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CHAPTER 7.3

Intestinal Surgery

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Duodenotomy

Surgical Considerations

Description: A duodenotomy is performed to ligate a bleeding vessel at the base of a duodenal ulcer or to perform some procedure on the ampulla of Vater or the duct of Santorini. It is important, therefore, to be familiar with the anatomy of the proximal duodenum in relation to the major and minor pancreatic duct orifices (Fig. 7.3-1). The duodenotomy may be made longitudinally or transversely, depending on the surgeon's preference. A transverse opening allows one to close the duodenotomy without tension; however, it must be made very accurately for the purpose of exposure. Bleeding vessels at the base of an ulcer must be secured with suture ligatures. Care must be taken to avoid perforating the duodenum when performing a sphincterotomy.

Usual preop diagnosis: Duodenal ulcer; impacted common duct stone; chronic pancreatitis 2° alcoholism, gallstones, pancreatic divisum, or other obstruction of the main pancreatic duct

Summary of Procedures

Position	Supine
Incision	Midline abdominal or subcostal
Unique considerations	Magnifying glasses, if operation involves lesser pancreatic sphincter
Antibiotics	Cefoxitin 1 g iv
VTE prophylaxis	Heparin 5,000 units sq
Surgical time	1–2 h
Closing considerations	Secure closure of duodenum without tension
EBL	Minimal
Postop care	NG decompression
Mortality	< 0.5%
Morbidity	Duodenal leak: < 5% Postop pancreatitis: < 3%
Pain score	6–8

Patient Population Characteristics

Age range	Any age
Male:Female	1:1
Incidence	Not uncommon
Etiology	Duodenal ulcer; impacted common duct stone; villous tumors of ampulla; chronic pancreatitis, pancreatic divisum Bleeding duodenal ulcer (50–60%); chronic pancreatitis

Associated conditions	(20–25%); impacted common duct stones (10–15%)

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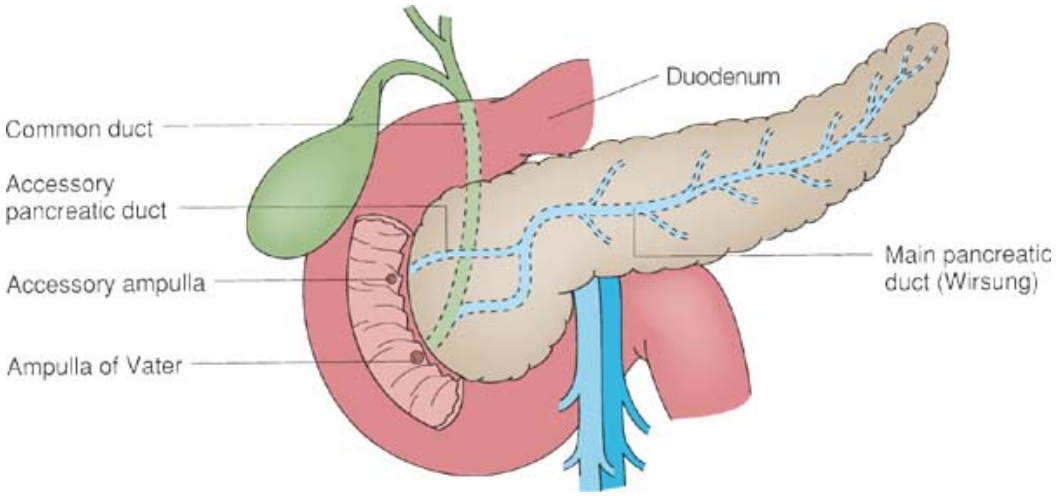

Figure 7.3-1. 1. Anatomy of pancreatic ductal system. In 30% of patients, the accessory duct ends blindly. (Reproduced with permission from Greenfield LJ, Mulholland MW, Oldham KT, et al: *Surgery: Scientific Principles and Practice,* 3rd edition. Lippincott Williams & Wilkins, Philadelphia: 2001.)

Anesthetic Considerations

See Anesthetic Considerations following Operations for Peptic Ulcer Disease, Stomach Surgery, p. 515.

Suggested Readings

1. Cisco RM, Norton JA: Surgery for gastrinoma. *Adv Surg* 2007; 41:65–76.

2. Nora PF: *Operative Surgery: Principles and Techniques,* 3rd edition. WB Saunders, Philadelphia: 1990.

Open Appendectomy

Surgical Considerations

Description: Open appendectomy is performed for appendicitis or suspected appendicitis; however, it has been largely replaced by the laparoscopic approach (see p. 591). The negative laparotomy rate has been reduced by the judicious use of preoperative CT examination. Through a RLQ (**McBurney**) or right paramedian incision, the cecum is exposed and pulled into the wound (Fig 7.3-2). The appendix is then delivered through the wound; and the mesoappendix is clamped, cut, and ligated. The appendix is removed by crushing, ligating, and then transecting the base. The appendiceal stump may be invaginated into the wall of the cecum or left alone. In some instances it may be easier to divide the base of the appendix before delivering the appendix into the wound. The wound should be left open and soft drains used in cases of perforated appendix. In children, the appendix may be inverted and allowed to slough off internally.

