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## **Discoid excision for colorectal endometriosis associated infertility: A balance between fertility outcomes and complication rates**

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1 **Title: Discoid excision for colorectal endometriosis associated infertility: a balance**  
2 **between fertility outcomes and complication rates**

3 **Short running title: Impact of discoid excision for deep endometriosis on fertility.**

4

5

6 **Abstract**

7

8 **Objective:** The objective of our study was to study the impact of discoid excision for deep  
9 endometriosis (DE) with colorectal involvement on fertility outcomes.

10 **Methods:** 49 patients with a desire for pregnancy treated with discoid excision for colorectal  
11 endometriosis in our endometriosis expert center between January 2015 and August 2020  
12 were selected from our prospectively maintained database. Indications for surgery were either  
13 infertility and / or pelvic pain. Postoperative complications were graded according to the  
14 Clavien-Dindo classification. Fertility outcomes, both spontaneous and post-ART  
15 pregnancies, were analyzed.

16 **Results:** Among the 49 patients who underwent discoid excision exclusively (no other  
17 digestive resection) with a desire to conceive, 25 had a pregnancy after surgery and 24 did  
18 not. Double discoid excision was performed in 6.1% of the cases (3/49). A colectomy was  
19 performed in 12.2% of the patients (6/49), and a protective stoma in 12.2% (6/49).  
20 Fenestration of endometriomas was performed in 28.6% of the patients (14/49), and  
21 parametrectomy in 40.8 % (20/49). The postoperative complication rate was 24.5% (12/49)  
22 including 10.2% (5/49) grade I, 12.2% (6/49) grade II, and 2% (1/49) grade III. Prior to  
23 surgery, 28 (57.1%) patients had infertility including 13 (52%) that successfully conceived  
24 following surgery and 15 (62.5%) that remain infertile. Spontaneous pregnancy was achieved  
25 in 60% (15/25) of infertile patients' prior surgery. The live-birth rate in patients conceiving  
26 spontaneously was 75% (12/16).

27 **Conclusion:** Our results support that discoid excision is safe and associated with good  
28 fertility outcomes. Whether first-line surgery using discoid excision is superior to first-line  
29 ART remains to be determined.

30 **Keywords:** colorectal endometriosis; discoid excision; postoperative complication; infertility;  
31 pregnancy.



## 33 **Introduction**

34 Endometriosis, particularly in its advanced stages, is a well-known cause of disabling  
35 pelvic pain and infertility. The exact prevalence of endometriosis is unknown, but it is thought  
36 to affect between 5 and 10% of women of reproductive age, and up to 50% of infertile  
37 women. Colorectal endometriosis is the most severe form of deep endometriosis (DE) and  
38 concerns 5 to 12% of endometriosis patients [1–3]. The main location of bowel endometriosis  
39 is the colorectum representing 85% of all bowel lesions [2,4–6].

40 Many studies have demonstrated that the main factor associated with recurrence in  
41 patients undergoing surgical management is incomplete excisional surgery with residual  
42 disease. Recurrence is associated with negative outcomes both in terms of pain, quality of life,  
43 and fertility. Historically, surgical management of colorectal endometriosis consisted of  
44 radical treatment with segmental resection. While segmental resection has been shown to  
45 have long term benefits on pain and probably on fertility [7,8], it is associated with significant  
46 morbidity, exposing women to the multiple risk of severe postoperative complications such as  
47 rectovaginal fistula and voiding dysfunction, sometimes with persistent sequelae decreasing  
48 quality of life [9–14].

49 As an alternative to systematic segmental resection, conservative techniques, such as  
50 rectal shaving and discoid excision, have been developed. Rectal shaving is mainly indicated  
51 in patients with serosal or superficial muscularis involvement, but is associated with a  
52 relatively higher risk of recurrence when compared to discoid excision or segmental resection  
53 [15]. Conversely, discoid excision allows for complete resection with a lower morbidity and a  
54 similar recurrence rate to segmental resection [16]. Discoid excision is mainly indicated in  
55 patients with a lesion involving less than 90° of the bowel circumference and up to 3 cm in  
56 length, although a larger resection (around 5 cm) can be achieved with double discoid  
57 excision [17]. Discoid excision has demonstrated its effectiveness in reducing morbidity

58 including the need for temporary stoma and postoperative complications [9,18]. This less  
59 morbid procedure could reduce time to conception as well as increase pregnancy and live-  
60 birth rates. However, insufficient data are available to support these hypotheses.

