

32. Laparoscopic Segmental Colectomies, Anterior Resection, and Abdominoperineal Resection

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A. Indications

1. **Laparoscopic colon resection** may be considered whenever resection of a segment of colon is required. Large masses such as a phlegmon in Crohn's disease or a large bulky tumor may not be amenable to the laparoscopic technique. Laparoscopic colectomy is most commonly performed for one of the following indications:
 - a. Endoscopically unresectable benign colon polyps
 - b. Crohn's disease
 - c. Volvulus
 - d. Diverticulitis
 - e. Colon carcinoma
2. **Laparoscopic anterior resection** is primarily indicated for neoplasms of the colon, sigmoid, and upper rectum, for which surgical removal is the treatment of choice. This includes the following:
 - a. Endoscopically unresectable benign polyps
 - b. Rectosigmoid or upper-third rectal cancers
3. **Laparoscopic abdominoperineal resection** is indicated whenever surgical extirpation of the entire rectum and anus is required, and is almost always reserved for cure or palliation of low colorectal malignancies. Indications for this procedure include the following:
 - a. Rectal cancer
 - b. Squamous cell carcinoma of the anus
 - c. Anal or rectal melanoma
 - d. Anal or rectal sarcomas
 - e. Crohn's disease of the rectum

B. Patient Position and Room Setup

1. Position the patient supine on the operating table with both arms tucked, padded, and protected at the sides.

2. Place the patient in a modified lithotomy position using Allen stirrups (Lloyd-Davies or other designs may be used). It is imperative that the thighs be at or lower than the level of the abdominal wall to obviate difficulty in maneuvering the lower abdominal instruments. This position enables intraoperative colonoscopy, if needed, as well as the introduction of a circular stapler through the anus for construction of a low anastomosis.
3. In general, the surgeon stands on the side of the patient opposite the pathology and site of dissection, with the first assistant standing across the table.
 - a. Thus, for **right hemicolectomy or ileocolic resection**, the surgeon typically stands on the patient's left side. At times it may be beneficial to stand between the patient's legs. Two monitors are placed at the head of the table.
 - b. For **left colon resections (including abdominoperineal resection)**, the surgeon usually stands on the patient's right side. During mobilization of the splenic flexure it is often easier to stand between the patient's legs. Two monitors are placed at the foot of the table.
4. **Trocar position and choice of laparoscope** will be discussed with each individual procedure.

C. Performing the Laparoscopic Assisted Ileocolic Resection or Right Hemicolectomy

1. Place the **first (10–12 mm) trocar** in the supraumbilical region at the site of the planned incision for specimen extraction. In certain instances where an infraumbilical extraction may be possible (based on pathology and patient's body habitus), this site may be used. Threaded trocars are sometimes helpful in heavy patients with thick abdominal walls.
2. Pass a **0-degree laparoscope** through this trocar.
3. Place **two 10- to 12-mm trocars** in the left upper and left lower quadrants, lateral to the rectus muscles.
4. **Additional trocars** may be needed for retractors (Fig. 32.1). These are generally placed in the right upper or right lower quadrants (again lateral to the rectus muscles). Occasionally, a third additional trocar may be placed very high in the left upper quadrant.
5. Position the patient in steep Trendelenburg position with the left side of the table down.
6. Identify the terminal ileum and base of cecum. Grasp the cecum with an endoscopic Babcock-type clamp.
7. Incise along the white line of Toldt with ultrasonic scissors or electrocautery scissors, and mobilize the right colon superiorly to the level of the liver.

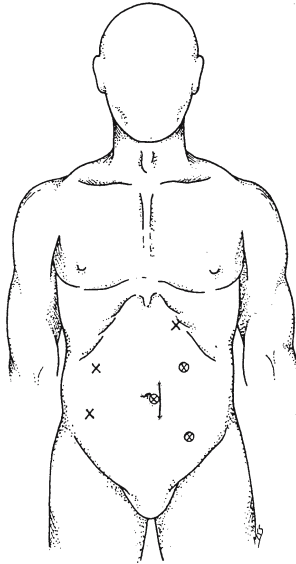


Figure 32.1. Positions of the 10- to 12-mm trocars for ileocolic resection and right hemicolectomy. The small midline incision is made as an extension of a trocar site and is used for exteriorization of the specimen and extracorporeal resection and anastomosis: ⊗, typical trocars; ×, optional trocars.