Variant procedure or approach: Laparoscopic appendectomy (see p. 592).

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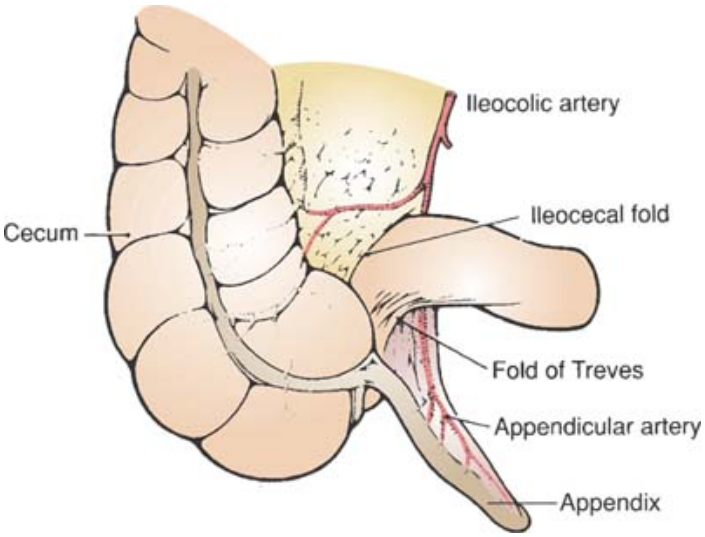

Figure 7.3-2. 2. Relevant anatomy for appendectomy. (Reproduced with permission from Scott-Conner CEH, Dawson DL: *Operative Anatomy,* 2nd edition. Lippincott Williams & Wilkins, Philadelphia: 2003.)

Usual preop diagnosis: Appendicitis

Summary of Procedures

Position	Supine
Incision	RLQ (McBurney's) or right paramedian
Unique considerations	Variation in stump closure; NG tube if prolonged ileus expected.
Antibiotics	Cefoxitin 1 g preop
VTE prophylaxis	Heparin 5,000 units sq
Surgical time	1 h
Closing considerations	Skin wound should not be closed when appendix is perforated. Drain in presence of well-defined abscess cavity.
EBL	< 75 mL
Postop care	Wound care when left open
Mortality	Perforated: 2% Nonperforated: < 0.1%
Morbidity	Pelvic, subphrenic, or intraabdominal abscess (perforation): 20% Wound abscess: < 5% Fecal fistula: < 1% Wound hematoma: < 0.5% Ileus: Variable
Pain score	5–7

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Patient Population Characteristics

Age range	Any age
Male:Female	1:1
Incidence	1/15 persons
Etiology	Obstruction (80–90%); fecaliths (75%); carcinoid tumors (< 5%)

Associated conditions	None

Anesthetic Considerations

See Anesthetic Consideration following Excision of Meckel's diverticulum, below p. 512.

Suggested Readings

1. Nguyen NT, Hinojosa MW, Fayad C, et al: Laparoscopic surgery is associated with a lower incidence of venous thromboembolism with a lower incidence of venous thromboembolism compared with open surgery. *Ann Surg* 2007; 246:1021–7.

2. See Suggested Readings following Excision of Meckel's diverticulum, pp. 513–514.

Excision of Meckel's Diverticulum

Surgical Considerations

Description: Meckel's diverticulum is a true congenital diverticulum, usually arising within 100 cm of the ileocecal valve. It was first described by Meckel in 1809. Excision of a Meckel's diverticulum is indicated for bleeding, obstruction, perforation, inflammation, intussusception, and when there is a palpable mass near the base of the diverticulum. Ectopic mucosa is present in roughly 50% of symptomatic patients, with gastric mucosa the most frequent. After entering the peritoneal cavity, the distal ileum, along with the diverticulum, is delivered into the wound. The diverticulum is excised and the wound is closed in two layers. Following excision of the diverticulum, care must be taken not to narrow the bowel lumen during closure. If a diagnosis can be made preop, a laparoscopic approach may be used (see Laparoscopic Bowel Resection p. 588).

Usual preop diagnosis: Meckel's diverticulum

Summary of Procedures

Position	Supine
Incision	Midline abdominal or RLQ (McBurney's)
Antibiotics	Cefoxitin 1–2 g iv
VTE prophylaxis	Heparin 5,000 units sq
Surgical time	1–1.5 h
EBL	< 100 mL
Mortality	< 0.5%
Morbidity	Wound infection: 5% Pulmonary complication: < 5% Anastomotic leak: < 1%
Pain score	6–8

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Patient Population Characteristics

Age range	< 40 yr
Male:Female	3:1
Incidence	0.3–2.5%
Etiology	Congenital

Associated conditions	Exomphalos; esophageal atresia; anorectal atresia; gross malformations of CNS or CV system

Anesthetic Considerations

(Procedures covered: open appendectomy; excision of Meckel's diverticulum)

Preoperative

This patient population is generally fit and healthy, apart from their acutely presenting illness. Full-stomach precautions are appropriate in these patients. Surgery for appendicitis is one of the most common nonobstetric procedures performed on the pregnant patient (1/1,500 pregnancies). These patients often are more ill at the time of diagnosis, because early symptoms may be attributed to pregnancy, and the gravid uterus may hinder an accurate abdominal exam. Anesthesia management for the gravid appendicitis patient mirrors that of the nongravid patient (full-stomach precautions) with consideration of the maternal physiologic changes of pregnancy and the effects of anesthesia on the fetus and uteroplacental perfusion (See Anesthetic Considerations for Cervical Cerclage, Obstetric Surgery, p. 835.)

