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Long-term evaluation of painful symptoms and fertility after surgery for large rectovaginal endometriosis nodule: a retrospective study

Running title: Shaving and colorectal resection

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Abstract

Introduction: Optimal surgical treatment of rectovaginal endometriosis remains a controversial topic. The objective of this study was to evaluate long term postoperative outcomes after rectal shaving or colorectal resection for rectovaginal endometriosis. *Material and methods:* 195 patients underwent surgery (172 managed by shaving, 23 by colorectal resection) between January 2000 and June 2013 for rectovaginal endometriosis (>2cm) involving at least the serosa of the rectum. Primary outcome measures were pain and fertility. Secondary outcome measures were complications, recurrence rates and quality of life.

Results: Mean follow-up was 60 ± 42 months in the shaving group and 67 ± 47 months in the resection group. The mean VAS score for pelvic pain between the pre and postoperative period decreased from 5.5 ± 3.5 (shaving group) and 7.3 ± 2.9 (resection group) to 2.3 ± 2.4 ($p<0.001$) and 2.0 ± 1.8 ($p<0.001$) respectively. For dysmenorrhea, the mean baseline VAS score fell postoperatively from 7.7 ± 2.8 (shaving group) and 8.2 ± 2.6 (resection group) to 3.3 ± 2.9 ($p<0.001$) and 2.7 ± 2.7 ($p<0.001$) respectively. Pregnancy rates were 73% for shaving and 69% for resection. Major complications occurred in 4% of patients in the shaving group and in 26% in the resection group ($p=0.001$). Thirteen patients (7.6%) from the shaving group and none from the resection group were reoperated for suspicion of endometriosis recurrence ($p=0.37$). Postoperative quality of life scores revealed no differences between the two groups. *Conclusion:* Our study demonstrates that rectal shaving, when feasible for rectovaginal nodule (>2cm) infiltrating the digestive serosa, has equal impact on pain and pregnancy rates compared to colorectal resection at long-term follow-up, with low complication and favorable pregnancy rates.

Keywords

Endometriosis, rectovaginal endometriosis, rectal shaving, colorectal resection, pain, infertility

Abbreviations:

ART: assisted reproductive technologies

GIQLI: Gastro Intestinal Quality of Life Index

SF-36: Medical Outcome Study Short Form 36 Item Health Survey

QoL: quality of life

RG: resection group

SG: shaving group

VAS: visual analog scale

MRI magnetic resonance imaging

RR relative risk

CI confidence interval

Key message

Analysis of long-term postoperative outcomes after rectal shaving or colorectal resection for rectovaginal nodule (>2cm) demonstrate that, when it is feasible, conservative treatment without bowel resection is a favorable alternative for management of deep endometriosis.

Introduction

Three different surgical techniques are advocated for colorectal endometriosis: resection (radical surgery) (1, 2), full thickness disc excision (3, 4) and shaving (conservative surgeries) (5, 6). Despite the significant number of clinical studies conducted, optimal surgical treatment for rectovaginal endometriosis remains highly controversial (7). Shaving involves nodule removal without opening of the rectal lumen (8). It is principally for this reason that reported postoperative complication rates after shaving appear lower than those following radical surgery (6), while reported recurrence rates may be higher.

Our approach includes both radical and conservative techniques depending on lesion size, rectal wall invasion, patient symptoms, surgery objectives, operative assessment and benefit-risk balance (9). The aim of this study was to evaluate short and long-term outcomes of the different surgical modalities for management of colorectal deep infiltrating endometriosis (DIE) in our department. Primary outcome measures were pain and fertility. Secondary outcome measures were complications, recurrence rates and quality of life.

Material and methods

Patients and methods

All patients included in this study (331) underwent surgery for rectovaginal septum nodule exceeding 2cm in size, with invasion of at least the serosa of the rectum following a histologically confirmed diagnosis of endometriosis in our center between January 2000 and June 2013.

Exclusion criteria included patients aged 18 or under, non-French speakers, patients with psychiatric disorders, patients who declined or who failed to respond firstly by phone or later by e-mail when invited to participate in the study.

All selected patients when initially contacted by phone, gave informed consent orally for use of their data anonymously for clinical research, having received information on objectives and research procedure. Women who did not respond were subsequently contacted by e-mail.

