Laparoscopic Left Colectomy

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Alessio Pigazzi and Matthew T. Brady

Introduction

Over the past decades, advances in minimally invasive surgery have been observed in all surgical fields. Within colon and rectal surgery, the adoption of minimally invasive surgical techniques has allowed for improvements in patient care and recovery. Patients can now anticipate shorter recovery times, decreased hospital lengths of stay, less postoperative pain, and decreased risk of incisional hernia as a result of these minimally invasive approaches. Despite such advantages only 50% of annual colon resections in the USA are performed by laparoscopic techniques [1]. The low rate may be a result of the technical challenges of performing laparoscopic colon resection. This chapter aims to present a stepwise approach to laparoscopic left colectomy to aid in developing the necessary skills to master this approach. Here, we present our preferred approach as well as secondary approaches to skillfully perform laparoscopic left colectomy.

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A. Pigazzi (✉) · M. T. Brady
Department of Surgery, Division of Colon and Rectal Surgery, University of California, Irvine Medical Center, Orange, CA, USA
e-mail: apigazzi@uci.edu

Necessary Equipment

Laparoscopic left colectomy requires an adequate array of laparoscopic instruments and equipment to safely perform this procedure. Given the progress of the minimally invasive surgical era, there have been great advancements in the equipment for performing these operations. As is true for all surgical disciplines, it is important to balance the cost of equipment with its necessity. Additionally, while there are many options for equipment, it is important to use the instruments that provide the surgeon comfort and ease of use. Below is a list of equipment, categorized by its use in the operation, which we feel are important.

Positioning

To assist with colon mobilization, the operating table will be placed in a variety of positions, occasionally at steep angles. It is imperative to secure the patient to prevent sliding on the table while avoiding restriction of respiration and formation of pressure wounds. Additional positioning requirements include free access to the rectum for transanal staplers and endoscopes. Below are some available options for positioning equipment:

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- The Pink Pad® Advanced Trendelenburg Positioning System
- Bean bag positioners
- Lithotomy stirrups
- Split-leg operating table

Abdominal Insufflation

Numerous methods for accessing the peritoneal cavity for laparoscopic surgery have been described. We prefer to perform Veress needle insertion. This technique is safe and allows for easy placement of ports away from the umbilicus.

Mobilization

Certain equipment is necessary to safely perform laparoscopic colon mobilization. Regarding visualization, an angled laparoscope, typically 30 ° lens, is sufficient. Either a 5 mm or 10 mm lens is adequate. If visualization is poor with the 5 mm lens, it is advisable to change to a 10 mm lens. Often, laparoscopic energy devices and staplers are costly, but they remain necessary to ensure safe mobilization. Vessels can often be coagulated and transected with energy devices alone, although we prefer to apply clips prior to division. Some surgeons may prefer to staple named vessels, but this comes with increased costs compared with clips.

- High-definition angled laparoscope
- Laparoscopic energy device capable of sealing vessels (e.g., inferior mesenteric vein (IMV) and inferior mesenteric artery (IMA))
- Monopolar cautery hook
- Atraumatic graspers
- Laparoscopic scissors
- Laparoscopic suction-irrigator
- Laparoscopic clip appliers
- Laparoscopic linear staplers

Specimen Extraction

If transabdominal extraction is planned, specimen extraction is best performed through a Pfannenstiel incision given the decreased risk of hernia and improved cosmesis [2]. A wound protector should be used for specimen extraction to decrease postoperative wound complications [3].

Anastomosis

We prefer to perform the colorectal anastomosis using a transanal circular stapler. We also inspect every anastomosis using a flexible endoscope. Flexible endoscopy, as opposed to rigid proctoscopy, offers superior visualization of the anastomosis. The improved visualization allows for assessment of tissue perfusion on each side of the staple line [4], control of staple line bleeding with endoscopic clips, and identification of anastomotic disruptions.

