

Modern surgical techniques for gastrointestinal endometriosis

Current operative techniques for extragenital endometriosis can provide excellent outcomes with less risk for postoperative complications

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IN THIS ARTICLE

Clinical presentation
page 38

Medical management
page 39

Surgical approaches
page 40

About 10% of all reproductive-aged women and 35% to 50% of women with pelvic pain and infertility are affected by endometriosis.^{1,2} The disease typically involves the reproductive tract organs, anterior and posterior cul-de-sacs, and uterosacral ligaments. However, disease outside of the reproductive tract occurs frequently and has been found on all organs except the spleen.³

The bowel is the most common site for extragenital endometriosis, affected in an estimated 3.8% to 37% of patients with known endometriosis.⁴⁻⁷ Implants may be superficial, involving the bowel serosa and subserosa (**FIGURE 1**), or they can manifest as deeply infiltrating lesions involving the muscularis and mucosa (**FIGURE 2**, page 38). The rectosigmoid colon is the most common location for bowel endometriosis, followed by the rectum, ileum, appendix, and cecum^{4,8} (**FIGURES 3, 4, and 5**, pages 38-39). Case reports also have described endometrial implants on the stomach and transverse colon.⁹ Although isolated bowel involvement has been recognized, most patients with bowel

FIGURE 1 Diffuse serosal disease across the bowel



endometriosis have concurrent disease elsewhere.^{2,4}

Historically, segmental resection was performed regardless of the anatomical location of the lesion.¹⁰ Even today, many surgeons continue to routinely perform segmental bowel resection as a first-line surgical approach.¹¹ Unnecessary segmental resection, however, places patients at risk for short- and long-term postoperative morbidity, including the possibility of permanent ostomy. Modern surgical techniques, such as shaving excision and disc resection, have been performed to successfully treat bowel endometriosis with excellent long-term outcomes and fewer complications when compared with traditional segmental resection.^{2,12-16}

In this article, we focus on the clinical indications and surgical techniques for video-laparoscopic management, but first we

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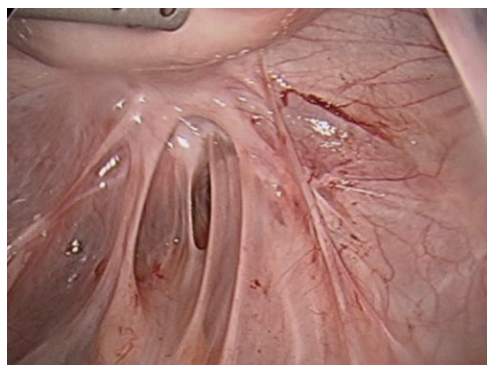
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CONTINUED ON PAGE 38

Modern surgical techniques for gastrointestinal endometriosis

CONTINUED FROM PAGE 36

FIGURE 2 Severe rectovaginal adhesions



describe the pathophysiology, clinical presentation, and diagnosis of bowel endometriosis.

Pathophysiology of bowel endometriosis

The pathogenesis of endometriosis remains unknown, as no single mechanism explains all clinical cases of the disease. The most popular proposed theory describes retrograde menstruation through the fallopian tubes.¹⁷ Once inside the peritoneal cavity, endometrial cells attach to and invade healthy peritoneum, establishing a blood supply necessary for growth and survival.

In the case of bowel endometriosis, deposition of effluxed endometrial cells may lead to an inflammatory response that increases the risk of adhesion formation, leading to potential cul-de-sac obliteration. Lesions may originate as Allen-Masters peritoneal defects,

developing into deeply infiltrative rectovaginal septum lesions. The anatomical shelter theory contributes to lesions within the pelvis, with the rectosigmoid colon blocking the cephalad flow of effluxed menstrual blood from the pelvis, thus leading to a preponderance of lesions in the pelvis and along the rectosigmoid colon.²

Clinical presentation and diagnosis

Women presenting with endometriosis of the bowel are typically of reproductive age and commonly report symptoms of dysmenorrhea, chronic pelvic pain, dyspareunia, and dyschezia. Some women also experience catamenial diarrhea, constipation, hematochezia, and bloating.² The differential diagnosis of these symptoms is broad and includes irritable bowel disease, ischemic colitis, inflammatory bowel disease, diverticulitis, pelvic inflammatory disease, and malignancy.

