



Robotic Surgery for Diverticular Disease

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16.1 Background

Diverticular disease (DD) is a common benign condition that in Western countries has a remarkable clinical and economic impact on public health [1, 2]. Over the last decade, the non-operative management of acute DD has increased with a progressive reduction of emergent surgery and a relative shift toward elective resection [3, 4].

Minimally invasive surgery is now almost universally accepted as a valid option for the treatment of DD, provided specific expertise is available [1, 4].

Some of the main factors favoring minimally invasive surgery over conventional open colectomy are improved overall morbidity, lower rate of postoperative ileus, shorter hospitalization, and earlier return to daily activities [5, 6]. Nevertheless, the conversion rate during laparoscopic colectomy for DD ranges from 0% to 36% for complicated diverticulitis [7–9].

The use of robots in colorectal surgery has been spreading and evolving rapidly over the last two decades. The application of robots has also shifted to benign conditions, such as uncomplicated and complicated diverticulitis. Our group recently published a meta-analysis comparing the laparoscopic and robotic approach for the surgical treatment of DD, based on 4177 patients from nine studies. We found that patients undergoing laparoscopic colectomy compared to those who underwent

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surgery with a robotic approach had a significantly higher risk of conversion into an open procedure (12.5% vs. 7.4%, $p < 0.00001$) and abbreviated hospital stay ($p < 0.0001$), at the price of a longer operating time ($p < 0.00001$).

In this chapter, we describe our operative technique of robotic colorectal resection for diverticulitis.

16.2 Equipment, Patient Positioning and Operating Room Setup

Recommended main equipment:

- 30° endoscope
- fenestrated bipolar forceps
- monopolar scissors
- large needle driver
- vessel sealer (optional)
- SureForm endostapler: green cartridge (superior rectum)
- tip-up grasper.

The patient is placed in a lithotomy position with arms alongside the body. The pneumoperitoneum is established via a Veress needle inserted in the left hypochondrium at Palmer's point. Access to the abdominal cavity is gained with a 12-mm assistant port in the right flank. Three 8-mm and one 12-mm robotic trocars are placed along an oblique line which may vary according to the confirmation of the abdomen, as well as to intra-abdominal anatomy. Trocar layout is shown in Fig. 16.1.

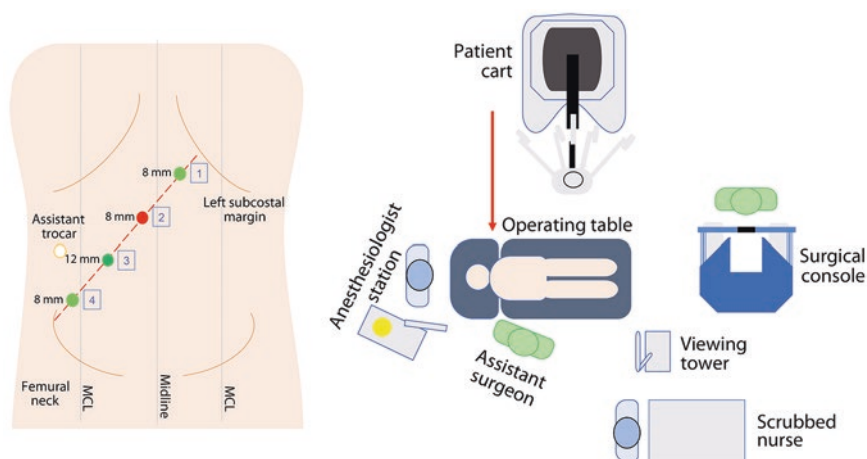


Fig. 16.1 Trocar layout (*left*): (1) bipolar forceps; (2) camera 30° down; (3) monopolar scissors/robotic stapler; (4) tip-up grasper. Operating room setup (*right*)

A limited lysis of adhesions, when present, is performed laparoscopically just to enable robotic trocar positioning under direct vision; adhesions are then taken down under robotic assistance (see Video 16.1).

The patient is then placed in a steep Trendelenburg and right tilt in order to achieve exposure of the operative field. The robotic cart is docked from the patient's left side and a da Vinci Xi system (Intuitive Surgical, Sunnyvale, CA, USA) is used. A full-robotic single-targeting procedure is performed. The assistant surgeon and the scrub nurse stand on the patient's right side (Fig. 16.1). The tip-up grasper, monopolar scissors/robotic stapler and bipolar forceps are mounted on robotic arm 4 (R4), arm 3 (R3) and arm 1 (R1), respectively. Robotic arm 2 (R2) is used for the 30°-down scope (Fig. 16.2). We place the tip-up grasper on arm 4 (in the right iliac fossa) because traction and exposure, especially during the pelvic dissection, is easier and more effective compared to the epigastric region where R1 is placed.

