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CHAPTER 7.8

Pancreatic Surgery

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Operative Drainage for Pancreatitis

Surgical Considerations

Description: Surgical treatment for pancreatitis is indicated for drainage or debridement of infected peripancreatic tissue or pancreatic necrosis. Pancreatic abscesses usually develop in the lesser sac, but may spread to the subphrenic spaces or into the pericolic gutters. Fistulization into adjacent organs, particularly the transverse colon, is common. Severe intraabdominal hemorrhage from erosion into major arteries lying adjacent to the pancreas is uncommon, but may occur prior to, during, or after operative drainage. Intraop, exploration of the peritoneal cavity is performed before opening the lesser sac. Areas lateral to the left and right sides of the colon, as well as the base of the transverse mesocolon and the subhepatic areas, should be palpated to identify fluid or abscess collections. The gastrocolic ligament is then incised to approach the pancreas through the lesser sac. There are different operative approaches, depending on location of involved tissue and surgeon's preference. Upper midline or transverse abdominal incisions are used most often. Posterior drainage through the bed of the 12th rib, or retroperitoneal lateral approaches, may be used (Fig. 7.8-1).

Usual preop diagnosis: Severe pancreatitis 2° to gallstones, alcohol, or post ERCP

Summary of Procedures

Position	Supine or rotated slightly (Fig. 7.8-1) for posterior approach
Incision	Midline, transverse, flank, or synchronous anterior and posterior
Unique considerations	Must perform adequate debridement of necrotic tissue and provide adequate drainage of abdomen; NG tube; jejunal feeding tube
Antibiotics	Cefoxitin 1–2 g 30 min preop, or antibiotic directed at cultured organisms
VTE prophylaxis	Heparin 5000 units sq
Surgical time	1–2 h
Closing considerations	Adequate drainage of pancreatic bed and fluid resuscitation of patient
EBL	300–750 mL
Postop care	Routine wound and drain care; usually ICU and intubated; often, subsequent operative procedures are required.
Mortality	8–30%
Morbidity	Fistulae formation: 18–55% Delayed gastric emptying: 50% Unremitting sepsis: 10–30% Atelectasis: 5–10% Respiratory deterioration: 5% Hemorrhage Bowel perforations
Pain score	7–9

Patient Population Characteristics

Age range	30–60 yr
Male:Female	1:1
Incidence	10–30% of patients with pancreatitis
Etiology	Alcoholism (30–50%); postop pancreatitis (15–40%); biliary tract disease (20–30%); idiopathic pancreatitis (15–20%)
Associated conditions	Malnutrition; glucose intolerance; multiorgan dysfunction

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Figure 7.8-1. 1. Incision for anterior and posterior drainage in pancreatitis. Note that bed or table is rotated until patient is almost supine. (Reproduced with permission from Berne TV, Donovan AJ: Synchronous anterior and posterior drainage of pancreatic abscess. *Arch Surg* 1981; 116:527–33. Copyright 1981, American Medical Association.)

Anesthetic Considerations

See Anesthetic Considerations for Pancreatic Surgery, p. 619.

Suggested Readings

1. Berne TV: Pancreatic abscesses. *Probl Gen Surg* 1984; 1:569–82.

2. Bradley EL: Fifteen-year experience with open drainage for infected pancreatic necrosis. *Surg Gynecol Obstet* 1993; 177(3): 215–22.

3. Feranandez-del Castillo C, Rattner DW, Makary MA, et al: Debridement and closed packing for the treatment of necrotizing pancreatitis. *Ann Surg* 1998; 228:676–84.

4. Gotzinger P, Sautner T, Kriwanek S, et al: Surgical treatment for severe acute pancreatitis: Extent and surgical control of necrosis determine outcome. *World J Surg* 2002; 474–8.

5. Shinzeki M, Ueda T, Takeyama Y, et al: Prediction of early death in severe acute pancreatitis. *J Gastroenteral* 2008; 43:152–8.

6. Villazon A, Villazon O, Terrazas F, et al: Retroperitoneal drainage in the management of the septic phase of severe acute pancreatitis. *World J Surg* 1991; 15:103–8.

Drainage of Pancreatic Pseudocyst

Surgical Considerations

Description: Internal drainage of a pancreatic pseudocyst may be accomplished by anastomosing the cyst to the stomach, duodenum, or other small bowel via a Roux-en-Y loop of jejunum. The procedure of choice for internal decompression depends on the location of the pseudocyst in relation to the portion of the GI tract that will provide maximal dependent drainage of the cyst. Operation is reserved for patients with refractory symptoms. At operation, the abdomen is entered via a midline incision. The pseudocyst is localized by palpation with or without intraoperative ultrasound. If the pseudocyst lies behind the stomach (or duodenum), it is approached anteriorly, through the posterior wall of the stomach (or duodenum). A portion of the posterior wall is excised, allowing entry into the cyst cavity, which is then drained. An anastomosis is created between the cyst and stomach (or duodenum). The anterior wall of the stomach (or duodenum) is then closed. If the cyst presents inferior to the stomach, it is anastomosed in a *(Print pagebreak 612)* similar fashion to a Roux-en-Y loop of jejunum (Fig. 7.8-2). Drains are placed; external drainage is sometimes necessary, especially in the setting of infection. Spontaneous resolution of pancreatic pseudocyst may be expected in most patients. If infection of the pseudocyst occurs with clinical signs of sepsis, percutaneous drainage under CT guidance can be performed, although subsequent operative drainage is often necessary.