61 Therefore, the objective of the present study was to evaluate the impact of discoid  
62 excision on complication rates and fertility outcomes including both spontaneous and  
63 Assisted Reproductive Technique (ART) pregnancies.

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83 **Materials and methods**

84 We queried a prospectively maintained database of patients surgically treated for  
85 endometriosis in Tenon University Hospital, AP-HP, Sorbonne University, Paris, France.  
86 Patients with colorectal endometriosis lesions treated by discoid excision between January  
87 2015 and August 2020 were eligible. Inclusion was restricted to patients with a desire to  
88 conceive. The criteria used to define discoid eligibility were as classically described, i.e.,  
89 preoperative length  $\leq 3$  cm and involving  $<90^\circ$  of the bowel circumference [19,20], and  
90 confirmed by transvaginal ultrasonography, magnetic resonance imaging (MRI) and rectal  
91 echo-endoscopy (REE). Patients with multifocal lesions or requiring intraoperative  
92 conversion to segmental resection were excluded.

93 The study protocol was approved by the Ethics Committee of the National College of  
94 French Gynecologists and Obstetricians (reference number: CEROG 2022-GYN-1205) [21].

95 The following data were abstracted from the database: socio-demographic features,  
96 physical examination, fertility features, prior surgery, preoperative imaging workup, surgical  
97 details, and intra- and postoperative outcomes.

98 Indications for surgery were based on the European Society of Human Reproduction  
99 and Embryology (ESHRE) guidelines and could include medical treatment failure in  
100 symptomatic patients, and infertility before or after failure of two cycles of in vitro  
101 fertilization/intracytoplasmic sperm injections (IVF-ICSI) [22,23]. All decisions for surgery  
102 were systematically validated by a multidisciplinary committee. Infertility was defined as  
103 failure to achieve pregnancy after at least 12 months of regular unprotected sexual  
104 intercourse. Anti-Müllerian hormone (AMH) serum levels were assessed prior to surgery for  
105 all the patients. The option to preserve fertility was systematically discussed with the patient  
106 preoperatively.

107 Preoperative workup included physical examination, transvaginal ultrasonography,  
108 and pelvic MRI. The MRI protocol included 3D T2, 3D T1 sequences with and without fat  
109 saturation and gadolinium injection in accordance with French guidelines (HAS-CNGOF)  
110 [24]. REE was prescribed at the surgeon's discretion to accurately assess the distance between  
111 the lesion and the anal margin, as well as to assess the characteristics of the colorectal lesion.

112

### 113 *Surgical procedure*

114 All laparoscopies were performed by three experienced surgeons (SB, ED, CT) with  
115 the intention to perform complete excision of all endometriosis lesions. The surgical  
116 technique used has been previously described [16]. Briefly, the bowel procedure included  
117 two steps after extra bowel removal of lesions involving the torus uterinum, uterosacral  
118 ligaments, parametrium by ureterolysis, ovarian cystectomy or fenestration, salpingectomy for  
119 hydrosalpinx, and colectomy when required. The first step consisted of rectal shaving to  
120 excise the extraserosal component of bowel endometriosis, and the second was the actual  
121 discoid excision using a transanal circular stapler (CDH 29 or 33A; Endo-Surgery, Ethicon,  
122 France). A double discoid excision was performed for large lesion size over 3 cm or in the  
123 case of positive margins on macroscopic analysis, and consisted of two consecutive discoid  
124 excisions for a single colorectal lesion. A protective stoma was performed only in the case of  
125 associated colectomy when the interposition of the peritoneum was not possible between the  
126 vaginal and the digestive sutures.