Respiratory	Respiratory impairment may occur 2° the acute abdominal pain and splinting. Tachypnea and hyperpnea can be heralding Sx of appendiceal perforation and sepsis. Patients with acute abdomen pain should be treated as if they have full stomachs. Consider administration of metoclopramide (10 mg iv), H_2antagonist (ranitidine 50 mg iv), and Na citrate 0.3 M 30 mL po. **Tests:** As indicated from H&P.
Cardiovascular	May be dehydrated from fever, emesis, and ↓ oral intake → ↑ HR + ↑ BP (2° pain), or ↓ BP (sepsis, hypovolemia). Assess volume status appropriately and hydrate adequately prior to proceeding with anesthetic induction. **Tests:** ECG, if indicated from H&P.
Gastrointestinal	Patient typically has abdominal pain with N/V. Muscular resistance to palpation of abdominal wall frequently parallels the severity of the inflammatory process. With spreading peritoneal irritation (as with perforation), patient will develop abdominal distension and paralytic ileus. Electrolyte abnormalities are common 2° N/V. **Tests:** Electrolytes
Hematologic	Moderate leukocytosis (10,000–18,000) with moderate left shift. Hemoconcentration is probable if patient is dehydrated. **Tests:** CBC
Laboratory	Other tests as indicated from H&P.
Premedication	Full-stomach precautions (see p. B-4). Consider midazolam 1–2 mg iv. Opiate medications (morphine 0.03–0.15 mg/kg iv) often delayed or minimized until diagnosis made. Opiate analgesics not contraindicated during the evaluation of an acute abdomen including appendicitis.

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Intraoperative

Anesthetic technique: GETA, with rapid-sequence iv induction, followed by ET intubation (see full-stomach precautions, p. B-4). If systemic sepsis is absent, hydration is adequate, the patient is cooperative, and high abdominal exploration is unlikely, then regional anesthesia may be considered.

Induction	Rapid-sequence induction of anesthesia (see p. B-4). Restore intravascular volume prior to anesthetic induction if patient is clinically hypovolemic.
Maintenance	Standard maintenance (see p. B-2), without N_2O. Evacuate stomach with OG or NG tube. Maintain muscle relaxation based on nerve stimulator response.
Emergence	Patient should be extubated awake after return of airway reflexes.
Blood and fluid requirements	IV: 16–18 ga × 1 NS/LR @ 5–8 mL/kg/h
Monitoring	Standard monitors (see p. B-1). Others, as indicated by patient's status.
Positioning	and pad pressure points eyes
Complications	Sepsis

Postoperative

Complications	Sepsis (possible with appendiceal rupture)	Adequate antibiotic coverage
	Paralytic ileus Atelectasis	Adequate pain control, incentive spirometry, early ambulation
	PONV (see p. B-6)	
Pain management	PCA (see p. C-4).	
Tests	As indicated clinically.	

Suggested Readings

1. McBurney C: Experience with early operative interference in cases of disease of the vermiform appendix. *NY Med J* 1889; 50:676–84.

2. Meckel JF: Ulcer die divertikel an darmkanal. *Arch Physiol* 1809; 9:421–53.

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3. Merritt WT: Anesthesia for gastrointestinal surgery. In: *Principles and Practice of Anesthesiology,* 2nd edition. Longnecker DE, Tinker JH, Edward G, eds. Mosby-Year Book, St. Louis: 1998, 1881–903.

4. Morgan EG, Mikhail MS, Murray MJ: *Clinical Anesthesiology,* 4th edition. Lange Medical Books, Stamford: 2006, 919–20.

5. Rosen MA: Management of anesthesia for the pregnant surgical patient. *Anesthesiology* 1999; 91:1159–63.

6. Way LW, Doherty GM, eds: *Current Surgical Diagnosis Treatment*. Appleton & Lange, Stamford: 1994, 610–13.

7. Zani A, Eatons S, Rees CM, Pierro A. Incidentally detected Meckel diverticulum: to resect or not to resect? *Ann Surg* 2008; 247:276–81.