- Transanal circular stapler for colorectal anastomosis
- Flexible endoscope

Operative Setup

Positioning

Laparoscopic left colectomy requires the patient be positioned to allow for colon mobilization both in the pelvis and upper abdomen. Patient factors such as splenic flexure position, intra-abdominal fat distribution, and prior scarring can greatly influence the ease of left colon mobilization. Importantly, mobilization is greatly aided by proper operating room table positioning during the case.

For the majority of the cases, the left side of the operating room table will be elevated to allow the small bowel to fall away from the surgical field. Both steep Trendelenburg and reverse Trendelenburg positioning are employed during pelvic and splenic flexure mobilization, respectively. Access to the rectum for transanal staplers and endoscopes require either lithotomy positioning or split-leg operating table, depending on surgeon preference and equipment access. As described above, it is imperative to have a patient

positioning system that will secure the patient to the operating table to avoid patient sliding or movement. Communication with the anesthesia and nursing teams during positioning will help ensure that the patient is safely moved during the case.

Abdominal Access and Port Placement

We prefer using a Veress needle insufflation technique. The Veress needle is inserted at Palmer's point in the left upper quadrant, and the abdomen is insufflated. After gaining pneumoperitoneum the camera and working ports are placed (Fig. 20.1). The camera port is placed halfway between the xiphoid process and pubic tubercle. In the majority of cases, this position coincides with the umbilicus; if it does not, it is important not to sacrifice camera position for cosmesis. Visualization is critical to performing safe and efficient laparoscopic surgery; therefore, placing the camera port away from the umbilicus to optimize field of view supersedes cosmetic benefits. The next port is a 12-mm right lower quadrant working port that is placed approximately 8 cm from the camera port on a line connecting the camera port and the anterior superior iliac spine. This port coincides with the surgeon's right hand and the laparoscopic stapler, clip applier, energy device, and needles for suturing will be passed through this port. The remainder of the ports will be 5-mm ports. The surgeon's left hand port is placed a minimum of one handbreadth above the 12-mm port in the midclavicular line. The assistant 5-mm port is placed in the midline below the xiphoid. For the majority of the cases, the surgeon will stand below the assistant utilizing the right lower quadrant 5-mm and 12-mm ports, while the assistant will control the camera with the right hand and assist through the midline 5-mm port with the left hand (Fig. 20.2). Occasionally, when dividing the gastrocolic ligament and working toward the splenic flexure, the surgeon and assistant may switch positions, and the surgeon will work through both 5-mm ports.