Prior to surgery all patients were systematically asked to evaluate the severity of their gynecological symptoms (dysmenorrhea, chronic pelvic pain) and digestive symptoms (diarrhea, constipation, rectal bleeding, dyschezia) during a consultation with the surgeon, thus these data were obtained from medical records. Individual data (demographics, fertility), preoperative data (symptoms, clinical examination), intra-operative data (surgery, hospitalization) and postoperative data (complications, recurrences) were also obtained from medical records. Postoperatively, patients were sent the following questionnaires by post for completion: gynecological and digestive symptoms, standardized Medical Outcome Study Short Form 36 Item Health Survey (SF-36), Ditrovie and Gastro Intestinal Quality of Life Index (GIQLI) questionnaires. Quality of life (QoL) questionnaires were completed without preoperative evaluation. Digestive disorders were expressed as nominal variables (yes/no) and

the visual analog scale (VAS) scale used for gynecological symptoms was a continuous 10cm scale. (0 represents no pain, 10 represents the worst imaginable pain) (10). The official French version of the SF-36 used in this study has been adapted and validated for clinical studies (11, 12), as has the GIQLI self-assessment questionnaire used for evaluation of digestive symptoms (13). The total GIQLI score can reach 144 (best QoL) with an established normal score of 125.8 for healthy persons (14). Ditrovie is a validated self-assessment tool for evaluating impact of urinary disorders on personal and social QoL (15).

Preoperative evaluation and surgical technique

Surgical management was performed by shaving or when a satisfactory shaving procedure was deemed impossible, by colorectal resection. Our surgical technique has been previously reported (16). Symptoms and clinically suspected rectovaginal nodules were evaluated (vaginal and rectal involvement, blue nodule at speculum examination) prior to surgery. Invasion of rectum layers was further assessed using magnetic resonance imaging (MRI) and/or vaginal or rectal ultrasound (figure 1). Colorectal resection was organized in conjunction with the gastro-intestinal surgeon following an assessment carried out by experienced gynecological surgeons.

Patients received full information on digestive risks, including that of undergoing colorectal resection and those related to specific complications (postoperative complications, pelvic abscess, secondary surgery or the need for a stoma) and were informed that the gastro-intestinal surgeon would be present if needed. Shaving was performed using the “reverse technique” (16) starting by the lateral and the vaginal parts of the nodule and ending with rectal invasion (figure 2). The nodule was dissected all around the rectal involvement so as to provide essential exposure of the rectal part of the nodule for the most difficult part of the procedure (16) (figure 2). The need for colorectal resection was reevaluated after shaving was completed and primarily involved consideration of the following factors: residual disease, persistence of bowel stenosis (lesions involving more than 130 to 150° of the rectum), opening of the digestive lumen without the possibility of satisfactory suture (tension-free suture using healthy surrounding tissue), and patient digestive preoperative symptoms. The final decision was made with the gastro-intestinal surgeon and took into consideration vaginal opening, adhesions related to previous surgeries, technical difficulties and co-morbidities. Colorectal resection was performed using a classic laparoscopic technique (16).

Statistical analyses

Statistical analyses were performed using Stata software, version 13 (StataCorp, College Station, TX, USA). The tests were two-sided, with $\alpha=0.05$. Patient characteristics were described for each group (shaving group (SG) and resection group (RG)) as mean \pm standard-deviation or median and interquartile range for continuous variables, according to statistical distribution (normality assessed using the Shapiro-Wilk test), and the number of patients (%) for categorical variables. Comparisons between the shaving and RGs were performed using the Chi-squared or Fisher exact tests for categorical variables and the Student t-test or Mann-Whitney test when t-test assumptions were not met ((i) normality and (ii) homoscedasticity were analyzed using the Fisher-Snedecor test) for quantitative parameters. Results were expressed as relative risks (RR) with a 95% confidence interval. For intra-group comparisons, the paired t-test or Wilcoxon test were used for quantitative variables and the Stuart-Maxwell test for categorical parameters.

Ethical approval

This retrospective non-interventional study was approved by the CNIL (*Commission Nationale de l'Informatique et des Libertés*, the French data protection commission) (n°0066) for the department of Gynecology and Obstetrics of a University Hospital.

Results

Of the 331 patients selected with septum nodule (> 2 cm), 298 patients (90%) underwent shaving and 33 (10%) underwent colorectal resection. After exclusions, participant rates totaled 57.7% (172) patients for the SG and 69.7% (23) patients for the RG (figure 3).