Enterostomy

Surgical Considerations

Description: Enterostomy is performed for stenting the small intestine with a long tube for feeding purposes, for bypassing small or large bowel obstructions, and following total proctocolectomy. An intestinal tube is either purse-stringed into the small bowel and brought through the abdominal wall or the intestine itself is brought to the exterior and fashioned into a stoma. Different tubes are used for feeding, according to surgeon's preference. After purse-stringing the tube in the bowel, the seromuscular layer of the

jejunum is sutured over the tube for a distance of 3–4 cm before exiting through the abdominal wall. The **Brooke ileostomy** is created by bringing a 2-inch segment of ileum through an abdominal wall stab wound. The ileum is folded back on itself and sutured to the skin edge or dermis (Fig. 7.3-3). Some surgeons secure the ileum to the underlying peritoneum and/or fascia, but this is not necessary.

Variant procedure or approaches: There are various intestinal or drainage tubes that may be inserted into the bowel, depending on the function required. For example, certain tubes are used for feeding, while others may be used for drainage or decompression.

Usual preop diagnosis: Intestinal obstruction due to extensive adhesions; following removal of the large intestine (including the rectum); for enteral feedings

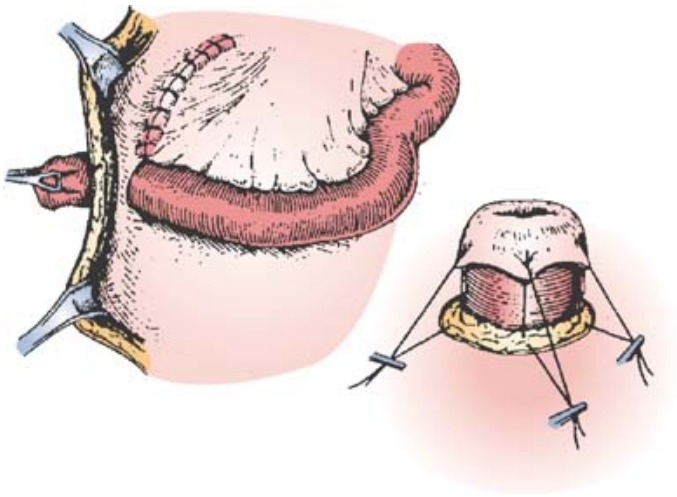

Figure 7.3-3. 3. Brooke ileostomy. (Reproduced with permission from Hardy JD: *Rhoad's Textbook of Surgery,* 5th edition. JB Lippincott, Philadelphia: 1977.)

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Summary of Procedures

	Enterostomy	Ileostomy
Position	Supine	
Incision	Midline abdominal	
Antibiotics	Cefoxitin 1–2 g iv preop	
VTE prophylaxis	Heparin 5,000 units sq	
Surgical time	1–1.5 h	
Closing considerations	Securing tube to abdominal wall	Viable stoma
EBL	< 100 mL	
Postop care	Tube irrigation	Stoma care
Mortality	< 0.5%	
Morbidity	Ileus: 60–70% Wound infection: < 5%	Stoma necrosis: < 2%
Pain score	5–6	5–6

Patient Population Characteristics

Age range	20–65 yr
Male:Female	1:1
Incidence	Common

Etiology	Intestinal obstruction (60–70%); diseases resulting in total proctocolectomy (10–15%); inability to eat (5–10%)
Associated conditions	Inflammatory bowel disease (IBD); intestinal adhesions; inability to eat orally

Anesthetic Considerations for Ostomy Procedures

(Procedures covered: enterostomy; continent ileostomy; gastrostomy; gastrojejunostomy)

Preoperative

This patient population is very diverse and includes those with IBD, cancer, and those presenting post-CVA and trauma. Thus, the population ranges from the otherwise healthy to the critically ill. Many of these patients will have abnormal protective airway reflexes and are at risk of aspiration of gastric contents.

Respiratory	Patients post-CVA or head trauma may have abnormal laryngeal reflexes and difficulty swallowing, making them prone to aspiration of gastric contents and associated pneumonitis (evaluate gag reflex). Decreased pulmonary reserve and hypoxemia can be seen in patients with pulmonary infections. **Tests:** Consider CXR to r/o pneumonia. Consider ABG.
Cardiovascular	Patients may be hypovolemic 2° chronically poor po intake. **Tests:** ECG; orthostatic vital signs
Musculoskeletal	Patients often sick and debilitated (e.g., post-CVA).
Gastrointestinal	Patients often malnourished and prone to electrolyte abnormalities 2° poor po intake. **Tests:** Electrolytes; BUN; Cr, consider PT/PTT.
Laboratory	CBC with differential; others as indicated from H&P.
Premedication	Depends on patient status. Titrate small doses of benzodiazepines (midazolam 0.25–0.5 mg iv) or opiate (fentanyl 25–50 mcg iv). Consider H_2antagonists (e.g., ranitidine 50 mg iv, 60 min preop) and metoclopramide (10 mg iv 20 min preop).

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Intraoperative

Anesthetic technique: GETA is appropriate for most ostomy procedures; MAC with local anesthesia may be appropriate in selected patients.