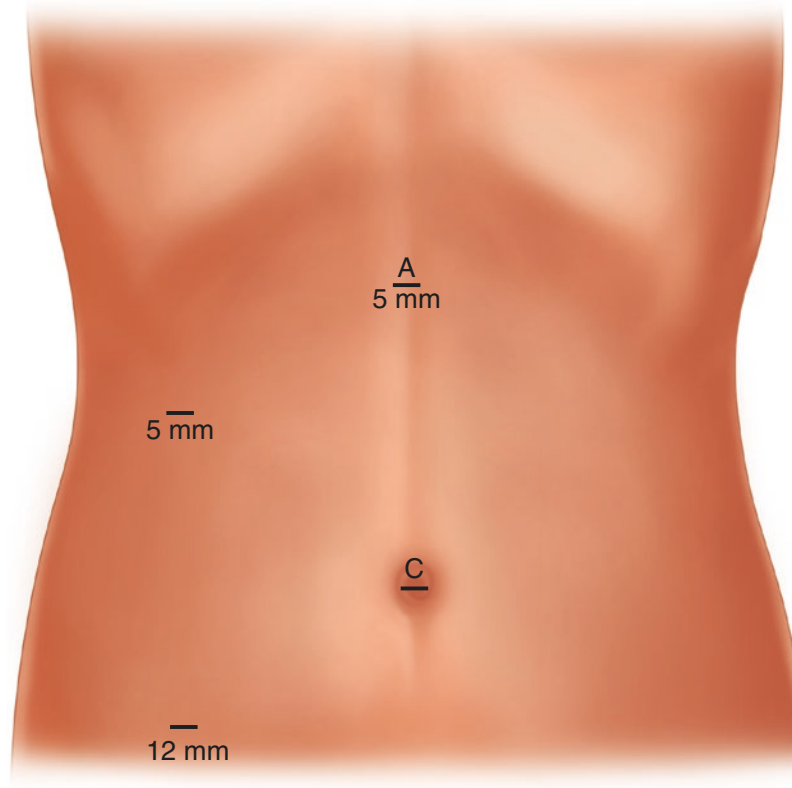

Fig. 20.1 Trocar/port placement for laparoscopic left colectomy. The camera port is placed midway between the xiphoid and pubic symphysis. The 12-mm working port is placed in the right lower quadrant on a line connecting the camera and the anterior superior iliac spine. A 5-mm port is placed in the midclavicular line in the left upper quadrant and a 5-mm port is placed below the xiphoid

