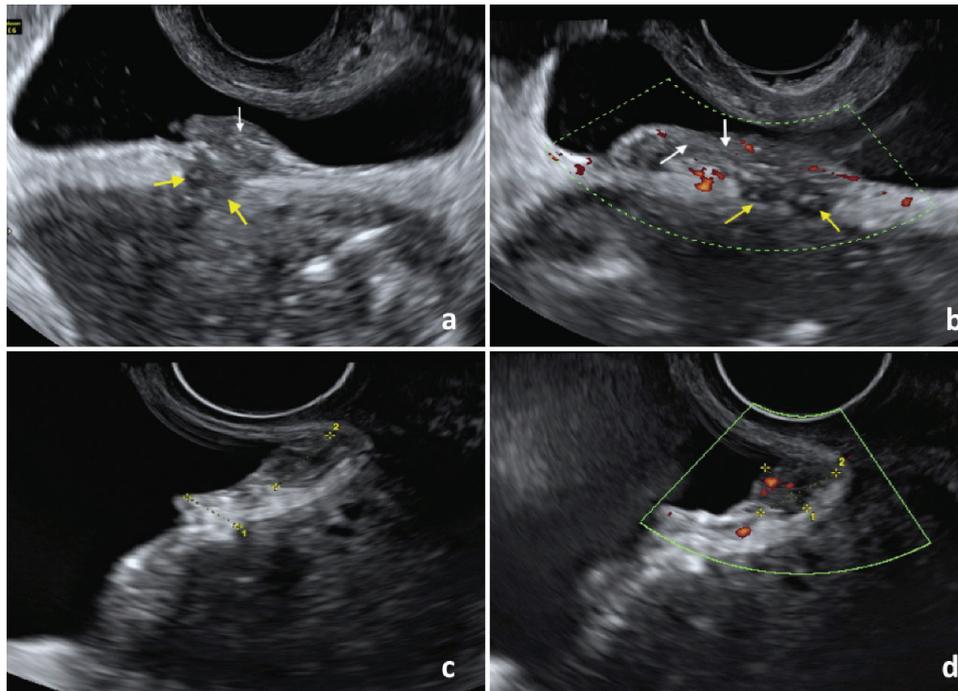


Figure 1. Residual endometriosis of the bladder wall after bladder resection for deep endometriosis TVS (view of the same case): a) 2D grey scale transverse view of the bladder; b) longitudinal view of the bladder lesion with power Doppler. Note the hypoechoic non-vascularized (white arrows) lesion interrupting the bladder wall and the surrounded hyperechoic fibrotic tissue (white arrows). In c) and d) another case of residual endometriosis in 2D grey scale c) and power Doppler view d). Note in c) the hypoechoic lesion the bladder wall attached to the uterus (yellow line 2) and the surrounded hyperechoic fibrotic scar tissue (yellow line 1). In d) the hypoechoic endometriotic lesion showed few vessels at power Doppler (yellow line 1 and 2) consistent with active endometriosis

TVS: Transvaginal sonography, 2D: Two-dimensional

Diagnosis of adenomyosis was made when at least two of the typical ultrasound features of the disease (intramyometrial cystic areas, hyperechoic intramyometrial islands, globally enlarged uterus, asymmetrically enlarged uterus, myometrial hypoechoic linear striations, irregular or infiltrated junctional zone) were observed. The location of the adenomyosis inside the uterus (anterior, posterior, lateral) was noted.

Furthermore, the uterus, and the bladder, and the suspected anterior adhesions between uterus and bladder were assessed by the absence of the “sliding sign”.

The adnexa, pouch of Douglas, further pelvic organs (rectum, rectosigmoid junction, tubes) and other sites [parametria, rectovaginal septum (RVS), retro cervix, uterosacral ligaments (USL)] were examined to look for features of endometriosis according to a previously described ultrasound mapping system (5,16). The presence of DIE of the posterior pelvic compartment was recorded according to the specific sites, including the RVS, USL, vagina, torus, and rectosigmoid. Ovarian endometriosis and adnexal adhesions were accurately described.