8. Continually regrasp and manipulate the right colon as needed for further medial dissection to expose the ureter, Gerota's fascia, and the duodenum (see Figs. 32.2 and 32.3).
9. Grasp the hepatic flexure and divide the hepaticocolic ligament with ultrasonic or electrocautery scissors. When using electrocautery scissors, it is necessary to have ligaclips or endoclips available as bleeding may occur.
10. Finally, grasp the transverse colon and divide the greater omentum distal to the gastroepiploic vessels to the level of the middle colic artery. The ultrasonic scissors work better than other modalities for this dissection.
11. Once the right colon has been completely mobilized as described, grasp the cecum with an endoscopic Babcock clamp passed through the selected site of specimen removal. Place the laparoscope in one of the other trocar sites if necessary.
 - a. In patients with Crohn's disease, it is imperative to "run" the small bowel.
 - b. Accomplish this maneuver by a "hand-over-hand" technique using two Babcock clamps under direct vision.

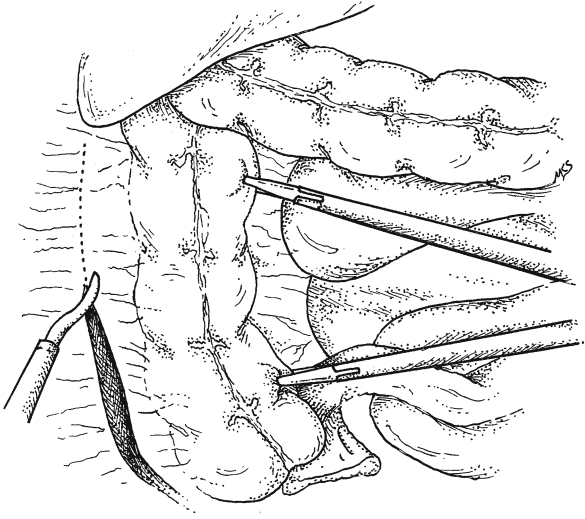


Figure 32.2. Mobilization of right colon. Two graspers pull the right colon medially as the white line of Toldt is incised.

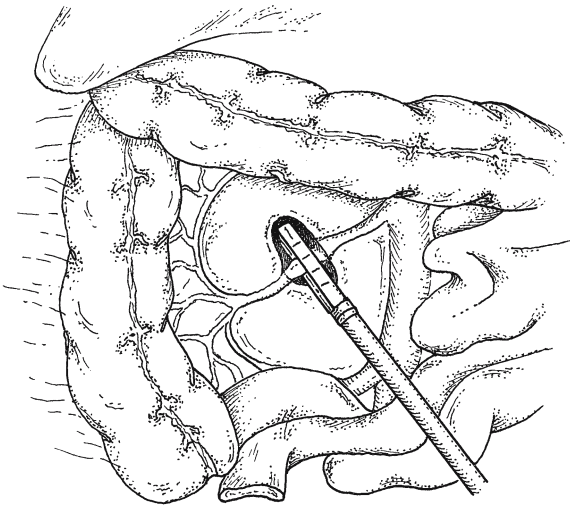


Figure 32.3. Intracorporeal division of mesenteric pedicle is an alternative to totally extracorporeal resection.

