

# Accepted Manuscript

Title: Multiple Nodule Removal by Disc Excision and Segmental Resection in Multifocal Colorectal Endometriosis

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PII: S1553-4650(17)31128-7  
DOI: <http://dx.doi.org/doi: 10.1016/j.jmig.2017.09.007>  
Reference: JMIG 3273

To appear in: *The Journal of Minimally Invasive Gynecology*

Received date: 28-6-2017  
Revised date: 18-8-2017  
Accepted date: 4-9-2017

Please cite this article as: Jenny-Claude Millochau, Emanuela Stochino-Loi, Basma Darwish, Carole Abo, Julien Coget, Rachid Chati, Jean-Jacques Tuech, Horace Roman, Multiple Nodule Removal by Disc Excision and Segmental Resection in Multifocal Colorectal Endometriosis, *The Journal of Minimally Invasive Gynecology* (2017), <http://dx.doi.org/doi: 10.1016/j.jmig.2017.09.007>.

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1           **Multiple nodule removal by disc excision and segmental resection in multifocal**  
2 **colorectal endometriosis**

3           **Running title: Multiple endometriosis nodule removal.**

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18

19           **Conflicts of interest:** Prof. Roman reports personal fees from Plasma Surgical Inc.  
20 (Roswell, GA, US) for participating in a symposium and a master class, where he presented  
21 his experience in the use of PlasmaJet®. This was outside the submitted work. The other  
22 authors have no conflict of interest.

23           **Capsule**

24           The combination of rectal disc excision and sigmoid colon segmental resection to  
25 remove multiple colorectal endometriosis nodules can preserve the healthy bowel located  
26 between two consecutive nodules.

27

28           **Abstract**

29           ***Objective.*** To report postoperative outcomes after dual digestive resection for deep  
30 endometriosis infiltrating the rectum and the colon.

31           ***Design.*** Retrospective study using data prospectively recorded in the CIRENDO  
32 database.

33           ***Design classification:*** Canadian Task Force classification II-2.

34           ***Setting.*** University tertiary referral center.

35           ***Patients.*** Twenty-one patients managed for multiple colorectal deep endometriosis  
36 infiltrating nodules.

37           ***Interventions.*** Concomitant disc excision and segmental resection of both the rectum  
38 and sigmoid colon.

39           ***Main outcome measures.*** Assessment of postoperative outcomes.

40           ***Results.*** Rectal nodules were managed by disc excision and by segmental resection in  
41 20 patients and 1 patient respectively. Sigmoid colon nodules were removed by short  
42 segmental resection and disc excision in 15 and 6 patients respectively. Rectal nodule

43 diameter was between 1-3 cm and over 3 cm in 33% and 67% of patients respectively.  
44 Associated vaginal infiltration requiring vaginal excision was recorded in 76.2 % of patients.  
45 The mean diameter of rectal disc removed averaged 4.6 cm and the mean height of rectal  
46 suture was 5.8 cm. The length of the sigmoid colon specimen and height of the anastomosis  
47 were respectively 7.3 cm and 18.5 cm. Mean operative time was 290 minutes and mean  
48 postoperative follow-up averaged 30 months. Clavien Dindo 3 complications occurred in 28%  
49 of patients, including four with rectal fistulae (19%). The pregnancy rate was 67% among  
50 patients with pregnancy intention.

51 **Conclusion.** Our data suggest that combining disc excision and segmental resection to  
52 remove multiple deep endometriosis nodules infiltrating the rectum and the sigmoid colon can  
53 preserve the healthy bowel located between two consecutive nodules. However, the rate of  
54 postoperative complication is high, particularly in patients with large low rectal nodules.

55 **Keywords.** Deep endometriosis; colorectal endometriosis; bowel endometriosis; disc  
56 excision; multifocal endometriosis.

57

## 58 **Introduction**

59 Deep endometriosis infiltrating the rectum and/or sigmoid colon is not a rare disease.  
60 More than 1,135 patients were managed for deep endometriosis in France during the year  
61 2015 (1). Patients may present with multiple localizations of the bowel, which may require  
62 long en bloc segmental resections (2-5). However, such long segmental resections may have  
63 an unfavorable impact on long-term digestive function. For that reason, alternative  
64 management of multifocal bowel disease may be considered with the aim of sparing healthy  
65 bowel located between two consecutive nodules (6, 7).

