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CHAPTER 7.4

Colorectal Surgery

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Laparoscopic Colorectal Surgery

Laparoscopic surgery has changed the face of general surgery with the widespread use of laparoscopic cholecystectomy, appendectomy, and other surgical procedures. Although most colorectal surgery continues to be done in the standard open fashion, laparoscopic techniques are being used more and more for procedures on the colon and rectum. All of the following procedures can be done, and have been done, laparoscopically. Advantages to the patient include smaller incisions, less postop discomfort, and, possibly, a slight decrease in hospital stay, with early return to work and normal activity. Steep positional changes are often used to facilitate retraction of the small bowel out of the operative field. The patient is often placed on a beanbag to prevent movement. The term *laparoscopic-assisted* is more appropriate for colorectal procedures since the colon often is mobilized laparoscopically. A small incision is then made, through which the bowel is exteriorized, the mesentery divided, and an anastomosis created. “Hand-assisted” laparoscopy involves placement of a hand-port through a 5–10 cm incision. The abdominal cavity is then insufflated as in standard laparoscopy, but the surgeon's hand is used alongside the other laparoscopic instruments. An important consideration for any laparoscopic procedure is that the surgeon might need to convert to an open laparotomy. This may occur in a secondary fashion for failure to progress or in an emergent fashion for technical difficulties.

Suggested Readings

1. Bonjer HJ, Hop WC, Neslon H, et al: Laparoscopically assisted vs open colectomy for colon cancer: a meta-analysis. *Arch Surg* 2007; 142(3): 298–303.

2. Dwivedi A, Chahin F, Agrawal S, et al: Laparoscopic colectomy vs. open colectomy for sigmoid diverticular disease. *Dis Colon Rect* 2002; 45(10):1309–14; discussion 1314–5.

3. Gordon PH, Nivatvongs S, eds.: *Principles and Practice of Surgery of Colon, Rectum, and Anus*, 3rd edition. Informa Healthcare, New York: 2006.

4. Ky AJ, Sonoda T, Milsom JW: One-stage laparoscopic restorative proctocolectomy: an alternative to the conventional approach; *Dis Colon Rect* 2002; 45(2):207–11.

5. Scheidbach H, Schneider C, Konradt J, et al: Laparoscopic abdominoperineal resection and anterior resection with curative intent for carcinoma of the rectum. *Surg Endo* 2002; 16(1):7–13.

Total Proctocolectomy

Surgical Considerations

Description: A total proctocolectomy involves the removal of the entire colon, rectum, and anus (Fig. 7.4-1). Indications for this operation include ulcerative colitis (UC), Crohn's disease (CD), and familial adenomatous polyposis (FAP). Inflammatory bowel disease (IBD) can be diagnosed at any age, but there are peaks in diagnosis in the teens and twenties and the sixties and seventies.

The most common indication for total proctocolectomy in the setting of UC or CD is intractable symptoms despite maximal medical therapy. Patients are commonly chronically or acutely ill, and may be malnourished or anemic. They are often on high-dose steroids and other immune suppressants, such as 6-mercaptopurine or Imuran. Another important indication for proctocolectomy in patients with UC is the presence of dysplasia or cancer. FAP is an autosomal-dominant disease resulting in hereditary colon cancer. Patients develop hundreds to thousands of adenomatous polyps throughout their colon and rectum, as well as elsewhere in the GI tract. Colorectal cancer is inevitable unless proctocolectomy is performed. This is typically done in the late teens or twenties. In contrast to patients with CD or UC, patients with FAP are usually healthy without other medical comorbidities.

Patients usually are given a preop bowel preparation. The bacterial load of the colon is diminished by mechanical cleansing, which may be accomplished by cathartics, or nonabsorbed lavage solutions. As a result of this preparation, patients are often hypovolemic and hypokalemic. Sequential compression stockings are used for thromboprophylaxis. Patients with CD and UC are at ↑ risk for the development of DVT and are often given subcutaneous heparin. Patients on chronic steroids are given stress-dose steroids before the procedure. Broad-spectrum antibiotics covering gram-negative rods and anaerobes are given prior to the incision.

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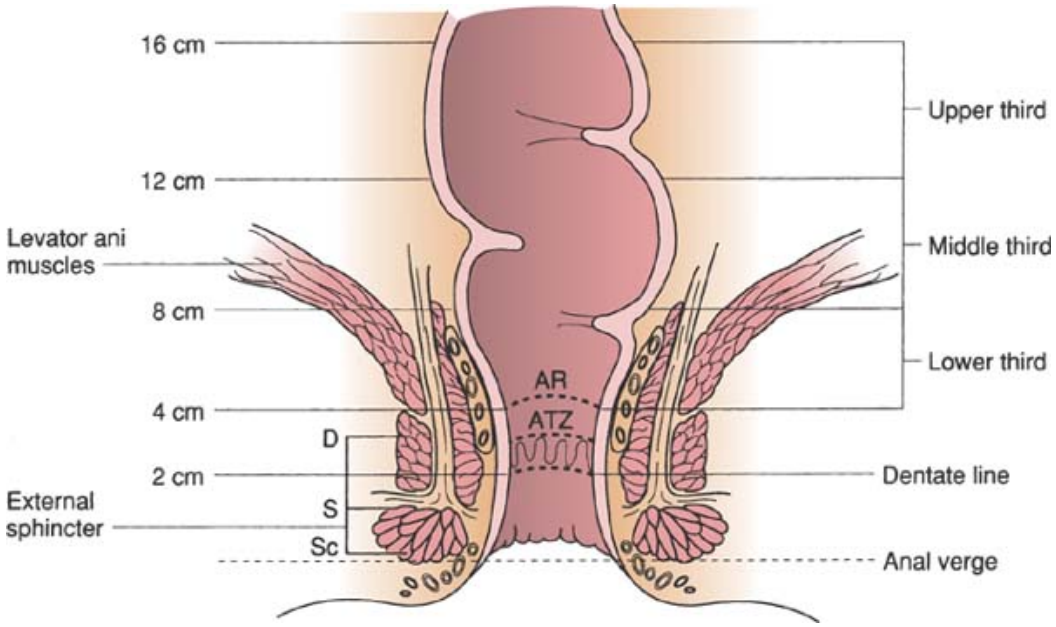

Figure 7.4-1. 1. Anorectal anatomy with important landmarks. Approximate measurements are relative to the anal verge. D = deep; S = superficial; Sc = subcutaneous; AR = anorectal ring; ATZ = anal transition zone. (Reproduced with permission from Yahanda AM, Chang AE: Colorectal cancer. In *Surgery: Scientific Principles and Practice,* 3rd edition. Greenfield LJ, Mulholland MW, Oldham KT, et al, eds. Lippincott Williams & Wilkins, Philadelphia: 2001.)

Total proctocolectomy with end ileostomy, total proctocolectomy with **continent ileostomy (Koch pouch),** and **restorative proctocolectomy** with **ileal pouch anal anastomosis (IPAA)** all involve complete removal of the colon and rectum, down to the level of the pelvic floor or levator ani muscles. They differ in the fate of the anal canal, creation of a stoma, or construction of an anastomosis. The patient is placed in a lithotomy position in padded Allen stirrups. A Foley catheter is placed. The procedure is performed through a midline incision. The abdomen is explored for evidence of unexpected malignancy or, in the case of FAP, for desmoid tumors. The right colon is mobilized first, and then the small bowel mesentery is mobilized to allow for creation of an ileostomy. The transverse colon may be mobilized by separating it from the greater omentum, or the greater omentum may be resected along with the specimen. The sigmoid and descending colon are mobilized, and the splenic flexure is taken down. At this point, the ileum is divided flush with the cecum. The vessels in the colon mesentery are ligated. At this point, the entire abdominal colon has been resected. An avascular fascial envelope surrounds the rectum and its mesentery, the mesorectum. It is possible to circumferentially dissect the rectum down to the level of the pelvic floor without ligating any vessels. There may be significant blood loss if an inadvertent injury to the spleen occurs during mobilization of the splenic flexure. Massive blood loss may occur if the presacral venous plexus is entered during posterior rectal mobilization.

Total proctocolectomy with ileostomy: For patients with CD, elderly patients with UC, or FAP patients with low rectal cancer, complete removal of the colon, rectum, and anus is the procedure of choice. After completing the abdominal mobilization of the colon and rectum, the perineal phase of the operation begins. Ideally, two teams of surgeons participate in the operation simultaneously. The abdominal surgeon can create the ileostomy and close the abdomen, while the perineal surgeon finishes removal of the rectum and anus. A circumferential incision is made at the anal verge and the intersphincteric plane is identified. The dissection proceeds cephalad until the abdominal dissection is encountered, and the specimen is removed. The levator ani muscle,

external anal sphincter, and skin are closed. While this is being done, the abdominal surgeon makes a circular incision over the previously marked ileostomy site. A muscle-splitting incision is carried through the rectus fascia. The terminal ileum is then brought through this site. After the fascial and skin are closed, the ileostomy is matured.

Total proctocolectomy with continent ileostomy (Koch pouch): Because of frequent complications and the development of alternative procedures (see below) this procedure has been largely abandoned.

