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Outcome of sonography-based minimally-invasive surgery for deep infiltrating endometriosis of the ureter and urinary bladder – a retrospective cohort study

Running headline: Sonography-based minimally-invasive surgery for DIE

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Abstract

Introduction: To evaluate the accuracy of transvaginal sonography for preoperative detection of bladder endometriosis and surgical outcomes regarding fertility and pain symptoms of women with urinary tract endometriosis. *Material and Methods:* Retrospective cohort study of consecutive patients with urinary tract endometriosis undergoing laparoscopic partial cystectomy and/or ureterolysis/decompression, ureteric resection and end-to-end anastomosis or ureteroneocystostomy for ureteral stenosis and hydronephrosis. *Results*: Out of 207 patients with deep infiltrating endometriosis, 50 exhibited urinary tract endometriosis consisting of 30 patients with bladder endometriosis and 23 women with solitary or additional hydronephrosis. Sensitivity, specificity, positive and negative predicitive value, positive/negative likelihood ratios and test accuracy for transvaginal sonography detecting bladder endometriosis were 93%, 99%, 97%, 99%, 155.5, 0.07 and 98.6%. All women with bladder endometriosis underwent partial cystectomy. In cases of hydronephrosis, 14 conservative ureterolysis/decompressions, 6 ureteral resection anastomoses and 3 ureteroneocystostomies were performed. Duration of surgery was 205 minutes (range 89-365 minutes), avarage blood loss was 1.6 g/dL (range 0.3-4.6 g/dL) and hospital stay on average 8 days (range 2-16 days) and the conversion rate was 4%. We observed 5 grade III complications. After a median follow-up of 23 months dysmenorrhea (7.6 to 1.6; $p<0.001$), dyspareunia (3.0 to 0.9, $p<0.001$), dysuria (3.3 to 0.2; $p<0.003$) decreased and quality of life increased (3.3 to 8.1; $p<0.001$). The overall clinical pregnancy rate and life birth rate was 46% and 18%. *Conclusions***:** Laparoscopic surgery for urinary tract endometriosis is effective regarding treatment of hydronephrosis, reduction of pain symptoms and may improve fertility. Transvaginal sonography is highly accurate for presurgical detection of bladder involvement.

Key words

endometriosis, urinary bladder, transvaginal sonography, hydronephrosis, ureteral stenosis

Abbrevations:

BE bladder endometriosis,

DIE deep infiltrating endometriosis;

NPV negative predicitive value

PC partial cystectomy

PPV positive predicitive value

TVS transvaginal sonography,

UCN ureterocystostomy

UE ureteral endometriosis

ULD ureterolysis and decompression,

URA ureteral resection anastomosis,

UTE urinary tract endometriosis

Key message

Laproscopic partial cystectomy is a safe therapeutical option for treatment of deep infiltrating endometriosis affecting the bladder and can be based on transvaginal sonography findings. Ureterolysis and decompression is feasible in the majority of women with deep infiltrating endometriosis causing hydronephrosis.

Introduction

Deep infilrating endometriosis (DIE) is defined as infiltrative growth of extrauterine endometrial glands and stroma extending below the peritoneal surface >5 mm (1). DIE affecting the urogenital tract, i.e. the urinary bladder and/or ureters often causing ureteric obstruction and secondary hydronephrosis has been observed in 19-53% of patients with DIE (2). Within this, bladder endometriosis (BE) apperars to occur more frequently than ureteral endometriosis (UE) and hydronephrosis (3), (4). Symptoms related to BE often include frequency, urgency, bladder pain,

dysuria and hematuria but are not necessarily present in all patients with bladder disease (4). In addition, secondary hydronephrosis does not occur abruptly but as a slowly progressing obstructive mechanism thereby often lacking symptoms such as flank pain (2). It has therefore been suggested to include kidney scans in women with suspected DIE in ordert to rule out secondary hydronephrosis. Transvaginal sonography (TVS) has been proven fundamental in diagnosing BE (5). However, test accuray seems to be operator-and anatomical-site dependent with sensitivities ranging between 25% and 100% but high specificity rates (4).

