



## Surgical Technique

# Laparoscopic anterior resection for cancer: a step-by-step technique

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**Abstract:** These videos show our step-by-step technique for laparoscopic low anterior resection (LAR) for rectal cancer with total mesorectal excision (TME). The procedure starts in the usual fashion with a high central ligation of the inferior mesenteric vessels, complete excision of the mesorectum, fluorescence angiography for perfusion control and end-to-end anastomosis. The splenic flexure is not mobilized routinely, but just when it is necessary to perform a tension free anastomosis.

**Keywords:** Rectal cancer; laparoscopic anterior resection; total mesorectal excision (TME); indocyanine green perfusion control (ICG perfusion control)

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## Introduction

In the 1980s, Heald and Ryall introduced a new surgical technique consisting in complete removal of the fatty envelope surrounding the rectum (mesorectum), called total mesorectal excision (TME) (1,2). There is evidence that this technique is associated with low local recurrence rates and hence considered to be the gold standard surgical treatment of rectal cancer (3).

Laparoscopic surgery has progressively replaced open colonic surgery in recent decades owing to favourable short-term outcomes, such as less pain, reduced blood loss, and improved recovery time, with the same oncological outcomes compared to the traditional open approach. During the last decades, the minimally invasive approach to rectal cancer has been progressively investigated (4).

## Operative technique

### *Trocar position and exposure of the operative field (Figure 1)*

We routinely induce pneumoperitoneum with Veress needle inserted in left hypochondrium, at the pressure of 12 mmHg but an open technique can also be used. The first trocar (5/10 mm of diameter) is inserted 2–3 cm above



**Figure 1** Trocar position and exposure of the operative field (5).

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the umbilicus along the linea alba (1). A 30-degree scope is initially introduced through this access and, under direct vision, a second trocar (5/10 mm) is placed 2–3 cm right to umbilicus along the emiclavicular line for the scope. A 12 mm trocar is introduced in the right iliac fossa for the right hand of the surgeon (2) and finally one 5 mm trocar is placed in the left flank for the assistant (3). Such a trocar set-up allows a good ergonomic dissection of descending colon/splenic flexure as well as adequate pelvic dissection/



**Figure 2** Opening the sigmoid mesentery (6).  
Available online: <http://www.asvide.com/article/view/31069>



**Figure 3** Identification, isolation and division of the inferior mesenteric artery (IMA) (7).  
Available online: <http://www.asvide.com/article/view/31070>

mesorectal excision. The extraction site for the specimen is normally located in the suprapubic area.

Before starting any dissection, in order to better expose the surgical field, the greater omentum is pushed over the transverse colon toward the liver and ileal loops are gently moved towards the right upper quadrant. During this phase adhesions between the terminal ileum the caecum can be divided in order to facilitate the mobilization.

#### ***Opening the sigmoid mesentery (Figure 2)***

At this point the sigmoid colon is lifted by the assistant and using scissors attached with low voltage spray-mode monopolar electrocautery, the surgeon divides the peritoneum of sigmoid mesentery and identifies the posterior aspect of the superior rectal artery. Using a combination of bland monopolar energy and CO<sub>2</sub> pneumo-



**Figure 4** Dissection of Toldt's fascia (8).  
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dissection the embryological plane can be easily identified leading towards the origin of inferior mesenteric artery (IMA) along the aortic plane respecting the hypogastric plexus nerves.

#### ***Identification, isolation and division of the IMA (Figure 3)***

The IMA is fully dissected at its origin from the aorta clipped and divided using advanced energy devices according to surgeon's preferences. At this point, a wider plane is created, and it's possible to identify and gently take down the retroperitoneal structures including the left ureter and gonadic vessels.

#### ***Dissection of Toldt's fascia (Figure 4)***

Sigmoid and descending colon are dissected from medial to lateral in the avascular plane of Toldt, separating the intra- and retroperitoneal structures that belong to different bloodless embryological compartments. Any evidence of excessive bleeding usually indicates that dissection is either too deep or too superficial.

#### ***Dissection and division of the inferior mesenteric vein (IMV) and opening the lesser sac (Figure 5)***

Dissection of Toldt's fascia is carried out up to Treitz's ligament along the inferior border of the pancreas, where the IMV is identified, dissected, clipped and divided. At this point the body and tail of the pancreas are gently detached from the transverse mesocolon entering the lesser sac exposing the posterior face of the stomach and, in certain cases, the lower pole of the spleen



**Figure 5** Dissection and division of the inferior mesenteric vein (IMV) and opening the lesser sac (9).

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**Figure 7** High mesorectal dissection and low mesorectal dissection (11).

Available online: <http://www.asvide.com/article/view/31076>



**Figure 6** Lateral mobilization (10).

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### *Lateral mobilization (Figure 6)*

After completing the medial dissection, the descending colon is tracted medially and the remaining lateral peritoneal attachments divided joining the medial dissection completing the splenic flexure mobilization by dividing the gastrocolic ligament.

### *High mesorectal dissection and low mesorectal dissection (Figure 7)*

Once splenic flexure's mobilization is completed (if needed) the initial dissection plane at the level of the sigmoid colon is identified, at the level of the promontory where the posterior mesorectal plane is identified and the initial "holy plane" is dissected using monopolar scissors. TME is carried out laterally, paying attention to nerves and the



**Figure 8** Rectal division, specimen extraction, perfusion control and circular anastomosis (12).

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left ureter, up to the peritoneal reflection. During the low mesorectal dissection proper traction and counter-traction is essential to respect the embryological planes, avoiding accidental nerves injuries since they run around the rectal wall aiming towards the seminal vesicles in men and the vagina in women. At this level, introduction of an accessory suprapubic port or the use of transcutaneous suspension sutures may help to obtain proper exposure. The dissection must be carried out down to the pelvic floor where the mesorectal fat usually ends.

### *Rectal division, specimen extraction, perfusion control and circular anastomosis (Figure 8)*

Once the distal extent of resection is identified, rectal wall is dissected circumferentially. The section of the distal margin is performed with mechanical linear staplers: this

can be tricky because of narrow space in the pelvis and it might be difficult to divide the rectum with a single stapler application.

A suprapubic mini-laparotomy without muscles division is carried out and, after placing a wound protector, the descending colon is exteriorized

Once the transection point is decided the mesentery of the descending colon is divided up to the bowel wall. Before proceeding to proximal colonic resection, fluorescence angiography with indocyanine green (ICG) is performed, in order to confirm good perfusion of the chosen transection point. Once adequate vascularization of the bowel is confirmed a purse string sutures is performed and the anvil of a circular stapler is inserted into the proximal end of bowel.

Pneumoperitoneum is re-established, the correct position of the colon is checked to eliminate any eventual twisting of the mesocolon. End-to-end anastomosis with a transanal circular stapler is performed under laparoscopic control. The donuts must be evaluated ensuring that they are complete, an air-leak test is performed and in some cases a drain is placed for postoperative surveillance.

## Conclusions

Laparoscopic low anterior resection (LAR) can reproduce the same steps described by Heald for the original TME technique. Better visualization of the anatomical structures allows to perform the dissection following the embryological planes.

Standardization of the technique is the key to minimize the incidence of complications and adapt the procedures to different types of patients.

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## Footnote

*Conflicts of Interest:* The authors have no conflicts of interest to declare.

*Informed Consent:* Written informed consent was obtained from the patient for publication of this manuscript and any accompanying images.

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