



# Robotic Treatment of Colorectal Endometriosis

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## 19.1 Introduction

Deep infiltrating endometriosis (DIE) is defined as endometriosis lesions infiltrating more than 5-mm beneath the peritoneal layer [1]. The endometriosis nodules generally arise from the posterior portion of the uterine cervix and spread to the recto-vaginal septum, uterosacral and parametrial ligaments. This leads to a chronic inflammatory reaction and fibrosis that can provoke a distortion of normal pelvic anatomy, pain, and subsequent infertility [2]. Bowel endometriosis is a type of DIE defined by the presence of ectopic endometrial glands and stroma outside the endometrial cavity and infiltrating at least the muscularis propria of the intestinal wall [3]. Patients with bowel endometriosis may suffer pain, dyschezia, abdominal bloating, constipation or diarrhea, passage of mucus with the stools, cyclical rectal bleeding, defecation urgency, a feeling of incomplete evacuation, and even bowel occlusion [2, 4]. Endometriosis prevalence varies from 7% to 10% among women of reproductive age rising to between 30% and 35% in infertile women. The percentage of bowel involvement ranges from 8% to 30% with high incidences in referral hospitals [4]. The main locations of intestinal endometriosis, in order of frequency, are the rectum and the sigmoid (83%) followed by the appendix, the small bowel, the cecum and ileocecal junction [2, 4]. Endometriosis could be seen as the tip of an iceberg, with a large proportion of women having a misdiagnosed and incorrectly treated disease.

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Hormonal therapies may improve the symptoms caused by bowel endometriosis. However, surgery is required in patients with occlusive or subocclusive symptoms, in those whose symptoms have not improved despite the use of hormonal treatments, in those with contraindications to the use of hormonal therapies and also in patients hoping to conceive [5]. Nowadays a minimally invasive approach is the standard of care in the surgical treatment of endometriosis [1, 2, 4, 5]. The robotic approach is a consolidated and developing technique that can lead to good surgical results in this field. In this chapter the technical details of robotic surgery for bowel endometriosis are reported.

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## 19.2 Patients' Preoperative Work-Up

Endometriosis is staged according to the revised American Fertility Society Classification [6]. Preoperatively, all women are asked to define endometriosis-related symptoms and their intensity using the Visual Analog Scale [2, 3, 5]. All women with suspected bowel endometriosis should undergo a clinical rectovaginal examination, an abdominal and pelvic ultrasound scan and a double-contrast barium enema or magnetic resonance imaging to map deep endometriotic lesions which may affect the rectovaginal septum and the posterior compartment [2, 3, 5].

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## 19.3 Colorectal Surgery for Endometriosis

### 19.3.1 Patient Positioning and Docking

The patient is placed in a lithotomic position on a specific pad which creates friction. The arms are positioned alongside the trunk and the legs are bent/apart and abducted using specialized stirrups. A 30° Trendelenburg position and a right tilt are the first movement to expose the pelvic operative field from the small bowel loops. A bladder catheter and a uterine manipulator are placed before starting the surgery. Pneumoperitoneum is induced using the Veress needle in the Palmer's point. The 12-mm camera port can be placed infraumbilically with the aim of maintaining the operative field on the pelvis, focusing on the fundus of the uterus. Two or three additional 8-mm robotic ports are then positioned for the robotic instruments, paying close attention to maintaining a distance of at least 10 cm (the breadth of four fingers) from one another to avoid collision of the robotic arms upon docking. We usually put two 8-mm robotic accesses on the two oblique lines that connect the camera's port and the anterior superior iliac spine bilaterally at 8–10 cm from the camera port. A third robotic arm could be placed along the left side of the abdomen to create the correct traction in the complex pelvic field. In addition to the two robotic 8-mm trocars, we usually put one 5-mm laparoscopic assistant port of about 10 cm, in a lateral position to the camera port on the right. In cases of a rectal resection, a 12-mm laparoscopic port is placed in the suprapubic position for the bowel transection with the laparoscopic linear stapler. Docking could be performed by

placing the robotic cart at a 45° angle to the operating table, or parallel to the operative bed or between the patient's legs. The gynecologists and the urologists use a 0° camera, and the colorectal surgeons use a 30° camera. We usually utilize a monopolar hook/scissors on the robotic arm on the right side and a robotic bipolar grasper on the robotic arm on the left side along the lines connecting the camera port and the anterior superior iliac spines.