The primary surgical therapy option for symptomatic bladder BE is laparoscopic partial cystectomy (PC) which can be viewed as the gold standard technique and should involve complete, full thickness resection of the area affected by DIE (4). In contrast to BE where conservative treatment with oral contraceptives can be considered, ureteral involvement and hydronephrosis demands surgical decompression in order to avoid loss of renal function. The mode of surgery and surgical therapy of choice is, however, unclear since various ways to relieve compression *of the* ureteral wall in cases of non-infiltrating but obstructive disease or treat obstruction by intrinsic, full-thickness infiltration of the ureter by DIE have been described (6). These include decompression by extensive ureterolysis (ULD), segmental resection of the infiltrated ureter followed by end-to-end anastomosis (URA) and ureterocystostomy (UCN) via the psoas-hitch technique or Boari-flap technique (6). Within this, the type of procedure for UE and hydronephrosis depends on various factors: depth and extent of ureteral infiltration, location of DIE and finally surgical experience in an interdisciplinary setting commonly involving gynaecologists and urologists. The goal of the present analysis was to evaluate the accuracy of TVS for non-invasive diagnosis of BE and to describe the perioperative and postoperative outcomes of patients undergoing laparoscopic surgery for symptomatic BE and/or UE with hydronephrosis based on TVS-guided planning of minimal-invasive surgery performed by a multidisciplinary team in a tertiary referral center setting.

Material and methods

From January 2011 to March 2017, a total of 207 women underwent surgical treatment for DIE out of which 50 showed involvement the urinary tract (UTE). All preoperative scans and surgical procedures were perfomed in our departments by one main gynaecological surgeon (GH) in a multidisciplinary team setting consisting of of 2 urological surgeons (M.L; N.S) and 5 colorectal surgeons (B.D, T.B, M.D, F.B and F.H). The departments are linked tertiary referral centers for patients with severe endometriosis. Over the study period, a total of 207 women with DIE including 136 cases with colorectal resections and 71 women with DIE of other locations (vagina, rectovaginal septum - RVS) were treated surgically. Fifty out of 207 patients exhibited UTE. Only patients with histologically verified DIE affecting the urinary bladder and/ or patients with DIE causing ureteric obstruction (>

1cm) leading to secondary hydronephrosis confirmed by abdominal sonography, magnetic resonance imaging (MRI) and scintigraphy (MAG-3) were included in the present study. All patients were recruited from our pelvic pain clinic and underwent preoperative TVS and clinical examination by one person (GH) followed by renal sonography to diagnose possible hydronephrosis (7). Clinical data including age, body mass index, comorbidities, paritiy, previous surgical treatments and symptoms described by a numerical 10-point analogue rating scale for dysmenorrhea, dyspareunia, dyschezia and dysuria and quality of life were evaluated preoperatively. Women who failed to achieve a clinical pregnancy > 12 months or more of regular unprotected intercourse were considered infertile. Intraoperative details were noted and a postoperative check-up was performed at 2 months followed by a telephone survey at the time of re-evaluation of data in order to update the information on symptoms, fertility and bladder/renal function.

Surgical procedure and postoperative managment

Surgical treatment which was indicated on the basis of renal function imparment, pain symptoms and/or infertility was performed by a multidisciplinary team. All bladder resections and cases of ureterolysis or utereral resection with ureterouretostomy were performed by one gynaecological surgeon (G.H.). UCN and bowel resections were perfomed together with the urological and gastrointestinal surgeon in a team setting. All procedures were initially performed laparoscopically under general anaesthesia using 4 ports with single-shot antibiotic treatment i.v. one hour prior to surgery. PC was performed laparoscopically in all cases via dissection of the vesicouterine space and paravesical fossae followed by complete resection and closure with either a single layer continuous resorbable suture or combined interrupted suture. A bladder catheter was left in place for 7-8 days postoperatively followed by cystography. Ureteral stents were appplied preoperatively in cases were cystoscopy performed at the beginning of the procedure showed proximity to the ureter.