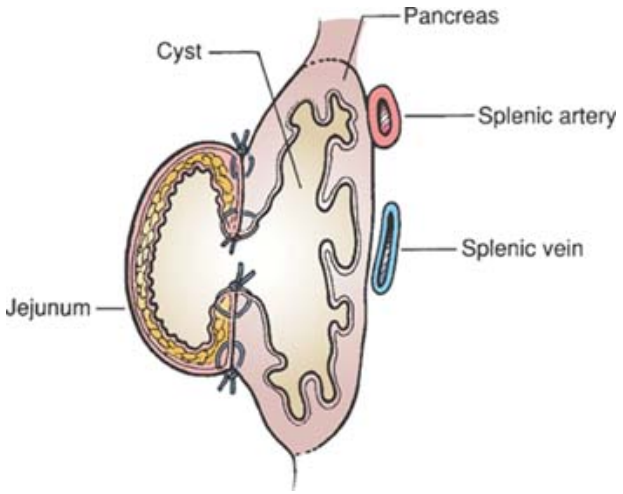

Figure 7.8-2. 2. Roux-en-Y drainage of a pseudocyst. (Reproduced with permission from Scott-Conner CEH, Dawson DL: *Operative Anatomy,* 2nd edition. Lippincott Williams & Wilkins, Philadelphia: 2003.)

Usual preop diagnosis: Pancreatic pseudocyst 2° to acute pancreatitis refractory to medical management

Summary of Procedures

Position	Supine
Incision	Midline abdominal or transverse
Unique considerations	Location of pseudocyst in relation to GI tract; NG tube
Antibiotics	Cefoxitin 1 g iv 30 min preop
VTE prophylaxis	Heparin 5000 units sq
Surgical time	1–2 h
Closing considerations	Adequate drainage
EBL	100–300 mL
Postop care	NG decompression
Mortality	5–10%
Morbidity	Bleeding: 5–7% Sepsis: < 5% Recurrence: 2–3%
Pain score	6–8

Patient Population Characteristics

Age range	15–80 yr
Male:Female	1:1
Incidence	Rare
Etiology	Acute pancreatitis; trauma
Associated conditions	Acute pancreatitis: 90%; gallstones; alcohol use; chronic pain

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Anesthetic Considerations

See Anesthetic Considerations for Pancreatic Surgery, p. 619.

Suggested Readings

1. Barthlet M, Lamblin G, Gasmi M, et al: Clinical usefulness of a treatment algorithm for pancreatic pseudocysts. *Gastrointest ENdosc* 2008; 67:245–52.

2. Neff R: Pancreatic pseudocysts and fluid collections. *Surg Clin North Am* 2001; 81(2):399–403.

3. Vitas GJ, San MG: Selected management of pancreatic pseudocysts: operative versus expectant management. *Surgery* 1992; 11 (2):123–30.

4. Warshaw AL, Rattner DW: Timing of surgical drainage for pancreatic pseudocyst: clinical and chemical criteria. *Ann Surg* 1985; 202(6):720–4.

5. Yeo CJ, Bastidas JA, Lynch-Nyhan A, et al: The natural history of pancreatic pseudocysts documented by CT. *Surg Gyn Obstet* 1990; 170:411.

Longitudinal Pancreaticojejunostomy

Surgical Considerations

Description: Pancreaticojejunostomy, as described by **Puestow,** consists of a longitudinal opening of the pancreatic duct, which is then anastomosed to a Roux-en-Y loop of jejunum (Fig. 7.8-3). This approach is necessary to ensure adequate drainage of a duct with multiple strictures and dilatations. Through a midline or transverse abdominal incision, the pancreas is exposed by mobilizing the duodenum (**Kocher maneuver**), exposing the head of the pancreas, and opening the lesser sac to visualize the body and tail. The pancreatic duct may be aspirated to identify its location and intraoperative ultrasound is commonly used, then it is incised longitudinally. A Roux-en-Y loop of jejunum is then brought up to the pancreas and anastomosed to the opened duct. A drain is left along the anastomosis; and the wound is closed in the usual fashion.

Variant procedure or approaches: A **Whipple resection (pancreaticoduodenectomy; see p. 618)** is an alternative surgical treatment for chronic pancreatitis confined to the head of the gland. Rarely, subtotal pancreatectomy is indicated.

