

# Bowel endometriosis: diagnosis and management

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## Background

Endometriosis is a chronic, estrogen-dependent inflammatory condition affecting approximately 10% of all reproductive-aged women and approximately 35-50% of women with pelvic pain and infertility.<sup>1</sup> Endometriosis can be classified as genital vs extragenital.<sup>2</sup> Endometriosis along the bowel is the most common site for extragenital

The most common location of extragenital endometriosis is the bowel. Medical treatment may not provide long-term improvement in patients who are symptomatic, and consequently most of these patients may require surgical intervention. Over the past century, surgeons have continued to debate the optimal surgical approach to treating bowel endometriosis, weighing the risks against the benefits. In this expert review we will describe how the recommended surgical approach depends largely on the location of disease, in addition to size and depth of the lesion. For lesions approximately 5-8 cm from the anal verge, we encourage conservative surgical management over resection to decrease the risk of short- and long-term complications.

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endometriosis.<sup>3,4</sup> Endometriosis of the bowel can manifest as deeply infiltrative lesions of the muscularis or mucosa, or as superficial disease that lines the bowel serosa or subserosal area. It is estimated to affect 3.8-37% of patients with known endometriosis.<sup>5,6</sup> Such significant differences in the estimated incidence may be due to differences in opinion regarding the definition of bowel endometriosis, or a reflection of missed diagnosis. Furthermore, a number of women with bowel endometriosis are diagnosed with other disorders such as irritable bowel syndrome and may never actually be diagnosed with or treated for endometriosis of the bowel.<sup>7</sup>

Multiple theories exist regarding the true pathogenesis of endometriosis, which is complex and likely multifactorial (Table 1). Nezhat and Mahmoud<sup>8</sup> have suggested that the Allen-Masters peritoneal defect may act as a potential pathway to deep infiltrative endometriosis in retrovaginal endometriosis. Deposits of retrograde menstruation may lead to an inflammatory process thereby causing increased risk of adhesion formation and, ultimately, cul-de-sac obliteration.<sup>9</sup> Bowel endometriosis is most frequently found on the rectosigmoid colon, followed by the rectum, ileum, appendix, and cecum,<sup>4,10</sup> with case reports of lesions found in the upper abdomen including the stomach<sup>11</sup>

and transverse colon.<sup>12</sup> Although isolated bowel involvement can be seen, the majority of patients with bowel endometriosis have evidence of disease elsewhere.<sup>4</sup>

Endometriosis, although generally considered a benign disease, may be associated with an increased risk of cancer. The overall risk for an endometriosis-associated neoplasm is thought to be up to 1%, with a quarter of these cases involving extraovarian tissue.<sup>13</sup> There have been several published cases of endometriosis-related gastrointestinal (GI) tumors, of which half involve primary adenocarcinoma of the rectosigmoid colon.<sup>14</sup> There remains a paucity of data on how endometriosis may specifically increase the risk of colorectal malignancy; however, evidence demonstrates an increased risk of malignant transformation in patients with endometrioid or clear cell ovarian carcinoma.<sup>15,16</sup> Thus, benefits of excisional surgery include not only pain relief and a potential increase in fertility, but also potential cancer prophylaxis.

Bowel resection has been performed to treat bowel endometriosis since the early 1900s.<sup>17</sup> Even though over a century has passed, many surgeons have not advanced their practices, with some surgeons still routinely performing segmental resection for bowel endometriosis.<sup>18</sup> Patients thus may be at

TABLE 1

**Theories surrounding pathogenesis of bowel endometriosis**

Theory	Explanation
Retrograde menstruation	Most commonly cited theory involving retrograde flow during menses
Coelomic metaplasia <sup>1</sup>	Metaplastic extrauterine cells aberrantly differentiate into endometrial cells along visceral or abdominal peritoneum
Benign metastasis	Where endometrial tissue spreads through lymphatic or hematologic system to ectopic anatomic sites
Genetic and immune dysfunction	Includes possible apoptosis suppression, greater expression of invasive mechanisms, greater expression of neoangiogenesis factors, genetic alterations of endometrial cellular function, and oxidative stress and inflammation <sup>2,3</sup>
Iatrogenic causes	For example, endometrial cells can be spread after surgical procedures that involve endometriosis or endometrium itself, with lesions presenting along scars such as laparoscopic port sites and cesarean delivery hysterotomies <sup>4</sup>
Anatomical shelter theory <sup>5</sup>	Rectosigmoid colon may act as anatomic barrier that prevents retrograde menstrual flow from spreading cephalad from pelvis, so that more endometriotic implants imbed along pelvis and rectosigmoid than along upper abdominal structures

1 Sourial S, Tempest N, Hapangama DK. Theories on the pathogenesis of endometriosis. *Int J Reprod Med* 2014;2014:179515.

2 Fortunato A, Boni R, Leo R, et al. Vacuoles in sperm head are not associated with head morphology, DNA damage and reproductive success. *Reprod Biomed Online* 2016;32:154-61.

3 Nezhat C, Falik R, McKinney S, King LP. Pathophysiology and management of urinary tract endometriosis. *Nat Rev Urol* 2017;14:359-72.

4 Buka NJ. Vesical endometriosis after cesarean section. *Am J Obstet Gynecol* 1988;158:1117-8.

5 Vercellini P, Chapron C, Fedele L, Gattei U, Daguati R, Crosignani PG. Evidence for asymmetric distribution of lower intestinal tract endometriosis. *BJOG* 2004;111:1213-7.

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increased risk of morbidity, including possible permanent ostomy, for a benign disease process that could have been managed conservatively with more modern surgical techniques. In an effort to decrease postoperative morbidity, conservative approaches including shaving excision and disc resection have been developed, but still all too many surgeons resort to overly aggressive bowel resection. Given the recognized importance for treatment of deeply infiltrative endometriosis of the bowel, surprisingly the current medical literature offers a variety of surgical approaches without an established guideline for which surgical approach is recommended for different patient presentations. This lack of clarity may unfortunately contribute to all too many

patients still undergoing unnecessary segmental bowel resection. We recognize the confusion that surrounds the surgical management of deeply infiltrative endometriosis of the bowel. Whereas one size does not fit all, there are principles and approaches that may guide the surgeon to perform the most effective and least harmful procedure in particular cases. The aim of this expert review is to help clinicians navigate the management of this complex disease.

## Diagnosis

### Clinical presentation

Clinical suspicion for deeply infiltrative endometriosis and bowel endometriosis starts with a thorough clinical history. It should be suspected in women who report dysmenorrhea, deep dyspareunia,

chronic pain, and/or dyschezia. Some women have catamenial diarrhea, blood in the stool, constipation, bloating, pain with sitting, and radiation of pain to the perineum. The pathogenesis of pain related to endometriosis is complex and multifactorial, with evidence suggesting that there may be an autonomic component explaining why symptoms may mimic that of irritable bowel syndrome.<sup>19</sup> Endometriotic lesions involving the enteric nervous system may cause significant damage; for example if they involve Auerbach plexus, Meisner plexus, or the interstitial cells of Cajal, they may cause nausea, vomiting, or a subocclusive crisis.<sup>20,21</sup> The differential diagnosis for these symptoms can be broad, including conditions such as inflammatory or ischemic colitis, radiation colitis, diverticulitis, malignancy, or pelvic inflammatory disease. If bowel endometriosis is not on the clinician's differential, the diagnosis may be missed and patients may go many years before adequate treatment.<sup>7,21</sup>