66 Deep endometriosis of the colon and the rectum is responsible for various digestive  
67 symptoms such as dyschesia, tenesmus, predominant catamenial diarrhea or constipation,  
68 rectal bleeding and bloating (8). In severe cases, progressive stenosis of the lumen can lead to  
69 colorectal subocclusion or occlusion (9, 10). Therefore, most authors recommend active  
70 management of colorectal endometriosis (11, 12). Management of dual localizations should  
71 take into account multiple factors, including age, pregnancy intention, symptoms, as well as  
72 the extension and localization of the disease. Rectal endometriosis surgery requires a high  
73 level of surgical expertise, as not only are the procedures challenging but also the risk of post-  
74 operative complications and unfavorable functional outcomes cannot be overlooked in young  
75 patients with pregnancy intention (13-16). To limit the use of low colorectal resection and  
76 attempt better preservation of the rectum, we employ disc excision to remove low/mid rectal  
77 nodules, with good functional outcomes (17-19). Furthermore, when rectal nodules are  
78 associated with deep endometriosis infiltrating the sigmoid colon, we use separate procedures  
79 on the rectum and sigmoid colon and preserve the upper rectum and rectosigmoid junction  
80 (7).

81 The goal of our study was to present our approach and report postoperative outcomes  
82 following multiple nodule removal in multifocal colorectal endometriosis.

83

#### 84 **Patients and Methods**

85 We enrolled consecutive patients managed by multiple nodule removal in multifocal  
86 colorectal endometriosis in the Department of Gynecology and Obstetrics of Rouen  
87 University Hospital between March 2011 and December 2016. Inclusion criteria were: deep  
88 endometriosis of the low or mid rectum along with concomitant infiltration of the sigmoid  
89 colon or rectosigmoid junction; at least 5 cm of healthy bowel between nodules; separate

90 surgical procedures requiring bowel sutures had to be performed on multiple colorectal  
91 nodules with preservation of healthy normal vascularized bowel. We excluded patients  
92 managed for multifocal colorectal endometriosis by two surgical procedures including at least  
93 one bowel shaving.

94 Since June 2009, all women with endometriosis managed in our department have been  
95 prospectively enrolled in the CIRENDO database (NCT02294825) (20). This latter is the  
96 North-West Inter-Regional Female Cohort for Patients with Endometriosis, which is a  
97 prospective cohort, financed by the G4 group (the University Hospitals of Rouen, Lille,  
98 Amiens and Caen) and coordinated by one of the authors (H.R). Data recording, contact and  
99 follow-up are carried out by a clinical research technician. Standardized gastrointestinal  
100 questionnaires are routinely used to assess pre- and post-operative digestive function: the  
101 Gastro-Intestinal Quality of life Index (GIQLI) (21), the Knowles-Eccersley-Scott-Symptom  
102 Questionnaire (KESS) (22), the Fecal Incontinence Quality of Life index (23) and the Bristol  
103 stool scale (24). Women are included in the CIRENDO database only when endometriosis is  
104 confirmed by both surgical exploration and biopsy.

105 All women referred to our department for deep endometriosis were clinically  
106 examined by a senior surgeon experienced in endometriosis (HR) and had MRI examination.  
107 The women answered a questionnaire concerning clinical history and symptoms. When deep  
108 endometriosis was suspected, an endorectal ultrasound examination was performed to check  
109 for rectal involvement and to estimate the depth of rectal wall infiltration. In cases with  
110 colorectal involvement, a computed tomography-based virtual colonoscopy was used to check  
111 for digestive tract stenosis and associated digestive tract localizations. Complementary  
112 examinations, such as cystoscopy and unenhanced helical computed tomography were  
113 performed in women with associated involvement of the urinary tract.