Usual preop diagnosis: Abdominal pain with chronic pancreatitis and dilated pancreatic duct (chain of lakes)

Summary of Procedures

Position	Supine
Incision	Midline abdominal or transverse
Antibiotics	Cefoxitin 1 g iv
VTE prophylaxis	Heparin 5000 units sq
Surgical time	2–3 h
Closing considerations	Adequate drainage
EBL	300–400 mL
Postop care	Monitor for glucose intolerance
Mortality	1–4%
Morbidity	Failure to relieve pain: 25–50% Pancreatic leak: 5–10% Wound infection: 5%
Pain score	6–8

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Patient Population Characteristics

Age range	17–72 yr
Male:Female	2.5:1
Etiology	Alcoholism; biliary tract disease; idiopathic; trauma; familial pancreatitis
Associated conditions	Biliary tract disease (25–50%); hyperparathyroidism (< 5%); chronic pain; narcotic dependency

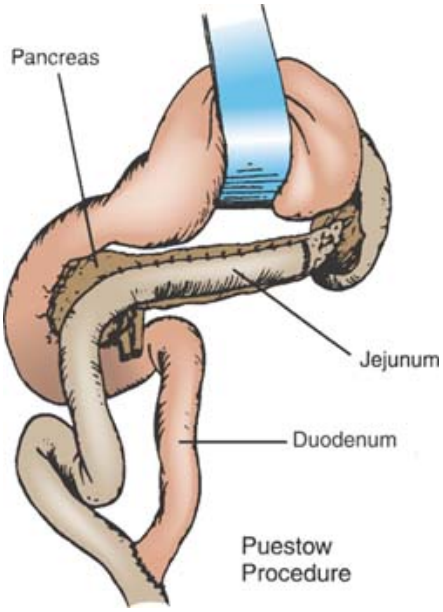

Figure 7.8-3. 3. Operative management of chronic pancreatitis with onlay Roux-en-Y pancreaticojejunostomy (Puestow). (Reproduced with permission from Hardy JD: *Hardy's Textbook of Surgery.* JB Lippincott, Philadelphia: 1988.)

Anesthetic Considerations

See Anesthetic Considerations for Pancreatic Surgery, p. 619.

Suggested Readings

1. Harrison JL, Prinz RA: Surgical management of chronic pancreatitis: pancreatic duct drainage. *Adv Surg* 1999; 32:1.

2. Howard VM, Zhaug Z: Pancreaticodenectomy (Whipple resection) in the treatment of chronic pancreatitis. *World J Surg* 1990; 14:77–82.

3. Nealon WH, Aatin S: Analysis of success in preventing recurrent acute exacerbations in chronic pancreatitis. *Ann Surg* 2001; 233:793–800.

4. Puestow CB, Gillesby WJ: Retrograde surgical drainage of the pancreas for chronic relapsing pancreatitis. *Arch Surg* 1958; 76:898–907.

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Pancreatectomy

Surgical Considerations

Description: Distal pancreatectomy is performed for tumors in the distal half of the pancreas (Fig. 7.8-4). The lesser sac is opened by dividing the gastro-colic ligament. After entering the lesser sac, the gastrosplenic ligament is divided, ligating the short gastric vessels and the left gastroepiploic vessel. The peritoneum is incised along the inferior surface of the pancreas, with care being taken to avoid injury to the middle colic vessels. Following mobilization of the spleen, the splenic artery is ligated near its origin. The inferior mesenteric vein is ligated sometimes at the inferior border of the pancreas, and the splenic vein is ligated at the proposed point of transection. The transected pancreas (Fig. 7.8-5) is usually stapled and drained, although some surgeons suture the cut end and ligate the duct. The spleen may be preserved when operating for benign disease.

Variant procedure or approaches: Subtotal pancreatectomy usually implies resecting the pancreas from the mesenteric vessels distally, leaving the head and uncinate process intact. This procedure may be performed for tumor or chronic pancreatitis. **Child's procedure** (near-total pancreatectomy) consists of removing the entire pancreas except a rim of tissue along the lesser curvature of the duodenum (Fig. 7.8-6); preserving the duodenum makes it unnecessary to reconstruct the bile duct. This procedure is usually reserved for patients with chronic pancreatitis.

Usual preop diagnosis: Carcinoma of pancreas; islet cell tumors; cystic neoplasms; chronic pancreatitis