In cases of DIE extending to the pelvic sidewall causing hydronephrosis surgical steps were as follows: adhaesiolysis of the physiological attachment of the sigmoid followed by identification of the left ureter. The peritoneum was then further opened to identify the hypogastric plexus on both sides, pararectal and Okobayashi spaces were dissected bilaterally including dissection of autonomous nerve fibres and lateralization of nodular DIE. In cases of bilateral involvement of the plexus, the side opposite to the hydronephrotic ureter was spared in order to avoid nerval damage. Following suspension of both ovaries, the hydronephrotic ureter was followed using blunt dissection down into the ureteric channel. In order to gain full access to the stenotic area, the ovarian and round ligament as well as the uterine artery and fallopian tube were divided in all cases of hydronephrotic stenosis. Ureterolysis was considered sufficient in cases of extrinsic involvement of the ureter and complete

removal of all fibrotic tissue elements surrounding the ureter leaving a sandtimer-like but completely freed ureter fully mobile in it`s channel. In cases of limited, intrinsic DIE causing a ureteric stricture and thereby stenosis, segmental resection of the stenotic ureter was perfomed followed by end- to end anastomosis using 5 to 6 sutures (5-0 poliglecaprone 25) in a clockwise manner with a ureteric stent in situ placed prior to surgery in all cases with hydronephrosis. This technique was applied in cases of intrinsic DIE reflected by macroscopic endometriotic infiltration of a major extent of the ureteral muscularis. Primary UCN was performed in cases were intrinsic DIE caused a stenotic stricture to an extent that caused tension for attempted end- to end anastomosis or in cases where ureteral stenosis was located within estimated 4 cm to the ureteral bladder ostium. Complications were graded according to the Clavien–Dindo classification system as follows: I, minor complications not requiring medical or surgical intervention; II, complications requiring pharmacological treatment or blood transfusion; III, complications requiring re-intervention; IV, life-threatening complications, and V, death (8).

Statistical analyses

Data were analyzed using CATmaker (CEBM, Oxford, UK). Normally distributed data are presented as mean SD, and skewed data as median (range). Categoric variables are reported as absolute values and percentages whereas continuous variables are compared using the paired samples t-test. P values <0.05 were considered statistically significant. Test accuracy for TVS was assessed by calculating the sensitivity and specificity for each site of possible endometriotic infiltration. Positive predictive values (PPV), negative predictive values (NPV) and positive and negative likelihood ratios were calculated to determine the ability of the test to predict the presence or absence of disease.

Ethical approval

The study was approved by the local IRB (Institutional Review Board reference number WSP 2011-1-GYN, 12 December 2011).

Results

TVS for BE yielded a sensitivity, specificity, PPV, NPV as well as positive and negative likelihood ratio and accuracy of 93%, 99%, 97%, 99%, 165.2, 0.07 and 98.6% (Table 1). The mean sonographic volume of DIE involving the bladder was calculated by assuming the lesion was ellipsoid i.e. mean volume was 5 cm^3 (range 0.52-57 cm^3) out of which 28 lesions were located in the vesicouterine space/posterior wall (Figure 1) and 2 nodules situated on the bladder dome. All cases of DIE involving the bladder were confirmed histologically. Values on diagnostic performance of renal ulrasound for hydronephrosis are also depicted in Table 1.