All data were stored as 2D still images, 2D video-clips, and 3D volumes.

Surgical treatment

Laparoscopic partial resection of bladder endometriosis was performed in all patients by a multidisciplinary group, including gynecologist and urologist. The indication was the presence of bladder DIE lesions associated with painful symptoms that were unresponsive to medical therapy. The shaving technique and cystoscopy treatment were not considered due to the high risk of disease persistence. For all patients, the surgical and medical reports were analyzed to confirm bladder resection, to record other endometriotic lesions that had been removed, and to assess difficulties and complications during and after the surgery. Ureteral catheters were employed if the lesion involved the trigone or the nodule was <2 cm from the ureteral ostia. Only 21 of the patients needed a ureteral stent before surgery by cystoscopy performed by a urologist. The ureteral catheters were removed at the end of surgical procedure in all 21 patients. During the surgery the bladder nodule was then identified, and a bladder incision and radical excision of the disease was performed; the latter was carried out for 24 lesions of the bladder base, 14 lesions of the bladder dome, one retroperitoneal lesion of the Retzius space, and one lesion involving the trigone. In all cases, the bladder was sutured by a double-layered intracorporeal laparoscopic knot.

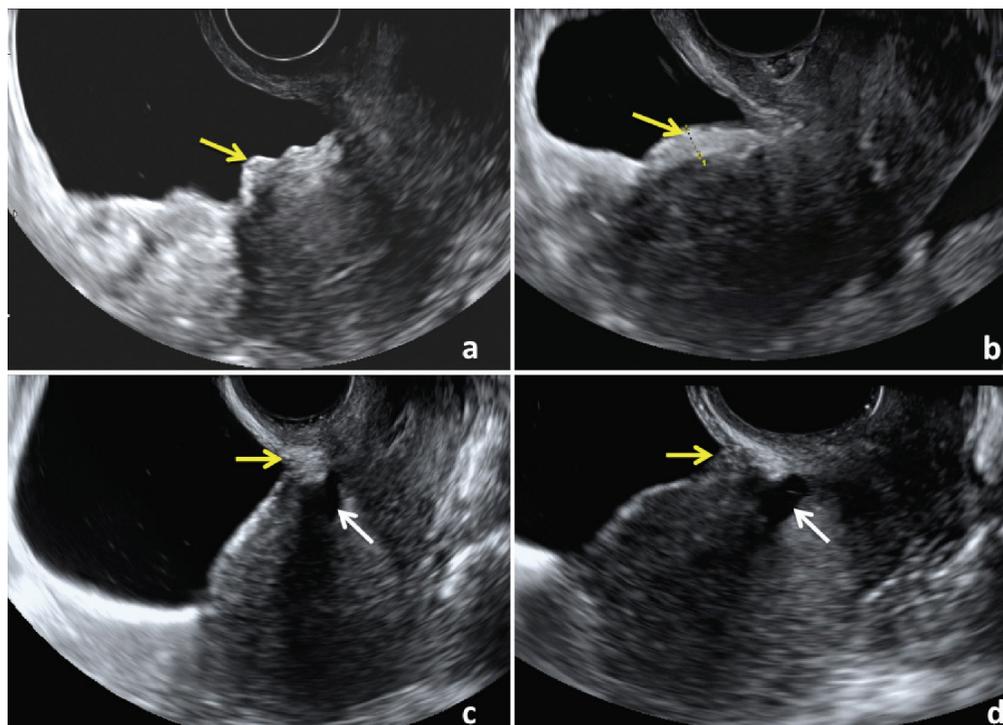


Figure 2. Four different cases of fibrosis and irregularities of the bladder wall after resection of an endometriotic nodule: a) small incision scar of the bladder wall (yellow arrow); b) hyperechoic thickening of the bladder wall (yellow arrow). Note the comparison of thickness with the normal adjacent wall (yellow line 2); c) residual fibrotic thickening of the bladder wall in patients with anterior adenomyosis (white arrow). Note the hyperechoic adenomyotic zone inside the myometrium and the asymmetric thickening of the uterine wall (orange arrow endometrial stripe); d) hypoechoic incision scar of the bladder wall (yellow arrow) adherent to the uterine adenomyosis (white arrow) with asymmetric thickening of the uterine wall (orange arrow endometrial stripe)