Physical examination, specifically rectovaginal examination, is often helpful in diagnosis, especially if performed at the time of menstruation, during which time lesions may be more inflamed, tender, and palpable. Findings may include a palpable nodule or a thickened area along the uterosacral ligaments, uterus, vagina, or rectovaginal septum. Visualization of the vagina may reveal a laterally displaced cervix or a blackish-blue lesion.<sup>22</sup> Bowel endometriosis may also be diagnosed incidentally at the time of surgery performed for other indications. Monitoring of CA-125 levels to diagnose and evaluate disease progression in deeply infiltrative endometriosis has been proposed but is of little utility and is not recommended.<sup>23,24</sup>

### Imaging modalities

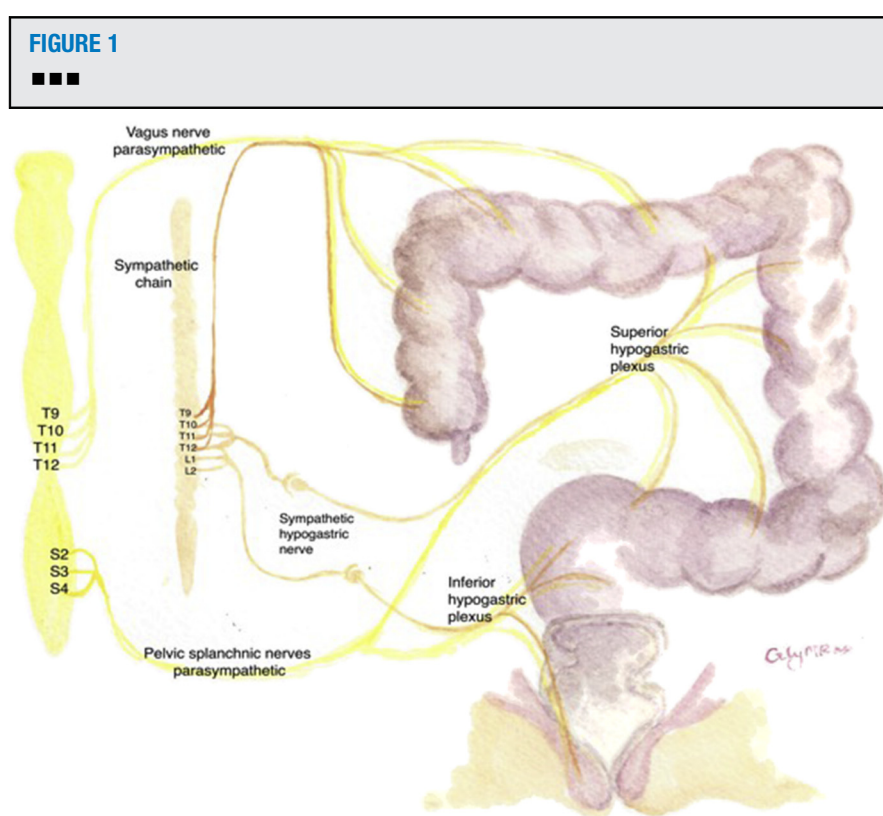
Transvaginal ultrasound (TVUS) can be used in conjunction with physical exam with an overall high sensitivity and specificity. Details regarding the size, location, depth of infiltration, presence of bowel lumen stenosis, and quantification of nodules are important in preoperative planning. In a meta-analysis published in 2011, Hudelist et al<sup>27</sup> found the overall specificity of TVUS was high

(92-100%), with a sensitivity of 71-98%. Similarly, Exacoustos et al<sup>25</sup> found the accuracy of detection to range from 76-97%, with the greatest accuracy (97%) found in the detection of bladder lesions and cul-de-sac obliteration. Accuracy of diagnosis is correlated with sonographer experience and even in the best of sonographers' hands. In an effort to address this, the International Deep Endometriosis Analysis group has published methods to obtain quality images, with several published image examples.<sup>26</sup> However, with TVUS, the problem remains that lesions on the sigmoid may be missed as these are typically outside of the field of view.<sup>27</sup> The use of computed tomography-based modified virtual colonoscopy to help predict severity of bowel endometriosis is a novel approach where 25 mm Hg of carbon dioxide is introduced into the rectum and computed tomography-guided images are used to recreate a 3-dimensional model of the bowel.<sup>28</sup> It remains experimental but does have promising preliminary findings.<sup>28</sup> Additional imaging options, including magnetic resonance imaging (Figure 3) and barium enema, are listed in Table 2.

### Medical Management

Medical management may be utilized for symptomatic patients with bowel endometriosis, with the understanding that patients may still require subsequent future surgery. Ovulatory suppression can improve some patients' symptoms, and may be advisable for those who are not surgical candidates or who prefer to avoid surgery. Hormonal suppression has been shown to significantly improve pain and GI symptoms in patients whose degree of bowel stenosis is <60%.<sup>29</sup> It is especially useful to prevent recurrence; after surgery, women who do not desire immediate fertility can be placed on hormonal suppression postoperatively to prevent regrowth of the endometriosis.<sup>22</sup>

To date, there is no established optimal hormonal regimen for the treatment or prevention of deeply infiltrative endometriosis or bowel endometriosis. General principles for treatment include the emphasis on long-term hormonal suppression and



Innervation of bowel.

Nezhat. Bowel endometriosis. *Am J Obstet Gynecol* 2017.

optimization to minimize the side-effect profile to improve patient compliance.<sup>30</sup> Low-dose progestins or combined oral contraceptives are generally well tolerated, and are the first-line medical treatment due to efficacy, minimal side effects, and low cost. Data from a randomized control trial by Vercellini et al<sup>31</sup> demonstrated that both progestins alone or combined with low-dose estrogen decreased symptoms of dysmenorrhea, dyspareunia, and dyschezia. Ferrero et al<sup>32</sup> showed that low-dose norethindrone (2.5 mg daily) can significantly decrease diarrhea, cramping, and cyclic rectal bleeding in women with histologically proven endometriosis, with 53% of the 40 participants reporting significant improvement in GI symptoms. By the end of the 12-month study period, 33% of patients opted to have surgical treatment of their bowel endometriosis due to overly bothersome symptoms.