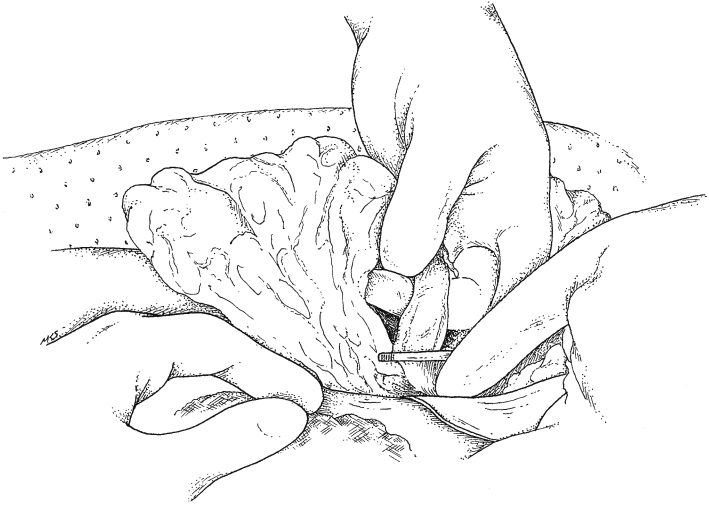


Figure 32.4. Terminal ileum, cecum, ascending and proximal transverse colon eviscerated through the small midline incision. Resection and anastomosis will be performed in an extracorporeal manner. The anastomosis is then returned to the abdominal cavity.

12. At the site of the initial trocar placement, usually in the supraumbilical position, make a 2- to 5-cm vertical incision in the skin.
13. Make the fascial incision along the insulated sheath of the forceps (which is attached to the cecum). Allow the pneumoperitoneum to collapse.
14. Deliver the cecum to the midline wound, and eviscerate the terminal ileum, cecum, and ascending and proximal transverse colon onto the abdominal wall (see Fig. 32.4).
 - a. The vascular ligation, bowel division, anastomosis, and closure of the mesenteric defect are performed as they would be during a laparotomy.
 - b. Typically, a stapled functional end-to-end anastomosis is performed. The mesenteric defect is closed in the usual fashion.
 - c. When the anastomosis is complete, return it to the abdominal cavity, taking great care not to damage or tear the bowel or mesentery during this manipulation.
 - d. Close the incision using interrupted absorbable sutures.
15. Reestablish pneumoperitoneum through one of the other trocar sites, and insert the laparoscope.
16. Inspect the bowel, anastomosis, and abdomen; irrigate and assure hemostasis. Close trocar sites in the usual fashion.

D. Laparoscopic Assisted Sigmoid Colon Resection or Left Hemicolectomy

1. Place the patient in **steep Trendelenburg position** with the right side of the table down.
2. Introduce the first trocar in the supraumbilical region and insert a **0-degree laparoscope**. Next, place two 10- to 12-mm trocars in the right upper and lower quadrants, lateral to the rectus muscle. Place a third 10- to 12-mm trocar in the left upper quadrant. This trocar will be exchanged for a 33-mm port using the Seldinger technique.
3. Rarely, a fourth 10- to 12-mm trocar placed in the left upper quadrant lateral to the rectus muscle is used for additional retraction. This site also provides an excellent vantage point for laparoscopic visualization of the anastomosis. A fifth trocar is sometimes high in the right upper quadrant if needed (Fig. 32.5).
4. Grasp the sigmoid colon with an endoscopic Babcock clamp and retract it medially to expose the white line of Toldt.
5. Using either a ultrasonically activated scissors or a cautery scissors, incise the peritoneum to mobilize the sigmoid and left colon to the level of the splenic flexure (Fig. 32.6).

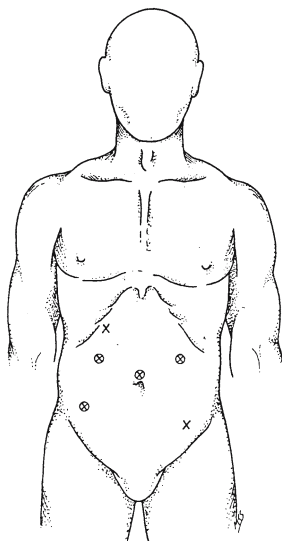


Figure 32.5. Placement of 10- to 12-mm trocars for laparoscopic assisted left colon resection. Two optional trocar sites (right upper quadrant and left lower quadrant) are occasionally helpful: ⊗, typical trocars; ×, optional trocars.