Based on these findings, 27 patients underwent laparoscopic PC, 20 women were treated for DIE causing secondary hydronephrosis, three patients underwent both procedures. Patient characteristics and demographic data are presented in Table 2. Mean duration of surgery was 205 minutes (range 89-365 minutes). The avarage blood loss was 1.6 g/dL (range 0.3-4.6 g/dL). Hospital stay was on average 8 days (range 2-16 days). Results and outcomes of colorectal procedures will be evaluated in a different analysis. Grade of DIE was evaluated according to the rAFS and ENZIAN score (9). Hydronephrosis and ureteral dilatation as demonstrated by abdominal sonography was confimed during surgery in all cases. Renal scintigraphy exhibited residual renal function above 16% (compared to the contralateral side) in all cases. Therefore, nephrectomy was not perfomed in any of the cases presented.

Intraoperative findings and surgical procedures are presented in Table 3. In 3 cases were PC was perfomed and in all cases of hydronephrosis double-J catheters were inserted preoperatively. Bladder operations were laparoscopic PCs in all cases of bladder involvement (Figure 2A-C). There were 28 cases of isolated bladder involvement, 23 cases of ureteric surgeries (Figure 3A,B) for hydronephrosis and 3 patients with both, PC and ureteral surgery. Nine cases of intrinsic disease and 14 cases of extrinsic ureteral were observed in women with UTE and hydronephrosis . In 28 patients, additional colorectal segmental resection (n=17), limited disc resection (n=4) and/or partial resection of the upper vagina (n=8) was performed concomitantly.

In women undergoing surgery for UTE, conversion to laparotomy was performed in 2 out of 50 patients (4%). Complications according to Clavien-Dindo are shown in Table 4. As depicted, grade 3 complications occurred in 5 (10%) patients, there were no cases with grade 4 or 5 events. No bladder leakages were observed on day 7 during routine cystography. Normal bladder function was present in all patients following PC following removal of the bladder catheter on day 7-10. Postoperative voiding dysfunction was observed in 1/50 cases of resection of DIE causing hydronephrosis. One out of 14 (7%) women who underwent ULD exhibited re-stenosis and obstruction 4 weeks postoperatively following removal of the double-J stent whereas all other patients post ureterolysis did

not reveal signs of obstruction on IVP. In cases of URA, 1 out of 6 women exhibited signs of peritonitis caused by leakage on day 4 postoperatively requiring a second surgical intervention and UCN. Finally, one out of the 3 women with primary UCN who underwent evacuation of a subcutaneous hematoma causing postoperative infection.

Postoperative follow-up data and fertility outcomes

All patients attended a follow-up visit 3 months postoperatively and 50/50 patients (100%) took part in a telephone interview. The mean follow-up interval was 23 months (range 2-71 months). Urinary problems were obsereved in none of the PC cases. No cases of recurrent UTE were observed at the visit 3 months postoperatively or reported later onwards. Table 5 depicts changes in symptoms and quality of life scores. In addition, a postoperative kidney scan at 3 months postoperatively performed in patients with prior hydronephrosis did not reveal any abnormalities in any of the cases either having undergone ULD, URA and/or UCN. We did not observe significant differences in the frequency or the improvement of symptoms in patients with BE versus ureteric involvement (without concomitant BE).

In the series presented, 24/50 (48%) women presented with infertility preoperatively. Eleven pregnancies (overall pregnancy rate 11/24, 46%) were observed with a mean postsurgical conception interval of 2.66 months (range 2-70months). Six out of 24 women became pregnant spontanously, one of these patients became spontaneously pregnant on two separate occasions and delivered to term both times, and 4/24 patients following in vitro fertilization. Nine term deliveries, two miscarriages and no ectopic pregnancies were observed. In the patient group that was not infertile preoperatively there were two spontaneous pregnancies, one patient delivered at term and one had a preterm delivery. At the time of postoperative re-evaluation, 9 deliveries were reported resulting in a postoperative live birth rate of 18%.