114 Each nodule was removed separately. Low and mid rectal nodules were treated by disc  
115 excision, using either a circular stapler (Video 1), a semicircular stapler (Video 2) (17, 25-29)  
116 or short segmental resection of the rectum. Upper nodules of the sigmoid colon or  
117 rectosigmoid junction were removed by either short colorectal resection or disc excision.  
118 Segmental resection was performed using a standardized technique, which has already been  
119 described by various authors (11, 12). Care was taken to preserve at least 5 cm of intermediate  
120 healthy bowel normally vascularized, in order to avoid bowel necrosis (7). When deep  
121 endometriosis also infiltrated the posterior vagina, resection was performed by either  
122 laparoscopic or vaginal route (17). In these latter cases, omentoplasty was always performed  
123 in order to separate rectal and vaginal sutures. A diverting stoma was routinely created in  
124 patients who had both rectal and vaginal sutures, and was usually closed 3 months later if  
125 rectal barium enema ruled out rectovaginal fistula or leakage. Conversely, in patients with  
126 rectovaginal fistula, primary repair was attempted by vaginal or transanal route. When this  
127 procedure failed, an abdominal approach was used by performing either suture of the rectal  
128 opening or segmental resection. The stoma was closed only when the barium enema  
129 confirmed complete fistula healing.

130 At the end of the procedure, the surgeon filled in a dedicated form and the data were  
131 recorded in the CIRENDO database. Postoperative complications were recorded using the  
132 Clavien Dindo classification (30). Patients were asked to fill in follow-up self-questionnaires  
133 1, 3 and 5 years after the procedure. Prospective recording of data and their use in studies has  
134 been approved by the French authority CCTIRS (Advisory Committee on Information  
135 Processing in Healthcare Research).

136

## 137 **Results**

138 Twenty-one patients were included in the study between March 2011 and December  
139 2016. All patients had multiple deep endometriosis nodules infiltrating both the mid/low  
140 rectum and the colon and were managed in our department.

141 The clinical history of patients, as recorded in the CIRENDO database is presented in  
142 Table 1. Patients were on average 30 years old and most had a previous surgical procedure for  
143 endometriosis, pelvic pain or infertility. More than half of them were referred for preoperative  
144 infertility and 86% of them had a pregnancy intention at the time of the surgery.

145 Table 2 presents the main baseline symptoms related to endometriosis. All patients  
146 had dysmenorrhea, dyspareunia and severe digestive symptoms as constipation, bloating and  
147 defecation pain. They presented abnormal values of the standardized gastrointestinal scores  
148 assessing digestive function.

149 Table 3 presents intraoperative findings and surgical procedures. One patient had a  
150 short rectal along with a short sigmoid colon segmental resection, 6 patients had double disc  
151 excision (involving both the rectum and the sigmoid colon), and 14 patients had rectal disc  
152 excision as well as segmental resection of the sigmoid colon. Rectal nodules were managed  
153 by disc excision in 20 patients and short segmental resection in one patient. Sigmoid colon  
154 nodules were removed by short segmental resection in 15 patients and disc excision in 6  
155 patients. The diameter of rectal nodules was over 3 cm in 67% of cases. The mean diameter of  
156 rectal disc removed averaged 4.6 cm and the mean height of rectal nodules was 5.8 cm. The  
157 length of sigmoid colon specimen and the height of the anastomosis were respectively 7.3 cm  
158 and 18.5 cm, resulting in the preservation of more than 10 cm of healthy bowel on average.  
159 Associated vaginal infiltration was removed in 16 cases (76.2%). All associated endometriosis  
160 lesions were treated in order to ensure complete removal of the disease on macroscopic  
161 examination. Mean operative time was 290 minutes.



162 Table 4 presents postoperative outcomes. Mean follow-up averaged 30 months. Severe  
163 complications requiring associated procedures (Clavien Dindo 3) were recorded in 28% of  
164 patients. Rectovaginal fistula occurred in four patients (19%) three of whom had associated  
165 vaginal excision; the four patients underwent a prophylactic diverting stoma. Two of these  
166 four patients benefited from repair by rectal fistula suture using resorbable stitches and have  
167 good functional outcomes. One of the four patients was managed by segmental resection and  
168 delayed colo-anal anastomosis (31) with satisfactory functional outcomes (follow-up was  
169 limited to 4 months after the last procedure). The remaining patient was managed by low  
170 colorectal resection with a colorectal anastomosis 4 cm above the anus and has presented with  
171 a low anterior rectal resection syndrome (follow-up was limited to 3 months after the last  
172 procedure). Among the patients with postoperative pregnancy intention, 67% conceived and  
173 83% have already delivered. Spontaneous conception was achieved in 33% of them.

174 Table 5 presents postoperative functional outcomes in patients with postoperative  
175 follow up superior to respectively 1 and 3 years, which reveals an overall improvement of  
176 digestive function one year after the surgery.