Fig. 16.2 Driving the laser lines to the scope port



16.3 Surgical Technique

With the tip-up grasper (R4) that has gently lifted up the sigmoid, the procedure starts with the incision of the peritoneum at the sacral promontory: the “holy plane” and superior rectal artery are identified. At this point, the tip-up grasper (R4) is placed under the mesosigmoid to traction it and facilitate the medial-to-lateral dissection. The mobilization of the sigmoid colon is then completed above or below the superior rectal artery depending on the level of vascular ligation planned.

The dissection is carried out with monopolar scissors (R3) and fenestrated bipolar forceps (R1), paying attention to preserve the hypogastric nerves, left ureter and gonadal vessels. This step can be technically demanding, especially in patients with previous abscess or recurrent episodes of diverticulitis, because of severely inflamed and fibrotic tissues making the dissection more demanding. The left ureter can be involved by the inflammatory process, causing a stricture with secondary hydroureteronephrosis [10]. It is mandatory to evaluate the computed tomography scan before the operation to assess the need for a preoperative double J catheter.

A lateral-to-medial dissection completes the mobilization of the sigmoid colon. The tip-up gasper (R4) and the assistant’s forceps pull the sigmoid colon in the right quadrants. Then, the lateral peritoneal reflection along the outer edge of the descending and sigmoid colon is opened and the plane previously developed is gained. Sometimes the sigmoid can be fused with the parietal peritoneum of the left iliac fossa/left side pelvic wall as a consequence of previous diverticulitis. In this case the traction of R4 associated with the traction of the assistant can help the colon mobilization.

Especially in young patients, to preserve the hypogastric nerve and innervation on the inferior mesenteric artery and superior rectal artery (to preserve the rectal emptying function), we suggest a vascular ligation at the level of the sigmoid arteries preserving the left colic and superior rectal arteries. However, in severely inflamed and thickened colon mesentery, ligation of the inferior mesenteric artery at the origin might facilitate the dissection achieving the embryological planes.

The dissection continues along the Toldt’s plane, in a bottom-to-up fashion: the peritoneum under the inferior mesenteric vein (IMV) is then incised. The integrity of the proper mesocolic fascia should be carefully preserved in order to ensure adequate perfusion to the splenic flexure/proximal descending colon. The transverse mesocolon is lifted with R4, and the origin of IMV is identified at the level of the duodenojejunal angle. The IMV is dissected at its origin and divided between self-locking clips at the inferior border of the pancreas. The dissection continues in a medial-to-lateral fashion. At this point the splenic flexure mobilization is carried out. Depending on the patient’s body characteristics and to the anatomy (e.g., high or low splenic flexure as well as the presence of colon-epiploic adherence) a medial approach, lateral approach, anterior approach, lesser sac approach or a combination of these might be adopted for the splenic flexure takedown.

Coloparietal detachment is completed and the distal transection site is chosen at the level of the sacral promontory, paying attention to remove the high-pressure zone at the level of colorectal junction. The upper rectum is transected with a 60-mm robotic SureForm linear stapler with green cartridge just a few centimeters below the sacral promontory (see Video 16.1).

The robot is undocked and the specimen is retrieved through a small suprapubic incision. The colon is transected and the anvil of a 28-mm circular stapler is introduced in the proximal stump. After re-docking of the cart, an assessment of bowel perfusion with indocyanine green fluorescence imaging system is performed and a conventional end-to-end colorectal anastomosis is performed according to the Knight-Griffen technique under robotic assistance. Colorectal anastomosis is reinforced with seroserosal absorbable interrupted stitches. An air leak test is performed and a drain is routinely left in place.

16.4 Conclusions

According to the data available in the literature, the application of the robotic approach compared to laparoscopic surgery offers significant advantages in terms of conversion rate and shortened hospital stay for the treatment of DD [11]. However, there is an absence of substantial evidence on the topic. In our experience the robotic approach is helpful especially in obese patients, with previous complicated DD or in those in whom other procedures are associated (small bowel resection, hysterectomy, ureteral reconstruction) [10].

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