Figure 32.6. Mobilization of the sigmoid colon to expose the left ureter as it crosses the pelvic brim. The iliac vessels are seen to the left of the ureter.

6. Continually regrasp and manipulate the colon as the dissection progresses medially to expose Gerota's fascia, the ureter, and the sacral promontory.
7. Next, mobilize the splenic flexure and distal transverse colon. The dissection may be easier if the surgeon stands between the patient's legs and uses a left lower quadrant port site.
8. Divide the gastrocolic omentum with an ultrasonic scalpel or cautery scissors to the level of the middle colic artery.
9. Grasp the transverse colon with an endoscopic Babcock clamp and dissect transverse colon and splenic flexure free of the retroperitoneum inferior to the spleen.
10. After complete mobilization, ligate the vascular pedicle intracorporeally.
 - a. Medially isolate either the superior hemorrhoidal and the left colic arteries or the inferior mesenteric artery.
 - b. Anterolateral retraction of the left colon facilitates this identification.
 - c. **Isolate the vessels** by scoring the mesentery and creating windows in the mesentery on each side.
 - d. These vessels are typically divided by using an endoscopic stapler with a (white) **vascular cartridge** introduced via the right lower quadrant port site.
 - e. Visualize the blades on the lateral side of the mesentery. **This is crucial** to ensure that nothing else is incorporated into them.

- f. After confirming satisfactory positioning, fire the stapler.
 - g. Typically, only the above-named vessels and possibly the inferior mesenteric vein are divided in this manner.
 - h. After isolating the smaller vessels in the sigmoid mesentery, control them with clips, ligatures, or the ultrasonic scalpel.
11. Identify the distal extent of resection and circumferentially expose the colonic or rectal wall.
 12. Exchange the right lower quadrant 10- to 12-mm trocar for an 18-mm trocar over an exchange rod under direct vision.
 13. Insert a 45- to 60-mm linear cutting stapler, encompass the bowel wall between the blades (making sure that laterally nothing else is incorporated into the blades), and fire the stapler (Fig. 32.7).
 14. In the left upper quadrant, enlarge the skin incision and exchange the previously placed 10- to 12-mm port over a rod for a 33-mm port.
 15. Place a Babcock clamp through this trocar and grasp the proximal staple line.
 16. Extrude the specimen through the port or in continuity with the port. If the specimen is too large, remove the port and deliver the bowel through an enlarged incision protected by a plastic wound drape.
 17. Perform the proximal resection extracorporeally in the conventional fashion. Place a pursestring suture and insert the circular stapling anvil into the proximal end of bowel. Secure the pursestring suture and replace the bowel into the abdominal cavity (Fig. 32.8).

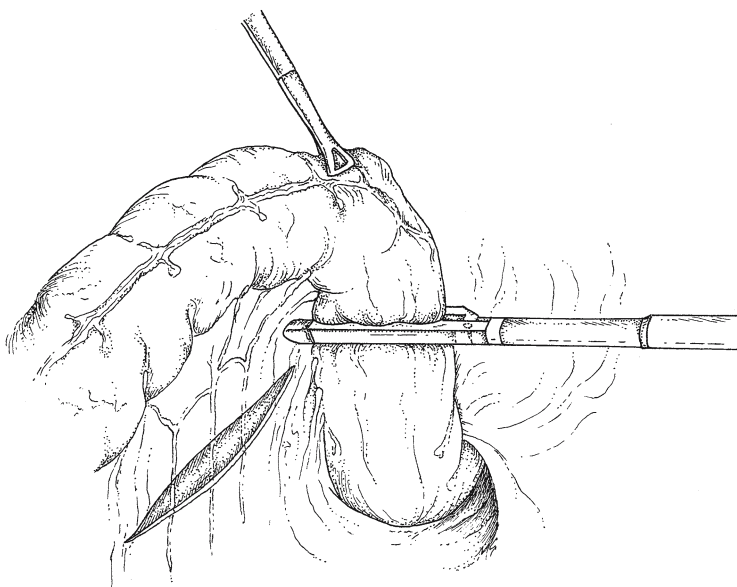


Figure 32.7. The endoscopic linear stapler is used to divide the bowel at the distal resection margin.