Demographic data and short term outcomes (Table 1)

In total 29% of women in the SG had previously undergone laparotomy (3%) or laparoscopy (26%) while 35% in the RG had previously undergone laparoscopy. Preoperative physical examination revealed a rate of 13% visible vaginal nodules (such as blue lesions) in the SG and 8.7% in the RG ($p=0.53$). Vaginal examination revealed 83% of palpable nodules for the SG and 85% in the RG ($p=0.77$) with mean nodule size 2.7 ± 0.7 cm in the SG and 4.1 ± 1.4 cm in the RG ($p<0.001$). In the SG 73% of patients had endometriosis in the serosa and 27% beyond the serosa (invasion of the muscularis mucosa). All SG patients were treated by laparoscopy and conversion to laparotomy was necessary for three patients in the RG (13%)

($p < 0.001$). For the RG group, all cases were identified as stage IV endometriosis according to the revised American Fertility Society classification, while in the SG cases were mainly stage III and IV ($p < 0.001$). Postoperative characteristics and complications (according to the Clavien Dindo classification) are detailed in Table 1 (17): The rate of minor complications (grade I and II) was 13% for the SG and 30% for the RG (RR=2.83; 95%CI; 1.01-7.63; $p=0.05$). Major complications (grade III) occurred in seven patients (4%) in the SG and in six patients (26%) in the RG (RR=6.55; 95%CI; 1.88-22.8; $p=0.001$).

Long term outcomes

Pain improvement linked to chronic pelvic pain and dysmenorrhea was observed in both groups between the pre and postoperative periods (Table 2). The mean baseline VAS scores for chronic pelvic pain decreased from 5.5 ± 3.5 for the SG and 7.3 ± 2.9 for the RG to 2.3 ± 2.4 ($p < 0.001$) and 2.0 ± 1.8 ($p < 0.001$) respectively at the end of the study. For dysmenorrhea, the mean baseline VAS score decreased from 7.7 ± 2.8 for the SG and 8.2 ± 2.6 for the RG to 3.3 ± 2.9 ($p < 0.001$) and 2.7 ± 2.7 ($p < 0.001$) respectively at the end of the study. The majority of patients who had complained of dyspareunia, dyschezia or rectal bleeding reported that these symptoms had significantly improved after surgery. No improvement in constipation was noted for either group, with *de novo* symptoms occurring in seven patients (4.1%) and disappearing in eight patients (4.7%) in the SG ($p=0.08$). Postoperatively in the RG six patients (26%) complained of *de novo* constipation ($p=0.06$), while six other patients (26%) reported *de novo* diarrhea ($p=0.06$). Thirteen SG patients (7.6%) and no RG patients were reoperated due to suspected endometriosis recurrence (Table 2) ($p=0.37$). The presence of endometriosis was histologically confirmed in 10 cases (5.8%). For the three remaining patients operated for pain recurrence, diagnoses discovered were scar tissue, salpingitis and rectovaginal fibrosis. Analysis of SF-36 questionnaire items completed by patients postoperatively showed that only the General Health (GH) aspect was significantly higher for the SG (49.8 ± 10.2) when compared to the RG (45.2 ± 7.7) ($p=0.04$). No differences were found for the Physical Component Summary (PCS) or Mental Component Summary (MCS). Postoperative GIQLI scores were 108.3 ± 11.9 for the SG and 96.6 ± 18.7 for the RG. Ditrovie scores were 1.17 ± 0.26 for the SG and 1.37 ± 0.38 for the RG. Fertility outcomes are presented in Table 3. No patient indicated worsening of symptoms or underwent surgery during pregnancy.

Discussion

In this study, we evaluated our approach to the surgical management (shaving or colorectal resection) of deep infiltrating endometriosis, which seeks to adapt surgical treatment according to patient symptoms, pain improvement and desire for pregnancy. Despite the backdrop of longstanding disagreement over optimal surgical treatment (resection or shaving) of rectovaginal endometriosis, choice of surgery in our department is based on preoperative symptoms and key information, such as nodule size or infiltration of the muscularis propria, sub mucosa or mucosa, obtained from examinations (MRI, endorectal and/or endovaginal ultrasound) and intra-operative data evaluated in conjunction with a gastro-intestinal surgeon. Our results suggest that our surgical strategy consisting of firstly performing rectal shaving, followed if unavoidable by rectal resection, is a valid procedure with low complication rates, a decrease in postoperative pain and favorable health-related QoL and pregnancy rates.