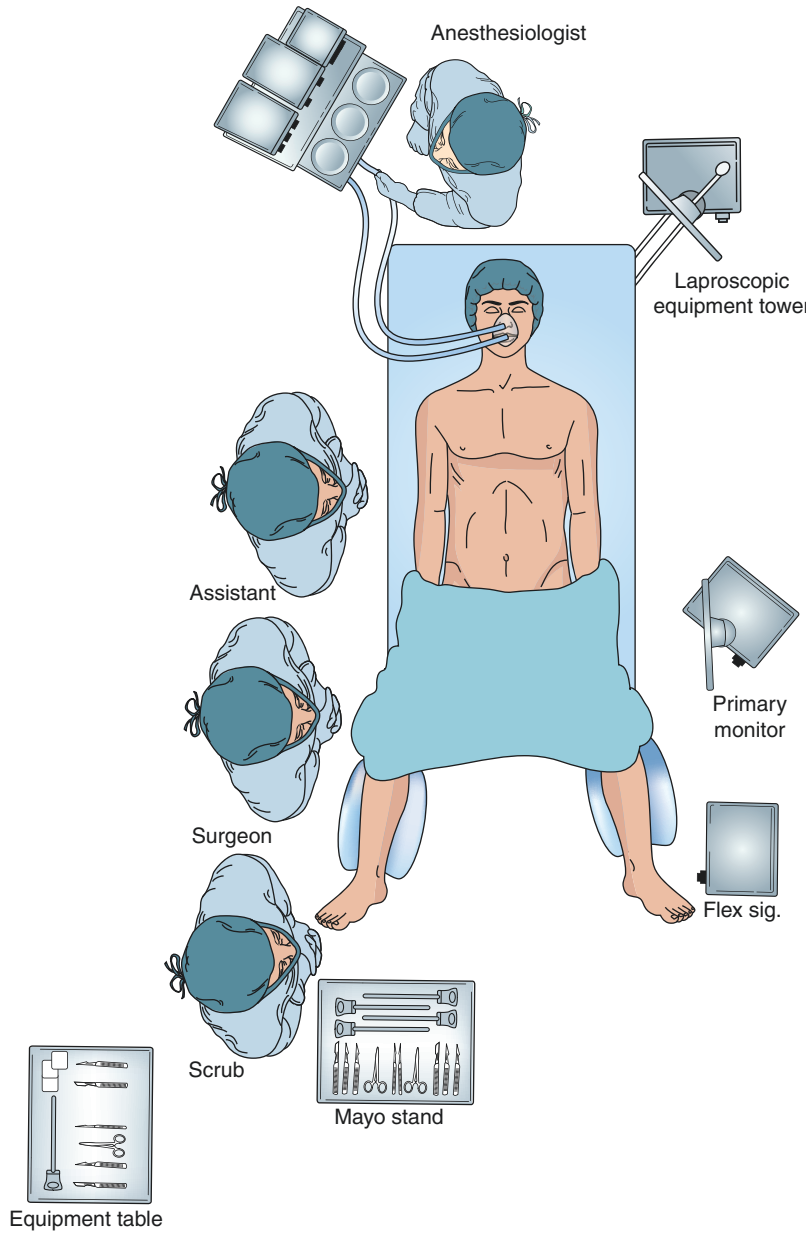

Fig. 20.2 Patient positioning and operating room setup for laparoscopic left colectomy. The patient is placed in lithotomy position with both arms tucked. The surgeon and assistant operate from the patient's right side. The laparoscopic monitor should be placed at eye level directly across from the operative field

Surgical Technique

Video 20.1

Left Colon Mobilization

The authors prefer a medial-to-lateral dissection for the majority of cases. In certain re-operative cases where the medial-to-lateral plane has already been violated, the surgeon may approach mobilization through a variety of directions. The medial-to-lateral dissection allows for early identification of critical landmarks, including the pancreas, lesser sac, ureters and gonadal vessels, and Gerota's fascia. This dissection approach also allows early identification and ligation of vascular pedicles [5]. Also, as the colon remains teth-

ered on the abdominal sidewall at the white line of Toldt until the completion of the dissection, the medial-to-lateral approach facilitates a totally laparoscopic dissection without the need for frequent repositioning of the patient.

The medial-to-lateral dissection begins with division of the fusion plane between the left colon mesentery and the left retroperitoneum. This fusion plane forms during the 12th week of development after the colon has completed its 270 ° counter-clockwise rotation [6]. The dissection can begin either above or below the level of the inferior mesenteric artery (IMA). The authors prefer to begin the dissection above the level of the IMA at the inferior mesenteric vein (IMV). The plane between the left colon mesentery and the retroperitoneum is relatively flat in this location and facilitates both its identification and separation. The dissection is begun by incising the peritoneum just below the IMV, which is found adjacent to the ligament of Treitz (Figs. 20.3 and 20.4). Once the peritoneum is incised, the plane is developed using blunt dissection (Fig. 20.5). In the correct fusion plane, this blunt dissection will not result in bleeding, and if bleeding is encountered, then that may likely signify that the wrong plane has been dissected and that the surgeon may need to readjust. As the dissection progresses, the IMV is clipped and divided which allows for complete mobilization of the splenic flexure. During these steps, the gonadal vein and occasionally the ureter can often be visualized at this level (Fig. 20.6).

Next, the attachments of the splenic flexure are released in a medial-to-lateral fashion as well. The mesocolic envelope is incised just above the

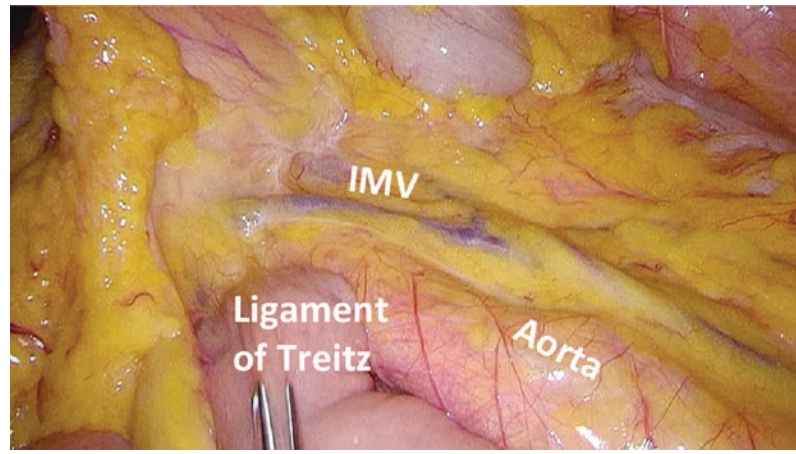

Fig. 20.3 Intraoperative images depict dissection beginning at the level of the inferior mesenteric vein (IMV), which is located adjacent to the ligament of Treitz