Because of its nonspecific symptoms, bowel endometriosis is often misdiagnosed and the disease goes untreated for years.¹⁸ Therefore, it is imperative that clinicians maintain a high index of suspicion when evaluating reproductive-aged women with gastrointestinal symptoms and pelvic pain.

Physical examination can be helpful in making the diagnosis of endometriosis. During bimanual examination, findings such as a fixed, tender, or retroverted uterus, uterosacral ligament nodularity, or an enlarged adnexal mass representing an ovarian endometrioma may be appreciated. Rectovaginal exam can identify areas of tenderness and nodularity along the rectovaginal septum. Speculum exam may reveal a laterally displaced cervix or blue powder-burn lesions along the cervix or posterior fornix.¹⁹ Rarely, endometriosis is found on the perineum within an episiotomy scar.²⁰

Imaging studies can be used in conjunction with physical examination findings to aid in the diagnosis of endometriosis. Images also guide preoperative planning by characterizing lesions based on their size, location, and depth of invasion. Hudelist and colleagues

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FIGURE 3 Appendiceal endometriosis



found transvaginal ultrasound (TVUS) to have an overall sensitivity of 71% to 98% and a specificity of 92% to 100%.²¹ However, it was noted that the accuracy of the diagnosis was directly related to the experience of the sonographer, and lesions above the sigmoid colon were generally unable to be diagnosed. Other imaging modalities that have been reported to have high sensitivity and specificity for diagnosing bowel endometriosis include rectal water contrast TVUS,^{22,23} rectal endoscopic sonography,²² magnetic resonance imaging,²² and barium enema.²⁴

Medical management

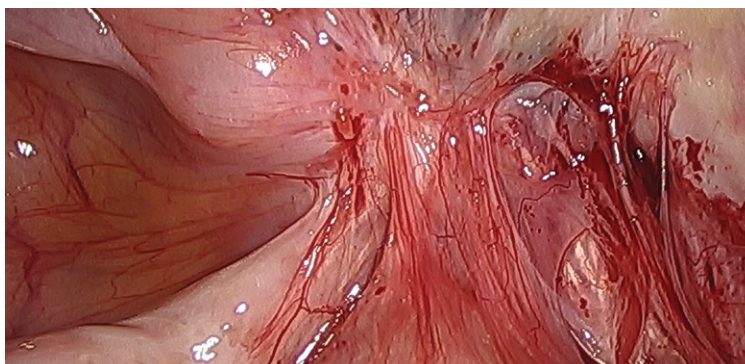
Medical therapy for patients with endometriosis is utilized with the goal of suppressing ovulation, lowering circulating hormone levels, and inducing endometrial atrophy. Medications commonly employed include gonadotropin-releasing hormone agonists and antagonists, anabolic steroids such as danazol, combined oral contraceptive pills, progestins, and aromatase inhibitors.

To date, no optimal hormonal regimen has been established for the treatment of bowel endometriosis. Vercellini and colleagues demonstrated that progestins with and without low-dose estrogen improved symptoms of dysmenorrhea and dyspareunia.²⁵ Ferrero and colleagues reported that 2.5 mg of norethindrone daily resulted in 53% of women with colorectal endometriosis reporting improved gastrointestinal symptoms.²⁶ However, by 12 months of follow-up, 33% of these patients had elected to undergo surgical management.

