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Laparoscopic Resection of The Splenic Flexure

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Abstract:

The splenic flexure is a critical junction in the colon, characterized by variable vascular anatomy with contributions from both the superior mesenteric artery (SMA) and inferior mesenteric artery (IMA). Resection at this site is required in a variety of clinical settings, including colorectal cancer, diverticulitis, ischemic colitis, and benign strictures. Historically, resections of the splenic flexure were performed via open surgery due to the difficulty of mobilization and lymphadenectomy in this region. However, laparoscopic resection has emerged as a feasible and safe alternative when performed by experienced surgeons, supported by evidence showing comparable oncologic outcomes with added benefits in recovery.

Keywords: Laparoscopic surgery; Splenic flexure; Colorectal resection; Minimally invasive surgery; Colorectal cancer; Diverticulitis; Oncologic outcomes.

Introduction:

Laparoscopic resection of the splenic flexure has gained increasing attention over the past decade due to improvements in minimally invasive techniques and better perioperative outcomes compared to open approaches. Recent studies have highlighted that laparoscopic surgery provides comparable oncological results while significantly reducing hospital stay and enhancing postoperative recovery **(1).**

One of the main challenges in splenic flexure resection is its complex vascular anatomy, with dual blood supply from both the superior mesenteric and inferior mesenteric arteries. Accurate preoperative imaging and intraoperative vascular control are therefore essential to minimize complications and ensure oncologic adequacy **(2).**

Moreover, the proximity of the splenic flexure to vital structures such as the pancreas, spleen, and diaphragm adds to the technical complexity of this procedure. Laparoscopic approaches, including medial-to-lateral or lateral-to-medial dissection, have been refined to safely address these anatomical challenges in specialized centers **(3).**

Finally, contemporary multicenter trials and meta-analyses confirm that laparoscopic splenic flexure resection is not only feasible but also safe, with equivalent oncologic outcomes and improved short-term recovery profiles, making it an increasingly recommended option for colorectal malignancy and benign disease at this site **(4).**

Preoperative Preparation:

A contrast-enhanced abdominal computed tomography (CT) scan with three-dimensional CT angiography is recommended to clarify the vascular anatomy and aid in surgical planning **(5).**

Positioning of Patient and Ports:

The patient is positioned supine on the operating table, with the right arm placed at the side. The surgeon stands on the patient's right side, while the assistant stands to the surgeon's left. The nurse and the monitor are positioned on the patient's left side to facilitate coordination and visualization during the procedure. A 10-mm trocar (U-T) is inserted in the midline just above the umbilicus. A second 10-mm trocar (RF-T) is placed in the right flank,

medial to the anterior axillary line at the same level as the U-T. A 5-mm trocar (RI-T) is positioned in the right iliac fossa, 2 cm below McBurney's point. Another 5-mm trocar (EPI-T) is placed in the epigastric midline, 4 cm above the U-T. Finally, a 5-mm trocar (LI-T) is inserted in the left iliac fossa, mirroring McBurney's point **(6).**

Operative Steps; Anatomy Key Points:

The left colic artery (LCA) is the only artery requiring intracorporeal ligation during the procedure. The LCA, along with the superior aspect of the inferior mesenteric artery (IMA) from which it originates, forms the right side of a rectangular anatomical boundary. This rectangle is defined by the aorta as its base, the duodenojejunal junction (DJJ) as its left side, and the inferior mesenteric vein (IMV) as its upper side **(7).**

To access this area, the peritoneum is incised below the DJJ and above the aortic profile, creating a window by separating Gerota's fascia from the posterior aspect of the left mesocolon. As this window is deepened toward the aortic bifurcation, the superior aspect of the IMA and the LCA is encountered, allowing for safe division of the LCA at its origin. It is important to note that there is a 5% chance of the LCA being absent, which should be considered during the procedure **(8).**

Step 1: Vascular Ligation and Division of the Left Colic Artery and Inferior Mesenteric Vein:

The patient is positioned in Trendelenburg with the left side inclined upward. The laparoscope is inserted through the right flank trocar (RF-T), while the umbilical trocar (U-T) and right iliac fossa trocar (RI-T) are used by the surgeon for dissection. The epigastric trocar (EPI-T) and left iliac fossa trocar (LI-T) are utilized by the assistant for retraction and exposure **(9).**

The greater omentum is retracted into the supramesocolic space, and the small bowel is moved to the right hypochondriac and lumbar regions to expose the duodenojejunal junction (DJJ). The peritoneum is incised between the inferior mesenteric vein (IMV) and the aortic profile, extending from the DJJ to the aortic bifurcation. A window is created by bluntly dissecting Gerota's fascia away from the left mesocolon, extending the dissection to the left paracolic gutter and the root of the transverse mesocolon at the lower edge of the pancreas. The left gonadal vessels should be visualized during this step **(10).**

The dissection continues toward the aortic bifurcation until the superior aspect of the inferior mesenteric artery (IMA) is identified. The IMA is cleared of lymph nodes, and the origin of the left colic artery (LCA) is prepared for ligation . Before dividing the LCA, the left ureter is identified in the space between the gonadal vessels and the IMA. If the LCA is absent, the first sigmoid artery is prepared and divided instead. Finally, the IMV is divided near the pancreas **(11, 12).**