127 The Endometriosis Fertility Index (EFI) score was calculated for each patient  
128 following surgery, and the severity of the endometriosis was staged using the revised  
129 American Society of Reproductive Medicine (rASRM) classification [25].



130 A postoperative visit was planned for all the patients 4 to 6 weeks after surgery.  
131 Postoperative complications were classified according to the Clavien-Dindo classification  
132 [27] as minor for grades I-II, and major for grades III-IV (complication requiring radiological  
133 intervention or surgery). Voiding dysfunction was defined as the need for intermittent bladder  
134 self-catheterization and was classified as immediate when lasting <30 days postoperatively,  
135 and persistent when lasting  $\geq 30$  days.

### 136 *Fertility*

#### 137 *Data*

138 Fertility was assessed during follow-up visits using questionnaires investigating: (i)  
139 the desire to conceive after surgery; (ii) the occurrence of pregnancy after surgery; (iii) the  
140 number of pregnancies; (iv) the mode of conception (spontaneous or after ART); (v) the time  
141 between surgery and the occurrence of pregnancy; and (vi) pregnancy outcomes including  
142 abortion, miscarriage, ectopic pregnancy, late miscarriage, premature labor, and live birth.  
143 The ART protocol was determined by reproductive specialists based on the patient's features  
144 (age, AMH, ART history, cause of infertility...). IVF-ICSI could be performed using either  
145 fresh or frozen embryos. A biochemical pregnancy was defined by an hCG level >25 UI/L,  
146 and a live birth as a live delivery >25 weeks of gestation.

#### 147 *Statistical analysis*

148 Databases were managed using Excel (Microsoft Corporation, Redmond, WA, USA)  
149 and statistical analyses were performed using R studio software (1.1.463 version, available  
150 online). Descriptive analysis included frequencies and percentages for qualitative variables  
151 and median (interquartile range (IQR)) for quantitative variables. Statistical analysis was  
152 based on the Student's t test for continuous variable and the  $\chi^2$  test or Fisher's exact test for  
153 categorical variables. P-values <0.05 were considered to denote significant differences.

154           First, we compared the features of the patients wishing to conceive following surgery.

155   Then, we investigated the impact of postoperative complications on fertility outcomes.

156

157 **Results**

158 *Epidemiological and surgical characteristics of the population*

159 During our inclusion period, 406 patients underwent surgery for colorectal  
160 endometriosis excluding those who underwent rectal shaving: 67% (273/406) underwent  
161 segmental colorectal resection, and 33% (133/406) discoid excision. Discoid excision was  
162 performed from January to December 2015 in 23% of the cases (8/35); in 2016 for 27%  
163 (29/107); in 2017 for 30% (28/94); in 2018 for 40% (28/71); in 2019 for 42% (29/69)  
164 including the first wave of the Covid-19 pandemic, and from January to August 2020 for 37%  
165 (11/30) including the second wave of the Covid-19 pandemic.

166 Forty nine patients fitted inclusion criteria and were selected for analysis, including 25  
167 that successfully conceived following surgery and 24 that did not (Figure 1). Median follow-  
168 up was 15 months (range: 1–57).

169 The main characteristics of the patients included are displayed in Table 1. Patients that  
170 successfully conceived following surgery were similar to those remain infertile regarding  
171 clinical and imaging disease extension. There was no significant difference between the group  
172 pregnancy after surgery and no pregnancy after surgery. Prior to surgery, 28 (57.1%) patients  
173 had infertility, 13 (52%) in the group pregnancy after surgery and 15 (62.5%) in the group  
174 without. Most patients were primarily infertile. Twenty-two patients (44.9%) had undergo  
175 ART prior surgery including 10 (40%) that successfully conceived following surgery and 12  
176 (50%) that remain infertile.

177 Regarding painful symptoms, 83.7% of patients (41/49) had dysmenorrhea, 69.4%  
178 (34/49) deep dyspareunia, 30.6% (15/49) chronic pelvic pain, 28,6% (14/49) dyschezia and  
179 22.4% (11/49) voiding dysfunction. The main surgical indication was pelvic pain in 38.8%  
180 (19/49) of the patients. Of the 28 patients who had associated infertility, 78.6% (22/28) had  
181 experienced a previous IVF-ICSI failure. Nine patients (18.4%) who underwent discoid

182 excision had no digestive lesions detected on preoperative MRI. The median MRI size of the  
183 lesion resected was 20 mm (range: 10-40).