177

178

179

## 180 **Discussion**

181 Our data suggest that dual digestive resection to remove multiple deep colorectal  
182 endometriosis nodules can preserve the healthy bowel located between two consecutive  
183 nodules. In our opinion this strategy is feasible when two consecutive nodules are separated  
184 by a healthy segment of more than 5 cm in length, ensuring normal vascularization of rectal  
185 wall separating two consecutive sutures.

186 Our study presents several weaknesses. Only a small subgroup of the overall  
187 population of patients managed for colorectal endometriosis was enrolled in our study. These  
188 patients presented with a deep nodule infiltrating the mid or low rectum along with a second  
189 localization on the sigmoid colon or upper rectum. As a result, our sample size was small.  
190 Our objective was to demonstrate the feasibility and good functional outcomes of our  
191 approach, rather than identifying risk factors for postoperative complications. As we report a  
192 preliminary study, there was no control group and postoperative outcomes cannot be  
193 compared to those following long and low colorectal resection, which are alternative  
194 approaches in these patients.

195 However, our study also presents several strengths. To our knowledge, this is the first  
196 report concerning multiple resections of multifocal colorectal deep endometriosis. As most  
197 obstetric surgeons only perform en bloc long segmental resection in patients with multifocal  
198 colorectal endometriosis (3), data on multiple nodule removal are scarce. Our recording of  
199 data was prospective and was performed by a clinical researcher dedicated to data  
200 management, which explains why no patient was lost to follow-up. Our protocol for  
201 postoperative follow-up includes rigorous assessment of digestive functional outcomes,  
202 allowing an accurate view of outcomes related to surgical procedures on digestive tract.

203 There are two main approaches for the surgical management of colorectal  
204 endometriosis: i) the radical approach, employing systematic segmental resection for  
205 infiltrations concerning at least the muscular layer; and ii) the conservative approach, based  
206 on rectal shaving or full-thickness disc excision, which may be associated with short  
207 segmental resection on the sigmoid colon. This second approach attempts to minimize the risk  
208 of long-term unfavorable functional outcomes related to rectal resection, such as low anterior  
209 rectal resection syndrome (32). When occurring in young women of reproductive age, these  
210 unfavorable functional outcomes may be even more embarrassing than the deep endometriosis

211 itself and their treatment may be particularly challenging and even ineffective (15). For these  
212 reasons, the prevention of these unfavorable functional outcomes by a more conservative  
213 approach may be a more reasonable strategy.

214 Our approach systematically employs disc excision on either the rectum (in 20 patients  
215 out of 21) or the sigmoid colon (6 patients out of 21). Our team is experienced in this  
216 procedure and as many as 145 patients have benefited from it since 2009. Recently, we  
217 reported postoperative outcomes in 111 patients managed by disc excision (17) and published  
218 several video-articles to demonstrate this technique. The first step of disc excision is rectal  
219 shaving to soften the rectal wall, which can then be removed generally using transanal  
220 staplers: either the end-to-end anastomosis (EEA) circular stapler or a semicircular stapler  
221 (this latter is also known as the Rouen technique, Fig1). The technique using a circular stapler  
222 is routinely performed in smaller nodules infiltrating the bowel over less than 3cm in length,  
223 while the Rouen technique is suitable even in large or very large nodules located on the mid  
224 and low rectum (17). The major advantage of rectal disc excision over low colorectal  
225 resection is the preservation of the mesorectum and rectal vessels and nerves. To date, we  
226 have recorded no low anterior rectal resection syndrome in any of our 145 patients managed  
227 by disc excision, 55 of whom benefited from the Rouen technique. Furthermore, we have  
228 observed no bowel stenosis at the level of the semicircular suture in our disc excisions, yet  
229 this risk is well known after segmental colorectal resection (7, 17). In our opinion, all these  
230 considerations support the use of our conservative approach in patients managed for  
231 multifocal colorectal endometriosis nodules including low rectal localization.

232 Based on our experience, the surgeon should start the procedure by shaving without  
233 opening the rectum in order to remove rectal stenosis. Then, the upper nodule should be  
234 removed by either short segmental resection or disc excision. Rectal shaving, which is the  
235 first step, allows the circular stapler to be safely inserted through the rectum, to achieve the

236 colorectal anastomosis or upper disc excision. Then, the shaved rectal area can be safely  
237 treated by disc excision using either semicircular or circular staplers. Conversely, if the  
238 surgeon starts by rectal disc excision and not by shaving, it may then be difficult to insert the  
239 circular stapler through the rectum and above the rectal suture, which may increase the risk of  
240 postoperative rectal leakage.