Induction	Patient may be at risk for pulmonary aspiration. If GA is planned, consider rapid-sequence induction with cricoid pressure. If patient is clinically hypovolemic, restore intravascular volume (colloid, crystalloid, or blood products) prior to induction and titrate induction doses of sedative/hypnotic agents.	
Maintenance	**MAC:** Titration of sedatives (e.g., propofol 25–150 mcg/kg/min) and analgesics (fentanyl 25–50 mcg iv). **GA**: Standard maintenance (see p. B-2).	
Emergence	Trachea should be extubated after return of protective laryngeal reflexes, if patient at risk for aspiration of gastric contents.	
Blood and fluid requirements	Minimal blood loss IV: 16–18 ga × 1 NS/LR @ 5–8 mL/kg/h	
Monitoring	Standard monitors (see p. B-1).	Others as clinically indicated.
Positioning	and pad pressure points eyes	

Postoperative

Complications	Atelectasis Aspiration Hypoxemia Hypercarbia VTE (see appendix p. B-7)
Pain management	PCA (see p. C-3).

Suggested Readings

1. Cingi A, Solmaz A, Attaqllah W, et al: Enterostomy closure site hernias: a clinical and ultrasonographic evaluation. *Hernia* 2008; in press.

2. Zinner MJ, Schwartz SI, Ellis H, eds: *Maingot's Abdominal Operations,* Vol I, 10th edition. Appleton & Lange, Stamford, CT: 1997, 427–51.

Continent Ileostomy Pouch (Kock)

Surgical Considerations

Description: A **Kock pouch** consists of an internal reservoir fashioned from the distal ileum and an intussuscepted nipple valve used to provide continence. Approximately 45 cm of small bowel are required for construction of the *(Print pagebreak 517)* pouch and valve. After suturing two limbs of the ileum together over a distance of 15 cm, the distal segment is intussuscepted over itself to form the nipple valve. The pouch is then sutured closed and mounted beneath the abdominal wall stoma site (Fig. 7.3-4). The stoma is made flush with the skin for cosmetic reasons and left intubated for 1 month with a special plastic catheter. The pouch remains decompressed for 1 month before intermittent catheterization is initiated. The continent ileostomy reservoir has been modified by **Barnett** to include the construction of an isoperistaltic valve with an intestinal collar around its base to prevent deintussusception and valve prolapse. These procedures are typically performed following a total proctocolectomy or to replace conventional ileostomies.

Usual preop diagnosis: Inflammatory bowel disease; familial polyposis or malfunctioning ileostomies

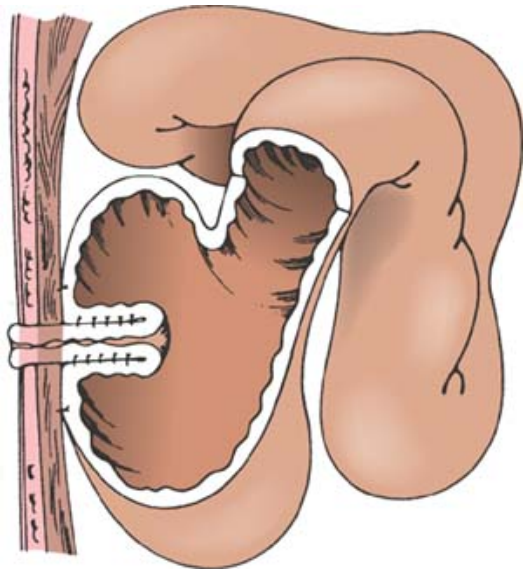

Figure 7.3-4. 4. Continent ileostomy or Kock pouch. (Reproduced with permission from Hardy JD: *Hardy's Textbook of Surgery,* 2nd edition. JB Lippincott, Philadelphia: 1988.)

Summary of Procedure (Kock or Barnett Pouch)

Position	Supine
Incision	Midline abdominal
Special instrumentation	GIA or TA staplers
Antibiotics	Usual bowel prep with antibiotics; cefoxitin 1 g iv preop
VTE prophylaxis	Heparin 5,000 units sq
Surgical time	3–4 h
Closing considerations	Valve vascularity
EBL	200–300 mL
Postop care	Maintain pouch decompression
Mortality	< 1%
Morbidity	Intestinal ileus: 5% Wound infection: < 5% Intestinal obstruction: 2–3% Pouch fistula: 1–3% Valve necrosis: < 0.5%
Pain score	6–8

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Patient Population Characteristics

Age range	18–80 yr
Male:Female	1:1
Incidence	Common
Etiology	Ileostomy (50%); proctocolectomy (5%)
Associated conditions	Extracolonic inflammatory bowel manifestations (10%)

Anesthetic Considerations

See Anesthetic Considerations for Ostomy Procedures, p. 515.

Suggested Readings

1. Barnett WO: Modified techniques for improving the continent ileostomy. *Am Surg* 1984; 50(2):66–9.

2. Becker JM, Stuchni AF: Ulcerative colitis. In: *Surgery: Scientific Principles and Practice,* 3rd edition. Greenfield LJ, Mulholland MW, Oldham KT, et al, eds. Lippincott Williams & Wilkins, Philadelphia: 2001, 1070–89.

3. Little UR, Barboors RN, Shrock TR, et al: The continent ileostomy–long-term durability and patient satisfaction. *J Gastrointest Surg* 1999; 3:625–32.