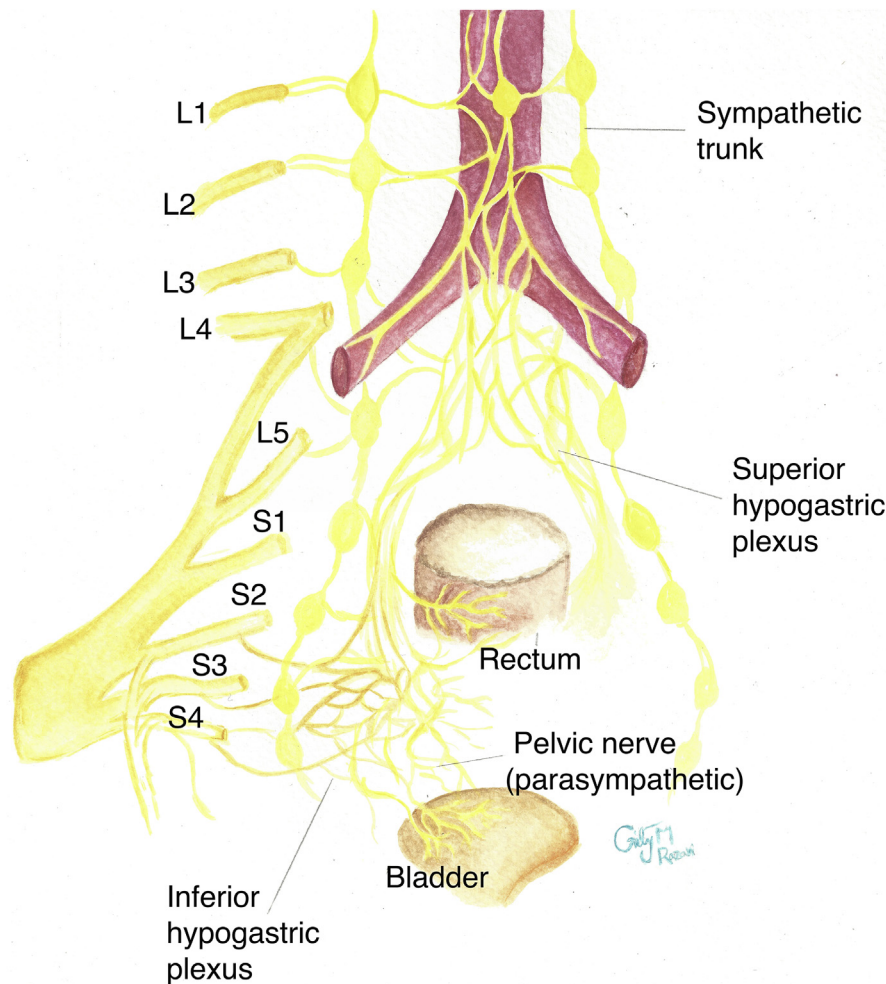
Several other medical therapies have shown promise, but have been studied on a smaller scale. Fedele et al<sup>33</sup> reported

improvement of dysmenorrhea, dyschezia, and pelvic pain in a series of 11 women who received a levonorgestrel intrauterine device. Razzi et al<sup>34</sup> reported use of danazol 200 mg per vagina daily to be well tolerated among a cohort of 21 women with rectovaginal endometriosis, with a significant reduction of pain at the 12-month follow-up.<sup>34</sup> Leuprolide acetate, a gonadotropin-releasing hormone agonist, can also help mitigate symptoms in women with rectovaginal endometriosis and can be used with add-back norethindrone therapy.<sup>35</sup> Leuprolide can also be useful preoperatively to decrease disease burden at the time of surgery. Extensive use of gonadotropin-releasing hormone agonists is often limited by their side-effect profile, namely vasomotor symptoms, as well as concern for decreased bone mineral density if used for >6 months.<sup>36</sup>

### Surgical Management

The exact mode of surgery will depend on surgeon expertise and experience, as

FIGURE 2



Innervation of bowel.

Nezhat. Bowel endometriosis. Am J Obstet Gynecol 2017.

well as availability of proper instrumentation. Cases of bowel endometriosis must often be managed in a multidisciplinary fashion, often with a minimally invasively trained gynecologic surgeon and involvement of a GI surgeon familiar with endometriosis.<sup>37-44</sup> As determined by the surgeon's experience and access to instrumentation, we recommend video-assisted laparoscopic surgery, with or without robotic assistance.<sup>43-48</sup>

Several authors have demonstrated the superiority of the laparoscopic approach as compared with laparotomy for the treatment of bowel endometriosis. Studies have consistently shown

that minimally invasive approaches result in lower blood loss, shorter length of hospital stay, and few postoperative complications<sup>43-48</sup> with about a 3% conversion rate to laparotomy in the hands of a trained expert.<sup>38</sup> Darai et al<sup>46</sup> published a randomized controlled trial for endometriosis in which 52 patients with colorectal endometriosis were randomly assigned to undergo laparoscopic-assisted or open colorectal resection. There were no differences in long-term outcomes related to postoperative diarrhea, bowel pain, cramping, dyspareunia, or dysmenorrhea. Blood loss was significantly lower in the laparoscopic group (1.6 vs 2.7 mg/L,

$P < .05$ ), and this group incurred fewer complications (9 vs 15 patients,  $P < .16$ ).<sup>39,40</sup> There was also a greater increase in postoperative desired fertility in the laparoscopic group.<sup>29</sup> In another prospective study comparing laparoscopic colorectal resection (n = 33) vs colorectal resection via laparotomy (n = 13) for bowel endometriosis, Ruffo et al demonstrated that those who underwent laparoscopic resection had a significantly higher postoperative pregnancy rate<sup>Q12</sup> (57.6% vs 23.1%,  $P < .035$ ).

Surgical approaches fall into 3 general categories: shaving excision, disc resection, and segmental resection. The choice of technique has been the subject of extensive debate and depends on the location of the bowel lesion, depth of infiltration, number of nodules, and presence or absence of stricture.<sup>38,40,48-51</sup> Generally speaking, there are 2 points of view with regard to the choice of surgical technique for bowel endometriosis. Some practitioners advocate more radical approaches with the primary goal of ensuring the complete removal of any possible endometriotic lesions within the bowel. This often achieves excellent outcomes with a relatively low rate of recurrence, but may come at the expense of increased risk of morbidity through lengthy recovery and untoward side effects or complications.<sup>52</sup>

There are an increasing number of surgeons who stress the risk of short- and long-term complications that radical segmental resection and even the more conservative disc excision entail, specifically when there is significant disruption of the surrounding neurovascular structures along the low rectum.<sup>50</sup> Especially at the level of the low rectum, aggressive resection requires extensive dissection of the retrorectal space, where extensive vascular and sympathetic and parasympathetic nerve bundles are located, including the pelvic splanchnic nerves, and the superior and inferior hypogastric plexus (Figures 1 and 2). Damage to these structures can lead to short- and long-term morbidity such as bowel stenosis, bowel ischemia resulting in fistula formation, severe constipation, and urinary retention.<sup>53,54</sup> In other areas of the intestine such as near the ileocecal valve,

complete excisional techniques do not carry risks as severe and may more often be indicated and beneficial to the patient. Our group stresses the importance of evaluating the balance between complete removal of the endometriosis and operative risk to the patient. In fact, no matter the surgical approach, whether it be more conservative shaving, or more radical disc or segmental resection, surgical treatment of bowel endometriosis can lead to long-term beneficial outcomes including increased fertility and pain relief.<sup>49,50,54,55</sup>

Those who advocate complete resection irrespective of the anatomical location cite the benefit of reduced recurrence. However, even with radical segmental resection, occult microscopic endometriosis has been shown to be present in 15% of specimen resection margins.<sup>56</sup> There are multiple documented cases of bowel endometriosis recurring after radical segmental resection. Roman et al<sup>50</sup> estimates that to avoid recurrence in 1 patient at 75 months, 11 patients would need to undergo segmental colorectal resection rather than shaving of the lesion. Moreover, to prevent the risk of a single recurrence that would necessitate repeat operation with a segmental resection, 23 patients would need to be treated initially with segmental resections.<sup>50</sup> Radical surgery, therefore, may not improve overall long-term outcomes as compared with conservative surgery yet is associated with a higher risk of complications.<sup>50</sup>

### Shaving excision

Shaving excision refers to the removal of disease layer-by-layer until healthy, underlying tissue is encountered, and can be considered the most conservative approach to surgical management of bowel endometriosis.<sup>41,42,57,58</sup> Shaving excision can be performed by ablation or resection of invasive and fibrotic endometriotic implants without entering the lumen of the bowel. The aim is to restore the normal soft-tissue anatomical architecture that may have otherwise been distorted by endometriosis and fibrosis. In the case of bowel endometriosis, the aim of shaving excision is to excise all or at least the majority of endometriotic and fibrotic lesions on the bowel while leaving the bowel mucosa and a portion

FIGURE 3



T2-weighted magnetic resonance revealing bilateral endometriomas. Ovaries are tethered to upper rectum by T2 hypointense fibrotic material consistent with deeply infiltrative endometriosis and cul-de-sac obliteration.