Discussion

Endometriosis affecting the urinary tract has been observed in 1-2% of patients with endometriosis but reaches prevalence rates of up to 50% in women with deep infiltrating disease (10), (4). In patients with UTE, BE can be detected in 70%-80%, whereas ureteric involvement accounts for about 10% of UTE cases (11). Several studies have demonstrated that TVS is highly useful for presurgical diagnosis of BE with overall pooled sensitivity and specificity reaching 62% and 100% with moderate heterogeneity in studies (12). In the present analysis, we observed an unusual high sensitivity and

specificity of TVS of 93% and 99% with positive and likelihood ratios of 166, 0.07 and a test accuracy of over 98%. These findings are in contrast to our previous publication (13) and could be explained by a learning curve effect but also diffferences in prevalence rates of UTE between the present study and the previous report. Changes in prevalence rates of UTE compared to our previous report could be explained by the fact that our hospital is one of the leading surgical tertiary referral centers for DIE in our country. The high accuracy of TVS emphasizes the use of TVS as a first line technique when BE is suspected. However, the present patient cohort represents a highly preselected group and does neither reflect the general population nor women attending general pelvic pain clinics. As a consequence, the use of TVS for detecting BE may yield different results when applied in a different hospital or outpatient setting due to a much lower prevalence of the condition and thereby different learning curves of the sonographers using TVS. Recent studies have also shown the value of TVS for visualization of ureters and possible ureteric obstruction. Pateman et al. (14) was able to detect ureteric involvement in 12 out of 848 (1.4%) patients with DIE with a 92% sensitivity, 100% specificity and PPV and NPV of 100% and 99.3%. Within this, Carfagna et al. (15) diagnosed ureteric dilatation by DIE via TVS in 13 out of 200 (6.5%) women with DIE. Interestingly, only 6 out of these 13 (46%) women exhibited hydronephrosis on renal ultrasound suggesting that TVS is able to diagnose incipient ureteric obstruction prior to the development of secondary renal dilatation. Due to the limited ability to scan and visualize ureters at the beginning of the present analysis, we did not include visualization of ureters in the present study protocol. However, based on the evidence so far, sonographic examination of ureters and detection of possible ureteric obstruction or anomalies should be included as an integral part of TVS of patients with suspected DIE.

This is underlined by the observation that BE may not involve the bladder mucosa leading to normal cystoscopic findings that may obscure the disease in many cases causing diagnostic delay. Since BE progresses from the serosa and muscular layer to the mucosa, even early stages of BE may be detectable with TVS with higher accuracy compared to cystoscopy or magnetic resonance imaging (4). In our series, the surgeon also performed all preoperative scans and was not blinded to the patient`s history which in our opinion strongly facilitates planning the most appropriate surgical treatment of patients with UTE. It does, however confer a possible diagnostic bias since sonographer and surgeon are not blinded to the results of the patient`s history, TVS and/or surgery which is a potential weakness of this study. We also can not provide scientific proof whether or to what degree TVS positively influences the surgical approach if performed by the same person and do support this approach based on our personal experience.

Since the primary goal of surgery is complete, full-thickness resection of bladder nodules, transureteral resection techniques or external ablation of peritoneal lesions with underlying deep disease should be avoided. Laparoscopic PC can be seen as the standard technique in patients with symptomatic BE and has been demonstrated as a feasible, safe and efficient surgical approach (4), (16). Our results are in line with these studies since we did not observe any complications such as leakage or recurrence in all 30 patients undergoing PC. In addition, complete resection of BE and concomitant DIE lead to a significant reduction of pain symptoms such as dysmenorrhea, dyspareunia, dyschezia and dysuria. In contrast to BE, the optimal surgical managment of DIE affecting the ureter causing secondary hydronephrosis is less clear since several options have been suggested including ureteral reimplantation (UCN), URA or surgical resection and decompression (ULD). In our series, only patients with ureteral dilatation and hydronephrosis were included which is in contrast to some previous studies where UE is not functionally relevant, i.e. causing hydronephrosis .