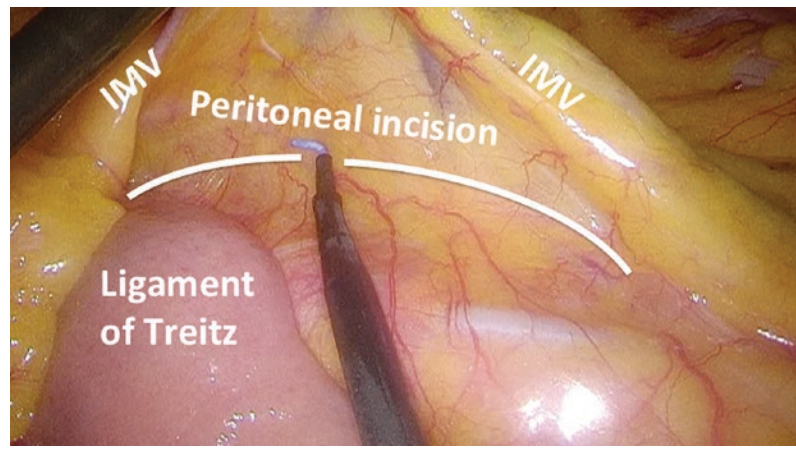

Fig. 20.4 Intraoperative image shows how the IMV is grasped and elevated and the peritoneum below is incised with electrocautery, separating the mesocolon from the retroperitoneum

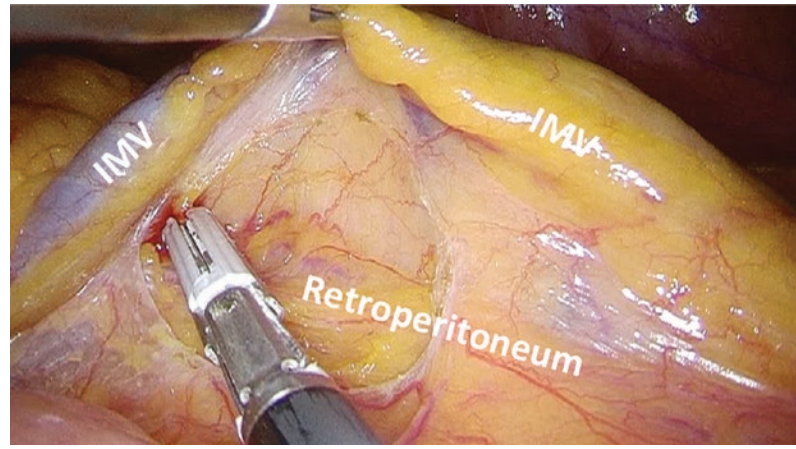

Fig. 20.5 Intraoperative image demonstrates the progression of medial-to-lateral dissection with blunt dissection of the fusion plane between the left colon mesentery and retroperitoneum

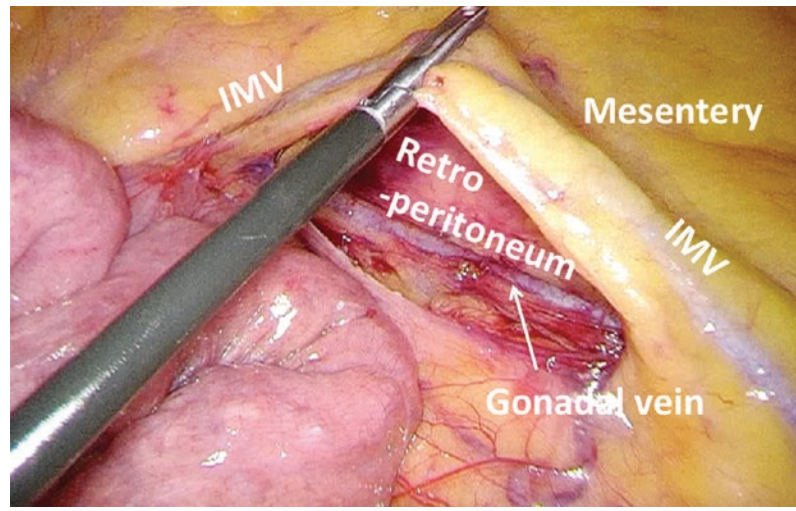

Fig. 20.6 Intraoperative image shows when the gonadal vein can be visualized during medial-to-lateral dissection