Gonadotropin-releasing hormone agonists, such as leuprolide acetate, also can be used to mitigate symptoms of bowel endometriosis or to decrease disease burden at the time of surgery, and they can be used with add-back norethindrone acetate. The use of these medications is limited by adverse effects, such as vasomotor symptoms and decreased bone mineral density when used for longer than 6 months.²

Medical therapy is commonly used for patients with mild to moderate symptoms and

FIGURE 4 Severe rectosigmoid adhesions



in those who are poor surgical candidates or decline surgical intervention. Medical therapy is especially useful when employed postoperatively to suppress the regrowth of microscopic ectopic endometrial tissue.

Patients must be counseled, however, that even with medical management, they may still require surgery in the future to control their symptoms and/or to preserve organ function.²

Surgical management

Surgical treatment for bowel endometriosis depends on the disease location, the size and depth of the lesion, the presence or absence of stricture, and the surgeon's level of expertise.^{2,12,27-30} In our group, we advocate for video-laparoscopy, with or without robotic assistance. Minimally invasive surgery offers reduced blood loss, shorter recovery time, and fewer postoperative complications compared with laparotomy.^{2,16,27,31-33} The conversion rate

FAST TRACK

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FIGURE 5 Ileocecal endometriosis



Modern surgical techniques for gastrointestinal endometriosis

Key points

- The clinical presentation of bowel endometriosis is often nonspecific, with a broad differential diagnosis. Maintain a high index of suspicion when reproductive-aged women present for evaluation of dysmenorrhea, chronic pelvic pain, dyspareunia, bloating, dyschezia, or hematochezia.
- Symptomatic patients not desiring fertility, poor surgical candidates, and those declining surgical intervention may benefit from medical management. Patients who fail medical therapy, have severe symptoms, or experience infertility are candidates for surgical intervention.
- Surgical management involves shaving excision, disc resection, and segmental resection. Some surgeons advocate for aggressive segmental resection regardless of the endometriotic lesion's location. Based on our extensive experience, we prefer shaving excision for lesions below the sigmoid to avoid dissection into the retrorectal space and inadvertent injury to nerve tissue controlling bowel and bladder function.
- Following shaving excision, patients experience low complication rates^{29,39,40} and favorable long-term outcomes.^{15,40,56} For lesions above the sigmoid colon, including the small bowel, segmental resection or disc resection for smaller lesions are reasonable surgical approaches.

to laparotomy has been reported to be about 3% when performed by an experienced surgeon.¹²

Darai and colleagues conducted a randomized trial of 52 patients undergoing surgery for colorectal endometriosis via either laparoscopic or open colon resection.³³ Blood loss was significantly lower in the laparoscopy group (1.6 vs 2.7 mg/L, $P < .05$). No difference was noted in long-term outcomes. In a retrospective study of 436 cases, Ruffo and colleagues showed that those who underwent laparoscopic colorectal resection had higher postoperative pregnancy rates compared with those who had laparotomy (57.6% vs 23.1%, $P < .035$).³²

The goal of surgical management of bowel endometriosis is to remove as many of the endometriotic lesions as possible while minimizing short- and long-term complications. Three surgical approaches have been described: shaving excision, disc resection, and segmental resection.²

Some surgeons prefer traditional segmental resection of the bowel regardless of the anatomical site, citing reduced disease

recurrence with this approach; however, traditional segmental resection confers increased risk of complications. Increasingly, in an effort to reduce morbidity, more surgeons are advocating for the less aggressive methods of shaving excision and disc resection.

Aggressive resection at the level of the low rectum requires extensive surgical dissection of the retrorectal space, with the potential for inadvertent injury to surrounding neurovascular structures, such as the pelvic splanchnic nerves and superior and inferior hypogastric plexus.²⁹ Injury to these structures can lead to significant complications, including bowel stenosis, fistula formation, constipation, and urinary retention. Complete resection of other areas, such as the small bowel, do not carry the same risks and may have more significant benefit to the patient than less aggressive techniques.