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Restorative proctocolectomy with ileal pouch anal anastomosis (IPAA): IPAA is the procedure most commonly performed for patients with FAP and UC. In this operation, the colon and rectum are removed, down to the level of the pelvic floor; however, the anal canal and anal sphincter complex are preserved. The rectum is stapled and divided at the level of the surgical anal canal, 1–1.5 cm above the dentate line. An ileal reservoir is constructed by anastomosing the distal 30 cm of ileum in a side–to–side fashion, creating a J-pouch. The apex of the pouch is then anastomosed to the anal canal using a circular stapling device. Rarely, a hand-sewn anastomosis is created. A temporary diverting loop ileostomy may or may not be created, depending on the clinical situation.

Usual preop diagnosis: Ulcerative colitis; familial adenomatous polyposis; Crohn's colitis

Summary of Procedures

	Total Proctocolectomy with End Ileostomy	IPAA
Position	Modified lithotomy	
Incision	Long midline	
Special instrumentation	Two-table setup (separate abdominal and perineal instruments); deep pelvic instruments	Two-table setup; anal retractors; spinal needle; 1:200,000 epinephrine; deep pelvic instruments
Unique considerations	Patients frequently on chronic high-dose corticosteroids	+ Epinephrine solutions injected under the rectal mucosa to facilitate dissection and reduce bleeding.
Antibiotics	Ertapenem 1 g iv or 2nd generation cephalosporin	
Surgical time	3–4 h	
Closing considerations	Ileostomy completed after skin closed (15–30 min).	Temporary ileostomy commonly used, completed after skin closure.
EBL	300–1000 mL (most blood loss during pelvic and perineal dissections)	
Postop care	Transient inability to void common.	Small bowel mesentery lengthened by dissection around duodenum. This frequently necessitates use of postop NG tube. Transient inability to void common.
Mortality	2–5% (older patients and those with underlying medical problems)	5–10%
Morbidity	Dyspareunia: 30% Stoma complications: 20% SBO: 10–15% Impotence: 2–4%	— Nocturnal incontinence: 20% Poor function: 5% Pelvic sepsis: 0–4%
Pain score	8	8

Patient Population Characteristics

	Ulcerative Colitis	Familial Adenomatous Polyposis
Age range	3rd–5th decade	2nd–4th decade
Male:Female	1:1	
Incidence	6–10/100,000	100–150 cases/yr
Etiology	Unknown	Genetic
Associated conditions	Cushing's syndrome; anemia; malnutrition; colorectal cancer; sclerosing cholangitis	Colorectal cancer; desmoid tumors; adenomas or cancers of the duodenum and small intestine; brain tumors (Turcot's syndrome); adrenal adenomas; osteomas

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Anesthetic Considerations

See Anesthetic Considerations for Large Bowel Surgery, p. 534.

Suggested Readings

1. Bertario L, Arrigoni A, Aste H, et al: Recommendations for clinical management of familial adenomatous polyposis. *Tumori* 1997; 83(5):800–3.

2. Ghosh S, Shand A, Ferguson A: Ulcerative colitis. *BMJ* 2000; 320(7242):1119–23.

3. Gordon, PH, Nivatvongs S, eds: *Principles and Practice of Surgery of Colon, Rectum, and Anus,* 3rd edition. Informa Healthcare, New York: 2006.

4. Guy TS, Williams NN, Rosato EF: Crohn's disease of the colon. *Surg Clin North Am* 2001; 81(1):159–68, ix.

5. Litle VR, Barbour S, Schrock TR, et al: The continent ileostomy: long-term durability and patient satisfaction. *J Gastrointest Surg* 1999; 3(6):625–32.

6. Katz JA: Medical and surgical management of severe colitis. *Sem Gastrointest Dis* 2002; 11(1):18–32.

7. King JE, Dozois RR, Lindor NM, et al: Care of patients and their families with familial adenomatous polyposis. *Mayo Clinic Proceedings* 2000; 75(1):57–67.

8. Metcalf AM: Elective and emergent operative management of ulcerative colitis. *Surg Clin North Am* 2007; 87(3):633–41.

9. Michelassi F, Hurst R: Restorative proctocolectomy with J-pouch ileoanal anastomosis. *Arch Surg* 2000; 135(3):347–53.

10. Wolff BG, Garcia-Aguilar J, Roberts PL, et al, eds: *The ASCRS Textbook of Colon and Rectal Surgery*. Springer Science-Business Media, New York: 2007.

Segmental (Partial) Colectomy

Surgical Considerations

Description: Segmental colectomy involves removal of a portion of the colon (Fig. 7.4-2) with the creation of an anastomosis or a stoma. The most common indications for the operation in the western world are colon cancer and diverticulitis. Less common

indications include traumatic perforation, gastrointestinal hemorrhage, ischemic colitis, volvulus, and inflammatory bowel disease (IBD). Both colon cancer and diverticular disease occur most commonly in patients > 50 yr. Patients may have any of the comorbid medical conditions associated with aging, as well as complications related to the disease requiring colon resection. **Free perforation** of the colon can occur from a variety of conditions, including diverticulitis, cancer, and ischemia. Patients may be hypovolemic and have systemic sepsis. Emergent laparotomy should follow a period of resuscitation and administration of antibiotics. The involved segment of bowel is resected, the abdomen is irrigated, and a stoma is created.

Colon cancer is the second most common cancer in the United States with 153,000 new cases diagnosed annually. Patients may be completely asymptomatic with the Dx being made only as the result of a screening exam. Because of the large caliber of the colon and the liquid nature of stool, patients with cancers of the right colon are more likely to present with large cancers and anemia. The caliber of the left colon is smaller, and the stool more solid. Symptoms of obstruction and change in bowel habits predominate for left-sided lesions.

Colonic diverticula occur in up to 60–70% of people > 50 yr in the United States. A colonic diverticulum is a herniation of the mucosa and submucosa through the relative weakening that occurs in the muscular wall of the bowel at the site of penetrating blood vessels. This occurs predominately in the sigmoid colon. Most people with colonic diverticula are completely asymptomatic and will never experience any complications related to *(Print pagebreak 530)* diverticulosis. Diverticulitis occurs when a microscopic or macroscopic perforation of a colonic diverticulum occurs, resulting in a pericolonic inflammatory and infectious process. The severity of the attack depends on the degree of perforation and how well the body is able to wall it off. This ranges from minor inflammation around the sigmoid colon that can be managed with antibiotics, to an intraabdominal or pelvic abscess requiring percutaneous drainage, to free perforation with purulent or feculent peritonitis requiring emergency surgery. Repeated bouts of diverticulitis eventually can result in fibrosis of the colon, stricture formation, and obstruction.

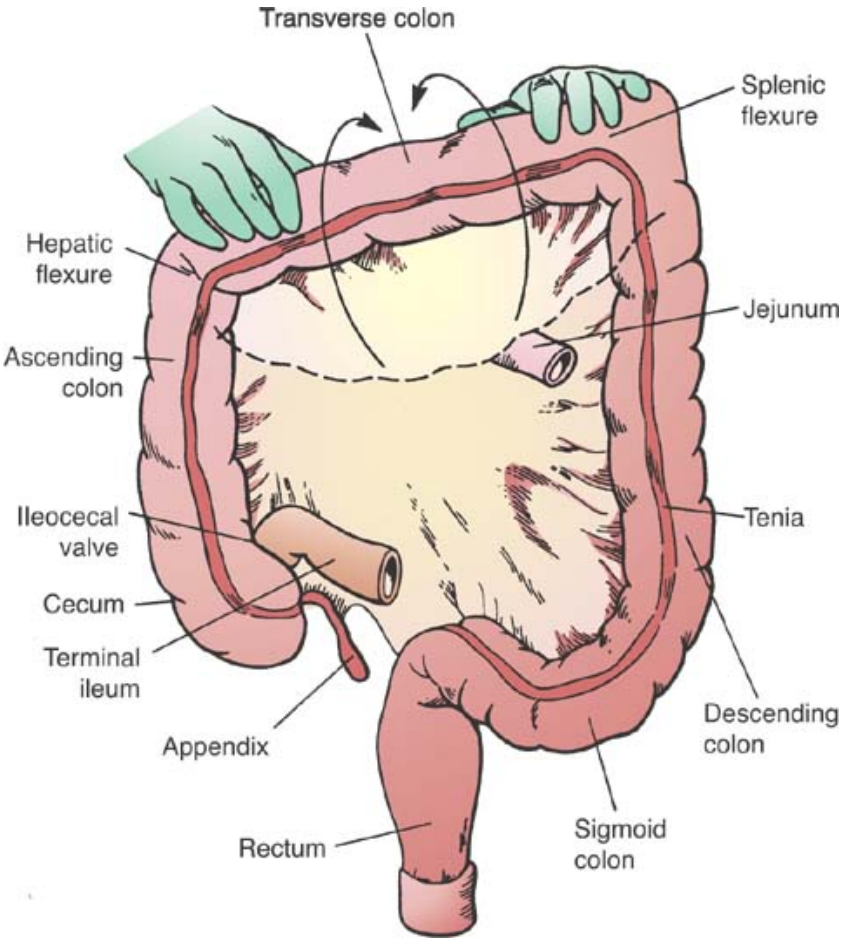

Figure 7.4-2. 2. Anatomy of the colon. (Reproduced with permission from Hardy JD: *Hardy's Textbook of Surgery,* 2nd edition. JB Lippincott, Baltimore: 1988.)