Concomitant pelvic endometriosis, such as endometrioma or posterior DIE, were removed, if indicated. Adenomyosis was treated with radiofrequency ablation in case of focal presentation, and no other surgical treatment was performed. No hysterectomy was performed. Cystography was performed before removing the Foley bladder catheter on day 7 after the surgery. There were no cases of ureteral endometriosis with ureteral obstruction and ureteral reimplantation. All included patients had stage III-IV endometriosis, according to the Revised American Society for Reproductive Medicine classification of endometriosis 1996. No major complications after surgery were recorded in any of the cases.

Statistical analysis

All patients enrolled in this study were divided into groups as follows: firstly, patients who received hormonal treatment after surgery and patients who did not receive hormonal treatment in order to attempt conception. The specific symptoms were calculated and analyzed. There was a statistical correlation only for dysmenorrhea and for HMB into two groups, so the subsequent statistical analysis was conducted on the total study population.

The prevalence of bladder features was divided into normal bladder, fibrotic thickening/irregularities of the bladder wall, and bladder DIE. The percentage of endometriotic pelvic findings were calculated. TVS findings were analyzed in the following manner:

- By comparing the presence of the TVS findings of pelvic endometriosis with TVS features of the bladder DIE, fibrotic thickening/irregularities of the bladder wall and normal bladder;
- Subsequently by correlating specific symptoms with the presence of TVS features of the bladder DIE, fibrotic thickening/irregularities of the bladder wall and normal bladder.

All continuous variables for population characteristics were expressed in terms of the mean \pm standard deviation, while categorical variables were expressed in terms of frequency and percentage.

Characteristics were compared between groups using the chi-square test for categorical variables and the independent samples t-test or Mann-Whitney U test, as appropriate, for continuous data. Fisher's exact test was used to compare the prevalence. A $p < 0.05$ was considered statistically significant.

Results

Fifty-three patients with laparoscopic partial bladder resection for endometriosis were initially identified. Seven patients were excluded because of incomplete history and symptoms reports, five were excluded for incomplete surgical report and one was excluded because the TVS examination occurred within

12 months of surgery. None of the included patients showed hydronephrosis before or after surgery. Therefore, a total of 40 women were included in this study.

Table 1 shows the characteristics and symptoms of all included patients. Mean age of the study patients was 36.4 ± 5.0 years, most of the patients (55.0%) were nulliparous and 40.0% suffered from infertility. Twelve patients (30.0%) reported previous surgery (myomectomy or caesarean section). Painful symptomatology was reported after surgery; 19 patients (47.5%) had dysmenorrhea, 13 (32.5%) had dyspareunia, and 13 (32.5%) had dysuria.

The total study population was initially divided into the following two subgroups: patients receiving hormonal therapy and patients not receiving hormonal therapy. Following surgery, of the 40 patients included in the study, 25 received medical treatment: 13 patients were prescribed estrogen-progestin contraceptive pills (a cyclic regimen was offered to 10 patients and a continuous regimen was offered to three); and 12 patients were given continuous progestin treatment.

No differences in age, BMI and menarche were observed between the two groups (Table 1), except for parity, dysmenorrhea and HMB. Patients who did not receive hormonal therapy after surgery reported a higher percentage of dysmenorrhea and HMB. However, no other significant differences were found regarding symptoms when comparing those who did and did not receive medical therapy. Since the differences in these two groups were minimal, these two groups were considered together for further analysis.