The first main argument in favor of our approach concerns long-term painful symptom results with substantial postoperative improvement in chronic pelvic pain, dysmenorrhea, dyspareunia, dyschezia and rectal bleeding observed for both groups. Postoperative VAS scores for chronic pelvic pain and dysmenorrhea were close to the pain threshold for therapeutic intervention (3/10) endorsing the long term effectiveness and safety of our surgical strategy (18). These results support the validity of our strategy for treatment of rectovaginal nodules.

The second argument is based on the high reported pregnancy rates following both surgeries. Even though in the literature, variations for calculating pregnancy rate exist (human chorionic gonadotropin blood test only vs. pregnancy after 12 weeks vs. delivery), our pregnancy rate is close to that reported by Roman et al. (65.8% after colorectal resection including 60% of spontaneous pregnancies at 32±18months of follow-up (19)). As regards the distribution between spontaneous and assisted reproductive technologies (ART) (49% and 51% after shaving, 67% and 23% after resection respectively), Donnez et al. reported similar results with, at 3 years follow-up, a spontaneous pregnancy rate of 57% and a pregnancy rate by ART of 43% for patients who underwent shaving surgery (n=500 patients) (5). In our series, both shaving and resection led to enhanced fertility with high spontaneous pregnancy rates. It is our common practice to refer all patients with infertility to the ART department and where there are no associated infertility factors such as abnormal semen analysis, ART is proposed 9

to 12 months after surgery. If semen analysis is normal and the fallopian tubes are permeable, women are firstly given the option of intrauterine insemination.

Thirdly, the postoperative complications rate demonstrates that resection resulted in high rates of both minor and major postoperative complications. Our study revealed one case of fistula (4.3%) in the RG and one in the SG (0.58 %), a rate approaching that of the meta-analysis presented by Meulemann et al. (2.7% rectovaginal fistulae, 1.5% anastomotic leakages and 0.34% abscesses were reported in a total of 2036 patients having undergone resection) (7). Darai et al. (1) reported 6 rectovaginal fistulae for 71 patients (8.4%) following colorectal resection. In 2005, Mohr et al. (20) analyzed medical records from 187 patients treated laparoscopically for intestinal endometriosis, identifying a complication rate of 38% for segmental resection. Roman et al (21) reported a 4% (n=1) rate of fistulae, 12% secondary surgery for presumed pelvic abscess and 12% bladder atony > 1 month requiring daily catheterization for the RG (n=25); while results for the SG revealed a 2.2% rate of fistulae, 10.9% secondary surgery for presumed pelvic abscess and 2.2% bladder atony > 1 month requiring daily catheterization. For the RG though our complication rates appear high they remain in line with other previously reported data. It would be unwise to make firm conclusions based on complication rates arising from series of 30 patients or less but as patients in the SG number 172, it should be noted that our rates for minor and major complications after rectal shaving are low.

Recurrence rate is a major concern when surgical strategy favors a conservative technique. In our series, the repeat surgery rate due to suspicion of recurrence is low even when taking into account long-term follow-up. Meulemann et al. reported a recurrence rate of 5.8% in their RG and 17.6% in their mixed surgical group (7). We report a recurrence rate for the SG approaching that related to the RG reported by Meulemann et al. (7). Recurrence revealed by histological results is even lower (5.8%, Table 2) and ultimately no resection was necessary for these patients, with only two (1.16 %) found to have a recurrence on the rectum (rectovaginal nodule recurrence). Interestingly, nearly half of recurrences were on the ovary (endometrioma n=5) and not in the rectovaginal septum. These results provide further support for use of a conservative technique when it is feasible.

While laparoscopic surgery has been proven effective in relation to deep infiltrating endometriosis, few studies have investigated patient QoL (7). The present study revealed no significant differences in SF-36 postoperative scores between the two groups except for those

concerning the General Health domain which were found to be higher in the SG. Mabrouk et al also reported no differences in SF-36 scores between patients who underwent shaving or resection surgery (22). Furthermore, in our study, postoperative GIQLI scores obtained for the two groups remained below normal values (score: 125) (14), consistent with those obtained by Roman et al (21; 23), with the GIQLI score in the SG far higher than in the RG. Though no preoperative evaluation using a QoL questionnaire was undertaken by the authors, these data suggest that after radical surgery, digestive symptoms continue to affect QoL. Radical resection fails to provide a solution to all digestive symptoms due most likely to their multifactorial origin, beyond the lesion itself (23).