Nezhat. Bowel endometriosis. *Am J Obstet Gynecol* 2017.

of the muscularis intact while preserving bowel integrity.<sup>42,43,57-59</sup>

*Outcomes following shaving excision.* Shaving excision has been advocated by experts as a delicate and precise technique to thoroughly treat extragenital endometriosis.<sup>42,57,58</sup>

Long-term outcomes following shaving excision are quite favorable, and the complication rate is the lowest among the surgical treatment options for bowel endometriosis. Our group has reported excellent postoperative outcomes since the 1980s.<sup>42,43,54,57,59</sup> We have described patient outcomes following shaving excision in 185 women aged 25-41 years, including 80 patients who had complete cul-de-sac obliteration. Of the 174 patients available for follow-up up to 5 years postoperatively, 162 (93%) achieved moderate to complete pain relief.<sup>42</sup>

Donnez et al<sup>60</sup> performed a retrospective analysis describing 3298 surgeries for deep rectovaginal endometriotic nodules, in which the shaving technique was utilized in all but 1% of the patients. The complication rate was low, with 1 case of rectal perforation, 3 cases of ureteral injury, and 1 case of fecal peritonitis. In an earlier series from Donnez et al<sup>61</sup> of 500 patients who underwent shaving of rectovaginal endometriotic nodules, 39 patients (8%) experienced recurrent pelvic pain. Of the 388 patients in his case series who wished to conceive, 221 (57%) became pregnant spontaneously and 107 (28%) conceived with in vitro fertilization.<sup>61</sup>

Roman et al<sup>62</sup> have also reported on the application of rectal shaving using both plasma energy as well as laparoscopic scissors in 54 and 68 women, respectively, with 2 cases of postoperative rectal fistula formation.

**TABLE 2**  
**Imaging options for diagnosis of bowel endometriosis**

Imaging modality	Description	Comments	Sensitivity	Specificity
TVUS <sup>1</sup>	Areas of tenderness should be evaluated closely as they may point to subtle disease <sup>2</sup>	Accuracy of diagnosis correlated with sonographer experience <sup>3</sup> Lesions above sigmoid generally are outside of view <sup>3</sup>	71–98% <sup>3</sup>	92–100% <sup>3</sup>
Rectal water contrast transvaginal sonography <sup>1,4</sup>	100–300 mL water instilled into rectum prior to TVUS	Provides enhanced imaging with TVUS probe <sup>5</sup>	95.7% <sup>5</sup>	98% <sup>5</sup>
Rectal endoscopic sonography <sup>1</sup>	Specialized high-frequency transducer coupled with colonoscope placed into rectum to level of sigmoid; enema and anesthesia often required <sup>6</sup>	Accuracy of diagnosis correlated with sonographer experience <sup>7</sup> Gives information regarding depth of invasion of lesion <sup>7</sup>	88.2% <sup>5</sup>	96% <sup>5</sup>
Magnetic resonance imaging <sup>1</sup>	Endoluminal coil can be placed in rectum to better visualize rectal lesions but use can be limited by patient discomfort	Not operator dependent Provides information for lesions above sigmoid colon Lacks sensitivity for measuring depth of invasion of lesion	88% <sup>8</sup>	97.8% <sup>8</sup>
Double contrast barium enema	Distends colon with barium, draining colon, and filling lumen with air prior to taking AP radiographs	Evaluates degree and length of bowel occlusion at level of sigmoid <sup>9</sup> Difficult to distinguish between other bowel pathologies (neoplasm, pelvic abscess, diverticulitis) <sup>9</sup>	87.5% <sup>5</sup>	94.2% <sup>5</sup>

TVUS, transvaginal ultrasound.

- 1 Nisenblatt V, Bossuyt PM, Farquhar C, Johnson N, Hull ML. Imaging modalities for the non-invasive diagnosis of endometriosis. *Cochrane Database Syst Rev* 2016;2:CD009591.
  - 2 Guerriero S, Ajossa S, Gerada M, Virgilio B, Angioni S, Melis GB. Diagnostic value of transvaginal 'tenderness-guided' ultrasonography for the prediction of location of deep endometriosis. *Hum Reprod* 2008;23:2452-7.
  - 3 Hudelist G, English J, Thomas AE, Tinelli A, Singer CF, Keckstein J. Diagnostic accuracy of transvaginal ultrasound for non-invasive diagnosis of bowel endometriosis: systematic review and meta-analysis. *Ultrasound Obstet Gynecol* 2011;37:257-63.
  - 4 Menada MV, Remorgida V, Abbamonte LH, Fulcheri E, Ragni N, Ferrero S. Transvaginal ultrasonography combined with water-contrast in the rectum in the diagnosis of rectovaginal endometriosis infiltrating the bowel. *Fertil Steril* 2008;89:699-700.
  - 5 Bergamini V, Ghezzi F, Scarperi S, Raffaelli R, Cromi A, Franchi M. Preoperative assessment of intestinal endometriosis: a comparison of transvaginal sonography with water-contrast in the rectum, transrectal sonography, and barium enema. *Abdom Imaging* 2010;35:732-6.
  - 6 Masseurin A, Petit E, Darchen MA, et al. Imaging of intestinal involvement in endometriosis. *Diagn Interv Imaging* 2013;94:281-91.
  - 7 Bazot M, Detchev R, Cortez A, Amouyal P, Uzan S, Darai E. Transvaginal sonography and rectal endoscopic sonography for the assessment of pelvic endometriosis: a preliminary comparison. *Hum Reprod* 2003;18:1686-92.
  - 8 Bazot M, Darai E, Hourani R, et al. Deep pelvic endometriosis: MR imaging for diagnosis and prediction of extension of disease. *Radiology* 2004;232:379-89.
  - 9 Gordon RL, Evers K, Kressel HY, Laufer I, Herlinger H, Thompson JJ. Double-contrast enema in pelvic endometriosis. *AJR Am J Roentgenol* 1982;138:549-52.
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Following shaving excision, the study of Roman et al<sup>62</sup> demonstrated excellent outcomes, with 4% of patients experiencing symptom recurrence, a pregnancy rate of 65.4% among patients with pregnancy intention, with 59% of those women conceiving spontaneously.