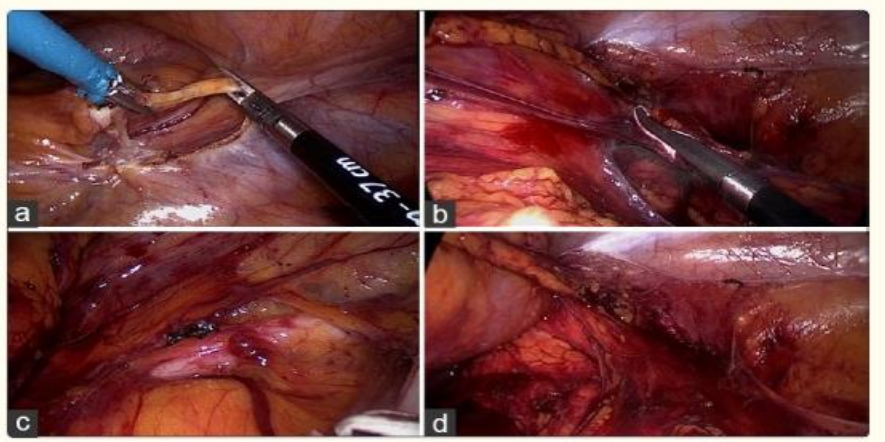

Figure (1): (a) Incision of the left paracolic gutter, (b) conjunction with the peritoneal window, (c) detachment of the sigmoid colon at the pelvic inlet, (d) end of mobilisation of the descending colon **(9).**

Step 2: Mobilization of the Sigmoid and Descending Colon:

The peritoneum is incised above the external iliac vessels on the left side of the sigmoid colon (Figure 1a). The left paracolic gutter is then incised, and the sigmoid and descending colon are mobilized until they connect with the window created in Step 1 (Figure 1b).

The sigmoid colon is sufficiently medialized when it is completely detached from the left ureter at the pelvic inlet (Figure 1c). Medialization of the descending colon continues upward but stops just before reaching the splenic flexure (SF) (Figure 1d). It is strongly advised not to proceed further with this approach for dissecting the splenic flexure **(9, 13).**

Step 3: Division of the Gastrocolic, Splenocolic, and Phrenicocolic Ligaments:

The patient is repositioned in reverse Trendelenburg with the left side inclined upward. The laparoscope is inserted through the umbilical trocar (U-T), while the epigastric trocar (EPI-T) and left iliac fossa trocar (LI-T) are used by the surgeon for dissection. The right flank trocar (RF-T) is utilized by the assistant to retract the stomach or transverse colon, or by the surgeon as an alternative to the EPI-T when working on the middle third of the gastrocolic ligament (GL) **(6).**

The GL is divided starting from its middle third and proceeding clockwise toward the lower pole of the spleen. The division is performed below the gastroepiploic arcade, opening the omental bursa. Lifting the stomach facilitates this dissection. To avoid splenic injury, downward traction of the greater omentum is avoided. Gentle lifting of the spleen is preferred when approaching the spleno-omental adhesions and the splenocolic ligament. The phrenicocolic ligament is divided clockwise, connecting the dissection to the left paracolic gutter. Finally, the transverse and descending colon are pulled downward, and the Gerota's fascia is fully divided to detach the splenic flexure (SF) from the renal capsule **(14).**

Step 4: Dissection of the Root of the Transverse Mesocolon:

This final step involves lowering the transverse colon and proceeding anticlockwise from the splenic flexure (SF) along the lower edge of the pancreas. This approach ensures clear visualization and preservation of the pancreas. The root of the transverse mesocolon is detached from the lower edge of the pancreas and above the duodenojejunal junction (DJJ), continuing until the head of the pancreas is encountered. At this stage, the left colon falls medially, exposing the aortic profile, the left renal capsule, and the left common and external iliac vessels **(9).**

Step 5: Extracorporeal Vascular Ligation and Colic Anastomosis:

The umbilical trocar (U-T) incision is extended cephalad to connect with the epigastric trocar (EPI-T), allowing the splenic flexure (SF) to be exteriorized. The colon is divided at least 12 cm above and below the tumor. The segment of the colon to be resected is pulled upward, and the transverse mesocolon is divided from its external edge toward the left branch of the middle colic artery (MCA). The MCA is identified by translucency and divided at its origin. A side-to-side colic anastomosis is then performed. A Jackson-Pratt drain is placed near the lower edge of the pancreas through the left iliac fossa trocar (LI-T) site, and the incisions are closed **(15, 16).**

Unique Challenges of the Splenic Flexure (SF):

The splenic flexure is anatomically unique due to its dual blood supply and lymphatic drainage, situated at the junction of the superior mesenteric and inferior mesenteric territories. This complexity, combined with the infrequency of SF resections, can hinder surgeons from developing a reliable learning curve and gaining sufficient experience in this area **(9).**

Potential Complications and Surgical Concerns:

Injuries to the spleen during SF mobilization, or to the pancreas or the main trunk of the middle colic artery (MCA) during division of its left branch, are among the most feared complications. These risks often discourage surgeons from attempting laparoscopic resection of the splenic flexure (LRSF), leading them to prefer open

procedures. To address this, combining laparoscopic mobilization of the SF with extracorporeal vascular ligation and bowel anastomosis—similar to open surgery—may offer a more accessible and less intimidating approach. Additionally, the inferior mesenteric artery (IMA), left colic artery (LCA), and inferior mesenteric vein (IMV) are managed as in laparoscopic left colectomy, a more familiar procedure for many surgeons **(9, 17).**

Importance of Surgical Education and Training:

Given that the majority of colectomies are performed by low-volume surgeons, there is growing consensus that enhancing local surgical education and training is crucial for improving outcomes and global health. Simplifying surgical techniques and making them easier to learn could play a pivotal role in this strategy, empowering surgeons to perform these procedures more confidently and effectively **(9).**

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