Limitations to this study pertain specifically to the low participant rates in both groups. For the RG, the rate of 69.7% (23 patients) does not allow further evaluation of fertility, painful symptoms, complications and recurrence outcomes. For the SG, though low at 57.7% (172 patients), this participation rate remains comparable to those found in the literature (Friedl et al. reported 28.6% (24) and Fourquet et al. 24% participation (25)), with many studies omitting to provide details on response rates (7). In the SG, we estimated that 27% of patients had endometriosis beyond the serosa (invasion of the muscularis mucosa). This result is most likely underestimated as estimation relies largely on subjective analysis. In the case of shaving it is impossible to obtain complete histological analysis of the digestive wall, unlike with resection. Finally since only a postoperative assessment of QoL was carried out, we were unable to analyze QoL evolution. The particular strengths of this study lie in the long-term nature of our results and the demonstrated high pregnancy rates in both groups.

Conclusion

In a context of rectovaginal nodule, we confirmed the efficiency and safety of the shaving technique. We believe that the technique may be addressed in relation to the patient's symptoms and thereby decreasing the complication rate without decreasing the impact of surgery on pain perception and fertility.

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References

1. Darai E, Ackerman G, Bazot M, Rouzier R, Dubernard G. Laparoscopic segmental colorectal resection for endometriosis: limits and complications. *Surg Endosc.* 2007;21:1572-7.
2. Roman H, Vassilieff M, Gourcerol G, Savoye G, Leroi AM, Marpeau L, et al. Surgical management of deep infiltrating endometriosis of the rectum: pleading for a symptom-guided approach. *Hum Reprod.* 2011;26:274–81.
3. Fanfani F, Fagotti A, Gagliardi ML, Ruffo G, Ceccaroni M, Scambia G, et al. Discoid or segmental rectosigmoid resection for deep infiltrating endometriosis: a case-control study. *Fertil Steril.* 2010;94:444–9.
4. Roman H, Abo C, Huet E, Bridoux V, Auber M, Oden S, et al. Full-thickness disc excision in deep endometriotic nodules of the rectum: a prospective cohort. *Dis Colon Rectum.* 2015;58:957-66.
5. Donnez J, Squifflet J. Complications, pregnancy and recurrence in a prospective series of 500 patients operated on by the shaving technique for deep rectovaginal endometriotic nodules. *Hum Reprod.* 2010;25:1949-58.
6. Roman H, Moatassim-Drissa S, Marty N, Milles M, Vallée A, Desnyder E, et al. Rectal shaving for deep endometriosis infiltrating the rectum: a 5-year continuous retrospective series. *Fertil Steril.* 2016;106:1438-1445.
7. Meuleman C, Tomassetti C, D'Hoore A, Van Cleynenbreugel B, Penninckx F, Vergote I, et al. Surgical treatment of deeply infiltrating endometriosis with colorectal involvement. *Hum Reprod Update.* 2011;17:311-26.
8. Darai E, Cohen J, Ballester M. Colorectal endometriosis and fertility. *Eur J Obstet Gynecol Reprod Biol.* 2017;209:86-94.
9. Roman H, Bourdel N, Rigaud J, Delavierre D, Labat JJ, Sibert L. Endométriose et douleurs pelvipérinéales chroniques. [Endometriosis and chronic pelvic pain] (in French). *Prog Urol.* 2010;20(12):1010-8.
10. McCormack HM, Horne DJ, Sheather S. Clinical applications of visual analogue scales: a critical review. *Psychol Med.* 1988;18(4):1007-19.
11. Aaronson NK, Acquadro C, Alonso J, Apolone G, Bucquet D, Bullinger M, et al. International Quality of Life Assessment (IQOLA) Project. *Qual Life Res.* 1992;1(5):349-51.