184 The surgical procedures performed are displayed in Table 2. Double discoid excision  
185 was performed in 6.1% of the cases (3/49). A colectomy was performed in 12.2% of the  
186 patients (6/49), and a protective stoma in 12.2% (6/49). Fenestration of endometriomas was  
187 performed in 28.6% of the patients (14/49), and parametrectomy in 40.8 % (20/49).

188 The median hospital stay was 6.5 days (range: 4–10) and the postoperative  
189 complication rate was 24.5% (12/49) including 10.2% (5/49) grade I, 12.2% (6/49) grade II,  
190 and 2% (1/49) grade III. The grade III complication consisted of a vaginal dehiscence that  
191 required a second surgery on postoperative day 20. No grade IV complication, rectovaginal  
192 fistulas or anastomotic leakage were observed. Postoperative voiding dysfunction requiring  
193 bladder self-catheterization occurred in 10.2% of the cases (5/49), mostly during the  
194 immediate postoperative period (80%, 4/5).

195

#### 196 **Fertility outcomes.**

197 Prior to surgery, 34 patients out of 49 wished to conceive and the remaining ones  
198 desired a pregnancy solely after resolution of pain symptoms following surgery (Figure 2).  
199 Pregnancy rate was 51% following surgery (25/49). Patients that successfully conceived were  
200 more often operated on because of infertility (65% versus 26%,  $p < 0.001$ ) and were more  
201 likely to have undergo ART (45% versus 17%,  $p = 0.03$ ) (Supplementary Table 1). Among the  
202 patients who achieved pregnancy, 60% (15/25) had spontaneous pregnancies, and 40%  
203 (10/25) underwent ART (Figure 2). As several women had more than 1 pregnancy, we  
204 recorded 29 pregnancies, 16 natural conceptions (55%) and 12 deliveries (75%). Some  
205 patients had more than one pregnancy following surgery.

206 Patients requiring ART to achieve pregnancy were more likely to be infertile prior to  
207 surgery (80% versus 47%,  $p=0.04$ ), and have a lower EFI score (4 (2-9) versus 9 (4-10),  
208  $p=0.003$ ) than those who achieved a spontaneous pregnancy (Supplementary Table 2). The  
209 rASRM scores were similar in these two groups.

210 Among the patients who conceived spontaneously, 60% (9/15) succeeded within the  
211 first year. The live-birth rate in the patients conceiving spontaneously was 75% (12/16).  
212 Nineteen percent (3/16) of these patients had an early miscarriage and one had an ongoing  
213 pregnancy at the time of the study.

214 The median time between surgery and a first ART attempt was 10.2 months (range: 4–  
215 24). The live-birth rate following ART was 38% (5/13), significantly lower than for  
216 spontaneous pregnancies ( $p < 0.01$ ). Conversely, the early miscarriage rate was significantly  
217 higher at 38% (5/13) ( $p < 0.01$ )

218 There were no significant differences in postoperative complication rates, but voiding  
219 dysfunction was more frequent in patients not wishing to conceive prior surgery (30% versus  
220 10%,  $p=0.04$ ).

221 Among the patients experiencing postoperative complications, 52% (12/23) desired to  
222 conceive following surgery and 58% (7/12) achieved a pregnancy. The occurrence of a  
223 postoperative complication had no impact on the probability of achieving pregnancy,  
224 including spontaneously (71% versus 55%,  $p=0.67$ ). However, the occurrence of a post  
225 operative complication was associated with longer delay prior achieving pregnancy ( $19 \pm 9.9$   
226 months versus  $16 \pm 6.7$  months) (Table 3).