### 19.3.2 Gynecological Surgical Steps

Eradication of DIE is a multidisciplinary surgery involving gynecologists and often colorectal surgeons and urologists. The first phase of this surgery, which is a nerve-sparing technique [5], is gynecological and involves the following main stages:

- Performing adhesiolysis, ovarian surgery and removing the involved peritoneal tissues.
- Opening the presacral spaces (Latzko's and Okabayashi's lateral and medial pararectal spaces) and then isolating and preserving the pelvic sympathetic fibers of the inferior mesenteric plexus, the superior hypogastric plexus, the upper hypogastric nerves, the lumbosacral sympathetic trunk and ganglia.
- Dissecting the parametrial planes, isolating the ureteral course, lateral parametrectomy and preserving the sympathetic fibers of posterolateral parametrium and lower mesorectum.
- Performing posterior parametrectomy and if necessary, doing a surgical dissection of Waldeyer's presacral space and Heald's retrorectal space.
- Developing the rectovaginal septum and sparing the distal portion of the inferior hypogastric plexus. This step allows for the isolation of the endometriotic nodule of the rectovaginal septum and/or the rectal nodule. In the case of infiltration of the vaginal wall, a portion of the wall is resected and the vaginal margins are sutured by laparoscopy or hand-sewn through the vagina.
- Opening of the tunnel of the ureter to separate the medial vascular portion of the vesicouterine ligament from its lateral part, in which the nerves of the inferior hypogastric plexus run. When the anterior parametrium is involved a complete unroofing of the ureter to the bladder is performed.

### 19.3.3 Type of Colorectal Surgery

Colorectal surgery for DIE is performed after both the gynecological and urological steps.

#### 19.3.3.1 Rectal Shaving

Rectal shaving is carried out in the case of the presence of rectal/sigmoid nodules  $\leq 3$  cm with involvement up to the muscular layer of the viscera. This technique involves the removal of the endometriotic nodule without opening the intestinal

lumen. In cases of evident deep damage of the muscular layer, a possible reinforcement suture could be applied [4, 7, 8]. This type of surgery could easily be performed using the two robotic arms with scissors and a bipolar grasper.

### 19.3.3.2 Disc Excision

Disc excision is performed in the case of rectal/sigmoid nodules  $\leq 3$  cm of the anterior wall of the bowel with muscle or full-thickness infiltration. This technique is a full-thickness resection of the anterior intestinal wall [2]. The first step is shaving of the redundant portion of the endometriotic nodule to reduce its size, and it is performed using the two robotic arms with scissors and bipolar grasper. The full-thickness disc excision of the shaved nodule is performed using a 29- or 31-mm transanal circular stapler placed under robotic vision and opened once it reaches the bowel nodule [2, 7, 8]. A gap is then created between the anvil and the shoulder of the stapler, placing the targeted anterior rectal/sigmoid surface inside this gap with the aid of a previous robotic intracorporeal single stitch used for pushing the nodule inside the jaws of the stapler. The stapler is closed and fired, resecting a half-moon shaped rectal nodule specimen. The stapler is then removed, and the integrity of the suture is checked by rectal endoscopy and a “bubble-test”. This technique does not require additional laparoscopic or robotic trocars [2, 7, 8].

### 19.3.3.3 Segmental Resection

Segmental resection is carried out in the case of large, circumferential, obstructive nodules and when multiple endometriotic nodules are present in the same bowel segment [5]. In this case, a 5-mm laparoscopic assistant trocar is placed about 10 cm lateral to the camera port on the right and a 12-mm laparoscopic trocar is put in the suprapubic position for the bowel transection with the linear stapler. The first step is the identification and isolation of the inferior mesenteric vessels at the sacral promontory which are closed between clips positioned through the 5-mm laparoscopic trocar [5]. Using the robotic arms, the surgeon completes the dissection on the rectum developing posteriorly the avascular plane between the Waldeyer’s fascia and the mesorectal fascia. The rectum is prepared below the endometriosis nodule and is transected using a linear stapler through a 12-mm laparoscopic suprapubic trocar. Based on the size of the bowel resection, which is the bare minimum including the nodule, a partial mobilization of the left colon is sometimes required to obtain a floppy and tension-free anastomosis [5, 7, 8]. In this case, at the end of the robotic phase, a partial laparoscopic lateral-to-medial mobilization of the left colon is performed developing the avascular plane between Gerota’s and Toldt’s fascias. After exteriorization of the surgical specimen through a Pfannenstiel incision, an end-to-end colorectal anastomosis according to Knight-Griffen is performed and is checked by rectal proctoscopy and a “bubble-test”. Loop ileostomy is created in all cases of ultra-low rectal resection, double bowel resection, concomitant vaginal suture or ureteral reimplantation or in the case of a large bladder resection.