12. Lepage A, Ecosse E, Verdier A, Perneger TV. The French SF-36 Health Survey: translation, cultural adaptation and preliminary psychometric evaluation. *J Clin Epidemiol.* 1998;51:1013-23.
13. Slim K, Bousquet J, Kwiatkowski F, Lescure G, Pezet D, Chipponi J. Première validation de la version française de l'index de qualité de vie pour les maladies digestives (GIQLI). [First validation of the French version of the Gastrointestinal Quality of Life Index (GIQLI)] (in French). *Gastroenterol Clin Biol.* 1999;23:25-31.
14. Eypasch E, Williams JJ, Wood-Dauphinee S, Ure BM, Schmulling C, Neugebauer E, et al. Gastrointestinal Quality of Life Index: development, validation and application of a new instrument. *Br J Surg.* 1995;82:216-22.
15. Amarenco G, Marquis P, Leriche B, Richard F, Zerbib M, Jacquetin B. Une échelle spécifique d'évaluation de la perturbation de la qualité de vie au cours des troubles mictionnels: l'échelle Ditrovie. [A specific scale to evaluate the perturbation of the quality of life during urinary troubles: the Ditrovie scale]. In French. *Ann Readapt Med Phys.* 1997;40:21-6 .
16. Kondo W, Bourdel N, Tamburro S, Cavoli D, Jardon K, Rabischong B, et al. Complications after surgery for deeply infiltrating pelvic endometriosis. *BJOG.* 2011;118:292-8.
17. Dindo D, Demartines N, Clavien PA. Classification of surgical complications: a new proposal with evaluation in a cohort of 6336 patients and results of a survey. *Ann Surg.* 2004;240:205-13.
18. Collins SL, Moore RA, McQuay HJ. The visual analogue pain intensity scale: what is moderate pain in millimetres? *Pain.* 1997;72:95-7.
19. Roman H, Quibel S, Auber M, Muszynski H, Huet E, Marpeau L, et al. Recurrences and fertility after endometrioma ablation in patients with and without colorectal endometriosis: a prospective cohort study. *Hum Reprod.* 2015;30(3):558-68.
20. Mohr C, Nezhat FR, Nezhat CH, Seidman DS, Nezhat CR. Fertility considerations in laparoscopic treatment of infiltrative bowel endometriosis. *JSLs.* 2005;9:16-24.

21. Roman H, Milles M, Vassilieff M, Resch B, Tuech JJ, Huet E, et al. Long-term functional outcomes following colorectal resection vs. shaving for rectal endometriosis. *Am J Obstet Gynecol.* 2016 Dec;215(6):762.e1-762.e9.
22. Mabrouk M, Montanari G, Guerrini M, Villa G, Solfrini S, Vicenzi C, et al. Does laparoscopic management of deep infiltrating endometriosis improve quality of life? A prospective study. *Health Qual Life Outcomes.* 2011;9:98.
23. Roman H, Hennetier C, Darwish B, Badescu A, Csanyi M, Aziz M, et al. Bowel occult microscopic endometriosis in resection margins in deep colorectal endometriosis specimens has no impact on short-term postoperative outcomes. *Fertil Steril.* 2016;105:423-9.
24. Friedl F, Riedl D, Fessler S, Wildt L, Walter M, Richter R, et al. Impact of endometriosis on quality of life, anxiety, and depression: an Austrian perspective. *Arch Gynecol Obstet.* 2015;292:1393-9.
25. Fourquet J, Gao X, Zavala D, Orengo JC, Abac S, Ruiz A, et al. Patients' report on how endometriosis affects health, work, and daily life. *Fertil Steril.* 2010;93:2424-8.

Legends

Figure 1: Pre-therapeutic evaluation of a 5.3cm nodule situated at the level of the torus uterinum invading the muscularis propria. Ut: uterus, Re: Rectal lumen, *: nodule, Arrow: invasion of the muscularis propria (suspected on MRI, confirmed on ultrasound: interruption of the muscosa); A, B, C T2 MRI, axial and sagittal view; D, E, F: vaginal ultrasound: axial (D) and sagittal (E, F) view (E): M: muscularis propria, sm: Submucosa, m: mucosa.

Figure 2: Principle of reverse technique: the objective is to free the nodule entirely before starting shaving on the rectum. A and B: the lateral part(s) (para-rectal space) of the nodule is/are dissected. C: then the anterior part of the nodule (torus uterinus and/or vagina). D: if necessary the vagina is resected and the rectovaginal space is dissected. E and F: the nodule is still only fixed to the surface of the rectum. The nodule can be grasped by the first assistant and fully mobilized from the deepest part of the pelvis to the superior pelvic strait. Shaving is performed with optimized exposure and traction.