Ideally, surgery on the colon is performed in an elective setting; however, perforation with peritonitis or complete obstruction of the colon may require emergency surgery. Most patients presenting for elective colon resection undergo preop bowel preparation that consists of mechanical cleaning of the colon. As a result, they are frequently hypovolemic and hypokalemic when they come to the OR. The patient is positioned either supine, or in the modified lithotomy position, depending on the segment of colon to be removed. Sequential compression stockings are used for thromboprophylaxis. Intravenous antibiotics covering gram-negative rods

and anaerobes should be given prior to the incision with redosing as appropriate for the antibiotic used.

Segmental colectomy: Segmental resection of the colon maybe performed via midline or transverse abdominal incisions, depending on the underlying disease, portion of the colon to be resected, and the surgeon's preference. In general, midline incisions are preferred when: a high-lying splenic flexure must be mobilized, IBD is present, or the extent of the colon resection is not known preop. Transverse incisions are most commonly reserved for resections of the right colon.

The most commonly performed **partial colon resections** are: right hemicolectomy, sigmoid colectomy, left hemicolectomy, and abdominal colectomy with an ileorectal anastomosis. The sequence of steps in a partial colectomy is the same for all parts of the colon. The right colon and left colon are retroperitoneal structures, whereas the transverse *(Print pagebreak 531)* colon and sigmoid colon are primarily intraperitoneal. The first step is mobilization of the colon and its mesentery. Care must be taken not to injure the left ureter during mobilization of the sigmoid colon or the duodenum during mobilization of the right colon. Proximal and distal sites for resection are selected and the intervening mesentery is divided. The anastomosis may be hand-sewn or stapled, which is a decision based primarily on the surgeon's preference. There is no clear advantage to either anastomotic technique. Creation of a diverting stoma rather than an anastomosis may be necessary in patients who are hemodynamically unstable, or when intraabdominal conditions, such as inflammation, make an anastomosis unsafe. There may be significant blood loss if an inadvertent injury to the spleen occurs during mobilization of the splenic flexure. Excessive traction of the hepatic flexure can result in difficult-to-control venous bleeding.

Obstruction of the colon most commonly occurs as a result of cancers of the sigmoid colon or repeated bouts of diverticulitis. Patients present with abdominal distention, obstipation, N/V. Patients are treated with NG tube decompression and correction of hypovolemia. An attempt may be made to stent the obstructing lesion endoscopically preop to allow decompression and preparation of the colon. If this is not possible, surgical options include segmental resection with a colostomy, segmental resection with primary anastomosis and an on-table colonic lavage, or subtotal colectomy with an ileorectal anastomosis.

Usual preop diagnosis: Colon cancer; diverticular disease; Crohn's disease; ulcerative colitis; trauma; ischemic colitis; lower GI hemorrhage; intractable constipation; colon volvulus

Summary of Procedures

Position	Supine or modified lithotomy
Incision	Transverse or vertical midline
Unique considerations	Bowel prep, or underlying disease may → dehydration, electrolyte abnormalities or anemia.
Antibiotics	Ertapenem 1 g iv or 2nd generation cephalosporin
Surgical time	1–3 h
Closing considerations	Colostomy or ileostomy matured after wound is closed (requires 10–20 min).
EBL	100–300 mL (500–2000 mL if splenic injury, loss of major vascular pedicle, or repeat operation for cancer, Crohn's disease)
Postop care	ICU for underlying disease; NG tube for distention or vomiting. Avoid use of long-lasting anticholinergics (e.g., Phenergan).
Mortality	0.5–2% (mostly related to underlying disease)
Morbidity	SBO: 5–10% Wound infection: 4–10% For anastomosis-anastomotic leak: 2–4% Wound dehiscence: 1–2% Bleeding: 1% Splenic injury: 1%
Pain score	8

Patient Population Characteristics

	Crohn's Disease	Colon Cancer	Trauma	Diverticula
Age range	2nd–4th decade	5th–7th decade	2nd–4th decades	> 40 yr
Male:Female	1:1	1.3:1	3:1	1:1
Incidence	1–6/100,000	30/100,000	1–2/100,000	10/100,000
Etiology	Unknown	Genetic: 5%	Trauma	Western countries: low-fiber diet
Associated conditions	Malnutrition; anemia; intraabdominal sepsis; intestinal fistulae; perianal disease; nephrolithiasis; sclerosing and ankylosing spondylitis	Iron deficiency; colonic obstruction; colonic perforation	Liver fracture; spleen fracture; rib fracture; closed-head injury; penetration of viscera adjacent to colon injury	Hemorrhoids; chronic constipation

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Anesthetic Considerations

See Anesthetic Considerations for Large Bowel Surgery, p. 534.

Suggested Readings

1. Blair NP, Germann E: Surgical management of acute sigmoid diverticulitis. *Am J Surg* 2002; 183(5):525–8.

2. Colquhoun PH, Wexner SD: Surgical management of colon cancer. *Curr Gastroenterol Rep* 2002; 4(5):414–9.

3. DeFriend D, Hill J: A review of emergency colonic surgery. *Br J Hosp Med* 1996; 56(7):326–9.

4. Gordon, PH, Nivatvongs S, eds: *Principles and Practice of Surgery of Colon, Rectum, and Anus*, 3rd edition. Informa Healthcare, New York: 2006.

5. Kumar SK, Goldberg RM: Adjuvant chemotherapy for colon cancer. *Curr Oncol Rep* 2001; 3(2):94–101.

6. Lavery IC, Lopez-Kostner F, Pelley RJ, et al: Treatment of colon and rectal cancer. *Surg Clin North Am* 2000; 80(2): 535–69, ix.

7. Maggard MA, Chandler CF, Schmit PJ, et al: Surgical diverticulitis: treatment options. *Am Surgeon* 2001; 67(12):1185–9.

8. Makela J, Kiviniemi H, Laitinen S: Prevalence of perforated sigmoid diverticulitis is increasing. *Dis Colon Rect* 2002; 45 (7):955–61.

9. Wolff BG, Garcia-Aguilar J, Roberts PL, et al, eds: *The ASCRS Textbook of Colon and Rectal Surgery*. Springer Science-Business Media, New York: 2007.

Stoma Closure or Peristomal Hernia Repair

Surgical Considerations

Description: A temporary colostomy or ileostomy can be made for a variety of staged procedures. An **end colostomy** is often created after resection of obstructing or perforated lesions of the left colon. A **proximal loop ileostomy or colostomy** is often created to protect a “high-risk” anastomosis, such as a low pelvic colorectal or ileoanal anastomosis. A patient with a permanent

stoma may develop a hernia at the stoma site. This may result in complications, such as obstruction or strangulation of the bowel, or problems with appropriate fitting of the stoma appliance. The extent of procedure depends on the type of stoma created.

Closure of loop stoma: Closure of a loop stoma is performed through a circular incision, placed just outside the mucocutaneous junction of the stoma and the skin. The proximal and distal ends of the bowel are separated from the subcutaneous tissue and anterior fascia, and then the posterior fascia. The bowel is cleaned of adherent skin, and the previously opened antimesenteric border of the bowel is simply closed with sutures. Alternatively, the previously exteriorized portion of bowel is resected and the two ends are anastomosed with sutures or staples. On rare occasions, it is necessary to extend the incision transversely through the abdominal wall to safely affect an anastomosis. The fascia is closed in the standard fashion.

Closure of end stoma: Closure of an end stoma usually requires a midline abdominal incision. After entering the peritoneal cavity, the stoma is freed from the abdominal wall. Adhesions are lysed and the dysfunctional distal bowel is identified. It may be necessary to mobilize the proximal bowel to provide a tension-free anastomosis. An anastomosis can then be created using either hand-sewn or stapled techniques.

Paracolostomy hernia repair: The abdomen may be entered via a midline or a peristomal incision. The stoma is freed from the abdominal wall and hernia sac. The stoma is then moved to an alternate site and the defect in the *(Print pagebreak 533)* abdominal wall is closed. Alternatively, the stoma may be left in its original site and the fascia closed around the bowel. When performed laparoscopically, transfascial sutures and tackers are used to hold the mesh in place. These may cause significant postop pain.