ULD was considered sufficient in cases were the ureter was fully dissected from fibrotic and endometriotic tissue causing stenosis. Only in cases of intrinsic DIE infiltrating the muscular layer we performed UCN or URA which was preferred in patients with intrinsic but limited (<1cm) ureteral involvement making a tension-free end-to-end anastomosis possible. Using this surgical approach, ULD was feasible in 14/23 (61%) cases of hydronephrosis including one patient with re-stenosis which is lower than the rates reported in a systematic review by Cavaco-Gomes et al. (6) reaching 86%. However, only half of all patients with UE included in the review by Cavaco-Gomes et al. presented with hydronephrosis which may explain the unusual high success rates of ULD. In our opinion ULD is the *treatment* of choice in patients with limited, extrinsic uretral DIE causing hydronephrosis where all fibrotic or endometriotic tissue components can dissected from the ureter. Patients with extensive intinsic ureteral DIE are candidates for URA and/or UCN depending on the localization of the lesion and the surgeons preferences. However, we have made the observation that this condition is rare.

In our patient cohort, half of all women were infertile and achieved an overall pregnancy rate of 46% (11/24 patients) and a life birth rate at the time of follow-up of 18% postoperatively. These included 4 in vitro fertilization and 7 spontaneous pregnancies. To date, several studies have highlighted the benefical effect of radical surgery for DIE in patients with fertility issues and extensive disease (17). Although women with UTE represent a highly preselected patient cohort, the fertility outcome observed in our series does support the value of surgery in infertile women with symptomatic DIE. However, the sample size in this study is too limited to draw a final conclusion regarding the benefical effect of surgical removal of UTE in order to optimize fertility. In addition, 21 patients underwent concomitant surgery for DIE affecting the rectum and/or sigmoid which again may confer

a benefical effect besides surgical removal of UTE and may therefore influence the final surgical outcome regarding infertility.

Based on great differences in complication rates and fertility outcomes observed in studies published to date (18), we strongly support a multidisciplinary team setting. In our opinion, presurgical evaluation by TVS performed by the gynaecological surgeon himself adds enormous value to this approach.

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Table and figure LEGENDS

Table 1. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), accuracy, positive likelihood ratio (+ve LHR) and negative likelihood ratio (-ve LHR) for the presence of bladder endometriosis (BE) detected via transvaginal sonography (TVS) and hydronephrosis detected by renal ultrasound (US) compared with laparoscopic findings in 207 patients with deep infiltrating endometriosis.

Table 2: Patient characteristics and demographic data of 50 patients undergoing surgery for urinary tract endometriosis.

Table 3: Intraoperative findings and surgical procedures in 50 patients with urinary tract endometriosis (UTE).

Table 4: Complications of surgical procedures classified by Clavien-Dindo in grades I-IV.

Table 5: Postoperative outcomes regarding pain symptoms at a median follow-up interval of 23 months (range 2-71 months).

Figure 1. Anterior-posterior transvaginal sonography section exhibiting isoechogenic-hypoechogenic nodule arising in the vesicouterine fold corresponding to bladder endometriosis (*normal bladder wall, ** bladder base, *** bladder endometriosis).

Figure 2. A-C: Laparoscopic partial cystectomy with opening, resection (A,B) and closure of the bladder (C).

Figure 3. A: Laproscopic dissection and clipping of uterine artery with extrinsic ureteral deep infiltrating endometriosis and ureter medially. B: Dissection and decompression of the left ureter leaving a hourglass-like narrowing of the ureter.

Table 1. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), accuracy, positive likelihood ratio (+ve LHR) and negative likelihood ratio (-ve LHR) for the presence of bladder endometriosis (BE) detected via transvaginal sonography (TVS) *and hydronephrosis detected by renal ultrasound (US)* compared with laparoscopic findings in 207 patients with deep infiltrating endometriosis.