Our group recommends carefully balancing the risks and benefits of aggressive surgical treatment for each individual and treating the patient with the appropriate technique. Regardless of technique, surgical treatment of bowel endometriosis can lead to long-term improvements in pain and infertility.^{29,30,34,35}

Shaving excision

The most conservative approach to resection of bowel endometriosis is shaving excision; this involves removing endometriotic tissue layer-by-layer until healthy, underlying tissue is encountered.² With bowel endometriosis, the goal of shaving excision is to remove as much of the diseased tissue as possible while leaving behind the mucosal layer and a portion of the muscularis.^{2,15,16,36-38} This is the most conservative of the 3 surgical techniques and is associated with the lowest complication rate.^{2,14,15,36,37}

Our group reported on 185 women who underwent shaving excision for bowel endometriosis. At the time of surgery, 80 women had complete obliteration of the cul-de-sac (**FIGURE 6**). Of the study patients, 174 patients were available for follow-up, with 93% reporting moderate to complete pain relief.¹⁵

In a retrospective analysis of 3,298 surgeries for rectovaginal endometriosis in

which shaving excision was used on all but 1% of patients, Donnez and colleagues reported a very low complication rate, with 1 case of rectal perforation, 1 case of fecal peritonitis, and 3 cases of ureteral injury.³⁹

Roman and colleagues described the use of shaving excision for rectal endometriosis using plasma energy (n = 54) and laparoscopic scissors (n = 68).⁴⁰ Only 4% of patients reported experiencing symptom recurrence, and the pregnancy rate was 65.4%, with 59% of those patients spontaneously conceiving. Two cases of rectal fistula were noted.

Disc resection

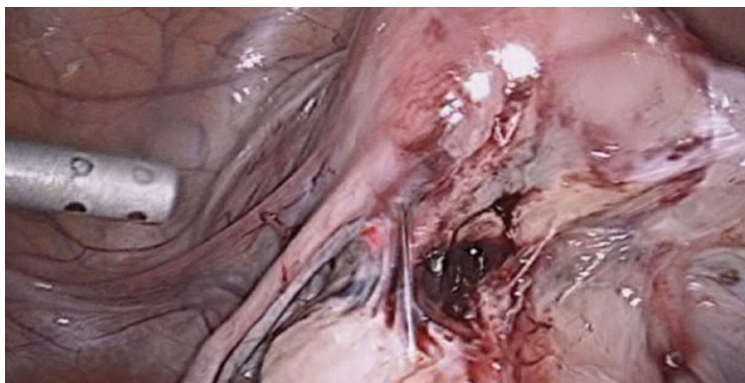
Laparoscopic disc excision has been described in the literature since the 1980s, and the technique involves the full-thickness removal of the diseased portion of the bowel, followed by closure of the remaining defect.^{2,12-14,28,29,31,41-45} To be appropriate for this technique, a lesion should involve only a portion of the bowel wall and, preferably, less than one-half of the bowel circumference.^{2,42} Disc excision results in excellent outcomes with fewer postoperative complications than segmental resection, but with more complications when compared to shaving excision.^{2,12,13,29,45,46}

We reported on a series of 141 women with bowel endometriosis who underwent disc excision.² At 1-month follow-up, 87% of patients experienced an improvement in their symptoms. No cases required conversion to laparotomy or were complicated by rectovaginal fistula formation, ureteral injury, bowel perforation, or pelvic abscess.²

Segmental resection

The most aggressive surgical approach, segmental resection involves complete removal of a diseased portion of bowel, followed by side-to-side or end-to-end reanastomosis of the adjacent segments.² For this procedure, a multidisciplinary approach is recommended, with involvement of a colorectal surgeon or gynecologic oncologist trained in performing bowel resections. Segmental resection is indicated for lesions that are larger than 3 cm, circumferential, obstructive, or multifocal.