241 Suture tissue tension might occur when the two sutures line are in close proximity to  
242 one another. For this reason, we do not employ this approach when the length of intermediate  
243 healthy rectum is less than 5 cm. In our series, the mean length of bowel preserved was 13  
244 cm, as mean height of low and upper sutures were respectively 5.8 and 18.5 cm. On the other  
245 hand, the length of the specimen removed by segmental resection was lower to that would  
246 have been removed by an en block colorectal resection, with favorable outcomes on suture  
247 effect tissue tension.

248 The rate of rectovaginal fistulae (19%) in our series may be surprisingly high. In a  
249 recent French survey enrolling 1,135 patients managed for colorectal endometriosis by  
250 various procedures, 121 of which were performed by our team, rectovaginal fistula or leakage  
251 was recorded in only 3.5% of cases (1). In a review including 49 studies, Meuleman et al. (33)  
252 reported that in patients managed by resection, the rate of rectovaginal fistulae was  
253 approximately 2.7%. However, a straight comparison between our present series and previous  
254 reports cannot reasonably be carried out, as the rate of low rectal nodules and that of  
255 simultaneous vaginal resection are completely unbalanced. Despite the use of diverting stoma  
256 and omentoplasty to separate vaginal and rectal sutures, the risk of rectovaginal fistulae in  
257 such circumstances is high. In addition, performing two concomitant bowel sutures may  
258 logically double the risk of leakage, even if the increased risk of immediate complications  
259 might be outweighed by the probability of better functional outcomes related to rectal  
260 preservation. Our assessment of postoperative digestive functional outcomes at 1 and 3 years

261 post surgery suggested an overall improvement of gastrointestinal function. Further  
262 comparative studies, involving several tertiary referral centers are required to answer the  
263 question raised by this hypothesis.

264 As patients managed for colorectal endometriosis are young, their ability to conceive  
265 and fertility outcomes should always be taken into account in the management of the disease.  
266 The pregnancy rate in our series (67%) was satisfactory and comparable to that previously  
267 reported by our team in women managed for ovarian and deep endometriosis of various  
268 localizations (34). Furthermore, it does not appear to be inferior to the rate reported in a recent  
269 review pooling case series of patients managed by colorectal resection, with an overall  
270 pregnancy rate estimated at 46.9% and a rate of spontaneous conception at 28.6% (35).  
271 Despite a high rate of immediate complications, our approach does not seem to impair fertility  
272 outcomes when compared to conventional management by low segmental resection.

273 To address the concerns of leaving two separate bowel suture lines and preserving a  
274 bowel segment of 10 cm. The two bowel sutures are reasonably associated with a higher risk  
275 of postoperative complications when compared to one suture line. When the 10 cm segment  
276 includes low and mid rectum, their conservation could potentially have a major positive  
277 impact on postoperative functional outcomes. This is achieved by decreasing the risk of low  
278 anterior rectal resection syndrome, which has horrific impact on patient's quality of life and  
279 treatment has sometimes proven to be inefficient. A combined strategy of disc excision and  
280 segmental resection seems feasible for the removal of multiple deep endometriosis nodules  
281 infiltrating the rectum and the sigmoid colon allowing preservation of the healthy bowel and  
282 providing good postoperative outcomes.

283

284 **Authors' role:** Horace Roman and Jenny-Claude Millochau performed analysis and  
285 wrote the first draft of the report. Jenny-Claude Millochau, Emanuela Stochino Loi and  
286 Basma Darwish checked data recording. Horace Roman performed surgical procedures. All  
287 authors have revised the manuscript. All authors have contributed to the writing of the final  
288 manuscript and have approved it to be published.

289 **Funding:** No financial support was received for this study. The North-West Inter  
290 Regional Female Cohort for Patients with Endometriosis (CIRENDO) is financed by the G4  
291 Group (The University Hospitals of Rouen, Lille, Amiens and Caen) and  
292 ROUENENDOMETRIOSE Association.