anterior surface of the pancreas and the lesser sac is entered (Fig. 20.7). It is critical to stay over the anterior surface of the pancreas. It is easy to dissect underneath the pancreas, which will lead directly to the splenic vein. Once the mesocolon is dissected off the pancreas, the inferior attachments of the mesocolon to the spleen and retroperitoneum are easily identified and divided with the energy device. The inferior splenic flexure mobilization is complete once the inferior pole of the spleen and posterior stomach are visualized and free from their attachments to the colon and mesentery.

The dissection is next moved below the level of the IMA. Again the peritoneum is incised at its base, and the mesocolon is dissected free from the retroperitoneum. Adequate elevation of the sigmoid colon by the assistant will help ensure the base of the mesentery is incised and the correct plane is entered. At this level the ureter and gonadal vessels must be identified and preserved. This dissection continues laterally to the abdominal sidewall and cephalad to join the previous dissection plane. Once this is complete, the IMA is isolated (Fig. 20.8). The IMA bifurcates into the left colic and superior hemorrhoidal arteries forming a characteristic "T"-shape configuration, which aids in its identification (Fig. 20.8). Once identified, the IMA is clipped and divided. Following division of the IMA, the white line of

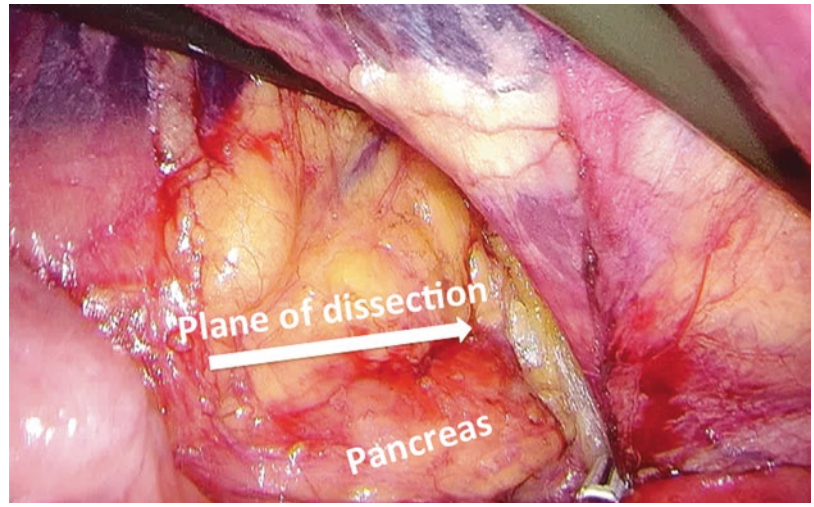

Fig. 20.7 Intraoperative images show the mobilization of the splenic flexure from beneath the left colon mesentery. The plane between the colon mesentery and pancreas is incised, and the dissection progresses over the pancreas and into the lesser sac