### Disc excision

Laparoscopic disc excision with and without the use of the linear or circular stapler for treatment of bowel endometriosis has been described by our group and others since the late 1980s<sup>38-41,44,48,49,54,63-66</sup> and is

considered a well-established and feasible surgical option.<sup>65-68</sup> It entails full-thickness excision of the diseased portion of the bowel wall with the resultant defect stapled or sutured. To be considered for disc excision, a lesion should be limited to only a portion of the bowel wall, usually less than half of the maximum circumference of the bowel.<sup>52</sup>

*Outcomes following disc excision.* Disc excision yields very good outcomes, and results in fewer postoperative complications compared to segmental resection, but has greater risk of complications

than shaving excision.<sup>38,39,49,66,69</sup> In 1994, our group first described a series of 8 women who underwent disc excision for bowel endometriosis. Mean length of hospital stay was 3 days, mean lesion size was 4.6 cm, and 1 patient achieved pregnancy.<sup>39</sup> We have subsequently published a series of 141 women who underwent treatment of endometriosis including laparoscopic disc excision of the bowel. There were no cases of conversion to laparotomy, postoperative rectovaginal fistula formation, ureteral damage, bowel perforation, or postoperative pelvic abscess. GI and pain

671 symptoms had improved by the end of  
672 the first postoperative month in 87%  
673 patients.<sup>49</sup>

674 In 2016, Afors et al<sup>70</sup> performed an  
675 observational study describing patients  
676 who underwent shaving (n = 47), disc  
677 (n = 15), and segmental resection (n =  
678 30); for all cohorts, they reported a sig-  
679 nificant reduction in short- and long-  
680 term pain including dysmenorrhea,  
681 dyschezia, and dyspareunia 3 months  
682 postoperatively. Those who underwent  
683 shaving excision and disc resection,  
684 however, were more likely to experience  
685 recurrence of symptoms requiring  
686 reoperation as compared with segmental  
687 resection (shaving: 27.6%; disc: 13.3%;  
688 segmental: 6.6%).<sup>70</sup> Although the sam-  
689 ple size is limited, the study suggests that  
690 disc excision may be performed safely  
691 with very good results, though results  
692 may not be as permanent as with  
693 segmental resection.

694 In a 2011 retrospective study by  
695 Moawad et al<sup>71</sup> comparing low anterior  
696 disc (n = 8) vs low anterior segmental  
697 (n = 14) resection, the disc resection  
698 cohort had shorter surgical times (4 vs  
699 7 hours), lower blood loss (134 vs 276  
700 mL), and shorter length of hospital stay  
701 (3 vs 5 days). There were no intra-  
702 operative complications in either  
703 cohort. There was no significant dif-  
704 ference in size of lesion excised, and  
705 neither group had visceral complica-  
706 tions, although there were 3 patients in  
707 the segmental resection cohort who  
708 had postoperative anastomotic stric-  
709 tures, with 2 patients requiring subse-  
710 quent rectal dilation. In contrast, there  
711 were no perioperative complications in  
712 the disc resection group. Both groups  
713 reported high levels of patient satis-  
714 faction postoperatively.<sup>71</sup> The study of  
715 Moawad et al,<sup>71</sup> although based on a  
716 small cohort, suggests that both disc  
717 and segmental resection improve pa-  
718 tients' symptoms, but that disc excision  
719 is a more technically straightforward  
720 surgical procedure with fewer compli-  
721 cations, especially when the lesion is  
722 located lower down in the intestinal  
723 tract. Further discussion of the location  
724 of lesions in determining which exci-  
725 sional technique a surgeon should  
726 consider will be reviewed below.

### Segmental resection

Segmental resection of endometriosis  
has been documented in the medical  
literature since 1907,<sup>17,72,73</sup> and has the  
largest body of data regarding post-  
operative outcomes. As the name sug-  
gests, this approach involves the  
complete resection of a diseased seg-  
ment of bowel with subsequent reanastomosis.  
Segmental resection is indicated for  
large, circumferential, obstructive, or  
multifocal lesions. Primary end-to-end  
or side-to-side anastomosis can be per-  
formed following segmental resection.  
Segmental resection was once consid-  
ered too difficult to complete without an  
open abdominal incision; however with  
the introduction of video-assisted  
laparoscopy, specialized laparoscopic  
instruments, and increasing surgical  
subspecialization and training, many  
trained surgeons are able to utilize  
minimally invasive approaches to improve  
clinical outcomes.<sup>21,37,44,46,48,54,71,74-77</sup> For  
segmental resections, a multidisciplinary  
approach is recommended with the  
involvement of a GI surgeon or gynecologic  
oncologist who is trained in per-  
forming bowel resections.

### Outcomes following segmental resection.

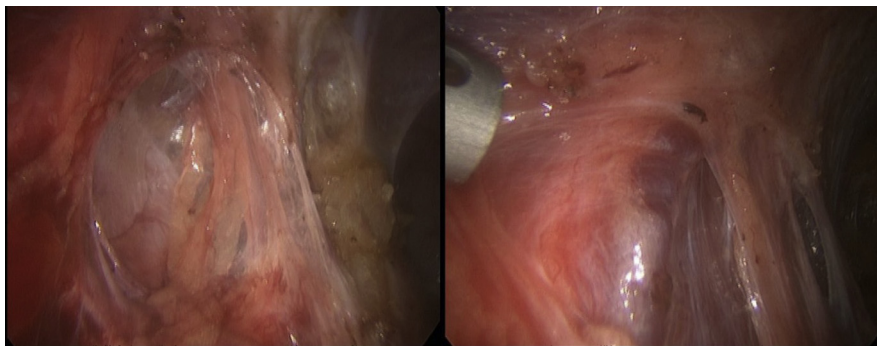
Since the late 1980s and early 1990s, our  
group has performed laparoscopic rec-  
tosigmoid resection of pathology-proven  
endometriosis.<sup>21,37,40,41,44,54,57</sup> Given  
favorable outcomes and fewer compli-  
cations associated with disc and shaving  
excision, we now avoid segmental  
resection whenever possible, especially  
for lesions close to the anal verge. In  
2005 our group reported on a cohort of  
178 women who underwent laparo-  
scopic treatment of deeply infiltrative  
bowel endometriosis utilizing shaving  
excision (n = 93), disc excision (n = 38),  
and segmental resection (n = 47).<sup>54</sup> The  
rate of major complications was signifi-  
cantly higher among those who under-  
went segmental resection ( $P < .001$ ); 6/  
48 (12.5%) had the following compli-  
cations: ureterovaginal fistula (1/48,  
2%), anastomotic stricture (2/48, 4%),  
intraoperative bladder perforation (1/48,  
2%), rectal bleeding requiring trans-  
fusion (1/48, 2%), and anastomotic leak

672 requiring temporary colostomy (1/48,  
673 2%). Of those who underwent disc  
674 excision, in contrast, only 3/39 (7.7%)  
675 developed a serious complication,  
676 including 2/39 (5%) who developed a  
677 pelvic abscess, and 1/39 (3%) who  
678 developed a rectovaginal fistula. Notably,  
679 there were no major complications  
680 encountered among patients who un-  
681 derwent shaving excision. Pregnancy  
682 among infertility patients who had  
683 either shaving or disc excision was higher  
684 (13/36, 36%, and 4/9, 44%, respect-  
685 ively) than those who had segmental resection  
686 (2/11, 18%).<sup>54</sup>

687 In 2011, De Cicco et al<sup>55</sup> performed a  
688 systematic review of 1889 bowel re-  
689 sections for deep endometriosis. Mean  
690 operating time varied from 101-436  
691 minutes, with hospitalizations ranging  
692 from 4-14 days. Major complications  
693 occurred in 11% of women, including a  
694 leakage rate of 2.7%, a fistula rate of  
695 1.8%, severe obstruction rate of 2.7%,  
696 and a hemorrhage rate of 2.5%.<sup>55</sup> Loca-  
697 tion of the lesion was inconsistently  
698 documented in the studies that De Cicco  
699 et al<sup>55</sup> reviewed, but it was noted that  
700 many of these complications correlated  
701 with lower rectal location of the  
702 segmental resection: the lower the  
703 resection, the higher the probability of  
704 postoperative leakage.<sup>74</sup> Riiskjær et al<sup>77</sup>  
705 published a prospective analysis of 128  
706 patients who underwent segmental  
707 resection for bowel endometriosis and  
708 found long-term improvement in uri-  
709 nary and sexual function 1 year after  
710 surgery. However, the rate of anasto-  
711 motic leakage was 7.4%.