#### 293 **Acknowledgements:**

294 We thank Miss Amelie Breant for her valuable management of the CIRENDO  
295 database. The authors are grateful to Mrs Nikki Sabourin-Gibbs, Rouen University Hospital,  
296 for her help in editing the manuscript.

297

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417

418 Figure 1. Disc excision of the mid rectum and short segmental resection of the sigmoid  
419 colon for multifocal colorectal deep endometriosis nodules using the semicircular stapler.

420

Table 1. Patients' antecedents.

	Whole sample N=21 (%)
<b>Dysmenorrhea</b>	
Primary dysmenorrhea	21 (100)
Biberoglou & Behrman dysmenorrhea score <sup>1</sup>	2.1± 1.1
Intensity of dysmenorrhea (VAS >4)	20 (95.2)
<b>Cyclic symptoms associated with dysmenorrhea</b>	
Defecation pain	14 (66.7)
Rectorrhage	6 (28.6)
Nausea	5 (23.8)
Constipation	16 (76.2)
Diarrhea	9 (42.6)
Bloating	11 (52.4)
Urinary pain	6 (28.6)
<b>Having had sexual intercourse</b>	
Deep dyspareunia	14 (68.7)
Biberoglou & Behrman deep dyspareunia score <sup>1</sup>	1.3±1.4
Intensity of dyspareunia (VAS>4)	8 (38.1)
<b>Assessment of digestive function</b>	
KESS <sup>2</sup> constipation score (total value)	13.14±7.6
Frequency of bowel movements (KESS item 3)	0.3±0.46
Abdominal pain (KESS item 6)	2.4 ± 1.2
GIQLI <sup>3</sup> score (total value)	88.2±23
Bowel urgency (GIQLI item 30)	2.6±1.1
Blood in stools (GIQLI item 34)	3.5±0.8
Wexner score <sup>4</sup>	1.5±2.1

Patients with Wexner score >2	5 (23.8)
Lack of ability to defer defecation	
<5min	2 (9.5)
5-10	5 (23.8)
10-15	5 (23.8)
>15	6 (28.6)

421 <sup>1</sup>Biberoglou & Behrman score (range of values from 0 to 3) . <sup>2</sup>Knowles-Eccersley-Scott-Symptom Questionnaire  
422 (range of values 0-39; patients without constipation have values <7); <sup>3</sup>Gastrointestinal Quality of Life Index  
423 (range of values 0-144; median value in patients with normal bowel movements at 124); <sup>4</sup>Patients with normal  
424 continence have a value at 0; VAS : Visual Analog Scale.

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Table 2. Principal pain symptoms related to pelvic endometriosis.

	Whole sample N=21 (%)
<b>Dysmenorrhea</b>	
Primary dysmenorrhea	21 (100)
Biberoglou & Behrman dysmenorrhea score <sup>1</sup>	2.1± 1.1
Intensity of dysmenorrhea (VAS >4)	20 (95.2)
<b>Cyclic symptoms associated with dysmenorrhea</b>	
Defecation pain	14 (66.7)
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Constipation	16 (76.2)
Diarrhea	9 (42.6)
Bloating	11 (52.4)
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<b>Having had sexual intercourse</b>	
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Blood in stools (GIQLI item 34)	3.5±0.8
Wexner score <sup>4</sup>	1.5±2.1

Patients with Wexner score >2	5 (23.8)
Lack of ability to defer defecation	
<5min	2 (9.5)
5-10	5 (23.8)
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>15	6 (28.6)

428 <sup>1</sup>Biberoglou & Behrman score (range of values from 0 to 3). <sup>2</sup>Knowles-Eccersley-Scott-Symptom Questionnaire  
429 (range of values 0-39; patients without constipation have values <7); <sup>3</sup>Gastrointestinal Quality of Life Index  
430 (range of values 0-144; median value in patients with normal bowel movements at 124); <sup>4</sup>Patients with normal  
431 continence have a value at 0; VAS: Visual Analog Scale.

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Table 3. Intraoperative findings.