Figure 3: Flow chart.

Table 1: Baseline demographic data and complications.

Footnote: AFSr, revised American Fertility Society.

Table 2: Long term outcomes: Evolution of gynecologic and digestive symptoms shaving or resection surgery.

Footnote: VAS, visual analog scale.

Table 3: Fertility outcomes.

Footnote: ART: assisted reproductive technologies; IUI: intra uterine insemination; IVF: in vitro fertilization. ICSI: intra cytoplasmic sperm injection.

Variable	Shaving (n=172)	Resection (n=23)	<i>P value</i>
Demographic data			
age (years) (Mean ± SD)	31.5 ± 5.4	32.7 ± 5.0	0.31
body mass index (kg/m ²) (Mean ± SD)	22.4 ± 3	22.2 ± 3	0.83
smoking (n (%))	49 (28)	2 (8.7)	0.04
parity (Mean ± SD)	0.62 ± 0.06	0.61 ± 0.19	0.94
gravidity (Mean ± SD)	0.76 ± 0.92	0.78 ± 1.24	0.92
Previous treatment for endometriosis			
surgery: laparotomy (n)	5 (3)	0	1.00
surgery: laparoscopy (n)	45 (26)	8 (35)	1.00
medical treatment (GnRH analogs)	26 (15)	6 (26)	0.22
Motive for the initial consultation			
infertility (n)	13 (7.5)	0	
pain (n)	88 (51.2)	18 (78)	0.01
infertility and pain (n)	71 (41.3)	5 (22)	
Pre-operative physical examination			
visible nodule (speculum examination) (n (%))	23 (13)	2 (8.7)	0.53
palpable nodule (vaginal examination) (n (%))	146 (83)	19 (85)	0.77
size of nodule (Mean ± SD)	2.7cm±0.7	4.1cm±1.4	<0.001
Operative characteristics			
duration of surgery (min) (median. range)	160 (120 to 220)	330 (300 to 500)	<0.001
laparoscopy (n (%))	172 (100)	20 (87)	<0.001
conversion to laparotomy (n (%))	0	3 (13)	
AFSr Stage II (n (%))	7 (4.0)	0	
AFSr Stage III (n (%))	60 (35)	0	<0.001
AFSr Stage IV (n (%))	105 (61)	23 (100)	

adhesiolysis (n (%))	129 (75)	18 (78)	0.73
ureterolysis (n (%))	117 (68)	16 (67)	0.17
colpectomy (n (%))	129 (75)	7 (30)	0.58
vesical nodule resection (n (%))	20 (12)	1 (4.4)	0.29
ureteral nodule resection (n (%))	3 (1.7)	0	0.52
Adnexal surgery			
unilateral cystectomy (n (%))	69 (40)	12 (52)	0.27
bilateral cystectomy (n (%))	16 (9.3)	3 (13)	0.57
unilateral oophorectomy (n (%))	5 (2.9)	4 (17)	0.002
bilateral oophorectomy (n (%))	0	1 (4.4)	0.12
Post-operative characteristics			
mean duration of hospital stay (Mean \pm SD)	4d \pm 3	9 d \pm 5	<0.001
average length of extracted tissue (Mean \pm SD)	3.6cm \pm 1.1	8.4cm \pm 3.2	<0.001
return of normal bowel function (hours)	24h	72h	<0.05
mean duration of post- operative follow-up (months) (Mean \pm SD)	60.3 \pm 41.8	67 \pm 46.9	0.16
minor complications (n (%))	23 (13)	7 (30)	0.05
Grade I			
- febrile episode	1	1	
- vaginal scar disunion	1		
- hematoma due to trocar insertion	1		
- urinary retention	6	1	
- urinary infection	5	3	
Grade II			
- urinary fistula (indwelling urinary catheter for 10 days)	1		
- colpectomy infection	1		
- hematoma of Douglas pouch	4		
- abscess on Douglas pouch (medical treatment)	2	2	
- pyelonephritis	1		
major complications (n (%))	7 (4.0)	6 (26)	0.001
Grade III			
- hemoperitoneum	3		
- recto-vaginal fistula	1	1	
- ureteral stenosis	1		
- abscess on Douglas pouch (surgical treatment)	2	1	
- anastomosis leakage		2	
- urinoma		1	
- edema of ileostomy		1	

Table 2: Long term outcomes

Evolution of gynecologic and digestive symptoms after shaving or resection surgery