The TVS endometriosis pelvic findings and the relationship with bladder DIE, bladder fibrotic thickening/irregularities of bladder wall and normal bladder are shown in Table 2. Bladder DIE was detected in nine patients (22.5%), ultrasound findings of bladder fibrotic thickening/irregularities were detected in 15 (37.5%), and normal bladder morphology was seen in 40.0%. Of note, there were 11 patients with bladder fibrotic thickening and four patients with irregularities of bladder wall, so we again considered these two-ultrasound features together.

In the groups with ultrasound findings of bladder DIE and fibrotic thickening, we observed a greater presence of anterior adenomyosis (respectively 77.8% and 80.0%) compared to patients with normal bladder walls (25.0%). Instead, for ultrasound findings of posterior DIE, that is DIE of RVS, USL, vagina, torus, and/or rectosigmoid, and endometrioma, we did not detect statistically significant differences.

In patients with negative "sliding sign" indicating probable anterior adhesions, we observed a statistically significant difference between bladder DIE (88.9%) and fibrotic thickening (86.7%) compared to normal bladder (18.7%). However, when considering patients with anterior negative "sliding sign" without ultrasound findings of adenomyosis, no statistically

significant differences were observed between the three groups.

The correlation between ultrasound bladder features and symptoms is shown in Table 3. Dysmenorrhea was mainly present in patients who had ultrasonographic findings of bladder DIE (77.8%), whereas it was less prevalent in patients with ultrasound findings of normal bladder

morphology (31.2%) and fibrotic thickening (46.6%). Dysuria was statistically significant associated with the presence of bladder DIE (66.7%) compared to patients with ultrasound findings of normal bladder morphology (12.5%). No differences were observed for dyspareunia, HMB, recurrent cystitis and dyschezia regarding the bladder TVS findings.

Table 1. Patients' characteristics and referred symptoms

Patients characteristics	Total population (n=40)	Patients on hormonal therapy (n=25)	Patients not on hormonal therapy (n=15)
Age (years, mean ± SD)	36.4±5.0	37.6±4.8	35.1±4.0
BMI (mean ± SD)	23.5±2.8	23.1±3.5	22.1±4.5
Menarche (years, mean ± SD)	12.5±1.8	12.2±2.2	12.8±1.8
Nulliparity (n, %)	22 (55.0%)	9 (36.0%)*	13 (86.7%)*
Primiparity (n, %)	8 (20.0%)	6 (24.0%)	2 (13.3%)
Multiparity (n, %)	3 (7.5%)	3 (12.0%)	0 (0.0%)
Primary infertility (n, %)	16 (40.0%)	9 (36.0%)	7 (46.7%)
Previous uterine surgery (n, %)	12 (30.0%)	9 (36.0%)	3 (20%)
Symptoms after surgery			
Dysmenorrhea	19 (47.5%)	8 (32.0%)**	11 (73.3%)**
Dyspareunia	13 (32.5%)	8 (32.0%)	5 (33.3%)
Dysuria	13 (32.5%)	8 (32.0%)	5 (33.3%)
Recurrent cystitis	2 (5.0%)	2 (8.0%)	0 (0.0%)
Heavy menstrual bleeding	6 (15.0%)	1 (4.0%)***	5 (33.3%)***
Dyschezia	10 (25.0%)	6 (24.0%)	4 (26.7%)
Patients' characteristics and referred symptoms after surgery in the total study population and the following subgroups: - Patients receiving medical therapy (continuous or cyclic hormonal therapy), - Patients not receiving medical therapy (mostly because they are trying to conceive). *p<0.05 pts on hormonal treatment vs. not on hormonal therapy, **p<0.05 pts on hormonal treatment vs. not on hormonal therapy, ***p<0.05 pts on hormonal treatment vs. not on hormonal therapy, SD: Standard deviation			

Table 2. Transvaginal ultrasound findings after partial bladder resection for DIE