FIGURE 6 Complete obliteration of the cul-de-sac



Given the higher complication rate associated with this procedure and the good outcomes associated with less invasive techniques, we avoid segmental resection whenever possible, especially for lesions near the anal verge.²

Complications associated with surgical approach

In 2005, our group reported on a cohort of 178 women who underwent laparoscopic treatment of deeply infiltrative bowel endometriosis with shaving excision (n = 93), disc excision (n = 38), and segmental resection (n = 47).³⁴ The major complication rate was significantly higher for those undergoing segmental resection (12.5%, $P < .001$); only 7.7% of those who underwent disc resection experienced a major complication; and none were observed in the group treated with shaving excision.

In 2011, De Cicco and colleagues conducted a systematic review of 1,889 patients who underwent segmental bowel resection.³⁵ The major complication rate was 11%, with a leakage rate of 2.7%, fistula rate of 1.8%, major obstruction rate of 2.7%, and hemorrhage rate of 2.5%. Many of these complications, however, occurred in patients who had low rectal resections.

Regardless of surgical approach, the complication rate is related to the surgeon's ability to preserve the superior and inferior hypogastric plexuses and the sympathetic and parasympathetic nerve bundles. Nerve-sparing techniques should be used to

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Modern surgical techniques for gastrointestinal endometriosis

decrease the incidence of postoperative bowel, bladder, and sexual function complications.² (See “Innervation of the pelvic organs” in the online version of this article.)

Our group's preferences

In our practice, we emphasize that the choice of surgical technique depends on the location, size, and depth of the lesion, as well as the extent of bowel wall circumferential invasion.²

We categorize lesions by their anatomic location: those above the sigmoid colon, on the sigmoid colon, on the rectosigmoid colon, and on the rectum. For lesions above the sigmoid colon, segmental or disc resection is appropriate.² We recommend segmental resection for multifocal lesions, lesions larger than 3 cm, or for lesions involving more than one-third of the bowel lumen.^{37,44,45,47} Disc resection is appropriate for lesions smaller than 3 cm even if the bowel lumen is involved.^{44,45,48} If endometriosis is encountered in any location along the bowel, appendectomy can be performed even without visible disease, due to a high incidence of occult disease of the appendix.^{49,50}

When lesions involve the sigmoid colon, we prefer utilizing shaving excision when possible to limit dissection of the retrorectal space and pelvic sidewall nerves.² Segmental resection at or below the sigmoid colon has been associated with postoperative surgical site leakage⁵¹ and long-term bowel and bladder dysfunction with risk of permanent colostomy.^{52,53} For lesions smaller than 3 cm

or involving less than one-third of the bowel lumen, disc resection can be performed. Segmental resection is required if multifocal disease or obstruction are present, if lesions are larger than 3 cm, or if more than one-third of the bowel lumen is involved.

For lesions along the rectosigmoid colon, we prefer utilizing shaving excision when possible.² Disc excision can be performed utilizing a transanal approach, being mindful to minimize dissection of the retroperitoneal space and pelvic sidewall nerves.⁴⁸ Segmental resection is avoided even with lesions larger than 3 cm, unless prior surgery has failed. Approaches for segmental resection can utilize laparoscopy or the natural orifices of the rectum or vagina.^{31,51}

For lesions on the rectum, we strongly advise shaving excision.² Evidence fails to show that the benefits of segmental resection outweigh the risks when compared to conservative techniques at the rectum.^{30,39,54} There is evidence indicating that aggressive surgery 5 to 8 cm from the anal verge is predictive of postoperative complications.⁵⁵ In our group, we use shaving excision to remove as much disease as possible without compromising the integrity of the bowel wall or surrounding neurovascular structures. We err on the side of caution, leaving some of the disease on the rectum to avoid rectal perforation, and plan for postoperative hormonal suppression in these patients.

For patients desiring fertility, successful pregnancy is often achieved using the shaving technique.⁴¹ ●

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For lesions on the rectum, we err on the side of caution and leave some disease on the rectum to avoid rectal perforation; we plan for postoperative hormonal suppression in these patients

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