712 Although the complication rate may  
713 be higher with segmental resection, it is  
714 location-dependent. Segmental resec-  
715 tion remains a critical tool for treating  
716 bowel endometriosis in certain circum-  
717 stances, such as in patients whose  
718 symptoms persist after shaving or disc  
719 excision. De Cicco et al<sup>55</sup> noted complete  
720 pain relief to be 81.5% (111/135) with  
721 segmental resection patients, and some  
722 studies suggest shaving excision may be  
723 less effective in the symptomatic relief of  
724 dysmenorrhea and dyspareunia.<sup>70</sup> Our  
725 group has found complete pain relief to  
726 be high with segmental resection but also  
with the other surgical excision

FIGURE 4



Dissection of inferior hypogastric nerves.

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techniques: 80% (74/93) after shaving excision, 95% (36/38) following disc excision, and 89% (42/47) following segmental resection.<sup>54</sup>

### Nerve-sparing surgery

Whether shaving, disc, or segmental resection of bowel endometriosis is performed, a surgeon's complication rate may depend on adequately avoiding involved nerves. Deeply infiltrative endometriosis can invade the superior and inferior hypogastric plexus, as well as the sympathetic and parasympathetic nerve bundles (Figures 1, 2, and 4). Disruption of these structures may worsen reproductive, genitourinary, and GI symptoms and negatively affect quality of life.<sup>2,78</sup> The incidence of postoperative urinary tract disorders following surgery for bowel endometriosis is estimated to be as high as 19.5% due to interruption of the nervous plexus, especially the hypogastric plexus.<sup>75,76</sup> Nerve-sparing techniques have therefore been introduced to preserve bowel, bladder, and sexual function.<sup>79,80</sup> One successful nerve-sparing method, which we utilize in our practice, is the Tokyo method, in which the surgeon separates and ligates the vascular portion of the cardinal ligament while preserving the branches of the pelvic splanchnic nerves.<sup>81</sup> Kockel et al introduced a different technique, using liposuction to expose the autonomic peripheral

nerves to minimize damage to the pelvic plexus, whereas Possover et al<sup>82</sup> utilized electrostimulation to identify and preserve these nerves. However, increased severity of disease leads to increased risk of dense nervous plexus involvement, which may preclude nerve-sparing.

Long-term results of nerve-sparing techniques in regard to bowel endometriosis surgery are limited but favorable. With the nerve-sparing technique, Ceccaroni et al<sup>79</sup> performed a single-center prospective study of 126 patients, and found reduced incidence of bowel and bladder dysfunction as well as higher rates of patient satisfaction, with similar rates of intraoperative complications as compared to traditional methods for surgical excision of bowel endometriosis. Although data are limited, nerve-sparing techniques appear promising for decreasing postoperative complications. More research is needed to make the practice more widespread.

### Decisions involved in surgical approach

We emphasize foremost that asymptomatic patients do not warrant surgical intervention. For symptomatic patients, the choice between surgical techniques depends upon the anatomic location, size, and depth of the endometriotic bowel lesion. We categorize lesions by location. The

physiologic attachments of the sigmoid colon and peritoneal reflection along the left pelvic sidewall are the anatomic landmarks we recommend using when deciding on surgical approach. We categorize lesions as: (1) above the sigmoid colon; (2) on the sigmoid colon; (3) on the rectosigmoid colon; and (4) on the rectum. In addition to location, lesion size, depth of involvement (when the endometriotic lesion either compresses or invades the lumen of the bowel), and extent of bowel wall circumferential invasion are taken into account.

Location is paramount in deciding on excisional technique because ideally a surgeon will avoid dissection of the retrorectal space and lateral pelvic sidewall (Table 3). Dissection of these spaces risks disruption of the superior and inferior hypogastric plexus, parasympathetic and sympathetic nerve branches, and local vascularity. Such injuries can lead to long-term autonomic dysfunction of the bowel and bladder, which may ultimately necessitate long-term self-catheterization or permanent colostomy.<sup>53</sup> Specifically, dissection of the retrorectal space puts the patient at higher risk for ureterovaginal fistula, anastomotic stricture, intraoperative genitourinary complications, rectal bleeding requiring transfusion, and anastomotic leakage requiring temporary ostomy.<sup>21,54,74-77</sup> With severe disease, nerve involvement may be encountered, and complete resection may render damage to these structures unavoidable. However, we emphasize the importance of prudence, and strongly advise conservative surgery whenever possible. These potential harms rarely outweigh the benefits of a radical excision of bowel endometriosis.

### Lesions found incidentally

When bowel lesions are found incidentally at the time of another surgery, extensive dissection during the initial surgery is not generally advisable, especially if the patient has



endorsed minimal GI symptoms. For surgeons capable of performing shaving excision, lesions that are amenable to safe excision can be removed and sent to the pathologist for histological analysis. This can serve to prove the presence of endometriosis of the bowel in symptomatic patients, may in fact fully treat the patient's symptoms, and is used to rule out malignancy. It is reasonable to subsequently plan for a future surgery with the assistance of a multidisciplinary team including a GI surgeon should a patient's symptoms persist.

### Lesions above the sigmoid colon

Dissection above the sigmoid colon typically does not require extensive retroperitoneal interruption, and risk of injury to the nervous and vascular plexuses is lower. As such, segmental or disc resection is feasible with a lower risk of intraoperative and postoperative complications. Dissection should be performed preferentially along the antimesenteric surface of the bowel to spare the vascular and nervous plexuses housed in the mesentery itself.

Segmental resection with a tension-free anastomosis is preferred for multifocal lesions, or for lesions >3 cm. Segmental resection for lesions involving more than one third of the lumen of the upper bowel is generally advisable.<sup>40,55,65,66,79</sup> Disc resection can be considered for lesions <3 cm even if the bowel lumen is involved.<sup>65,66,83</sup> We have found that laparoscopic disc excision using the linear stapler is more straightforward with minimal leakage complications, perioperative pain, and morbidity.<sup>49</sup>

For lesions on the distal small bowel, ileocolic region, right hemicolon, and appendix, segmental resection is recommended as the surgery itself is relatively straightforward, and risk of nerve damage is very low (Figure 5).<sup>4,53,54,84</sup> If endometriosis is encountered in any location along the bowel, appendectomy can be performed even if there is no visible disease on the appendix due to the high incidence of occult appendicular endometriosis.<sup>85,86</sup>