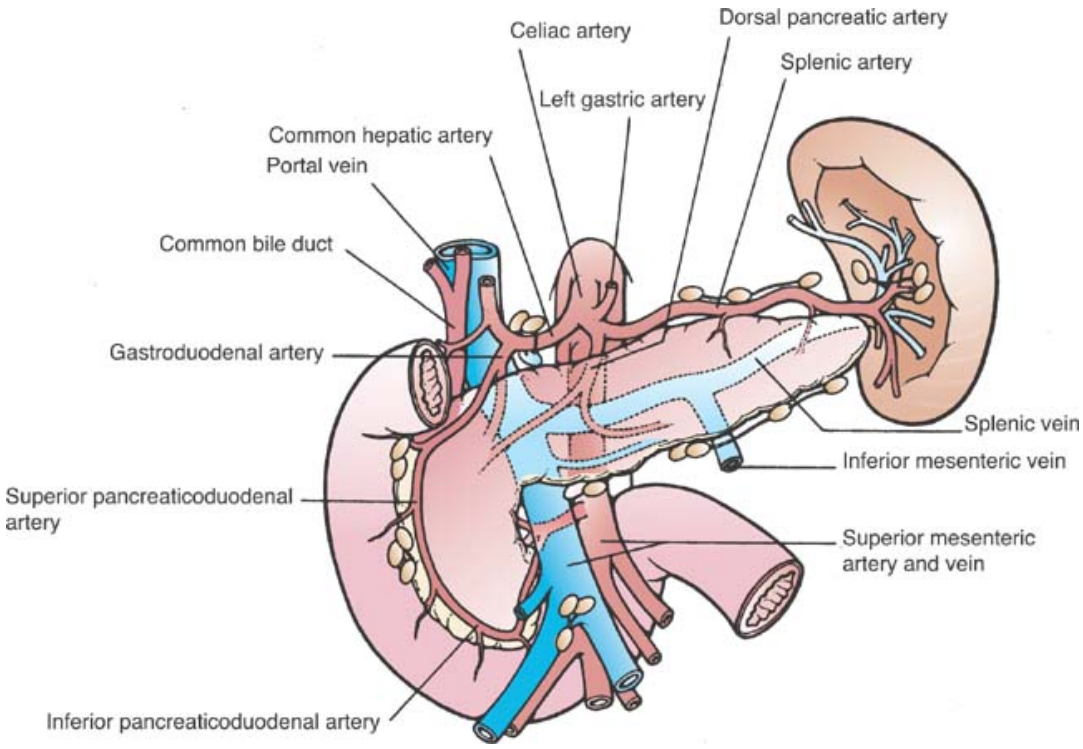

Figure 7.8-4. 4. Pancreatic anatomy. (Reproduced with permission from Scott-Conner CEH, Dawson DL: *Operative Anatomy,* 2nd edition. Lippincott Williams & Wilkins, Philadelphia: 2003.)

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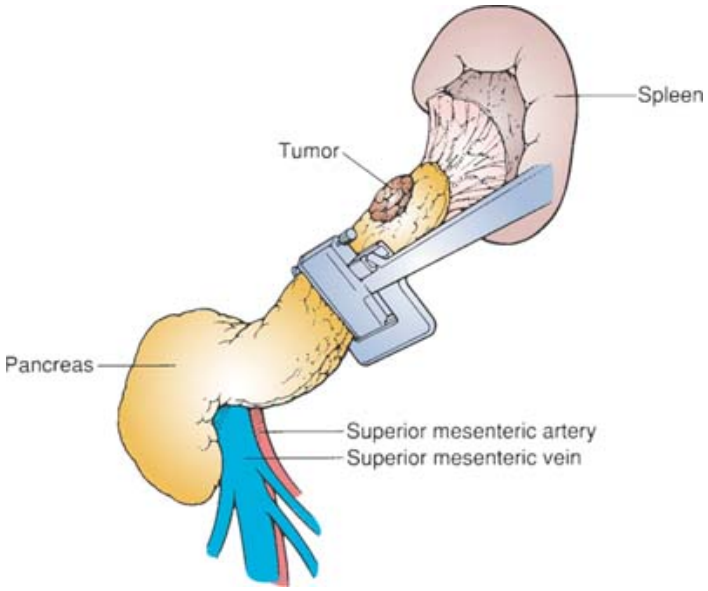

Figure 7.8-5. 5. Resection of distal pancreas. (Reproduced with permission from Scott-Conner CEH, Dawson DL: *Operative Anatomy,* 2nd edition. Lippincott Williams & Wilkins, Philadelphia: 2003.)

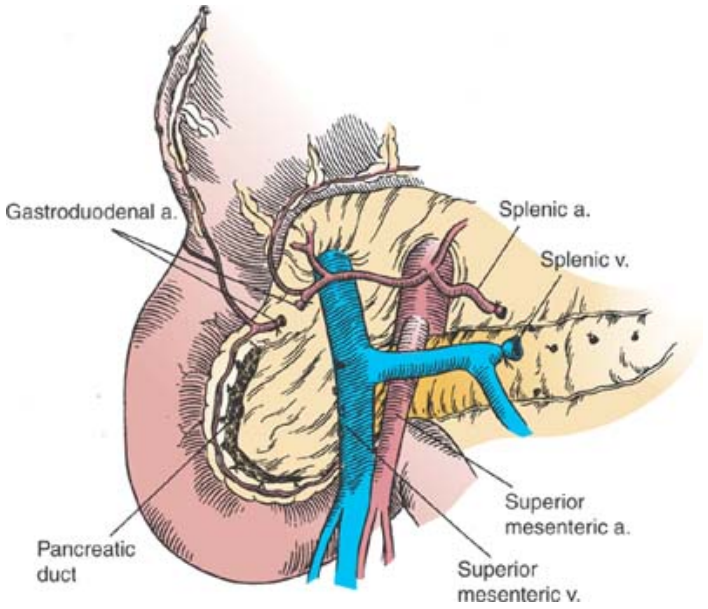

Figure 7.8-6. 6. Near-total pancreatectomy. Shown is the operative field at the conclusion of the procedure. (Reproduced with permission from Baker RJ, Fischer JE: *Mastery of Surgery,* 4th edition. Lippincott Williams & Wilkins, Philadelphia: 1997.)