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229

230 **Discussion**

231 The present study demonstrates that discoid excision for colorectal endometriosis is  
232 associated with a high pregnancy rate. Moreover, discoid excision was found to be associated  
233 with a high live-birth rate –the principal goal of surgery for both patients and practitioners–  
234 especially in patients who conceived spontaneously. Finally, in patients with prior infertility,  
235 surgery enhanced fertility.

236 This is the first study to focus on fertility outcomes after discoid excision in patients  
237 with DE and colorectal endometriosis. So far, little is known about fertility outcomes  
238 following discoid excision rendering shared decision-making difficult. Half of the patients in  
239 our study who wished to conceive became pregnant (51%, 25/49). Moreover, we observed a  
240 high spontaneous pregnancy rate of 60%. It is well known that patients with colorectal  
241 endometriosis have a low spontaneous pregnancy rate ranging between 0 and 10%. However,  
242 these rates are brut and not stratified based on the size of the colorectal lesion or according to  
243 colorectal surgeries [28–31]. Previous studies evaluating fertility outcomes after colorectal  
244 resection (mainly based on segmental resection) reported a spontaneous pregnancy rate of 40  
245 to 59%, lower than in our cohort [23,32,33].

246 Our data suggest a higher positive impact of surgery on fertility outcomes for small  
247 colorectal lesions. Besides patients undergoing double discoid excision, commonly used  
248 eligibility criteria for this technique are a lesion size under 3 cm and involving less than 90°  
249 of the bowel circumference. These criteria could explain the better fertility outcomes after  
250 discoid excision (when compared to segmental resection) by selecting less severe lesions and  
251 limited disease extension [16]. Although not designed to evaluate fertility after colorectal  
252 surgery for endometriosis, Roman et al. reported a similar overall pregnancy rate  
253 (spontaneous and after ART) in the radical surgery group (segmental resection) of the

254 ENDORE trial compared to the conservative group (rectal shaving and discoid excision)  
255 without specifically reporting results for discoid excision [33].

256 The low intra- and postoperative severe complication rates observed in our cohort are  
257 probably because the procedures were performed by experienced surgeons in an expert center,  
258 as has already been demonstrated [34]. In our cohort, a total of 6 patients had protective  
259 stoma at the end of surgery. While this rate is already low, recent reports by Roman et al. is in  
260 favor of aiming a near zero rate which could improve patients' quality of life following  
261 surgery [35]

262 Furthermore, Netter et al. found that discoid excision is associated with very high  
263 satisfaction rates [36]. The occurrence of a complication had no effect on the desire to  
264 conceive: out of the six patients or couples who no longer desired to conceive following  
265 surgery, only two experienced postoperative complications. This is in line with the work of  
266 Ferrier et al. reporting a 41.2% pregnancy rate, 80% of which were spontaneous in patients  
267 who experienced severe complications after colorectal endometriosis resection [37].

268 Another crucial result in the current study, is the low early miscarriage rate after  
269 discoid excision. In our cohort, patients conceiving spontaneously had a significantly lower  
270 early miscarriage rate than those undergoing ART. Previous meta-analyses have underlined a  
271 higher risk of miscarriage in patients with endometriosis compared to control groups [38,39].  
272 Huang et al., in their meta-analysis, demonstrated the high risk of early miscarriage for  
273 spontaneous pregnancies in women with endometriosis [39]. However, they did not take into  
274 account the benefits of laparoscopic surgery for endometriosis [39]. Moreover, Huang et al.  
275 underlined that the risk of miscarriage was influenced by the endometriosis phenotype and  
276 was higher for DE than for endometrioma [39]. Finally, in agreement with the meta-analysis  
277 of Hodgson et al., evaluating the various medical and surgical options to enhance fertility in  
278 patients with endometriosis, both laparoscopy alone and a GnRH agonist alone offered

279 similarly high pregnancy rates while the data were insufficient to evaluate their impact on  
280 live-birth and miscarriages rates [40].