**TABLE 3**

### Guidelines surrounding surgical management of bowel endometriosis

Lesions found incidentally	<ul style="list-style-type: none"> <li>- Extensive dissection not advisable</li> <li>- Recommendation is for shaving excision and biopsy</li> <li>- Patient to be followed up and evaluated clinically and hormonally</li> <li>- Reasonable to expect and plan for future surgery with multidisciplinary team if patient becomes symptomatic and nonresponsive to medical therapy</li> </ul>
Lesions above sigmoid colon	<ul style="list-style-type: none"> <li>- Segmental resection or disc excision can be performed safely</li> <li>- Segmental resection is preferable for multifocal lesions, lesions &gt;3 cm, or lesions involving &gt;1/3 of bowel lumen</li> <li>- Segmental resection is straightforward approach for disease located on ileocecal region, as well as small bowel in cases of stricture</li> <li>- For singular lesions &lt;3 cm in size or &lt;1/3 of bowel lumen, disc excision can be considered</li> </ul>
Lesions along sigmoid colon	<ul style="list-style-type: none"> <li>- When possible, we prefer utilizing shaving excision</li> <li>- Starting at this level, surgeons should be aware that extensive lateral dissection may lead to short- and long-term complications</li> <li>- For lesions &lt;3 cm, or involving &lt;1/3 of bowel lumen, disc excision can be performed</li> <li>- Segmental resection can be performed if obstruction is encountered, there is multifocal disease, lesion is &gt;3 cm in size, or patient has history of failed conservative surgical management</li> </ul>
Lesions along rectosigmoid colon	<ul style="list-style-type: none"> <li>- When possible, we prefer to utilize shaving excision</li> <li>- Additional options include disc resection or segmental resection (via laparoscopy, laparotomy, or natural orifice); however, surgeons must exercise extreme caution to minimize dissection of lateral and retrorectal space</li> </ul>
Lesions along rectum	<ul style="list-style-type: none"> <li>- We strongly advocate for shaving excision at this level due to risk of complications when aggressive surgery is performed within 5–8 cm of anal verge</li> <li>- We err on side of leaving disease on rectum, with consideration made for postoperative hormonal suppression, rather than risk injuring rectum itself or neurovascular structures surrounding rectum</li> <li>- We minimize lateral dissection, as well as dissection of retrorectal space</li> <li>- Theoretically, patients with acute obstruction at this level still require segmental resection, but this clinical scenario is very rare</li> </ul>

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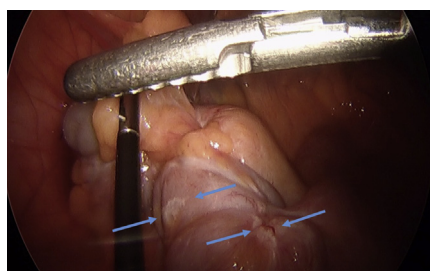
### Lesions along the sigmoid colon

Along the sigmoid, we emphasize the importance of limiting dissection of the retrorectal space to minimize the risk of long-term morbidity (Video). Segmental resection at or below the sigmoid, and even the relatively more conservative disc excision that involves bowel mobilization laterally and posteriorly, has been associated with significant risk of postoperative surgical-site leakage,<sup>74</sup> as well as long-term bowel and bladder dysfunction with risk of permanent colostomy.<sup>87,88</sup>

We primarily utilize shaving excision for disease on the sigmoid colon.

Whenever shaving technique is utilized, especially along the sigmoid and rectosigmoid colon, thorough evaluation of the bowel wall thickness should be performed for defects along the bowel wall. Significant defects should be reinforced with suture. Should the surgeon believe more extensive excision to be necessary, disc excision can be performed for lesions <3 cm or involving less than one third of the lumen without significant retroperitoneal and lateral pelvic wall dissection. Segmental resection can be performed if colonic obstruction is encountered; if lesions are multifocal, >3 cm, or involve more than two thirds

FIGURE 5



Bowel endometriosis along ileocecal junction.  
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of the bowel lumen; or if patients have a history of failed conservative surgical management. The patient must be counseled, however, regarding the higher risk for postoperative bowel dysfunction. If resection is performed, entry into the retrorectal space and lateral pelvic wall should be minimized and a tension-free anastomosis is paramount.

### Lesions along the rectosigmoid colon

At the level of the rectosigmoid colon, surgeons must exercise extreme caution. Here, segmental resection can be approached through the natural orifices of the rectum or vagina.<sup>40,44,83</sup> Resection requires significant lateral mobilization and entry into the retrorectal space to allow for adequate bowel mobilization. To avoid significant postoperative complications as

previously described, we recommend using shaving excision whenever possible, and avoiding segmental resection in this area even with lesions >3 cm unless prior surgeries have failed. Disc excision can be done, but must be performed with caution. The Rouen technique has been introduced as a feasible transanal approach for the disc resection of large lesions.<sup>83</sup> Complications following disc excision include pelvic abscess and rectovaginal fistula, although with less frequency than with segmental resection.<sup>21,54,89</sup> The lower the dissection, the higher the risk.

### Lesions along the rectum

Although others have suggested disc resection or even segmental resection at this level,<sup>70,90,91</sup> we use shaving excision as much as possible due to the higher postoperative risk to the patient. There is no evidence that benefits of segmental resection outweighs the risks when compared with conservative surgery at this level,<sup>50,60,92</sup> with evidence suggesting aggressive surgery 5-8 cm from the anal verge (Figure 6) may be predictive of postoperative complications.<sup>93</sup> These lower endometriotic lesions typically cannot be accessed by the linear stapler, and although a transrectal approach to disc excision has been suggested,<sup>40,90</sup> the necessary extensive dissection of the bowel can lead to serious neurologic and vascular complications as described

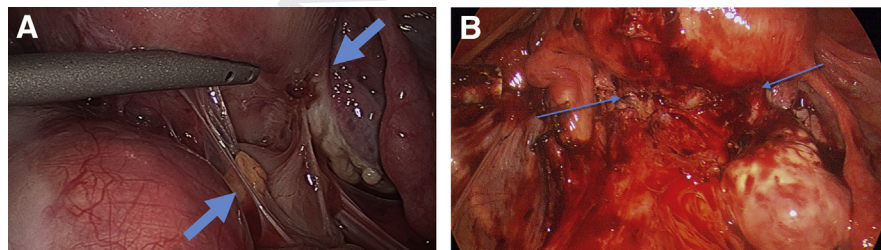
above. Theoretically, patients with acute obstruction of the low rectum due to deeply infiltrative endometriosis would require segmental resection with subsequent ostomy; however, this scenario is very rare.

Using the shaving technique along the rectum, we excise as much disease as possible without compromising the bowel lumen, and limiting lateral dissection that could compromise the sympathetic and parasympathetic nervous plexus. We err on the side of leaving disease on the rectum rather than risk perforating the bowel. For patients who do not desire fertility, a risk-benefit discussion regarding bilateral salpingo-oophorectomy with or without hysterectomy should be considered in lieu of aggressive segmental or disc resection of the rectum.<sup>94,95</sup> We emphasize that infertility is not an indication for aggressive bowel surgery. In fact, for patients interested in fertility, successful pregnancy is very often achieved even in cases of severe disease with bowel stricture treated using the shaving technique.<sup>54</sup> For a subset of these patients who require second-look laparoscopy following their delivery (often for subsequent infertility), we have frequently encountered notable regression of rectal endometriosis well beyond what shaving from their prior surgery alone could explain. We do not have a clear explanation as to why there seems to be regression of bowel endometriosis spontaneously following pregnancy. We recognize that using pregnancy as an endpoint is difficult to correlate definitively with surgical management as there are many confounders, including use of in vitro fertilization, age, male factor, and ovarian surgery. For now, we reiterate that this finding may also reflect the enigmatic nature of endometriosis.

### Complications

Complications are a reality for surgeons, especially for those who perform complex procedures. Our rate of adverse outcomes has been very low, and by avoiding aggressive

FIGURE 6



A, Endometriosis of rectovaginal septum. B, Initiation of shaving technique for treatment of deeply infiltrative endometriosis of rectovaginal septum.