4. Smith LE: Surgical therapy in ulcerative colitis. *Gastroenterol Clin North Am* 1989; 18:99–110.

Small-Bowel Resection with Anastomosis

Surgical Considerations

Description: Resection of the small bowel is performed for a number of diseases (listed below). After entering the peritoneal cavity, the involved small bowel is delivered into the wound and the lesion resected between bowel clamps (Fig. 7.3-5). Varying amounts of mesentery are included, depending on the diagnosis. More extensive resections are indicated for malignant disease, including regional lymph nodes. Reanastomosis may be accomplished by various suturing techniques or stapling. The peritoneal cavity may be accessed through vertical or transverse incisions. Operative techniques include **open end-to-end, closed end-to-end, side-to-side,** or **stapled, functional end-to-end anastomoses.**

Variant procedure or approaches: Laparoscopic small-bowel resections are being performed more frequently (see p. 588).

Usual preop diagnosis: Intestinal obstruction, complicated by intestinal gangrene due to adhesions, internal hernia, volvulus, intussusception, mesenteric vascular occlusion, Crohn's disease, radiation enteritis, intestinal fistulae, small bowel tumors, and trauma

Summary of Procedures

Position	Supine
Incision	Vertical or transverse
Unique considerations	Adequate fluid resuscitation; NG tube
Antibiotics	Cefoxitin 1–2 g iv preop
VTE prophylaxis	Heparin 5,000 units sq
Surgical time	1–3 h
EBL	50–100 mL
Postop care	NG or long intestinal tube decompression
Mortality	Varies according to etiology: 1–5%
Morbidity	Atelectasis: < 10% Intestinal ileus: < 10% Wound infection: < 5% Intestinal leak, fistula: < 3%
Pain score	7–9

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Patient Population Characteristics

Age range	20–90 yr
Male:Female	1:1
Incidence	Common
Etiology	Interference with blood supply (obstruction, strangulated hernia, volvulus, mesenteric thrombosis); trauma; tumors; Crohn's disease
Associated conditions	Multiple, depending on etiology (see Preop diagnosis, above).

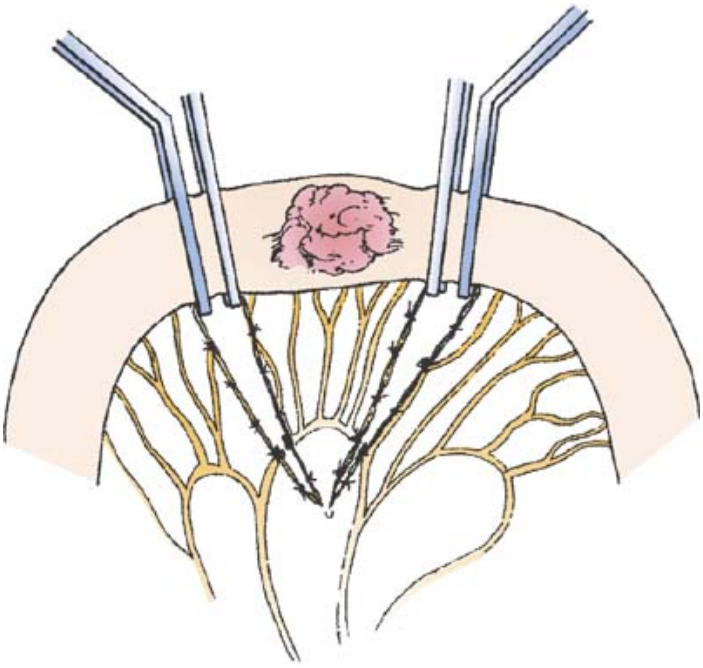

Figure 7.3-5. 5. Block-Potts bowel clamps are applied from the antimesenteric to mesenteric border to avoid twisting. A Kocher clamp is applied on the specimen side, and the bowel is transected with a scalpel. (Reproduced with permission from Baker RJ, Fischer JE, eds: *Mastery of Surgery,* Vol II, 4th edition. Lippincott Williams & Wilkins, Philadelphia: 2001.)

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Anesthetic Considerations

See Anesthetic Considerations for Intestinal and Peritoneal Procedures, p. 522.

Suggested Readings

1. Chaiyasate K, Jain AK, Cheung LY, et al: Prognostic factors in primary adenocarcinoma of the small intestine. *World J Surg Oncol* 2008; 31:6–12.

2. Zollinger RM Jr, Zollinger RM: *Atlas of Surgical Operations,* 7th edition. MacMillan, New York: 1993.

Enterolysis

Surgical Considerations

Description: Enterolysis consists of separating loops of bowel adhesed to other loops or the abdominal wall by sharp dissection, and by excising adhesive bands. Care must be taken to avoid producing enterotomies. Covering potential adhesion sites with a hyaluronic carboxymethylcellulose membrane may lessen the formation of intraperitoneal adhesions.