Usual preop diagnosis: Stomal stenosis; retraction; parastomal hernia; fistula

Summary of Procedures

	Closure of Loop Stoma	Closure of End Stoma	Repair of Parastomal Hernia
Position	Supine	Supine or modified lithotomy*	Supine
Incision	Circumstomal	Midline or transverse abdominal	Midline or circumstomal
Special instrumentation	Anastomotic staplers	Endoscope for closure of Hartmann's procedure	Prosthetic mesh
Antibiotics**	Ertapenem 1 g iv or 2nd generation cephalosporin		
Surgical time	1–1.5 h	1–3 h	
Closing considerations	Requires only a few fascial sutures; skin may be left open.	None	Stoma matured after abdomen closed.
EBL	< 100 mL	100–500 mL	< 100 mL
Mortality	1%	2–4%	1 %
Morbidity	Anastomotic leak SBO Wound infection		Recurrent hernia Peristomal infection Stomal ischemia
Pain score	5	8	6

*The modified lithotomy position is used for closure of a Hartmann's procedure when an endoscope or stapling device may need to be passed through the anus.
**Bowel prep consists of mechanical cleaning of the colon, accomplished with cathartics or lavage solutions, as well as oral antibiotics. A commonly used regimen is: neomycin 1 g po and erythromycin base 1 g po given at 1 PM, 2 PM and 10 PM on the night before surgery.

Patient Population Characteristics

Age range	Variable
Male:Female	1:1
Incidence	Not uncommon

Etiology	Protection or avoiding an insecure anastomosis; traumatic injuries to the colon; complete colonic obstruction; colonic infections, such as diverticulitis; inflammatory processes, such as Crohn's disease or ulcerative colitis; after-emergency resection for ischemic colitis
Associated conditions	Multiple trauma; inflammatory bowel disease (IBD); colon cancer; gut ischemia

Suggested Readings

1. Amin SN, Memon MA, Armitage NC, et al: Defunctioning loop ileostomy and stapled side-to-side closure has low morbidity. *Ann Royal Coll Surgeons England* 2001; 83(4):246–9.

2. Doberneck RC: Revision and closure of the colostomy. *Surg Clin North Am* 1991; 71(1):193–201.

3. Edwards DP, Chisholm EM, Donaldson DR: Closure of transverse loop colostomy and loop ileostomy. *Ann Royal Coll Surgeons England* 1998; 80(1): 33–5.

4. Ghorra SG, Rzeczycki TP, Natarajan R, et al: Colostomy closure: impact of preoperative risk factors on morbidity. *Am Surgeon* 1999; 65(3):266–9.

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5. Gordon, PH, Nivatvongs S, eds: *Principles and Practice of Surgery of Colon, Rectum, and Anus*, 3rd Edition. Informa Healthcare, New York: 2006.

6. Israelsson LA: Parastomal hernias. *Surg Clin North Am* 2008; 88(1): 113–25.

7. Londono-Schimmer EE, Leong AP, Phillips RK: Life table analysis of stomal complications following colostomy. *Dis Colon Rect* 1994; 37(9): 916–20.

Anesthetic Considerations for Large Bowel Surgery

(Procedures covered: total proctocolectomy; partial colectomy with anastomosis; colostomy; stoma closure and peristomal hernia repair)

Preoperative

Patients presenting for this group of surgical procedures have in common an increased risk for pulmonary aspiration. In addition, patients with bowel obstruction must be treated urgently as the obstruction may rapidly progress to bowel necrosis, perforation, and septic shock. Patients with IBD (e.g., ulcerative colitis or Crohn's disease) may have extracolonic manifestations of the disease (e.g., ankylosing spondylitis, liver disease, anemia), requiring modification of their anesthetic plan.

Respiratory	Patients may have respiratory insufficiency 2° pulmonary metastases (colon cancer) or acute abdominal process (e.g., pain, splinting, sepsis, metabolic acidosis) and bowel distention limiting diaphragmatic excursion (↓ TV, ↓ FRC). Arthritis associated with IBD → ↓ neck ROM → difficult intubation. **Tests:** Consider CXR, ABG
Cardiovascular	Hemodynamic instability 2° sepsis or pain (↑ HR, ↓ BP). Hypovolemia 2° poor po intake, vomiting, diarrhea, and bowel prep. Should restore intravascular volume and hemodynamic stability before induction of anesthesia.

	Tests: Orthostatic VS; ECG
Renal	Electrolyte abnormalities (hypokalemic hypochloremic metabolic alkalosis 2° vomiting or NG suctioning, hyperchloremic metabolic acidosis from diarrhea) are common and may be worsened by bowel prep. **Tests:** Electrolytes
Gastrointestinal	A NG tube is usually in place and the stomach should be emptied before induction of anesthesia. IBD may be associated with impaired liver function and altered drug metabolism.
Hematologic	Hemoconcentration due to GI fluid loss; anemia due to acute/chronic GI bleeding **Tests:** CBC with Plt
Laboratory	Other tests as indicated from H&P
Premedication	Standard premedication (p. B-1) is usually appropriate. For aspiration prophylaxis, ranitidine 50 mg iv 1 h before induction, followed by Na citrate (30 mL, 0.3 M po) 10 min before induction, will significantly decrease the acidity of gastric contents. Metoclopramide is contraindicated in patients with bowel obstruction or perforation. Patients with IBD on chronic steroid therapy should receive their usual daily dose of steroids throughout the periop period and may require full stress-dose steroids. (Glucocorticoid-dependent, critically ill patients requiring vasopressors should be tested for adrenocortical insufficiency and started on 100 mg iv hydrocortisone immediately.)

Intraoperative

Anesthetic technique: GETA ± epidural for postop analgesia. Thoracic epidural is associated with improved postop pain control, earlier return of bowel function, intake of food, and out-of-bed mobilization. Placement of the catheter before anesthetic induction is helpful to establish correct placement in the epidural space (accomplished by injecting 5–7 mL of 1% lidocaine via the epidural catheter with development of a segmental block).

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Induction	The patient with an acute abdominal process is at risk for pulmonary aspiration; trachea should be intubated with patient awake or after rapid-sequence induction with cricoid pressure (p. B-4). A NG tube does not interfere with cricoid pressure and may be left in place, or removed immediately prior to induction after suctioning as may obscure airway anatomy during laryngoscopy. If patient is clinically hypovolemic, restore intravascular volume (colloid, crystalloid, or blood products) before induction and titrate induction dose of sedative/hypnotic agents.
Maintenance	Standard maintenance (p. B-2) without N_2O. **Combined epidural/GA:** local anesthetic (1.5–2% lidocaine with 1:200,000 epinephrine (5–10 mL q 60–90 min) can be injected into the epidural catheter to provide both anesthesia and optimal surgical exposure (contracted bowel and profound muscle relaxation). A continuous infusion of local anesthetic (e.g., 0.25% or 0.125% bupivacaine at 4–8 mL/h may enhance hemodynamic stability compared to bolus technique. A loading dose of epidural opiate (e.g., hydromorphone 0.4–0.8 mg) should be administered at least 1 h before conclusion of surgery for optimal results. Patients receiving epidural opiates should be monitored for development of delayed postop respiratory depression and systemic sedatives (e.g., opiates, benzodiazepines) should be minimized.
Emergence	The decision to extubate at the end of surgery depends on the patient's underlying cardiopulmonary status and extent of surgical procedure. Patient should be hemodynamically stable, warm, alert, and cooperative, and fully reversed from any muscle relaxants before extubation, and have adequate return of pulmonary function (as measured by VC of 15 mL/kg, MIF of -25 cmH_2O, RR < 25, and ABG that approaches patient's baseline).

Blood and fluid requirements	Anticipate large 3rd-space losses. IV: 14–16 ga × 1 NS/LR @ 10–15 mL/kg/h Warm fluids Consider T&S or T&C	Plt, FFP, and cryoprecipitate should be administered according to lab tests (Plt count, PT, PTT, DIC screen). NS preferable to LR for fluid replacement in patients with metabolic alkalosis. Maintain euvolemia based on EBL, and estimates of fluid shifts, UO, HR, BP, base deficit, lab studies, and invasive monitoring when used.
Monitoring	Standard monitors (p. B-1) UO ± Arterial line ± CVP Temperature	Arterial line and CVP, as indicated by patient's status. Hypothermia may delay healing and predispose patients to wound infections. Avoid hypothermia with forced-air warmer (s), warming blanket, warming room temperature, keeping patient covered until ready for prep.
Positioning	and pad pressure points eyes	
Complications	Septic shock	Hemodynamic instability 2° sepsis, hemorrhage, especially during manipulation of necrotic bowel.

Postoperative

Complications	Hypoxemia Hemodynamic instability Sepsis VTE (see Appendix B) PONV (see Appendix B)	Patients with metabolic alkalosis receiving opiates are especially prone to hypoxemia/hypoventilation. Patients may have considerable 3rd-space losses that require invasive monitoring, ICU admission, vasopressors.
Pain management	Epidural analgesia (p. C-2) PCA (p. C-3)	
Tests	CBC; CXR (if central line placed); electrolytes; glucose	

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Suggested Readings

1. Brown CJ, Buie W: Perioperative stress dose steroids: do they make a difference? *J Am Coll Surg* 2001; 193(6):678–86.

2. Carli F, Mayo N, Klubien K, et al: Epidural analgesia enhances functional exercise capacity and health-related quality of life after colonic surgery: Results of a randomized trial. *Anesthesiology* 2002; 97(3):540–9.

3. Carli F, Trudel J, Belliveau P: The effect of intraoperative thoracic epidural anesthesia and postoperative analgesia on bowel function after colorectal surgery: A prospective, randomized trial. *Dis Colon Rect* 2001; 44(8):1083–9.