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Summary of Procedures

	Distal Pancreatectomy	Subtotal Pancreatectomy	Child's Procedure
Position	Supine		
Incision	Midline abdominal or transverse		
			Preservation of vasculature of

Unique considerations	NG tube		duodenum
Antibiotics	Cefoxitin 1–2 g iv		
VTE prophylaxis	Heparin 5000 units sq		
Surgical time	2–3 h		3–4 h
Closing considerations	Adequate drainage		
EBL	300–500 mL	500–750 mL	500–1000 mL
Postop care	NG decompression; PACU		
Mortality	< 5%		
Morbidity	Diabetes: 5% Wound infection: 5% Pancreatic fistula: < 5% Common bile duct injury Hemorrhage Duodenal necrosis Pancreatic leakage Pancreatic insufficiency		90%
Pain score	6–8	6–8	6–8

Patient Population Characteristics

Age range	30–60 yr
Male:Female	1:1
Incidence	26,000/yr in the United States.
Etiology	Adenocarcinoma; chronic pancreatitis; islet cell tumors
Associated conditions	Alcoholism and biliary tract disease with chronic pancreatitis (90%); other endocrine disorders (3–5%)

Anesthetic Considerations

See Anesthetic Considerations for Pancreatic Surgery, p. 619.

Suggested Readings

1. Samuel I, Joehl RJ: Chronic pancreatitis. In *Surgery: Scientific Principles and Practice,* 4th edition. Mulholland MW, et al., eds. Lippincott Williams & Wilkins, Philadelphia: 2006, 849–60.

2. Sohn TA, Campbell KA, Pitt MA, et al: Quality of life and long-term survival after surgery for chronic pancreatitis. *J Gastrointest Surg* 2000; 4:355–64.

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Whipple Resection

Surgical Considerations

Description: A **Whipple resection** consists of a **pancreaticoduodenectomy,** followed by a **pancreaticojejunostomy**, a **hepaticojejunostomy** and a **gastrojejunostomy** (Fig. 7.8-7). On entering the peritoneal cavity, the resectability of the pancreatic tumor is determined. Contraindications to standard resection include: liver or peritoneal metastases; involvement of the superior mesenteric vessels; infiltration by tumor into root of the mesentery; and extension into the porta hepatis, with involvement of the hepatic artery. If the tumor is deemed resectable, further mobilization of the head of the pancreas is performed. The common duct is

transected above the cystic duct entry and the gall bladder is removed. After the superior mesenteric vein is freed from the pancreas, the latter is transected, with care being taken not to injure the splenic vein. The duodenum is transected 2 cm distal to the pylorus, or the stomach proximal *(Print pagebreak 619)* to the pylorus if involved by tumor. The jejunum is transected beyond the ligament of Treitz and the specimen is removed by severing the vascular connections with the mesenteric vessels. Reconstitution is achieved by anastomosing the pancreatic stump, bile duct, and duodenum into the jejunum. Drains are placed adjacent to the pancreatic anastomosis.