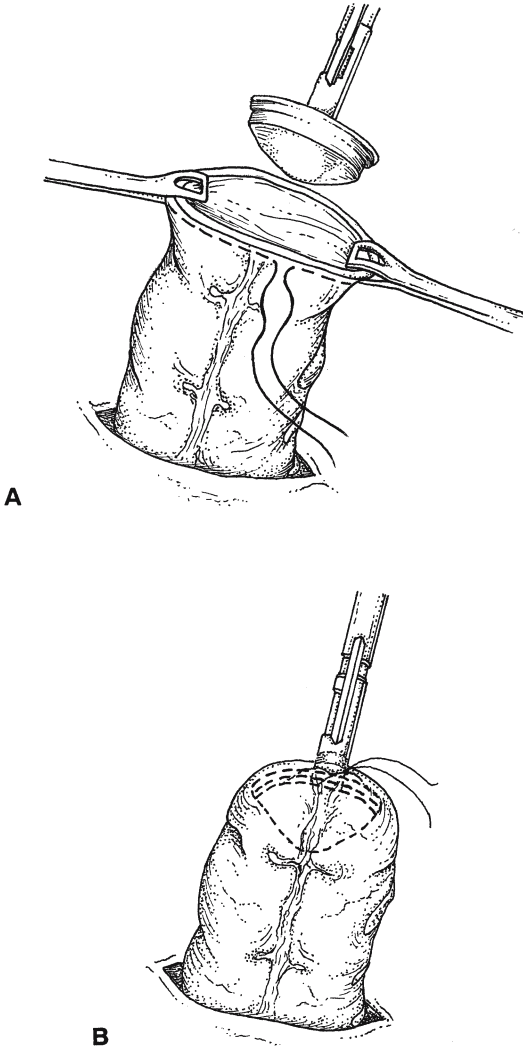


Figure 32.8. A. The anvil of the circular stapler is inserted in the proximal end of the bowel (which has been drawn out of the abdomen through an enlarged trocar site). B. The pursestring suture is tied. The bowel is then returned to the abdomen.

18. Replace the 33-mm trocar (if it was removed) and reestablish pneumoperitoneum.
19. Grasp the anvil with an anvil-grasping clamp, usually passed through the right upper or lower quadrant trocar sites. Assess the ability of the anvil to reach the planned anastomotic site. Further mobilization and/or vascular division may be needed, and should be performed if necessary. Verify the correct orientation (i.e., no twist) for the proximal bowel.
20. Insert a circular stapler transanally and advance it to the distal staple line. Under direct laparoscopic visual control, extend the spike of the stapler through the distal staple line. Attach the anvil (Fig. 32.9).

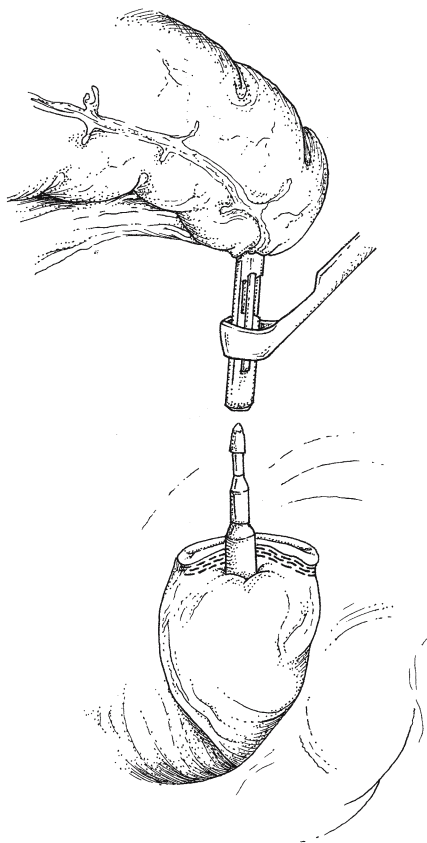


Figure 32.9. The anvil is attached to the circular stapler (which has been passed transanally); the stapler will be closed and fired in the usual fashion.