4. Kurz A, Sessler D, Lenhardt R: Perioperative normothermia to reduce the incidence of surgical-wound infection and shorten hospitalization. *New Eng J Med* 1996; 334(19):1209–15.

Operations for Rectal Prolapse

Surgical Considerations

Description: Rectal prolapse (procidentia) is intussusception of the full thickness of the rectal wall beyond the anal canal. It must be distinguished from rectal mucosal prolapse, caused by elongation of the mucosal attachments to the underlying sphincter muscle, and internal intussusception, where the upper rectum folds into the lower rectum, but does not descend through the sphincter mechanism. Rectal mucosal prolapse is treated as part of the spectrum of hemorrhoidal disease, and mild-to-moderate intussusception does not benefit from surgery. Procidentia is associated frequently with anal incontinence. The surgical approaches to procidentia are determined by patient age, concurrent medical disease, sphincter function, and operative Hx.

Surgical treatment of procidentia may be undertaken through an abdominal or a perineal approach. The **abdominal approaches** have a lower recurrence rate and, because they do not diminish the capacity of the rectal reservoir, are generally preferable for maintaining fecal continence. **Rectopexy** is an abdominal approach in which the rectum is mobilized in the posterior plane from the sacral promontory to the levator muscles. The rectum is then pulled cephalad and sutured to the presacral fascia with multiple nonabsorbable sutures. Many surgeons routinely perform **sigmoid resection** along with rectopexy. They believe that removal of the redundant sigmoid further diminishes the chance of late recurrence and may alleviate constipation. The rectum also may be suspended by use of a sling attached to the rectum and secured to the presacral fascia. A number of approaches have been described, the most popular being the **Ripstein procedure. Sling procedures** have equivalent recurrence rates, but higher complication rates. As in rectopexy, the rectum is mobilized along the presacral plane down to the level of the levators. A band of Marlex mesh is sewn to the presacral fascia at the sacral promontory, upward traction is placed on the rectum, and the mesh is sutured to the rectum.

In patients with significant comorbidities, prolapse may be repaired via a **perineal approach.** The most common of these is **perineal rectosigmoidectomy** (or **Altemeier procedure**). The prolapsed rectum is withdrawn through the anal canal to its full extent, and a circumferential incision is made in the outer tube of the prolapsed bowel just proximal to the dentate line. This exposes the inner tube of prolapsed bowel and mesentery. Redundant bowel is mobilized from the distal end, up to the point that no additional bowel can be delivered into the operative field. The redundant bowel is transected and a primary anastomosis is fashioned between the cut ends of the inner and outer bowel. Prior to anastomosis, the levator muscles are often approximated in the midline in an effort to aid continence. When the volume of prolapsed tissue is small or a previous abdominal approach makes blood supply to the rectum questionable, the **Delorme procedure** often is performed. During this procedure, the mucosa is stripped off the prolapsed rectum, and the prolapsed rectal muscle is foreshortened by plication until it resides above the sphincters.

Usual preop diagnosis: Full-thickness rectal prolapse (procidentia)

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Summary of Procedures

	Rectopexy	Rectopexy with Sigmoid Resection	Perineal Rectosigmoidectomy	Delorme Procedure
Position	Lithotomy		Prone jackknife; lithotomy	
Incision	Low transverse; low midline		No external incision	
Special instrumentation	Deep pelvic instruments; mesh if sling planned	Deep pelvic instruments	Hip-roll for jackknife position; anastomosis may be created with EEA stapler	Hip roll for jackknife position
Unique considerations	Presacral venous plexus bleeding may occur; bowel prep may cause dehydration or hypokalemia.		Epinephrine solutions may be used to diminish bleeding; bowel prep may cause dehydration or hypokalemia.	
Antibiotics	Ertapenem 1 g iv or 2nd generation cephalosporin			
Surgical time	1–2 h			
EBL	< 100 mL; more if reoperation	100–300 mL; more if reoperation	100–200 mL	100 mL

Postop care	No rectal probes or medications			
Mortality	0–2%	0–4%	1–4%	0–1%
Morbidity	Rectal stricture (with sling): 5–10% Recurrent prolapse: 2–8% Pelvic infection: 5%	— 2–5% — Anastomotic leak: 2–4%	— 20–40% — —	— 5–10% — —
Pain score	7	7	2	2

Patient Population Characteristics

Age range	Women: peak incidence in 6th–7th decade; men: evenly distributed through age range
Male:Female	1:4
Incidence	Unknown
Etiology	Decreased pelvic muscular support; congenital deficiency of rectal support; pudendal neuropathy; chronic constipation and straining; multiparity; myelomeningocele; spina bifida; cystic fibrosis (children); acute parasitic diarrheal illness (children)
Associated conditions	Fecal incontinence; urinary stress incontinence; rectocele; cystocele

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Anesthetic Considerations

See Anesthetic Considerations following Operations for Fecal Incontinence, p. 546.

Suggested Readings

1. Gordon, PH, Nivatvongs S, eds: *Principles and Practice of Surgery of Colon, Rectum, and Anus*, 3rd edition. Informa Healthcare, New York: 2006.

2. Hayashi S, Masuda H, Hayashi I, et al: Simple technique for repair of complete rectal prolapse using a circular stapler with Thiersch procedure. *Eur J Surg* 2002; 168(2):124–7.

3. Kariv Y, Delaney CP, Casillas S, et al: Long-term outcome after laparoscopic and open surgery for rectal prolapse: a case-control study. *Surg Endosc* 2006; 20(1): 35–42.

4. Lechaux JP, Atienza P, Goasguen N, et al: Prosthetic rectopexy to the pelvic floor and sigmoidectomy for rectal prolapse. *Am J Surg* 2001; 182:465–9.

5. Liberman H, Hughes C, Dippolito A, et al: Evaluation and outcome of the Delorme procedure in the treatment of rectal outlet obstruction. *Dis Colon Rectum* 2000; 43(2):188–92.

6. Schultz I, Mellgren A, Dolk A, et al: Long-term results and functional outcome after Ripstein rectopexy. *Dis Colon Rectum* 2000; 43: 35–43.

7. Solomon MJ, Young CJ, Eyers AA, et al: Randomized clinical trial of laparoscopic versus open abdominal rectopexy for rectal prolapse. *Br J Surg* 2002; 89(1):35–9.

8. Zbar AP, Takashima S, Hasegawa T, et al: Perineal rectosigmoidectomy (Altemeier's procedure): a review of physiology, technique and outcome. *Tech Coloproctol* 2002; 6(2):109–16.

Rectal Surgery

Surgical Considerations

Description: Many lesions within the distal two-thirds of the rectum can be excised through a **transanal approach.** The most common benign tumors treated by local excision are adenomas. Lesions such as carcinoid tumor, endometrioma, and solitary rectal ulcer also may be locally excised. **Transanal excision** of benign lesions may be performed in the submucosal plane, whereas suspected malignancies are excised by removing the entire thickness of the rectal wall. A full antibiotic and mechanical bowel prep is given. Transanal excision usually is performed in the prone jackknife position, although the lithotomy position may be used when the lesion is located on the posterior rectal wall. A local anal block, usually 0.25% bupivacaine with 1:200,000 epinephrine, is performed to relax the sphincter mechanism and minimize sphincter injury, aid in hemostasis, and diminish postop pain. An anoscope is inserted into the anal canal. Stay sutures may be placed adjacent to the area of resection. On occasion, lesions may be prolapsed all the way through the anus and excised outside of the body. Generally, the dissection starts at the distal end of the lesion and proceeds proximally. The proctotomy may be closed with running or interrupted sutures. These sutures are then grasped and used for further traction. When the specimen is removed, a few final sutures are needed to close the proximal-most incision. **Rigid proctoscopy** is performed to confirm preservation of an adequate lumen.

Variant procedure or approaches: The **transsacral (Kraske) approach** to rectal tumors offers wider exposure than the transanal approach, but is more painful and has a substantially greater likelihood of complications (wound infection, fecal fistula, incontinence). A transsacral approach may be advantageous when the lesion is located behind the rectum (retrorectal tumors) and when resection of the lower sacrum or coccyx is anticipated. Transsacral resection generally is performed in the prone jackknife position. An incision is made from the posterior commissure of the anus to the base of the sacrum. The sphincter muscles are spared, but the levator muscles are divided to expose the posterior wall of the rectum. The coccyx may be disarticulated and removed to improve exposure. It is also possible to remove the lower sacral segments through this approach, but increasing morbidity accrues as the sacral nerve roots are sacrificed. For a posterior-wall lesion, the posterior wall of the rectum is opened and the lesion, along with a full-thickness disc of rectal wall, is excised. If the lesion is on the anterior wall, two proctotomy incisions are necessary. The proctotomy incisions are closed with standard anastomotic techniques. The levator muscles are reapproximated and the skin is closed. A drain may be placed within the retrorectal space before closing. The transsacral approach may be combined with an abdominal approach (**abdominal-transsacral resection**) in some cases of low rectal cancer.