<b>Surgical procedures on the rectum and colon</b>	N=21 (%)
	Mean +/- SD
<b>Procedures on the rectum (N=21)</b>	
<i>Rectal disc excision N (%)</i>	20 (95.2)
Largest diameter of rectal disc removed (mm)	4.6±1.3
Height of the rectal nodule (mm)	5.8±1.4
<i>Rectal resection</i>	1 (4.8)
<b>Procedures on the sigmoid colon (N=21)</b>	
<i>Sigmoid colon segmental resection N (%)</i>	15 (71.4)
Length of sigmoid colon specimen (mm)	7.3± 2.8
Height of the anastomosis (mm)	18.5±3.8
<i>Sigmoid colon disc excision N (%)</i>	6 (28.6)
Largest diameter of disc excision (mm)	3.3±0.4
Transverse colon disc excision <i>N (%)</i>	1 (4.8)
<b>Size of rectal nodule</b>	
1-2.9 cm	7 (33.3)
>=3 cm	14 (66.6)
<b>Vaginal infiltration</b>	
Size of vaginal infiltration	16 (76.2)
<1 cm	1 (4.6)
1-2.9 cm	6 (28.6)
>=3 cm	9 (42.9)
Operative time (min)	290±99
<b>Operative route</b>	
Laparoscopic + transanal approach	20 (95.2)
AFSr score	71±30.8
Douglas pouch complete obliteration	15 (71.4)
Endometriosis lesions on the diaphragm	2 (9.5)
<b>Management of ovarian endometriomas</b>	
Drainage of cyst	1 (4.8)
Ablation using plasma energy	13 (61.9)



<b>Adhesiolysis of adnexa</b>	21 (100)
Right adnexa	12 (57.1)
Left adnexa	19 (90.5)
<b>Deep posterior endometriosis nodule localization</b>	
USL	8 (38.1)
Right USL	3 (14.3)
Rectovaginal septum	10 (47.6)
Both USL and rectovaginal septum	8 (38.1)
<b>Additional procedures on digestive tract</b>	
Appendectomy	6 (28.6)
Omentoplasty	18 (86)
Transitory stoma	17 (81)
Decompression of sciatic nerve roots	1 (4.8)
<b>Surgical procedures on urinary tract</b>	
Resection of the bladder	4 (19)
Ureterolysis	21 (100)
Advanced ureterolysis requiring JJ stent	1 (4.8)
Ureteral resection and uretero-cystostomy	1 (4.8)

435

436 SD: standard deviation; AFSr: American Fertility Society revised score USL: uterosacral ligament

437

438

439

Table 4. Postoperative complications and fertility outcomes.

	N = 21 (%)
	Mean +/- SD
<b>Follow-up</b> (months)	30 (+/- 25.4)
<b>Clavien Dindo 2 postoperative complications</b>	
Transitory bladder atony requiring self catheterization over Day 7	4 (19)
<b>Clavien Dindo 3 postoperative complications</b>	6 (28.6)
Rectal fistulae (at the level of the low rectal suture)	4 (19)
Occlusion due to small bowel strangulation through mesocolon	1 (4.8)
Stenosis of colorectal anastomosis	1 (4.8)
<b>Fertility outcomes</b>	
<i>Postoperative pregnancy attempt</i>	9 (42.6)
Pregnant	6 (67)
<i>Pregnancy outcomes</i>	
Delivery or ongoing pregnancy >25wk	5 (83)
Miscarriage	1 (17)
<i>Conception mode (N=21)</i>	
Spontaneous conception	2 (33)
ART	4 (67)

440 SD: standard deviation; ART: Assisted Reproductive Technology

441

442

443

444 Table 5. Postoperative assessment of digestive function.

	Baseline	1 year follow up	P
	N=21	N= 15	
	Median [min-max]	Median [min-max]	
KESS <sup>1</sup> score	13 [0-26]	7[2-17]	0.038
GIQLI <sup>2</sup>	86 [47-127]	117[83-138]	0.001
Abdominal pain <sup>3</sup>	2 [0-4]	3[1-4]	0.023
Embarrassed by bowel frequency <sup>4</sup>	3 [0-4]	4[0-4]	0.26
Diarrhea <sup>5</sup>	3 [1-4]	4[2-4]	0.015

445 <sup>1</sup>Knowles-Eccersley-Scott-Symptom Questionnaire (KESS) differentiates patients with constipation  
 446 for whom overall values are superior to 10 (maximum possible 39), from healthy controls for whom  
 447 the median value averages 2 (range 0 to 6)

448 <sup>2</sup>Gastro-Intestinal Quality of life Index (GIQLI), total score ranges from 0 (worst) to 144 (best quality  
 449 of life) while median values vary around 126 for healthy subjects;

450 <sup>3</sup>GIQLI item 1: How often during the past 2 weeks have you had pain in the abdomen? All of the time  
 451 (0), most of the time (1), some of the time (2), a little of the time (3), never (4).