21. Move the laparoscope to the right or left lower quadrant port to best visualize the anvil and stapler head coming together. Once satisfied, close, fire, and remove the stapler. Inspect the two donuts for completeness.
22. Test the anastomosis by placing an atraumatic Dennis-type clamp across the bowel proximal to the anastomosis. Use the suction-irrigator to fill the pelvis with saline and immerse the anastomosis. Insufflate the rectum with air, using a bulb syringe, proctoscope, or flexible sigmoidoscope, and observe for air bubbles.
23. Irrigate the abdomen, obtain hemostasis, and close the trocar sites. Close the 33-mm port site with interrupted absorbable sutures.

E. Performing the Laparoscopic Anterior Resection

1. Patient position is similar to that described in Section D.
2. A thorough inspection is required for patients with cancer to exclude any metastatic disease.
3. Place the first three (10–12 mm) trocars in the supraumbilical region (laparoscope) and right upper and right lower quadrants, lateral to the rectus muscle.
4. Place a fourth (10–12 mm) trocar in the left upper quadrant lateral to the rectus muscle. This will be exchanged for a 33-mm trocar later. Additional (10–12 mm) trocars may be needed for retraction.
5. After mobilizing the left colon (see Section D), grasp the rectosigmoid junction using an endoscopic Babcock clamp and retract it anteriorly toward the abdominal wall.
6. Enter the presacral plane posteriorly with ultrasonic or cautery scissors. Dissect posteriorly to well below the level of the pathology, using sharp dissection.
7. Intraoperative rigid proctoscopy is often helpful to confirm the exact level of the lesion. Mark the site with clips.
8. Continue the dissection laterally and finally anteriorly to circumferentially free the mesorectum at least 5 cm distal to the distal edge of the tumor.
9. Serially divide and ligate the mesorectum (at right angles to the rectum) with a series of clips, vascular stapler, or ultrasonically activated scissors. Bare rectum should be demonstrated circumferentially. Perform a total mesorectum excision for tumors in the lower two thirds of the rectum, to obtain adequate tumor control.
10. The remainder of the procedure is analogous to that described above for a sigmoid or left colectomy (Section D).

F. Performing a Laparoscopic Abdominoperineal Resection

1. The patient position and trocar sites are as previously described, except that the third 10- to 12-mm trocar should be placed at the site of the proposed colostomy (which will have been marked by the enterostomal therapist prior to surgery). This mark will typically overlie the rectus muscle. Insert this trocar with great care to avoid laceration of the inferior epigastric vessels.
2. The initial mobilization is similar to that already described for a sigmoid colectomy, left colectomy, or anterior resection.
 - a. Depending on the length and mobility of the sigmoid colon, it may not be necessary to mobilize the splenic flexure.
 - b. The level of vascular ligation may vary based on the same considerations.
3. Choose a point at which to divide the bowel. Serially divide the mesentery at this level using ultrasonically activated scissors, ligatures, clips, or vascular stapler. At this site, the mesentery is serially divided to this level using either the ultrasonically activated scissors, vessel loops, ligaclips, or vascular stapler.
4. Transect the bowel as previously described for sigmoid and left colectomy.
5. Grasp the distal colonic staple line and retract it anteriorly or inferiorly to expose the presacral space. The presacral space is entered posteriorly using either cautery scissors or an ultrasonic scalpel.
6. Dissect the presacral space posteriorly to the level of Waldeyer's fascia. Open this fascia to expose the levator muscles.
7. Continue this dissection laterally on both sides.
8. Perform the anterior dissection last.
 - a. Retract the rectum superiorly and posteriorly. In the female, retract the uterus (if present) anteriorly and inferiorly.
 - b. Dissect the rectum from vagina (in females) or seminal vesicles and prostate (in males).
9. At this point, with the rectum fully mobilized intracorporeally, the perineal dissection is made.
 - a. Make an elliptical incision around the external sphincter.
 - b. Deepen this incision into the ischiorectal fat to expose the levator muscles. Posteriorly, place the levator plate at the level of the tip of the coccyx. Introduce a finger into the pelvis posteriorly and visualize it with the laparoscope.
 - c. Divide the levators laterally and posteriorly.
 - d. Insert a ring forceps into the pelvis from below. Under laparoscopic control, the tip of the rectum/sigmoid colon is handed to the perineal operator via the ring forceps. The rectosigmoid colon is then extracted from below.
 - e. Complete the remaining dissection from the perineal aspect in the usual fashion.