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The **transsphincteric (Mason) approach** to rectal lesions also gives wider exposure than does the transanal approach, but at the expense of a substantially greater risk of fecal incontinence. Transsphincteric excision is performed with the patient in the prone jackknife position. An incision is made at the posterior commissure of the anus and is extended along the lateral border of the coccyx and sacrum. The external sphincter, internal sphincter and levator ani muscles are sequentially transected in the posterior midline. As each muscle is cut, the cut edges are tagged with sutures to facilitate accurate reapproximation. The rectal wall is incised and the lesion is excised. The proctotomy incision is closed via standard anastomotic suturing techniques, and the individual components of the sphincter muscle are reapproximated with interrupted sutures. The overlying skin is closed in a standard fashion.

Transanal endoscopic microsurgery involves the use of a resectoscope, 4 cm in diameter, that is inserted in the rectum. An airtight faceplate is placed and the rectum insufflated. The plate is exchanged for an adapter with working ports, through which instruments are placed and the resection is done similarly to the transanal approach described above.

Usual preop diagnosis: Villous adenoma; tubular adenoma; adenocarcinoma; carcinoid tumor; endometrioma; solitary rectal ulcer; retrorectal tumors (in decreasing frequency)

Summary of Procedures

	Transanal Excision	Transsacral Excision	Transsphincteric Excision	Transanal Endoscopic Microsurgery
Position	Prone jackknife or lithotomy	Prone jackknife		Prone jackknife, lithotomy, or lateral decubitus
Incision	Intrarectal	Anus-to-lateral sacral wall		Intrarectal
Special instrumentation	Rigid proctoscope; headlight and/or fiber optic retractors; Foley catheter	Gigli or power saw if sacral resection contemplated; headlight and/or fiber optic retractors; Foley catheter	Headlight and/or fiber optic retractors; Foley catheter	Proctoscope (40 mm diameter), removable faceplate, optical stereoscope, light cord, pressure transducer, laparoscopic camera, insufflator, instruments (5 mm diameter), 'Martin arm' to hold equipment
Unique considerations	Bowel prep may → dehydration and hypokalemia.			
Antibiotics	Ertapenem 1 g iv or 2nd generation cephalosporin			
Surgical time	15–120 min	1–2 h		
EBL	< 100 mL	< 100 mL (500 mL if sacral resection)		
Postop care	No rectal temperatures, suppositories, or enemas			
Mortality	0–2%			0.3–2%
Morbidity	Tumor recurrence: 5–50% Urinary retention: 10–20%	50%	5–50%	4–20%
	Bleeding: 2–5% Pelvic sepsis: 0–4% Ureteral injury: <; 1% (minimized by use of Foley)	Fecal fistula: 10–30% Fecal incontinence: 5–10%	10–40%	2% 0.8% Intraperitoneal entry: 1–4% 2%
Pain score	3	7	7	3

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Patient Population Characteristics

Age range	Rectal adenomas: 5th–7th decades; rectal adenocarcinoma: 6th–9th decades; endometrioma: 2nd–4th decades; solitary rectal ulcer syndrome: 4th–8th decades; carcinoid tumors: 5th–8th decades
Male: Female	1:1
Incidence	Varies with disease; not uncommon
Etiology	Varies with disease
Associated conditions	Preexisting anorectal pathology, such as fecal incontinence, may require concurrent treatment

Anesthetic Considerations

See Anesthetic Considerations following Operations for Fecal Incontinence, p. 546.

Suggested Readings

1. Bleday R, Breen E, Giacco GG, et al: Prospective evaluation of local excision for small rectal cancers. *Dis Colon Rectum* 1997; 40(4): 388–92.

2. Cataldo PA: Transanal endoscopic microsurgery. *Surg Clin North Am* 2006; 86(4): 915–25.

3. Chapuis P, Bokey L, Fahrer M, et al: Mobilization of the rectum: anatomic concepts and the bookshelf revisited. *Dis Colon Rect;* 2002; 45(1): 1–9.

4. Glimelius BL: The role of preoperative and postoperative radiotherapy in rectal cancer. *Clin Colorect Can* 2002; 2(2): 82–92.

5. Gould TH, Grace K, Thorne G, et al: Effect of thoracic epidural anaesthesia on colonic blood flow. *Brit J Anaesth* 2002; 89 (3):446–51.

6. Kapiteijn E, van de Velde CJ: Developments and quality assurance in rectal cancer surgery. *Euro J Cancer* 2002; 38(7): 919–36.

7. Moore HG, Guillem JG: Local therapy for rectal cancer. *Surg Clin North Am* 2002; 82(5):967–81.

8. Visser BC, Varma MG, Welton ML, et al: Local therapy for rectal cancer. *Surg Oncol* 2001; 10(1–2):61–9.

9. Wolff BG, Garcia-Aguilar J, Roberts PL, et al, eds: *The ASCRS Textbook of Colon and Rectal Surgery*. Springer Science-Business Media, New York: 2007.

Anal Fistulotomy/Fistulectomy/Fistula Plug

Surgical Considerations

Description: The majority of perianal fistulae are 2° infection in the anal glands within the rectal wall that communicates with crypts located at the dentate line (cryptoglandular fistula). Fistulae also may be the result of trauma, Crohn's disease, inflammatory processes within the peritoneal cavity, neoplasms, or as a consequence of radiation *(Print pagebreak 541)* therapy. The ultimate treatment of fistula-in-ano is determined by the etiology and the anatomic course of the fistula. The principle behind treatment of cryptoglandular fistulae is to ablate the offending gland and lay open the tract. Fistulae that track above the majority of the sphincter mechanism must be treated by procedures that either do not cut the overlying sphincter, cut the sphincter and repair it, or cut the sphincter very gradually (**seton,** see below). A fistula may be treated at the time of drainage of a perianal abscess or as a separate, elective operation. The route of a fistula tract is best determined by exploration at the time of operation. Although local anesthesia is acceptable for most fistulae, a few fistula operations require regional or general anesthesia because the ultimate route and depth of the fistula is unknown. Special consideration is given to fistulae that arise in the setting of Crohn's disease. Poor wound healing and the importance of sphincter function in patients with chronic diarrhea dictate that only the most superficial fistulae are laid open. The primary goal is palliation; specifically, abscess drainage and recurrence prevention. This is often accomplished by placing a Silastic Seton (a ligature around sphincter muscles) around the fistula tract and leaving it in place indefinitely. In the absence of active Crohn's disease in the rectum and anus, attempts at fistula cure may be undertaken.

Variant procedure or approaches: Fistulotomy involves cutting all tissues superficial to a fistula so that the fistula tract is brought to the skin level. The opened, fibrotic fistula wall is often sewn to the skin edge (marsupialized). **Fistulectomy** involves excision of the entire fistula tract. When conventional fistulotomy would cause incontinence, a **Seton** may be used. Other approaches that may be used to avoid fecal incontinence are **complete fistulotomy with immediate reconstruction** of the sphincter

and excision of the internal opening by an **endorectal advancement flap** technique.

The fistula plug involves the use of a bioabsorbable xenograft made of lyophilized porcine intestinal submucosa that is reconstituted in saline and placed in the fistula tract. This method may be preferred for fistulae that would require transection of a significant portion of the anal sphincters such that the surgeon is concerned about the impact on continence. It is used for both cryptoglandular fistulas and Crohn's disease-related fistulas.

Usual preop diagnosis: Fistula-in-ano

Summary of Procedures

	Fistulotomy or Fistulectomy	Fistulotomy with Seton	Endorectal Advancement Flap	Fistula Plug
Position	Prone jackknife; rarely lithotomy		Prone jackknife	
Incision	Perianal			None
Antibiotics	None	None	Ertapenem 1 g iv or 2nd generation cephalosporin	None
Surgical time	10–30 min		60–90 min	5–10 min
EBL	< 50 mL			Negligible
Mortality	Minimal			
Morbidity	Fecal incontinence: 0–30% Nonhealing, or recurrent fistula: 5%	10–30% 10–20%. (This procedure used only in complex fistulae, so complication rate appears higher.)	0–10% 10–40%. (This procedure used only in complex fistulae, so complication rate appears higher.)	0% 25–50%
Pain score	6	6	6	0–1

Patient Population Characteristics

Age range	2nd–7th decades
Male:Female	2:1
Incidence	Common
Etiology	Infection within anal glands located at dentate line (cryptoglandular fistula); trauma; Crohn's disease; inflammatory processes within the peritoneal cavity; neoplasms; consequence of radiation therapy

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Anesthetic Considerations

See Anesthetic Considerations following Operations for Fecal Incontinence, p. 546.

Suggested Readings

1. Bailey HR, Snyder MJ, eds: *Ambulatory Anorectal Surgery*. Springer-Verlag, New York: 2000.

2. Champagne BJ, O'Connor LM, Ferguson M, et al: Efficacy of anal fistula plug in closure of cryptoglandular fistulas: long-term

follow-up. *Dis Colon Rectum* 2006; 49(12): 1817–21.

3. Garcia-Aguilar J, Davey CS, Le CT, et al: Patient satisfaction after surgical treatment for fistula-in-ano. *Dis Colon Rectum* 2000; 43:1206–12.