	Prevalence	**Sensitivity (%)**	**Specificity (%)**	**PPV (%)**	**NPV (%)**	**Accuracy (%)**	**+ve LHR**	**-ve LHR**
BE via TVS	30/207 (15%)	28/30 (93%)	176/177 (99%)	97%	99%	93%	165.2	0.07
CI 95%:		*CI:84-100*	*CI:98-100*	*CI:90-100*	*CI:97-100*		*CI:23.3-1169*	*CI:0.02-0.26*
Hydronephrosis via renal US	*23/207 (11%)*	*22/23 (96%)*	*183/184 (99%)*	*96%*	*99%*	99%	*176*	*0.04*
CI 95%:		*CI:87-100*	*CI: 98-100*	*CI:87-100*	*CI: 98-100*		*CI:24.9-1245.3*	*CI:0.01-0.3*

CI, confidence interval.

Table 2: Patient characteristics and demographic data of 50 patients undergoing surgery for urinary tract endometriosis.

Patient data (n=50)	Number	Percent (%)	Mean	SD
Age (median)	38 (25-48)		*33,9*	*5.2*
Body mass index (median)	24 (19-30)		*24*	*2.7*
Previous surgery for endometriosis	20	40		
Previous pregnancy	16	32		
Previous hormonal therapy	15	30		
Infertility	24	48		
Dysmenorrhea (NAS score ≥4)	47	94	*7,9*	*1.6*
Dysuria (NAS score ≥4)	20	40	*8.1*	*1.7*
Dyschezia (NAS score ≥4)	16	32	*6.8*	*1.7*
Deep dyspareunia (NAS score ≥4)	24	52	*6.2*	*1.8*

NAS, numeric analogous scale.

Table 3: Intraoperative findings and surgical procedures in 50 patients with urinary tract endometriosis (UTE).

Disease stage (rAFS score)	**Number**	**Percent (%)**
Grade I	5	10
Grade II	15	30
Grade III	5	10
Grade IV	25	50
Disease stage (ENZIAN score[a])		
Compartment A (rectovaginal septum)	26	52
Compartment B (sacrouterine ligaments and pelvic sidewall)	31	62
Compartment C (bowel)	25	50
Adenomyosis(FA)	15	30
Ureter, hydronephrosis (FU)	23	46
Bladder (FB)	30	60
Surgical procedures for UTE		
Partial cystectomy (only) (PC)	27	56

Ureterolyis/decompression (ULD)	13	26
Ureteral resection with anastomosis (only) (URA)	4	8
Ureterocystoneostomy (UCN)	3	6
ULD and PC	1	2
URA and PC	2	8
Concominant surgical procedures		
Segmental bowel resection	17	34
Disc resection	4	8
Resection of DIE affecting the upper vagina/rectovaginal septum	8	16

[a]one patient can have more than one compartment affected and thereby be counted several times.

.rAFS, Retrospective American Fertility Society Score;

Table 4: Complications of surgical procedures classified by Clavien-Dindo in grades I-IV.

Intervention	Grade	Complication type	Managment
Partial cystectomy (PC)	3	hematoma	laparoscopic evacuation
	3	febrile episode	antibiotics intravenously diagnostic laparoscopy (normal findings)
Ureteral resection with anastomosis (URA)	3	ureter leakage	psoas hitch UCN
Ureterolyis/decompression (ULD)	3	re-stenosis via intravenous urogram	psoas hitch UCN
Ureterocystoneostomy (UCN)	3	subcutaneous hematoma, postop voiding dysfunction	revision

Table 5: Postoperative outcomes regarding pain symptoms at a median follow-up interval of 23 months (range 2-71 months).

Pain symptoms	Preoperative score (mean/SD)	Postoperative score (mean/SD)	p - value[a]
Dysmenorrhoea	7.46/4.24	1.6/0.71	<0.0001
Dyspareunia	3.02/4.24	0.98/0	<0.001
Dyschezia	2.14/2.12	0.70/0	<0.0001
Dysuria	3.28/7.07	0.20/0	<0.003
Quality of life score	3.3/1.4	8.1/2.1	<0.0001

[a]smaller than 5% was considered significant, paired samples t-test.