TVS findings in patients (n, % of total)	Bladder DIE (n=9)	Fibrotic thickening/wall irregularities (n=15)	Normal bladder walls (n=16)
Adenomyosis 33 (82.5%)	9 (100%)	14 (93.3%)	10 (62.5%)
Anterior adenomyosis 23 (57.5%)	7 (77.8%)*	12 (80.0%) [†]	4 (25.0%)** [†]
Endometrioma 6 (15.0%)	1 (11.1%)	2(13.3%)	3 (18.7%)
Posterior DIE 22 (55.0%)	7 (77.8%)	5 (33.3%)	10 (62.5%)
Total adhesions 37 (92.5%)	9 (100.0%)	13 (86.7%)	15 (93.7%)
Anterior negative sliding sign 24 (60.0%)	8 (88.9%) [‡]	13 (86.7%) [§]	3 (18.7%) ^{§§}
Anterior negative sliding sign without adenomyosis, 12 (30.0%)	3 (33.3%)	2 (13.3%)	7 (43.7%)
TVS findings after laparoscopic bladder resection for deep-infiltrating endometriosis (DIE) in the total study population and correlation to TVS bladder features. *p<0.05 residual bladder DIE vs. normal bladder wall, [†] p<0.05 fibrotic thickening of the bladder wall vs. normal bladder wall, [‡] p<0.05 residual bladder DIE vs. normal bladder wall, [§] p<0.05 fibrotic thickening of the bladder wall vs normal bladder wall, TVS: Transvaginal sonography, TVS: Transvaginal sonography			

Table 3. Correlation between TVS bladder features and the specific symptoms in patients after laparoscopic bladder resection for DIE

Symptoms after surgery	Bladder ultrasound findings		
	Bladder DIE (n=9)	Fibrotic thickening/wall irregularities (n=15)	Normal bladder walls (n=16)
Dysmenorrhea 19 (47.5%)	7 (77.8%)*	7 (46.6%)	5 (31.2%)*
Dyspareunia 13 (32.5%)	3 (33.3%)	4 (26.6%)	6 (37.5%)
Dysuria 13 (32.5%)	6 (66.7%)**	5 (33.3%)	2(12.5%)**
Recurrent cystitis 2 (5.0%)	1 (11.1%)	1 (6.7%)	0 (0.0%)
HMB 6 (15.0%)	1 (11.1%)	1 (6.7%)	4 (25.0%)
Dyschezia 10 (25.0%)	2 (22.2%)	2 (13.3%)	6 (37.5%)

Correlation between TVS bladder features and the specific symptoms in patients after laparoscopic bladder resection for DIE. *p<0.05 residual bladder DIE vs normal bladder wall, **p<0.05 residual bladder DIE vs normal bladder wall, TVS: Transvaginal sonography, HMB: heavy menstrual bleeding

Discussion

This study described the TVS features of patients who were surgically treated with laparoscopic partial bladder resection for DIE. Many previous studies have described complications and symptoms following this type of surgery (26). The present study focused on the post-operative imaging of bladder features and pelvis. Laparoscopic partial bladder resection gave the best results in terms of long-term outcomes compared with other surgical techniques (10). The shaving technique and cystoscopy treatment were associated with fewer complications than laparoscopic resection but the results were often incomplete in terms of residual disease. A general improvement of pain after bladder resection has previously been observed, although many studies have reported a decrease in the severity of symptoms rather than total regression (9,15). In fact, dysuria has been reported in up to 70% of patients with bladder endometriosis (27), and a positive correlation was observed between severity and lesion diameter and so, after total removal or reduction in size, it is common to find fewer symptoms. Compared to surgical treatment for DIE of the pelvic posterior compartment (involving the USL, vagina, parametrium, inferior hypogastric plexus, and splanchnic nerves) (28,29), bladder surgery that does not involve the trigone has been reported to result in fewer complications and reduced risks of anatomical nerve damage (30). However, such as in the ultrasound evaluation after surgical treatment for bowel endometriosis (31), we observed some alterations of the pelvis after partial bladder resection for DIE.