4. Gordon, PH, Nivatvongs S, eds: *Principles and Practice of Surgery of Colon, Rectum, and Anus*, 3rd Edition. Informa Healthcare, New York: 2006.

5. Ho YH, et al: Marsupialization of fistulotomy wounds improves healing (RCT). *Br J Surg* 1998; 85:105–7.

6. Knoefel WT, Hosch SB, Hoyer B, et al: The initial approach to anorectal abscesses: fistulotomy is safe and reduces the chance of recurrence. *Dig Surg* 2000; 17(3):274–8.

7. Ortiz H, Marzo J: Endorectal flap advancement repair and fistulectomy for high trans-sphincteric and suprasphincteric fistulas. *Br J Surg* 2000; 87(12):1680–3.

8. Zimmerman DD, Briel JW, Gosselink MP, et al: Anocutaneous advancement flap repair of transsphincteric fistulas. *Dis Colon Rectum* 2001; 44: 1474–80.

Hemorrhoidectomy/Stapled Hemorrhoidopexy

Surgical Considerations

Description: Hemorrhoids are normally occurring vascular tissues located in discrete aggregations known as hemorrhoidal cushions within the distal rectum and anus. Thought to play a role in the fine control of enteric continence, they are only treated if they cause a symptom that persists after conservative therapy. Hemorrhoids may bleed, prolapse, and cause mucous drainage, itching, or pain (when thrombosed). The primary pathophysiologic event in the development of symptomatic hemorrhoids is thought to be mucosal prolapse 2° degeneration of the fibroelastic tissue that tethers vascular cushions and overlying mucosa to the submucosa. Many modern treatments diminish prolapse by fixing the mucosa to the submucosa with scar tissue. Hemorrhoids are classified as internal (when above the dentate line) or external (when below). Internal hemorrhoids are further classified by symptoms: I–bleed; II–bleed, prolapse, and spontaneously reduce; III–bleed, prolapse, and require manual reduction; IV–bleed, prolapse, and cannot be reduced. The most common symptom from external hemorrhoids is severe pain caused by thrombosis. Surgical treatment involves excision of the thrombosed hemorrhoid, often under local anesthetic, in the office. Internal hemorrhoids may be treated by nonexcisional or excisional techniques. Nonexcisional techniques generally are used in the office or outpatient clinic. They do not require an anesthetic because their use is limited to the insensate tissues above the dentate line. Nonexcisional treatments include **rubber-band ligation, infrared coagulation, sclerotherapy,** and **cryotherapy.**

Surgical hemorrhoidectomy may be performed in the lithotomy or prone jackknife position. An anoscope is placed in the anal canal and a hemorrhoid column is grasped and tented up into the lumen. A suture is placed at the internal apex of the complex. An incision is started at the external apex of the hemorrhoidal complex and a plane is developed deep to the hemorrhoidal tissue and superficial to the sphincter muscles. When the internal sphincter is identified, the dissection proceeds in the avascular space along its luminal surface. The dissection is continued up into the rectum to the transfixing suture. Lateral incisions along the redundant tissue are completed to excise the hemorrhoid. Care is taken to leave healthy bridges of mucosa between adjacent hemorrhoidal columns. Hemostasis is obtained with cautery and the mucosal defect may be closed with a running, absorbable suture. It also *(Print pagebreak 543)* is acceptable to leave the mucosal wound open. The procedure is repeated over the other enlarged, symptomatic hemorrhoidal complexes, removing redundant tissue and leaving long, vertical scars to prevent further mucosal prolapse.

Variant procedure or approaches: The **Whitehead hemorrhoidectomy (circumferential hemorrhoidectomy)** and **Lord procedure (sphincter stretch)** have been largely abandoned. **Lasers** have not been shown to improve results in the treatment of hemorrhoids.

Rubber-band ligation requires no anesthesia because the band is placed on the insensate, distal rectal mucosa. An anoscope is inserted into the anal canal to visualize a hemorrhoid column. The most proximal area of redundant mucosa is grasped with a clamp and pulled into the barrel of the ligation gun. A rubber band is placed on the base of the tented-up hemorrhoid tissue. The

encompassed tissue sloughs over 4–7 d, and a scar is formed between the mucosa and the underlying muscle.

Stapled hemorrhoidopexy is used for the correction of mucosal hemorrhoidal prolapse. This procedure is performed in the same position and under the same anesthesia as a conventional hemorrhoidectomy. A circular anal dilator is anchored to the skin with heavy sutures, an obturator is passed and a purse-string is created with absorbable 2-0 suture 3 to 4 cm above the dentate line. The stapler head is passed above the purse-string, and the sutures are pulled while the stapler is closed. In women, the vaginal wall must be examined to ensure that it has not been incorporated. The stapler is fired, cutting the incorporated mucosal prolapse, pulling the internal and external hemorrhoids proximally. Thus the hemorrhoids themselves are not removed. Hemostasis is obtained with sutures as needed. Cautery should be used with caution, because of the staples. This procedure is associated with a higher rate of disease recurrence and cost.

Usual preop diagnosis: Symptomatic hemorrhoids; bleeding, and/or prolapse

Summary of Procedures

	Surgical Hemorrhoidectomy	Stapled Hemorrhoidopexy
Position	Prone jackknife, lithotomy or left lateral decubitus	Prone jackknife, lithotomy
Incision	Series of vertical incisions from anal verge to top of hemorrhoid columns	None
Special instrumentation	Headlight or lighted anoscope; operating anoscope	Circular anal dilator, obturator, stapler
Antibiotics	None	None
Surgical time	30–90 min	10–20 min
EBL	< 100 mL	100 mL
Postop care	Sitz baths, oral fluids, fiber supplements	
Mortality	Rare	
Morbidity	Urinary retention: 15–30% Incontinence: 1–6% Bleeding: 2–5% Stricture: 2–5% Infection: 1–2%	
Pain score	9	5

Patient Population Characteristics

Age range	Peak prevalence 45–65 yr
Male:Female	1:1
Incidence	Prevalence 75/1000
Etiology	Low-fiber diet; genetic; pregnancy
Associated conditions	Constipation

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Anesthetic Considerations

See Anesthetic Considerations following Operations for Fecal Incontinence p. 546.

Suggested Readings

1. Bailey HR, Snyder MJ, eds: *Ambulatory Anorectal Surgery*. Springer-Verlag, New York: 2000.

2. Corman ML, Gravie JF, Hager T, et al: Stapled haemorrhoidopexy: a consensus position paper by an international working party - indications, contra-indications and technique. *Colorectal Dis* 2003; 5(4): 304–10.

3. Gencosmanoglu R, et al: Hemorrhoidectomy: open or closed technique technique (RCT)? *Dis Colon Rectum* 2002; 45:70–5.

4. Hussein AM: Ligation-anopexy for treatment of advanced hemorrhoidal disease. *Dis Colon Rectum* 2001; 44:1887–90.

5. Khan S, Pawlak SE, et al: Surgical treatment of hemorrhoids: prospective, randomized trial comparing closed excisional hemorrhoidectomy and the Harmonic Scalpel technique of excisional hemorrhoidectomy. *Dis Colon Rectum* 2001; 44: 845–9.

6. Konsten J, Baeten CG: Hemorrhoidectomy vs. Lord's method: 17-year follow-up. *Dis Colon Rectum* 2000; 43:503–6.

7. Moore BA, Fleshner PR: Rubber band ligation for hemorrhoidal disease can be safely performed in select HIV-positive patients. *Dis Colon Rectum* 2001; 44:1079–82.

8. Shao WJ, Li GC, Zhang GH, et al: Systematic review and meta-analysis of randomized controlled trials comparing stapled haemorrhoidopexy with conventional haemorrhoidectomy. *Br J Surg* 2008;95(2):147–60.

9. Wolff BG, Garcia-Aguilar J, Roberts PL, et al, eds: *The ASCRS Textbook of Colon and Rectal Surgery*, Springer Science-Business Media, New York: 2007.

Operations for Fecal Incontinence

Surgical Considerations

Description: In the majority of patients, fecal incontinence is caused by a combination of pudendal neuropathy and atrophy of pelvic floor muscles. Only when an anatomic defect in the sphincter mechanism can be identified is surgery likely to be beneficial. **Sphincteroplasty** is performed in the prone jackknife position after a full mechanical bowel prep. An incision is made at the anal verge, centered over the area of injured sphincter, and extended sufficiently around the anus to reach the retracted, cut edges of the sphincter. The anoderm and rectal mucosa are dissected off of the internal surface of the sphincter. The external surface of the sphincter mechanism is then dissected free to the level of the pelvic diaphragm. Care must be taken not to injure the inferior hemorrhoidal nerves during dissection around the posterior-lateral sphincter. The fibrotic portion linking the two ends of sphincter is cut, and the ends are overlapped and secured in place with two layers of interrupted horizontal mattress sutures. In women with obstetric injuries, the transverse perineal muscles are reapproximated. The skin may be reapproximated at the anal verge and along the reconstructed perineum or left open. The remainder of the skin is closed as completely as possible.