281 Another issue for clinicians is to decide whether to opt for first-line surgery or to  
282 attempt ART first. In our cohort, the live-birth rate was higher among patients who conceived  
283 spontaneously after surgery. Moreover, half of the patients achieving spontaneous pregnancy  
284 following surgery were infertile prior to surgery including 27% with ART failure. Despite our  
285 results, insufficient data are available to draw a definitive conclusion on whether discoid  
286 excision enhances fertility compared to ART raising the issue of combined surgery and ART.  
287 In our cohort, 80% of the patients who achieved pregnancy using ART were infertile prior to  
288 surgery. Bendifallah et al. [23] reported an increase in the cumulative live-birth rate after first-  
289 line surgery with a specific cumulative live-birth rate at the first ICSI-IVF cycle compared  
290 with first-line ART alone of 32.7% vs 13.0%; after two ICSI-IVF cycles 58.9% vs 24.8%; and  
291 after three ICSI-IVF cycles 70.6% vs 54.9% for patients with colorectal endometriosis.  
292 Similar findings were reported by Barri et al. [29] with higher pregnancy rates in combined  
293 strategies but including few patients with colorectal endometriosis. In our cohort, the EFI  
294 scores were significantly lower in patients who required ART to achieve pregnancy following  
295 surgery. This is in line with the recent meta-analysis of Vesali et al. showing that patients with  
296 EFI scores between 0 – 2 had a lower chance of spontaneous pregnancy at 36 months than  
297 those with EFI scores ranging from 9 – 10 [41]. The location of the lesions is one of the main  
298 criteria involved. Tuominen and al. showed that patients with rectovaginal endometriosis have  
299 comparable and good reproductive prognosis regardless of the treatment method (surgery or  
300 ART) [42]. Ferrier et al. highlighted the higher cost associated with ART management  
301 following surgery and the relevant use of the EFI scores to help decide between spontaneous  
302 conception, immediate, or delayed ART [43]. In our cohort, ART was associated with a lower



303 time to pregnancy and EFI scores could help determine which patients could attempt  
304 spontaneous pregnancy following surgery and which should be referred for ART.

305 Our study has some limitations. First, the sample size remains limited with only one  
306 center included. These results can be considered only preliminary and can limit the  
307 generalizability of the findings. A multi-center study might provide more diverse and  
308 representative data. Second is a potential bias due to the lack of information about fertility  
309 outcomes in 10% of our patients. Third, only female parameters were taken into account to  
310 evaluate fertility with no information about male characteristics. This could have led to an  
311 underestimation of the benefit of surgery as ART was systematically required for couples  
312 with both female and male infertility. Moreover, these couples might have a lower chance of  
313 success even if surgery outperforms expectations by increasing fertility. Furthermore, some  
314 patients were relatively young at the time of surgery and might not have desired pregnancy at  
315 the time we completed this study with only a 5-year time frame. Fourth, most patients  
316 undergoing ART (before or after surgery) were managed outside our center and the protocols  
317 used could not therefore be reported. This could have influenced the success / failure rate as  
318 not all centers report similar pregnancy rates. Finally, this work focused on fertility outcomes  
319 but eluded the question of the functional digestive outcomes which were not evaluated by a  
320 specific questionnaire. However, secondary analysis of the ENDORE trial showed that the  
321 main factor impacting bowel movement following rectal surgery for endometriosis was  
322 preoperative constipation and not the type of surgery (radical or conservative) [44].  
323 Eventually, best option between first line surgery and primary ART for patients with severe  
324 disease wishing to conceive remain undetermined. The results of the ENDO FERT trial are  
325 highly expected to help the clinical decision making [45].

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327

328 **Conclusion**

329           Our results support that discoid excision is safe and associated with good fertility  
330 outcomes. Whether first-line surgery using discoid excision is superior to first-line ART  
331 remains to be determined.

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358 **Author's roles:** YD, LE, CT and ED were involved in study design. YD, LE, AF, KK, AP,  
359 AJ, CF were involved in execution and acquisition of data and YD, LE, AF, KK, AP, AJ, CF,  
360 CT, SB and ED were involved in data analysis and interpretation. YD, LE, SB and ED were  
361 involved in manuscript drafting and all authors were involved in critical discussion and in  
362 revising the manuscript critically for important intellectual content. All authors have given the  
363 final approval of the version to be published.

364

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