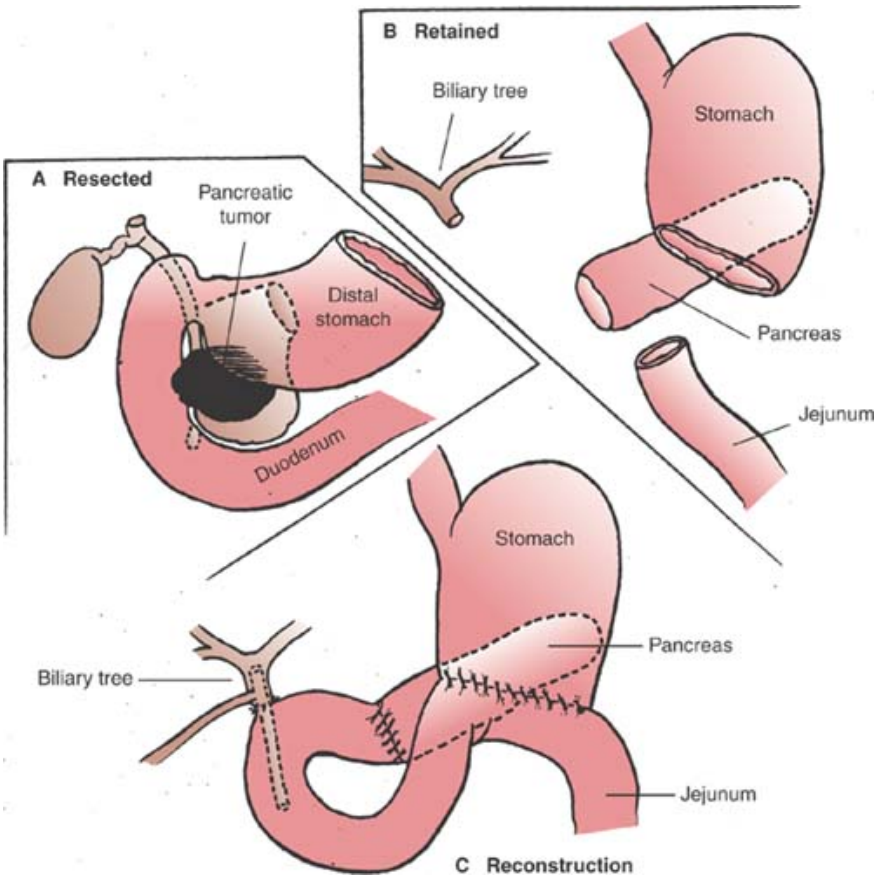

Figure 7.8-7. 7. Standard pancreaticoduodenectomy. **(A)** Structures resected, including distal stomach, entire duodenum, head and neck of pancreas with tumor, gallbladder, and distal extrahepatic biliary tree. **(B)** Structures retained, including proximal stomach, body and tail of pancreas, proximal biliary tree, and jejunum distal to ligament of Treitz. **(C)** Reconstruction: proximal pancreaticojejunostomy, hepaticojejunostomy over T tube, and distal gastrojejunostomy. (Reproduced with permission from Hardy JD: *Hardy's Textbook of Surgery,* 2nd edition. JB Lippincott, Philadelphia: 1988.)

Variant procedure or approaches: There are several variants that consist of extensions of the Whipple procedure: **total pancreatectomy; regional pancreatectomy,** involving resection and reconstruction of the retropancreatic superior mesenteric vein and/or artery; and the pylorus-preserving **pancreaticoduodenectomy** as described above. In addition, the distal pancreatic stump may be anastomosed to the posterior wall of the stomach.

Usual preop diagnosis: Carcinoma of the pancreas; malignant cystadenomas; chronic pancreatitis

Summary of Procedures

	Whipple	Total Pancreatectomy	Regional Pancreatectomy
Position	Supine		
Incision	Midline abdominal or transverse (chevron)		
Unique considerations	Large-bore iv lines		
Antibiotics	Cefoxitin 1–2 g iv		
VTE prophylaxis	Heparin 5000 units sq		

Surgical time	4–5 h	4–6 h	5–6 h
Closing considerations	Adequate drainage		
EBL	500–750 mL	750–1000 mL	750–1500 mL
Postop care	NG decompression; PACU/ICU	NG decompression; diabetes management	
Mortality	5–10%	12%	15%
Morbidity	Delayed gastric emptying: 25% Pancreatic fistula: 10–20% Sepsis: 5–15% Hemorrhage: 5% MI: 1–3% Biliary fistula: < 2%	NA 5% < 5% < 1 %	10–20% 25% 5% < 5% < 2%
Pain score	7–9	7–9	7–9

Patient Population Characteristics (for cancer of pancreas)

Age range	40–80 yr
Male:Female	1:1
Incidence	10th most common cancer in the United States. (33,000/yr)
Etiology	Familial and genetic factors (p16, K-vas); tobacco; diabetes; alcohol; diet; pancreatitis
Associated conditions	See Etiology, above.

Anesthetic Considerations For Pancreatic Surgery

(Procedures covered: drainage for pancreatitis; drainage of pancreatic pseudocyst; pancreaticojejunostomy; pancreatectomy; Whipple resection)

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Preoperative

Patients presenting for pancreatic surgery can be divided into four groups: (a) those with acute pancreatitis, who failed medical treatment and may be extremely ill, presenting for operative excision or drainage of necrotic or infected foci; (b) patients with adenocarcinoma of the pancreas; (c) patients with neuroendocrine active (60–70%) or inactive islet cell tumors (mainly insulinoma and gastrinoma; rarely VIP-oma and glucagonoma); and (d) patients suffering from the sequelae of chronic pancreatitis (e.g., pseudocyst or abscess).