Variant procedure or approaches: The surgical options for patients without anatomic defects in their sphincters are generally unsuccessful. The **posterior anoplasty of Parks** was designed to passively enhance continence by increasing the normally occurring angle between the rectum and the anal canal, and to increase the mechanical efficiency of weak sphincter muscle by shortening the fiber length. Lack of efficacy has limited its use, although some surgeons still perform it in the setting of continued incontinence after abdominal repair of rectal prolapse. The operation is performed in the prone jackknife position after a standard bowel prep. A hemispherical incision is placed at the level of the intersphincteric groove over the posterior half of the anus. The plane between the internal and external anal sphincters is identified and developed proximally to above the puborectalis musculus. The puborectalis fibers are “reefed,” or pulled together, as far as possible with nonabsorbable suture. The external sphincter is plicated together in the midline with a series of nonabsorbable sutures that start at the deep external sphincter and progress to the subcutaneous sphincter. Skin is closed with absorbable sutures.

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The **Thiersch operation (pinch graft)** has a high complication rate and should be considered primarily in debilitated patients with symptomatic rectal prolapse or fecal incontinence. As originally described, the anal canal was encircled with a silver wire, which served as a passive obstacle to prolapse or defecation. In more recent years, an elastic sheet of Dacron-impregnated Silastic mesh has been used. Two small incisions are made on opposite sides of the anal verge. A pathway around the anal canal is created by

blunt dissection and a 1.5-cm wide piece of mesh is led around the anal canal. The ends of the mesh are overlapped in one of the incisions and either sutured or stapled together at an appropriate level of tension. The wounds are irrigated with antibiotic solution, and the incisions are closed.

Usual preop diagnosis: Fecal (enteric) incontinence

Summary of Procedures

	Overlapping Sphincteroplasty	Parks Repair	Modified Thiersch Procedure
Position	Prone jackknife		Prone jackknife or lithotomy
Incision	Circumanal		2 small incisions lateral to the anus
Special instrumentation	Headlight		Headlight; Silastic mesh
Unique considerations	Urinary catheter preop; standard bowel prep		None
Antibiotics	Ertapenem 1 g iv or 2nd generation cephalosporin		
Surgical time	1–2 h	1 h	30–45 min
EBL	< 100 mL		
Postop care	Early: Sitz baths Late: fiber supplement, stool softener		
Mortality	Rare		
Morbidity	Unimproved incontinence: 20% Improved, but minor incontinence: 30% Prolonged wound healing: 20% Infection: 1–2%	60–80% — — —	20% Erosion of prosthesis: 30–60% Obstructed defecation: 20–40% Infection
Pain score	8	7	6

Patient Population Characteristics

Age range	Bimodal: 3rd–5th decades for obstetric injury, fistulotomy, and perineal trauma; 6th–8th decades for pudendal neuropathy/pelvic floor atrophy
Male:Female	1:4
Incidence	Not uncommon
Etiology	Pudendal neuropathy; pelvic floor atrophy; obstetric injury; injury during anal surgery (fistulotomy, sphincterotomy, hemorrhoidectomy); perineal trauma; neurologic disease; congenital anomalies
Associated conditions	Urinary incontinence; chronic constipation; multiparity

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Anesthetic Considerations

(Procedures covered: excision or repair of rectal prolapse; rectal surgery; anal fistulotomy/fistulectomy; anal sphincterotomy/sphincteroplasty; hemorrhoidectomy; operations for fecal incontinence)

Preoperative

Respiratory	A careful evaluation of patient's respiratory status is important. If patient has ↓ reserve, the lithotomy position may be better tolerated than the prone or jackknife positions. **Tests:** As indicated from H&P.
Musculoskeletal	Pain is likely to be present at the surgical site and should be considered when positioning patient for anesthetic induction (e.g., if patient has pain while sitting, perform regional anesthesia in the lateral decubitus position). Evaluate bony landmarks if regional anesthetic is planned.
Hematologic	Patients rarely anemic from chronic GI bleeding **Tests:** CBC
Laboratory	Other tests as indicated from H&P.
Premedication	Standard premedication (p. B-1)

Intraoperative

Anesthetic technique: MAC, GA, spinal, or epidural techniques may be used.

General anesthesia:

Induction	**General (LMA vs ETT):** Standard induction (p. B-2). Procedures done in the prone or jackknife position may require ET intubation for airway control if regional anesthesia is not performed.
Maintenance	Standard maintenance (p. B-2)
Emergence	No special considerations

Regional anesthesia:

Spinal	Patient in either sitting, lateral decubitus, prone, or jackknife position for placement of a subarachnoid block. Doses of local anesthetics should be adequate to provide a high lumbar level (L1-2) of sensory anesthesia (e.g., tetracaine 10–14 mg; bupivacaine 8–12 mg). Patients should remain in relative head-up position with hyperbaric solution and in head-down position with hypobaric solutions to limit cephalad spread of block.	
Epidural	Patient in sitting or lateral decubitus position for placement of epidural catheter. A test dose (e.g., 3 mL of 1.5% lidocaine with 1:200,000 epinephrine) is administered and the patient is observed for the development of a subarachnoid block or symptoms of an intravascular injection. Titrate 2% lidocaine with epinephrine (3–5 mL at a time) until the desired level (usually L1-2 adequate) is obtained.	
MAC	Should be performed only on selected patients who are highly motivated and with surgeons experienced in performing procedure with infiltration of local anesthesia (usually 2% lidocaine with 1:200,000 epinephrine and 0.5% bupivacaine mixture). Perirectal injection of local anesthetic is quite painful and very short-acting agents (e.g., propofol 30–50 mg, remifentanil 25–100 mcg, ketamine 20–50 mg, or alfentanil 250–750 mcg) should be administered to minimize patient discomfort during the injection. As drug effect will vary widely in patients, they should be carefully titrated to desired level of sedation. Deep sedation and apnea must be avoided, especially in patients in prone or jackknife positions. A bed must be immediately available to turn patients supine and the anesthesiologist should always be prepared to administer GA if necessary.	
Blood and fluid requirements	IV: 16–20 ga × 1 (depending on scope of rectal procedure NS/LR @ 5–8 mL/kg/h	Blood products rarely needed.
Monitoring	Standard monitors (p. B-1)	Others as clinically indicated.

Positioning	and pad pressure points eyes	Chest support or bolsters to optimize ventilation in the jackknife position; care in positioning the patient's extremities and genitals after turning into jackknife position. Avoid pressure on eyes and ears after turning patient.
Complications	Peroneal nerve injury	Lithotomy position can → damage to peroneal nerve, resulting in foot drop. Laryngospasm may occur if inadequate depth of anesthesia during anal dilation.

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Postoperative

Complications	Urinary retention. Cauda equina syndrome Poor wound healing Atelectasis	Catheterize until return of urinary function. Cauda equina syndrome is characterized by varying degrees of urinary/fecal incontinence, sensory loss in the perineal area, and lower extremity motor weakness.
Pain management	PCA (p. C-3) Epidural analgesia (p. C-2)	PO analgesics may be suitable: acetaminophen and codeine (Tylenol #3 1–2 tab q 4–6 h) or oxycodone and acetaminophen (Percocet 1 tab q 6 h).
Tests	As indicated by patient status.	

Suggested Readings

1. Bachoo P, Brazelli M, et al: Surgery for faecal incontinence in adults. *Cochrane Database Syst Rev* (2):CD001757.

2. Bailey HR, Snyder MJ, eds: *Ambulatory Anorectal Surgery*: Springer-Verlag, New York: 2000.

3. Barisic G, Krivokapic Z, Marković V, et al: The role of overlapping sphincteroplasty in traumatic fecal incontinence. *Acta Chir Iugosl* 2000; 47(4 Suppl 1):37–41.

4. Bernard C: Epidural and spinal anesthesia. In *Clinical Anesthesia,* 3rd edition. Barash PG, Cullen BF, Stoelting RK, eds. Lippincott-Raven, Philadelphia: 1997, 645–65.

5. Gordon, PH, Nivatvongs S, eds: *Principles and Practice of Surgery of Colon, Rectum, and Anus*, 3rd Edition. Informa Healthcare, New York: 2000.

6. Malouf AJ, Norton CS, Engel AF, et al: Long-term results of overlapping anterior anal-sphincter repair for obstetric trauma. *Lancet* 2000; 355(9200):260–5.

7. Matsuoka H, Mavrantonis C, Wexner SD, et al: Postanal repair for fecal incontinence–is it worthwhile? *Dis Colon Rectum* 2000; 43(11): 1561–7.

8. Rigler ML, Drasner K, Krejcie TC, et al: Cauda equina syndrome after continuous spinal anesthesia. *Anesth Analg* 1991; 72 (3):275–81.

9. Wolff BG, Garcia-Aguilar J, Roberts PL, et al, eds: *The ASCRS Textbook of Colon and Rectal Surgery*. Springer Science-Business Media, New York: 2007.

10. Wong WD, Congliosi SM, Spencer MP, et al: The safety and efficacy of the artificial bowel sphincter for fecal incontinence: results from a multicenter cohort study. *Dis Colon Rectum* 2002; 45(9):1139–53.