Usual preop diagnosis: Intraabdominal adhesions; intestinal obstruction

Summary of Procedures

Position	Supine
Incision	Midline abdominal

Special instrumentation	A long intestinal tube may be necessary for decompression and fixation of bowel loop.
Unique considerations	Bowel decompression
Antibiotics	Cefoxitin 1 g iv preop
VTE prophylaxis	Heparin 5,000 units sq
Surgical time	1–4 h
Closing considerations	Adequate decompression to permit wound closure
EBL	150–500 mL
Postop care	PACU; continued intestinal decompression 2–5 d
Mortality	1–3%
Morbidity	Wound abscess: 15–20% Prolonged ileus: 10–20% Fistula formation: < 10% Pulmonary complications: 5–10% Recurrent intestinal obstruction: 5–8%
Pain score	5–7

Patient Population Characteristics

Age range	Any age
Male:Female	1:1
Incidence	Common
Etiology	Previous intraabdominal operative procedure (> 90%); malignant tumors (15–20%); hernias (10–15%); volvulus (5–10%); inflammatory bowel disease (5%); gallstone ileus (< 5%); intussusception (< 5%)

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Anesthetic Considerations

See Anesthetic Considerations for Intestinal and Peritoneal Procedures, p. 522.

Suggested Readings

1. Aydeniz B, Teppey-Wessels K, Honig A, et al: Laparoscopic enterolysis before adjuvant radiotherapy in a case of endometrial cancer. *Gynecol Oncol* 2004; 92:331–3.

2. Close MB, Christensen NM: Transmesenteric small bowel plication or intraluminal tube stenting. Indications and contraindications. *Am J Surg* 1979; 138(1):89–96.

3. Vrijland WW, Tseng LN, Eijkman HJ, et al: Fewer intraperitoneal adhesions with use of hyaluronic acid-carboxymethylcellulose membrane: a randomized clinical trial. *Ann Surg* 2002; 235:193–9.

Closure of Enteric Fistulae

Surgical Considerations

Description: Enteric fistulae may occur between the bowel and abdominal wall (enterocutaneous), between loops of the intestine (enteroenteric or enterocolic), or between the bowel and bladder or vagina (enterovesical or enterovaginal). Surgical repair is usually

reserved for fistulae to the abdominal wall, bladder, and vagina, and consists of excising the fistula and repairing the bowel and the other organ separately. Most fistulae are characterized by the adherence of the two visceral organs with a communication between their lumens.

The organs involved are separated by blunt-sharp dissection and repaired locally after excision of the indurated margins of the defect. In the case of both the small and large intestines, it may be necessary to resect a segment of bowel with the defect and to perform an end-to-end anastomosis. If the repair sites involved lie close together, it is important to interpose tissue, such as the omentum, between the viscera to minimize chance of recurrence. Occasionally, a fistula may be bypassed rather than surgically resected.

Usual preop diagnosis: Enteric fistula

Summary of Procedures

Position	Supine
Incision	Midline abdominal
Unique considerations	Preop nutritional support and fistula wound care
Antibiotics	Cefoxitin 1–2 g iv preop
VTE prophylaxis	Heparin 5,000 units sq
Surgical time	2–4 h
Closing considerations	Separation of repairs by interposition of omentum and other tissue
EBL	50–300 mL
Postop care	NG decompression until bowel function returns; TPN support
Mortality	0–5%
Morbidity	Ileus: 60–70% Pulmonary complications: 10% Recurrent fistula: 5–10% Wound infection: 5–10%
Pain score	6–8

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Patient Population Characteristics

Age range	Any age
Male:Female	1:1
Incidence	Common
Etiology	Anastomotic leaks (60–70%); carcinoma (10–15%); Crohn's disease (5–10%); iatrogenic bowel injury (5–10%); perforative diverticulitis (5–10%); radiation enteritis (5%); foreign body perforation (< 5%)
Associated conditions	Malnutrition (30%); inflammatory bowel disease (25%); cancer (15%)

Anesthetic Considerations for Intestinal and Peritoneal Procedures

(Procedures covered: small-bowel resection; enterolysis; closure of enteric fistulae; excision of intraabdominal and retroperitoneal tumor; drainage of subphrenic abscess)

Preoperative

Patients requiring exploratory laparotomy present both electively and emergently for a very wide range of disorders. As a

result of their abdominal pathology, these patients are often at high risk for the pulmonary aspiration of gastric contents. Precautions to prevent this are necessary to help assure safe patient outcome (see p. B-4).

Respiratory	Respiratory insufficiency can be present due to intraabdominal pathology (e.g., ascites, large tumor, free blood, bowel distension, pain); ↓ FRC →↑ A-a gradient and arterial hypoxemia; diaphragmatic impairment and splinting →↑ respiratory insufficiency. **Tests:** Consider CXR; ABG.
Cardiovascular	Patients for emergency surgery often critically ill and unstable, and should be evaluated for presence of hypovolemia (hypotension, tachycardia) and should receive adequate volume replacement before anesthetic induction. Elective patients may be hypovolemic 2° bowel prep. **Tests:** ECG; consider orthostatic vital signs
Musculoskeletal	Abdominal rigidity may be present; abdominal pain is common.
Gastrointestinal	Diarrhea, vomiting, and prolonged npo status can lead to electrolyte abnormalities. Malnutrition may be present. **Tests:** Electrolytes, consider PT/PTT
Renal	Renal insufficiency/failure may be present, especially in elderly and/or chronically ill patients, and in those who are hypovolemic. **Tests:** Consider BUN; Cr; electrolytes.
Laboratory	CBC with differential; Plt count
Premedication	Standard premedication (see p. B-1). Consider H_2-antagonists (e.g., ranitidine 50 mg iv 1 hr preop), metoclopramide (10 mg iv 30 min preop; although contraindicated in bowel obstruction/perforation), and Na citrate (30 mL po 10 min preop).