452 <sup>4</sup>GIQLI item 7: How often during the past 2 weeks have you been troubled by frequent bowel  
 453 movements? All of the time (0), most of the time (1), some of the time (2), a little of the time (3),  
 454 never (4).

455 <sup>5</sup>GIQLI item 31: How often during the past 2 weeks have you been troubled by diarrhea? All of the  
 456 time (0), most of the time (1), some of the time (2), a little of the time (3), never (4).

457

458 Video 1. Multiple nodule removal for multifocal colorectal deep endometriosis by  
459 rectal disc excision and short sigmoid colon resection using a circular stapler.

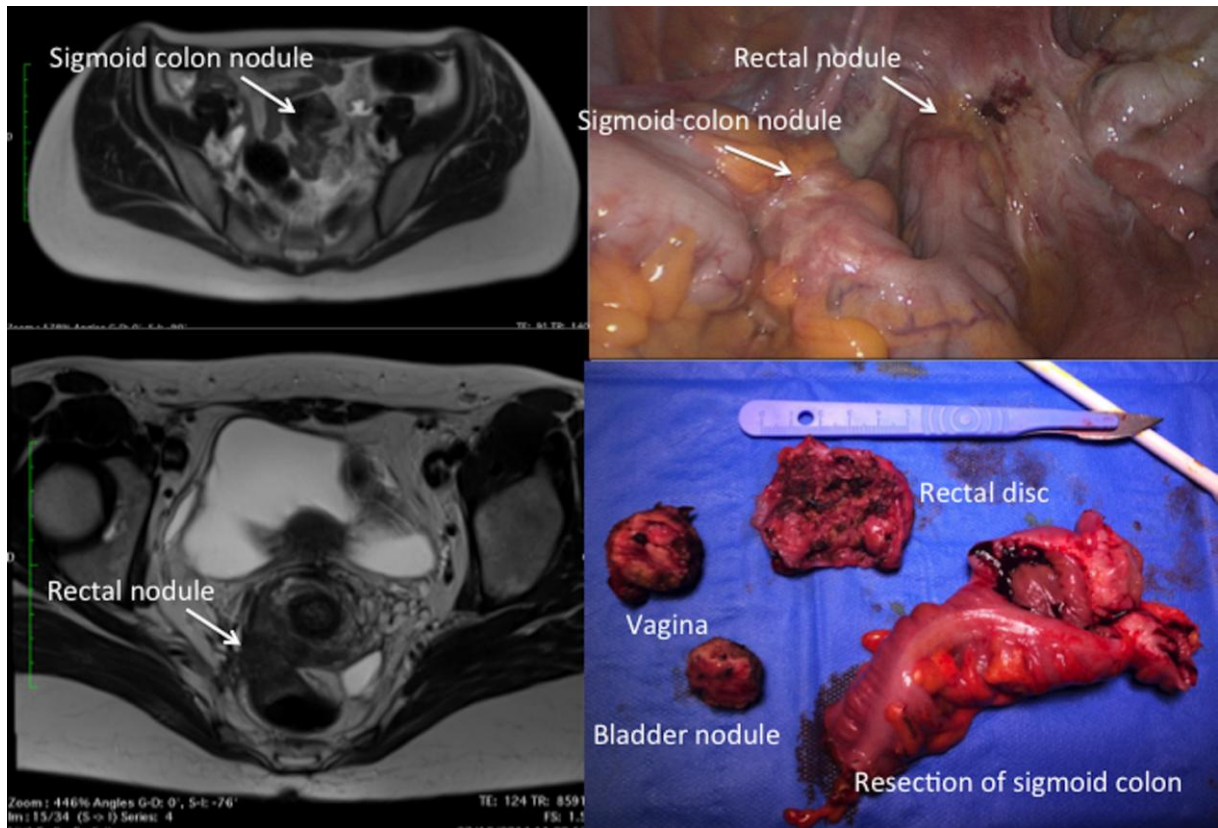
460 Video 2. Multiple nodule removal for multifocal colorectal deep endometriosis , by  
461 rectal disc excision and short sigmoid colon resection using a semicircular stapler.

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