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**TABLE 4**  
**Postoperative complications and management guidelines**

Complication	Management guidelines
Intestinal perforation or anastomotic leak	<ul style="list-style-type: none"> <li>• History and physical exam, with hospital admission</li> <li>• With low threshold for laboratory evaluation including complete blood cell count, basic metabolic panel, coagulation studies, and lactic acid</li> <li>• CT with IV contrast and oral Gastrografin is recommended</li> <li>• If CT reveals abscess, this can be drained either by interventional radiology or by second-look laparoscopy with thorough wash-out and IV administration of broad-spectrum antibiotics and possible surgical repair</li> <li>• Even if CT does not demonstrate pathology, surgeon must still maintain high index of suspicion if clinical exam is concerning; we recommend starting broad-spectrum antibiotics and placing patient on bowel rest if patient is febrile, has pain out of proportion to routine postoperative soreness, has abdominal distension, or if leukocytosis is present; when antibiotics are initiated, sites of microperforation may seal spontaneously without need for further intervention<sup>1</sup></li> <li>• Should patient not exhibit clinical improvement quickly, or if laboratory values stagnate or worsen, second-look laparoscopy can be done if there is expert surgeon available for thorough washing or possible bowel repair</li> <li>• If expert laparoscopist is not available for second-look surgery, gastrointestinal surgeon specializing in endoluminal surgery can be consulted for endoscopic repair of defect<sup>2</sup></li> <li>• If second-look surgery does not cure patient, or if patient is septic at time of her second-look laparoscopy, temporary ostomy (preferably loop ileostomy) should be considered</li> </ul>
Bleeding from anastomotic site	<ul style="list-style-type: none"> <li>• On differential diagnosis if patient reports rectal bleeding or becomes hemodynamically unstable</li> <li>• Patient should be evaluated immediately, hemoglobin level trended, and transfusion may be required; if brisk bright-red bleeding is encountered, hospital admission should be arranged</li> <li>• Control of bleeding at surgical bed can be approached laparoscopically or via colonoscopy by gastrointestinal specialist</li> <li>• Once site of bleeding is localized, it can be controlled using suture, laparoscopic stapling device, clip, or hemostatic agents</li> </ul>
Rectovaginal fistula	<ul style="list-style-type: none"> <li>• Conservative therapy can be considered in otherwise healthy patient with rectovaginal fistula when patient is not febrile or ill,<sup>3</sup> including usage of stool-firming medications with low residue diet to add bulk to stool, with avoidance of stool softeners and laxatives</li> <li>• As vaginal outflow drainage site is typically present, patients generally feel well otherwise; usually, rectovaginal fistula will heal spontaneously<sup>4</sup></li> <li>• Fistulas that persist &gt;3–6 mo are unlikely to resolve without intervention and typically need surgical repair; referral to proper specialist(s), including but not limited to gastrointestinal, urogynecologic, colorectal, or gynecologic-oncologist, is appropriate</li> <li>• Repair options include but are not limited to, patching area with biologic tissue specimen, using autologous tissue graft, and/or sewing of anal fistula plug<sup>5-7</sup></li> <li>• For certain complex or recurrent cases such as with concomitant inflammatory bowel disease, temporary ostomy, preferably ileostomy, can be considered prior to definitive surgical correction</li> </ul>

CT, computed tomography; IV, intravenous.

1 Araghizadeh FY, Timmcke AE, Opelka FG, Hicks TC, Beck DE. Colonoscopic perforations. *Dis Colon Rectum* 2001;44:713-6.

2 Kumar N, Thompson CC. A novel method for endoscopic perforation management by using abdominal exploration and full-thickness sutured closure. *Gastrointest Endosc* 2014;80:156-61.

3 Francis AP, Apostol R, Mrkaic A, Berman T, Sirota I, Nezhat F. Conservative management of coloperitoneal-vaginal fistula. *JLS* 2015;e2015.00015.

4 Debeche-Adams TH, Bohl JL. Rectovaginal fistulas. *Clin Colon Rectal Surg* 2010;23:99-103.

5 O'Riordan JM, Datta I, Johnston C, Baxter NN. A systematic review of the anal fistula plug for patients with Crohn's and non-Crohn's related fistula-in-ano. *Dis Colon Rectum* 2012;55:351-8.

6 Williamson PR, Hellinger MD, Larach SW, Ferrara A. Twenty-year review of the surgical management of perianal Crohn's disease. *Dis Colon Rectum* 1995;38:389-92.

7 Tsang CB, Rothenberger DA. Rectovaginal fistulas. Therapeutic options. *Surg Clin North Am* 1997;77:95-114.

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surgery at the level of the low rectum, we have decreased our rate of complications even further. Nonetheless, we have successfully diagnosed and managed a variety of postoperative complications, and all surgeons who perform bowel endometriosis surgery should be prepared to do likewise.

During the preoperative consent process, patients should be well informed of the immediate operative risks and risk for long-term functional changes.<sup>96</sup> Potential perioperative complications should be discussed include stricture, obstruction, infection, perforation, fistula formation, anastomotic leakage, and

perioperative hemorrhage.<sup>55,74</sup> With any bowel surgery, risk of intestinal perforation and leakage are possible, although to a much lesser extent with superficial shaving excision. Proper surgical technique maintains well-vascularized, tension-free anastomoses to minimize risk of an anastomotic leak.<sup>4,21,46,55</sup>

For better postoperative recovery, we advocate the enhanced recovery after surgery<sup>97</sup> protocol and close communication with the patient by daily telephone calls and as-needed in-office exams. With every passing day, the patient should experience overall symptom improvement. [T4] **Table 4** outlines a brief list of possible postoperative complications, and guidelines surrounding proper postoperative management.

## Conclusions

Deep infiltrative endometriosis of the bowel may have various presentations. Unfortunately, it often goes diagnosed, while in other instances it continues to be overaggressively treated. Bowel endometriosis can be encountered incidentally at the time of surgery performed for another indication, or it may be suspected when a premenopausal woman has significant pelvic pain, bloating, cyclic dyschezia, blood in the stool, changes in stool caliber, or irritable bowel syndrome—like symptoms. If a patient is relatively asymptomatic, close monitoring with long-term hormonal ovarian suppression is preferred over surgical management.

In the symptomatic patients who are not candidates for or who have failed medical therapy, a multidisciplinary surgical approach with the involvement of gynecologic and GI specialists familiar with bowel endometriosis is encouraged. Some surgeons advocate for segmental resection of the bowel as the treatment of choice for endometriosis at all levels of the bowel. Based on our extensive experience in conjunction with thorough and frequent review of current literature, we preferentially perform shaving excision for lesions below the sigmoid colon to avoid extensive lateral mobilization and dissection of the lateral and retrorectal spaces and avoid compromise of long-term bowel and bladder function. Indeed, patient results and satisfaction remain high following shaving excision and the complication rate following shaving excision is the

lowest among the surgical options,<sup>49,60,62</sup> with favorable long-term outcomes.<sup>42,61,62</sup> We employ the shaving technique as much as possible for the treatment of endometriosis located below the sigmoid colon, especially for lesions on the low rectum.<sup>42,57</sup> For lesions above the sigmoid colon, including the small bowel, segmental resection or disc resection remains our preference. ■

## KEY POINTS

- Endometriosis affects up to 10% of all reproductive-aged women, and affects approximately 35-50% of women with pelvic pain and infertility.
- The bowel is the most common site of extragenital endometriosis and is most frequently seen along the rectum, rectovaginal septum, and sigmoid colon.
- Surgical management is recommended for symptomatic patients with bowel endometriosis who have failed medical therapy, or in whom medical therapy is not indicated.
- Laparoscopy with or without the use of the robotic platform can be used for treatment of bowel endometriosis.
- Acute obstruction due to bowel endometriosis is rare and should generally be managed with segmental resection.
- Lesions along the low rectum should generally be preferentially managed conservatively with shaving excision first rather than with disc or segmental resection, to avoid extensive dissection of the retrorectal space and lateral spaces along the pelvic side wall to minimize nervous and vascular injury.

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