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Intraoperative

Anesthetic technique: GETA ± epidural for postop analgesia. If postop epidural analgesia is planned, placement of catheter prior to anesthetic induction is helpful to establish correct placement in the epidural space (accomplished by injecting 5–7 mL of 2% lidocaine via the epidural catheter, and confirming segmental block).

Induction	The patient with abdominal pathology is often at risk for pulmonary aspiration and the trachea should be intubated with patient awake or after rapid-sequence iv induction with cricoid pressure. (See Rapid-Sequence Induction, p. B-4.) If patient is clinically hypovolemic, restore intravascular volume (colloid, crystalloid, or blood products) prior to induction and titrate induction dose of sedative/hypnotic agents.
Maintenance	**Balanced anesthesia** without N_2O (see Standard Maintenance Techniques, p. B-2): Maintain neuromuscular blockade based on nerve stimulator response. Place OG or NG tube to evacuate stomach contents. **Combined epidural and GA:** Local anesthetic (2% lidocaine with 1:200,000 epinephrine 5–15 mL initial dose, then 3–5 mL q 60 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., 2% lidocaine or 0.25% bupivacaine) at 3–5 mL/h may be used in place of bolus redosing. Be prepared to treat hypotension with fluid and vasopressors. GA is administered to supplement regional anesthesia and for amnesia. If epidural opiates are used for postop analgesia, a loading dose (e.g., hydromorphone 0.5–1.0 mg) should be administered at least 1 h before the conclusion of surgery. Use of systemic analgesics may be minimized during this type of anesthetic with the benefit of decreasing the

	likelihood of postop respiratory depression.	
Emergence	The decision to extubate at the end of surgery depends on the patient's underlying cardiopulmonary status and the extent of the surgical procedure. Patients should be hemodynamically stable, warm, alert, cooperative, and fully reversed from any muscle relaxants prior to extubation. If the above criteria are not met, consider postop ventilation in ICU setting.	
Blood and fluid requirements	Anticipate large fluid shift. IV: 14–16 ga × 1–2 T&S, consider T&C NS/LR @ 10–15 mL/kg/h Fluid warmer	Plts, FFP, and cryoprecipitate should be administered according to lab tests (Plt count, PT, PTT, DIC screen, thromboelastography [TEG]). Strive to maintain euvolemia based on estimated blood loss and fluid shifts, HR, BP, UO, ABG, and invasive monitors when used.
Monitoring	Standard monitors (see p. B-1). UO ± Arterial line ± CVP/PA catheter ± TEE	Invasive monitors, as indicated by patient's status. Prevent hypothermia: use forced-air warmer; consider warming blanket, warming iv fluids, warm room temperature, keeping patient covered until ready for prep, etc.
Positioning	and pad pressure points eyes	
Complications	Hemorrhage Sepsis	Acute septic shock may require aggressive hemodynamic support; PA catheter or TEE may help guide management in the unstable patient.

Postoperative

Complications	Sepsis Hemodynamic instability Atelectasis Hypoxemia VTE (see p. B-7) Hemorrhage Ileus PONV (see p. B-6)	Pulmonary function abnormalities may persist for 1 wk postop (↓ vital capacity and ↓ FRC).
Pain management	Epidural analgesia (see p. C-2). PCA (see p. C-3).	Patient should be recovered in ICU or ward accustomed to treating the side effects of epidural opiates (e.g., respiratory depression, breakthrough pain, nausea, pruritus).
Tests	CBC; CXR (if central line placed); electrolytes; glucose	Others as directed by intraop course.

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Suggested Readings

1. Aguirre A, Fischer JE, Welch CE: The role of surgery and hyperalimentation in the therapy of gastrointestinal-cutaneous fistulae. *Ann Surg* 1974; 180(4):393–401.

2. Becker HP, Willms A, Schwab R: Small bowel fistulas and the open abdomen. *Scand J Surg* 2007; 96:263–71.

3. Merritt WT: Anesthesia for gastrointestinal surgery. In: *Principles and Practice of Anesthesiology,* 2nd edition. Longnecker DE, Tinker JH, Edward G, eds. Mosby-Year Book, St. Louis: 1998, 1881–903.

4. Zinner MJ, Schwartz SI, Ellis H, eds: *Maingot's Abdominal Operations,* 10th edition, Vol. I. Appleton - Lange, Stamford, CT: 1997, 593–616.