	Shaving (n= 172)	Resection (n=23)	<i>P</i> value intergroup	<i>P</i> value intragroup (shaving)	<i>P</i> value intragroup (resection)
dysmenorrhea (VAS)					
preoperative time	7.7±2.8	8.2±2.6	0.38		
postoperative time	3.3±2.9	2.7±2.7	0.27	p<0.001	p<0.001
Chronic pelvic pain (VAS)					
preoperative time	5.5±3.5	7.3±2.9	0.01		
postoperative time	2.3±2.4	2.0±1.8	0.44	p<0.001	p<0.001
Dyspareunia					
disappeared n(%)	61 (36)	7 (31)			
unchanged n(%)	104 (60)	15 (65)			
-> never had the symptom	19 (11)	1 (4.3)	0.93	<0.001	0.03
-> still had the symptom	85 (49)	14 (61)			
<i>de novo</i> n(%)	7 (4)	1 (4)			
Dyschezia (n=168)					
disappeared n(%)	51 (30)	7 (30)			
unchanged n(%)	117 (70)	16 (70)			
-> never had the symptom	78 (47)	12 (52)	0.99	<0.001	0.0082
-> still had the symptom	39 (23)	4 (17)			
<i>de novo</i> n(%)	0	0			
Constipation					
disappeared n(%)	8 (4.7)	1 (4.3)			
unchanged n(%)	157 (91)	16 (70)			
-> never had the symptom	127 (74)	16 (70)	<0.001 ^a	0.8	0.06
-> still had the symptom	30 (17)	0			
<i>de novo</i> n(%)	7 (4.1)	6 (26)			
Diarrhea					
disappeared n(%)	9 (5.0)	1 (4.3)			
unchanged n(%)	163 (95)	16 (70)			
-> never had the symptom	158 (92)	16 (70)	<0.001 ^a	0.003	0.06
-> still had the symptom	5 (3)	0			
<i>de novo</i> n(%)	0	6 (26)			
Rectal bleeding					
disappeared n(%)	10 (5.8)	6 (26)			
unchanged n(%)	162 (94)	17 (74)			
-> never had the symptom	162 (94)	17 (74)	0.001 ^b	0.0016	0.0143
-> still had the symptom	0	0			
<i>de novo</i> n(%)	0	0			

^a : difference for de novo

^b : difference for disappeared

Repeat surgery for suspicion of endometriosis recurrences

	Shaving (n=13) (n(%))	Resection (n=0)	delay (month)
suspicion of recurrences	13 (100)	0	
- pain	1 (8)		36
- salpingitis	1 (8)		18
- rectovaginal fibrosis	1 (8)		35
- endometrioma + ureteral lesion *	1 (8)		94
- endometrioma *	4 (31)		8; 36; 40; 66
- rectovaginal nodule *	2 (15)		46; 75
- vesical endometriosis *	2 (15)		12; 71
- adenomyosis *	1 (7)		132

*: histological confirmation of endometriosis

Table 3: Fertility outcomes

	(n (%))		<i>P value</i>
	Shaving (172)	Resection (23)	
Desire to become pregnant	125 (73)	13 (57)	0.11
Pregnancy rate (spontaneous + ART)	91/125 (73)	9/13 (69)	0.75
Spontaneous pregnancy	45/91 (49)	6/9 (67)	0.49
Period from surgery to pregnancy (month) (Mean ± SD)	13±12	9.4±4.8	0.16
ART (assisted reproductive technologies)	46/91 (51)	3/9 (33)	0.49
- IUI	4 (8.7)	0	
- IVF	35 (76)	2 (67)	
- ICSI	5 (11)	1 (33)	0.58
- Sperm donation	1 (2.2)	0	
- Oocyte donation	1 (2.2)	0	
Delivery rate	75/91 (83)	8/9 (89)	1.00
- miscarriage rate	10 (11.5)	0	
- ectopic pregnancy rate	2 (2.2)	0	
- therapeutic abortion rate	2 (2.2)	0	0.39
- abortion rate	1 (1.1)	1 (11)	
Delivery type			
vaginal delivery rate vs cesarean rate	47 (63) vs 28 (37)	4 (50) vs 4 (50)	0.71
Pregnancy type			
single vs multiple	82 (90.1) vs 9 (9.9)	9 (100) vs 0	1.00