Respiratory	Respiratory compromise—such as pleural effusions, atelectasis, and ARDS, progressing to respiratory failure, may occur in up to 50% of patients with acute pancreatitis. Postop mechanical ventilation may be needed for these patients **Tests:** Consider CXR; ABG; others as indicated from H&P.
Cardiovascular	Patients with acute pancreatitis may suffer from severe intravascular volume depletion 2° plasma exudation and in severe cases 2° hemorrhage (erosion of blood vessels). Aggressive volume resuscitation with crystalloids, colloids, and blood products may be required during surgery. Hypocalcemia is often present (arrhythmias and ↓ myocardial contractility). Serum K+ may be elevated (2° acidosis or renal failure associated with acute pancreatitis) or decreased (2° watery diarrhea associated with gastrinoma, VIP-oma, prolonged NG suction), and should be

	corrected before surgery. Hypokalemia resistant to K^+ replacement may point to ↓ Mg^{++} and warrants replacement. **Tests:** ECG; electrolytes; others as indicated from H&P.
Gastrointestinal	Jaundice and abdominal pain are common presenting Sx in this group of patients. The presence of ileus (common in acute pancreatitis) or intestinal obstruction should mandate full-stomach precautions and rapid-sequence induction. Electrolyte abnormalities are common and may be 2° metabolic acidosis (↑ K^+ 2° acute pancreatitis) or alkalosis and intestinal losses (↓ K^+ and ↓ Mg^{++} 2° diarrhea, NG suction). Acute pancreatitis is associated with ↓ Ca^{++} (omental fat saponification) and ↑ Na^+ (dehydration). Gastrinoma (Zollinger-Ellison syndrome) is associated with diarrhea, severe peptic ulcer, and GERD. VIP-oma often causes massive watery diarrhea (up to 20 L). Electrolyte abnormalities should be treated preop. **Tests:** Electrolytes; glucose; LFTs; others as indicated from H&P.
Renal	Patients should be evaluated for renal insufficiency predominantly 2° dehydration, with anesthetic plan adjusted accordingly. **Tests:** BUN; creatinine; others as indicated from H&P.
Endocrine	Many patients with acute pancreatitis have diabetes 2° loss of islet cells. Endocrine tumors of the pancreas are linked (10–30%) with multiple endocrine syndrome type I (MEN I), featuring adenoma of the pituitary, parathyroid, and/or pancreas. Endocrine tumors also can secrete parathyroid hormone-related peptide, growth hormone-RH, and corticotrophin-RH and adrenocorticotropin, and may be associated with ↑ Ca^{++}, acromegaly, and Cushing's syndrome. Insulinoma is the most common endocrine tumor of the pancreas and can result in severe hypoglycemia, necessitating frequent periop blood glucose measurements (up to every 15 min has been suggested). Surgical manipulation of the insulinoma may result in massive release of insulin. VIP-oma is associated with mild diabetes and ↑ Ca^{++} **Tests:** Electrolytes; glucose; others as indicated from H&P.
Hematologic	Hct may be falsely elevated, 2° hemoconcentration, or low, 2° hemorrhage. Coagulopathy may be present (DIC). **Tests:** CBC with differential; Plt; consider PT, PTT, fibrinogen.
Laboratory	Other tests as indicated from H&P.
Premedication	Consider midazolam 1–2 mg. Note: full-stomach precautions in patients with intestinal obstruction (see p. B-4): ranitidine (50 mg iv 30–60 min preop) and 0.3 M 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, establishing correct catheter placement in the epidural space can be accomplished by injecting 1–2% lidocaine (50–100 mg) via the catheter to elicit a segmental block. The use of epidural anesthetic techniques for postoperative pain management in patients undergoing major, non-vascular abdominal surgery has been shown to provide superior pain control compared with IV-PCA. However, adequate pain control can be achieved with the use of IV-PCA.

Induction	The patient with bowel obstruction or ileus is at risk for pulmonary aspiration, and rapid-sequence induction with cricoid pressure is indicated (see p. B-4). If the patient is clinically hypovolemic, restore intravascular volume (colloid, crystalloid, or blood products) prior to induction and titrate induction dose of sedative/hypnotic agents.