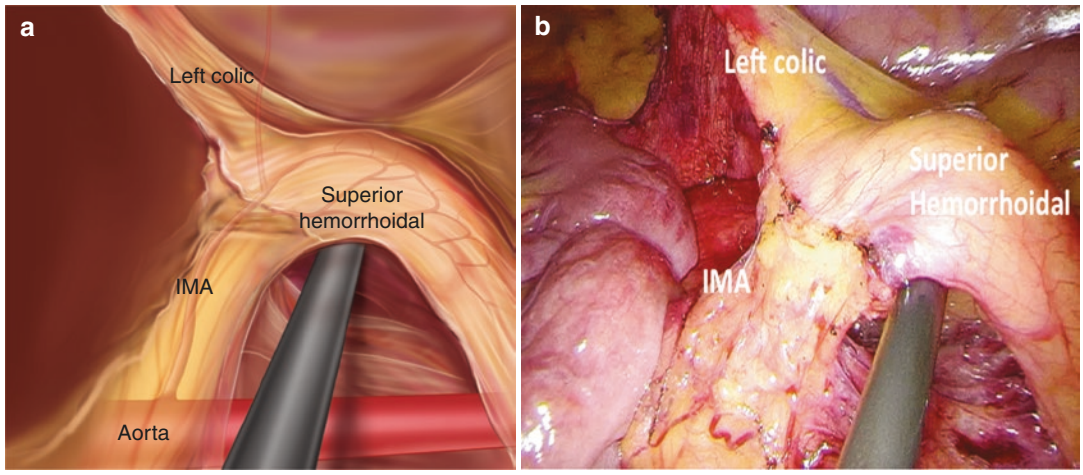

Fig. 20.8 (**a**) Illustration showing the branching of the inferior mesenteric artery (IMA) to its left colic and superior hemorrhoidal arteries. (**b**) Paired intraoperative image showing isolation of the IMA and the characteristic "T" configuration with the IMA branching into the left colic and superior hemorrhoidal arteries

Toldt is incised to release the colon from the abdominal wall. Also, the omentum is separated from the distal transverse colon to facilitate mobility.

Colon Resection and Reconstruction

Once the left colon has been fully mobilized, the next steps are division of the colon and its mesentery, specimen extraction, and reconstruction. Depending on whether the operation is performed for benign or malignant pathology, the sites of transection may vary. Once an appropriate location for transection has been selected, we proceed with intracorporeal mesocolic division at the distal resection margin. The mesocolon is grasped in the surgeon's left hand while the assistant holds the colon out toward the abdominal wall. The mesocolon is then divided with care to avoid harming the mesentery of the remaining colon. Once the wall of the colon is reached, the energy device is exchanged for a laparoscopic stapler and the colon is divided.

Next the surgeon must decide if they will perform a transabdominal extraction through a Pfannenstiel incision. In certain cases with concomitant hysterectomy or diverting ileostomy, an extraction can be performed through the vagina or stoma. In those circumstances, we perform intracorporeal division of the proximal margin. If a Pfannenstiel extraction site is selected, it is simple to extract the colon and perform extracorporeal division of the proximal margin. In this scenario, the colon is divided with electrocautery and the mesentery is divided with the energy device. A 28-mm anvil from the transanal circular stapler is inserted into the proximal colon and secured with a purse-string suture, typically a 2-0 monofilament suture. Alternatively, a side-to-end anastomosis can be performed, where the spike of the anvil is brought out the antimesenteric side of the colon and the end of the colon is stapled closed.

Once the anvil is in place and hemostasis is achieved, the colon is returned to the abdomen. The transanal stapler is then inserted and the spike deployed through the staple line of the distal margin on the rectum. The two ends are connected laparoscopically. When connecting the anvil with the stapler, it is important to move the colon with the left-handed grasper and to avoid pulling on the anvil with the right, since that may cause injury to the site of anastomosis or disrupt the purse-string. Once connected, the stapler is then closed and deployed. Care should be taken to ensure the mesentery is not twisted prior to firing the stapler. Once the anastomosis is created, it is tested by submerging it under water while insufflating with a flexible endoscope. Also, the anastomosis is inspected to ensure that viable tissue is present on both proximal and distal edges of the staple line and that there is no anastomotic hemorrhage. If brisk staple line bleeding is encountered, it can be addressed with endoscopic clips.

Conclusion

Laparoscopic left colectomy is a technically challenging operation that when it is mastered will provide the surgeon's patients with numerous advantages including shorter recovery time, decreased wound complications, and improved cosmesis. It is now a standard of care for both benign and malignant pathology [7, 8].

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