10. Pass an endoscopic Babcock clamp via the trocar at the stoma site, and grasp the remaining end of sigmoid colon. Excise a 2-cm disk of skin around the trocar site and enlarge the trocar site. Bring out the end of the colon as a colostomy. Mature this in the usual fashion.
11. From the perineal wound, pass an endoscopic Babcock clamp into the abdomen and guide it up retrograde through the right lower quadrant trocar site. Grasp and pull an irrigation sump catheter through the trocar site and position it just above the levators. Close the levators and perineum, and complete the operation in the usual fashion.

G. Complications

1. Anastomotic leak

- a. **Cause and prevention.** A well-vascularized, tension-free, circumferentially intact anastomosis is necessary to prevent anastomotic leakage. If any of the foregoing requirements are not present during a laparoscopic assisted colectomy, then the anastomosis must be revised. It is often prudent, if not mandatory, to convert to a laparotomy at this point. Identification of ischemia may be difficult and the aid of intravenous fluorescein should be used. One ampule of fluorescein given intravenously followed by inspection with a Wood's lamp allows for identification of ischemic bowel. Resection proximally to viable colon will alleviate this problem. Intraoperative testing of the anastomosis is mandatory as described earlier. Any leak requires, at minimum, reinforcement if not complete revision. The use of only a diverting stoma to protect such an anastomosis is inadequate.
- b. **Recognition and management.** Postoperative fevers, prolonged ileus, elevated leukocyte counts, and abdominal pain are all hallmarks of postoperative anastomotic leak. Aggressive detection and delineation will often allow conservative therapy to be employed. Perform prompt radiologic evaluation of the anastomosis using a water-soluble contrast enema (perhaps in concert with a computed tomography [CT] scan of the abdomen and pelvis). If a small leak or a leak associated with a localized abscess is identified, percutaneous drainage, antibiotics, bowel rest, and total parenteral nutrition often allow for spontaneous closure. If a large, free leak is identified, prompt laparotomy with stoma creation is necessary.

2. Postoperative small bowel obstruction

- a. **Cause and prevention.** Postoperative small bowel obstruction is almost universally caused by adhesion formation. Postoperative adhesions may be less common with the laparoscopic approach. However, internal hernias or port site hernias may still occur. Closing mesenteric defects and closing all port sites of 10 mm or greater should help minimize this problem.

- b. **Recognition and management.** Abdominal distention, cessation or no passage of flatus, and the inability to tolerate oral intake associated with nausea or vomiting are all common signs and symptoms of small bowel obstruction. When these symptoms occur early in the postoperative course (3–10 days), it is often difficult to distinguish a bowel obstruction from a normal postoperative ileus. Initial management is similar in both cases with nasogastric tube decompression, intravenous fluids, and possibly nutritional support. This conservative management may continue in the absence of fevers, rising white blood counts, or peritonitis (which would indicate leak, see above). Consider evaluation of the port sites via CT scan or ultrasound in any patient who develops a bowel obstruction after a laparoscopic procedure. Failure to resolve mandates reexploration (usually via laparotomy) for lysis of adhesions and possible bowel resection. If possible, the addition of an antiadhesion product should be employed to prevent further postoperative adhesions.

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