Despite accurate standardization of the procedures, the reduction but also the persistence of painful symptoms after

surgery for anterior DIE has often been reported. We evaluated the anatomical status of the pelvis at least one year after surgery using TVS mapping, particularly of bladder morphology, and correlated these ultrasound findings with post-surgical painful symptoms. These ultrasound findings could shed light on the possible mechanisms responsible for symptoms after surgery. Table 1 shows both the patients' characteristics and their post-operative symptoms. Most important was the mean age (36.4±5.0) of the patients that showed how the moderate-severe endometriosis (stage III/IV) is more common in this age-range than in young girls in whom endometriosis occurs at earlier stages (32-34). Another important characteristic was the percentage of infertile women (40%) according to the literature (2). Regarding post-operative symptoms, the results agree with the data presented in the literature (2,15), in which most patients have reported some painful bladder symptomatology. In terms of dysuria, which was the major bladder symptom reported, we found a prevalence of 32.5% in our study population, 12.5% in cases with normal bladder morphology after surgery without any ultrasound signs of bladder DIE or fibrotic thickening, and 66.7% in those who had ultrasound signs of disease.

Persistent painful symptoms might be attributable to the presence of endometriotic disease, but also to anterior adenomyosis, which is associated with most cases of bladder DIE and fibrotic thickening. Furthermore, anterior negative "sliding sign" may be associated with previous bladder surgery and thus correlated to painful symptoms. However, in the presence of isolated anterior negative "sliding sign" without bladder DIE and anterior adenomyosis, symptoms seem to be less severe.

In fact, bladder DIE was most associated to anterior adenomyosis. This could be explained by the fact that even when treating the bladder disease, it was difficult to remove the lesion from the contextual anterior adenomyosis (35). By contrast, anterior adenomyosis could be the cause of the bladder DIE which remained in situ and thus constituted the main disease.

Some studies hypothesized that painful symptoms might be attributable to other causes, such as pelvic floor dysfunction, bladder pain syndrome, interstitial cystitis, and central sensitivity syndromes and could explain the persistence of pain in the patients without ultrasound sign of disease or adenomyosis (36,37). This is an important point because an accurate TVS evaluation could be useful to choose the appropriate therapeutic management in the presence of persistent symptoms. In fact, these symptoms could be related to endometriotic disease and adenomyosis requiring hormonal therapy. Otherwise, they could be related to other causes, such as central sensitivity syndrome, pelvic floor dysfunction, interstitial cystitis requiring a different diagnostic and therapeutic management (38).

Therefore, it is important to perform an accurate pre-surgical assessment of pelvic endometriosis/adenomyosis and to offer presurgical counselling to make patients aware of the possibility of residual bladder lesions in case of anterior adenomyosis. Symptoms persisting after bladder surgery could be due not only to residual disease but to the association with anterior adenomyosis and, in the absence of ultrasound sign of these pathologies, to the other causes listed above.

Study Limitation

A limitation of this study was the retrospective nature. Another limitation was the absence of pain score evaluation before surgery in all patients, as we know that all included patients were referred for painful symptoms that were unresponsive to medical therapy and therefore underwent surgery. Probably this information could be useful to quantify the improvement of the quality of life after the surgery, although this type of comparison data has been previously reported. A further limitation was the small sample, so there is a need for more studies, with larger samples. Finally, a possible critical issue is the definition of residual or recurrent bladder DIE. We cannot be sure if the lesions are residual or recurrent, but we described the presence of endometriotic lesions that infiltrated the muscular layer of the bladder wall.

Conclusion

This study showed that during the follow-up of patients who underwent partial bladder resection for DIE, symptoms sometimes remained and TVS pelvic anatomical findings were

often abnormal. Post-operative TVS could be useful to choose the appropriate management for each patient.

Ethics Committee Approval: *The study was approved by Ethics Committee of University of Rome Tor Vergata (approval number: 194/21, date: 22.09.2021).*

Informed Consent: *All enrolled patients gave their informed consent before the TVS examination to allow the use of their data.*

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