## 19.4 Advantages and Limitations of the Robotic Approach to Colorectal Endometriosis

The robotic approach to colorectal endometriosis, like the robotic approach for all colorectal surgeries, allows the surgeon to be less reliant on a surgical assistant. A sitting position at a console improves the ergonomics, particularly during a long and complex surgery [7–9]. The robotic equipment guarantees other benefits such as excellent 3D stereoscopic visualization, a stable camera platform and improved dexterity [7–9]. As a result, a surgeon's possible tremor disappears and a free and high level of movement of the instruments is provided. All these aspects could be helpful in increasing the precision and the accuracy of dissection with potentially better functional outcomes (sexual, bowel and urinary function) in types of surgery, such as eradication of DIE, which require a procedure close to the nerves [9, 10]. Because of the better visualization and therefore excision, robotic procedures could improve the eradication of DIE, as stated by Mosbrucker et al. These gynecologists detected more endometriotic lesions using the robotic technique than with the standard laparoscopic approach [10]. The early postoperative outcomes, such as post- and intraoperative complications and the length of the hospital stay, are similar when comparing the laparoscopic and the robotic approaches for colorectal endometriosis [7–9]. A large number of studies have demonstrated that in this surgical field the main limits of robotic surgery compared to laparoscopy include longer operative time and higher costs. Most of the authors who analyzed the disadvantage of the longer surgical duration reported that docking and trocar setup were the main causes for the longer operative time [7–9]. However, a large number of papers have demonstrated that the robotic learning curve is shorter than that of laparoscopic technology [7, 8].

Further studies, possibly controlled trials, comparing the long-term functional outcomes between laparoscopic and robotic surgery for the eradication of bowel DIE are required.

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## References

1. Working group of ESGE, ESHRE, and WES, Keckstein J, Becker CM, Canis M, et al. Recommendations for the surgical treatment of endometriosis. Part 2: deep endometriosis. *Hum Reprod Open*. 2020;2020(1):hoaa002.
2. Ceccaroni M, Ceccarello M, Clarizia R, et al. Nerve-sparing laparoscopic disc excision of deep endometriosis involving the bowel: a single-center experience on 371 consecutive cases. *Surg Endosc*. 2021;35(11):5991–6000.
3. Chapron C, Chopin N, Borghese B, et al. Deeply infiltrating endometriosis: pathogenetic implications of the anatomical distribution. *Hum Reprod*. 2006;21(7):1839–45.
4. Ceccaroni M, Clarizia R, Mussi EA, et al. “The sword in the stone”: radical excision of deep infiltrating endometriosis with bowel shaving – a single-Centre experience on 703 consecutive patients. *Surg Endosc*. 2022;36(5):3418–31.
5. Ferrero S, Stabilini C, Barra F, et al. Bowel resection for intestinal endometriosis. *Best Pract Res Clin Obstet Gynaecol*. 2021;71:114–28.

6. American Society for Reproductive. Revised American Society for Reproductive Medicine classification of endometriosis: 1996. *Fertil Steril.* 1997;67(5):817–21.
7. Hur C, Falcone T. Robotic treatment of bowel endometriosis. *Best Pract Res Clin Obstet Gynaecol.* 2021;71:129–43.
8. Morelli L, Perutelli A, Palmeri M, et al. Robot-assisted surgery for the radical treatment of deep infiltrating endometriosis with colorectal involvement: short- and mid-term surgical and functional outcomes. *Int J Color Dis.* 2016;31(3):643–52.
9. Le Gac M, Ferrier C, Touboul C, et al. Comparison of robotic versus conventional laparoscopy for the treatment of colorectal endometriosis: pilot study of an expert center. *J Gynecol Obstet Hum Reprod.* 2020;29:101885.
10. Mosbrucker C, Somani A, Dulemba J. Visualization of endometriosis: comparative study of 3-dimensional robotic and 2-dimensional laparoscopic endoscopes. *J Robot Surg.* 2018;12(1):59–66.

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