	Etomidate (0.2–0.4 mg/kg iv) or ketamine (1–3 mg/kg iv) may provide better hemodynamic stability during induction of anesthesia. Both thiopental and propofol are associated with a significant reduction of SVR.
Maintenance	Standard maintenance (see p. B-2). **Combined epidural/GA:** The epidural catheter ideally is placed at the level of a dermatome corresponding to the surgical site (generally mid-to-low thoracic spine). This allows the use of both lipophilic and hydrophilic drugs at the lowest possible dose and adds flexibility to the anesthesiologist's drug selection while also minimizing the likelihood of side effects. A continuous infusion (after an initial bolus) is the preferred mode of administering local anesthetics via the epidural catheter because satisfactory analgesia can be achieved without major fluctuations in BP. Lower concentrations (e.g., bupivacaine 0.125–0.25%) are used to provide supplemental analgesia, while higher concentrations (e.g., bupivacaine 0.5%) generally provide optimal surgical conditions (i.e., a complete sensory and motor block). The infusion rate is contingent on the desired segmental spread, but often ranges between 5–10 mL/h. Lipophilic opioids can effectively be given by continuous infusion (e.g., fentanyl 2 mcg/mL) and offer the advantage of limited segmental spread. Longer-acting hydrophilic opioids (e.g., hydromorphone 0.4–0.6 mg or morphine 2–3 mg for epidural placement at the lower thoracic spine) can be injected as a bolus along with an initial bolus dose of local anesthetics. However, hydrophilic opioids tend to spread rostrally within the intrathecal space and may cause sedation and respiratory depression if dosed too aggressively. Vulnerable patients include the elderly, patients with obstructive airway disease, and patients suffering from obesity. The use of epidural local anesthetics is associated with sympatholysis and ↓ BP has to be anticipated. Critical ↓ BP is treated with fluids and/or vasopressors (e.g., ephedrine 5–10 mg iv). In patients undergoing a surgical procedure with a significant risk for major bleeding it is prudent to delay administration of epidural local anesthetics until the critical part of surgery has been completed. Systemic sedatives (e.g., opiates and benzodiazepines) should be minimized as they increase the likelihood of postop respiratory depression. **Low-dose ketamine:** If the placement of an epidural catheter is not an option, the use of a low-dose ketamine iv infusion may be considered as an adjuvant analgesic regimen (0.5 mg/kg bolus before surgical incision, followed by an infusion of 0.2 mg/kg/hr that is stopped 30 min before the end of surgery). Low-dose ketamine provides opioid-sparing effects (30–50%), reduces the incidence of opioid-mediated side effects, decreases postop wound hyperalgesia, and may decrease development of chronic pain after surgery. The risk for occurrence of psychomimetic side effects appears to be low in patients undergoing general anesthesia. **Gabapentin:** Single dose administration of 600–1200 mg gabapentin po before surgery should be considered as an adjuvant analgesic regimen in patients who are not eligible for an epidural anesthetic technique. Gabapentin provides opioid-sparing effects (30–50%), reduces postoperative pain (30–50%) and lowers the incidence of opioid-mediated side effects. Gabapentin can cause postoperative sedation. However, available data suggest that pronounced sedation only occurs in a small fraction of patients.
Emergence	The decision to extubate a patient at the end of surgery depends on the patient's underlying cardiopulmonary status. Patients undergoing extensive surgery with major fluid shifts may require prolonged intubation until sufficient reduction of soft tissue edema (compromised airway) is achieved.
Blood and fluid requirements	Anticipate large fluid loss IV: 14–16 ga × 2 NS/LR 6–10 mL/kg/h Warm fluids ± Humidify inhaled gases Blood loss can be significant, and blood products should be immediately available. Adequate large-bore IV access is mandatory. Procedures tend to be long and extensive, leading to hypothermia and large 3rd-space fluid loss. If procedure does not involve cancer or infection, cell-saving devices can be utilized. Intraoperative fluid management should be titrated to a patient's particular needs (adequate peripheral perfusion, urine output > 0.5 mL/kg/min, no base deficit). Overly generous

		intraoperative fluid administration may be associated with increased postoperative morbidity (e.g., delayed recovery of bowl function) and extended hospital stay.
Monitoring	Standard monitors (see p. B-1) UO Arterial line ± CVP or PA catheter	Most pancreatic surgery is associated with major fluid shifts and fluid loss. Availability of an infusion device assisting rapid delivery of intravenous fluids at body temperature is advised. Invasive monitoring is usually required. In patients with cardiopulmonary compromise, a PA catheter may prove helpful for intraop cardiovascular and fluid management. Use forced-air warmer to maintain normothermia.
Positioning	and pad pressure points eyes	
Complications	Hypocalcemia	Release of pancreatic lipase → omental fat saponification.
	Hypovolemia	Extensive 3rd-spacing, major hemorrhage during pancreatic dissection.
	Severe hypoglycemia	Uncontrolled insulin release from insulinoma
	Sepsis	Manipulation of infected tissue → cardiovascular instability, respiratory deterioration, DIC.

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Postoperative

Complications	Hyperglycemia Electrolyte imbalance Hypovolemia Hypothermia Hypocalcemia PONV (see p. B-6) VTE (see p. B-7)	Total pancreatectomy is associated with a brittle diabetes that can be very difficult to control. Subtotal resections lead to variable hyperglycemia.
Pain management	Continuous epidural analgesia (see p. C-2). PCA (see p. C-3).	Patient should be recovered in an ICU or hospital ward that is accustomed to treating the side effects of epidural opiates (e.g., arterial hypotension, respiratory depression, breakthrough pain, nausea, pruritus). Postop pain control with an epidural rather than a PCA regimen is superior in patients undergoing major abdominal surgery. Particularly in high-risk patients, an epidural regimen may reduce the incidence of respiratory failure. The improvement of other major clinical outcomes (e.g., cardiovascular) has not yet been demonstrated convincingly in patients undergoing nonvascular abdominal surgery.
Tests	CXR (if CVP placed); ABG; Hct	Electrolytes; Ca++; glucose; Plts—as indicated for postop management.

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Suggested Readings

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