



Indications

- Failed endoscopic retrieval of impacted distal CBD stones (Cameron and Sandone 2007)
- Sphincter of Oddi dysfunction (Miccini et al. 2010)
- Pancreas divisum (Madura and Madura 2007)
- Local excision of small to moderate-sized ampullary adenomas
- Ampullary or pancreatic duct orifice stenosis with recurrent abdominal pain or pancreatitis
- Primary or secondary papillitis (Stefanini et al. 1974)

Preoperative Preparation

Magnetic resonance cholangiopancreatography (MRCP) or ERCP to map the anatomy of the CBD, main and/or accessory pancreatic ducts

- Informed consent for surgery
- Anti-embolism stockings and heparin 5000 unit subcutaneous injection
- Perioperative antibiotics
- Preoperative checklist and “time out”

Pitfalls and Danger Points

- Pancreatic complications such as postoperative pancreatitis due to trauma to the pancreatic duct, with subsequent pancreatic pseudocyst or abscess (Anderson et al. 1985)
- Postoperative duodenal fistula secondary to a leak from either the closure of the duodenotomy or the sphincteroplasty
- Postoperative hemorrhage

Operative Strategy

Duodenotomy

After performing a Kocher maneuver, the second part of the duodenum (descending duodenum) is palpated to identify the ampulla or a mass in the case of a duodenal adenoma. If the ampulla cannot be identified, a biliary Fogarty catheter placed via the cystic duct can be used as described below before making a duodenotomy. A longitudinal (vertical) duodenotomy is preferred, in case it has to be extended in either direction.

Preventing Duodenal or CBD Leak

The anterior wall of the bile duct and the posterior wall of the duodenum merge to share a common wall (Moody et al. 1991). When performing the bile duct sphincteroplasty, one should pay close attention to the extent of the cephalad incision at the 12 o'clock position. Leakage from the apex can happen if the sphincterotomy is extended beyond that common wall, hence leaving an enterotomy in the back wall of the duodenum or a choledochotomy in the anterior wall of the CBD. It is also crucial to carefully approximate the CBD and the mucosa of the duodenum at the apex of the vertical incision, to prevent leakage.

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Identifying and Protecting the Pancreatic Duct

When transecting across the ampulla of Vater in the case of a mucosal resection of a periampullary adenoma, or when performing a papillotomy to expose the interior of the ampulla, one should be cognizant that there are two separate ducts that converge at this junction. The orifice of the pancreatic duct is normally inferior to the bile duct (Stefanini et al. 1974). A No. 3 Bakes dilator or a pediatric feeding tube can be used to identify, preserve, and protect the pancreatic duct while performing the bile duct sphincteroplasty. Great care should be taken to avoid obliterating the orifice of the pancreatic duct by pulling the duodenal mucosal over it while approximating the inferior border of the bile duct to the cut edge of the duodenal mucosa. In fact, it is best to place no sutures from the 4 o'clock to the 8 o'clock positions, to avoid injury to the pancreatic duct orifice.

Closure of Duodenotomy

The duodenotomy is closed transversely using a two-layer closure technique to prevent narrowing of the duodenal lumen and stricture.

Operative Technique

Incision and Exploration

Enter the abdomen through a vertical midline incision from below the xiphoid to above the umbilicus using a skin scalpel and electrocautery. Perform a thorough exploration of the liver, gallbladder, stomach, duodenum, small bowel, and colon to assess for abnormalities or metastatic disease. Protect the wound edges with moist lap pads and place a self-retaining retractor for optimum exposure. We favor a Bookwalter retractor system.

Mobilization of the Gallbladder and Kocher Maneuver

If the gallbladder is present, mobilize it from the gallbladder fossa with electrocautery using a dome down approach. Identify and tie the cystic artery with 3-0 silk. Dissect the cystic duct free of any adipose or fibrous tissues and prepare it for access with a biliary Fogarty catheter (if needed to identify the ampulla) and subsequent ligation.

Next, perform a generous Kocher maneuver to elevate the duodenum away from the flimsy retroperitoneal attachments, elevating the second portion of the duodenum (D2) up almost to the level of the anterior abdominal wall, facilitating exposure of the ampulla of Vater.

Location of the Ampulla of Vater and Duodenotomy

Attempt to palpate the ampulla or the mass through the duodenum to locate the correct position for the duodenotomy. If the ampulla cannot be easily identified, create a cystic ductotomy using Metzenbaum scissors or a #15 blade and carefully pass a biliary Fogarty catheter through the cystic duct, down the CBD and out of the ampulla. Once the catheter is in the duodenum, inflate the balloon to facilitate the location of the area of the ampulla.

In patients who have had a prior cholecystectomy, perform a small choledochotomy and insert a Bakes dilator or biliary Fogarty catheter through the distal CBD, pass it through the ampulla, and palpate it in the duodenum (Cameron and Sandone 2007). Place stay sutures of 3-0 silk in the duodenum over the ampulla and perform a longitudinal duodenotomy using electrocautery (Fig. 91.1).

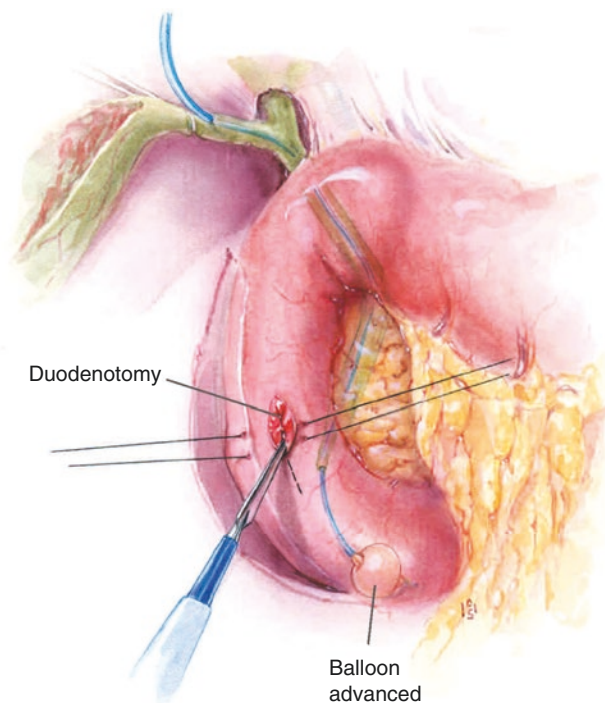


Fig. 91.1 (Reprinted from Cameron and Sandone 2007, p. 33. Copyright © 2008 by PMPH-USA, Ltd. Reprinted with permission)

Mucosal Resection of Periapillary Adenoma

Assess the mass for local resectability (i.e., confined to the mucosa), extent, and benign physical features. Place circumferential 3-0 silk mucosal stay sutures in the normal duodenal mucosa at least 5 mm away from the adenomatous lesion and hold these with mosquito clamps. We typically place at least four of these mucosal stay sutures. Elevate the mucosal mass off the submucosa by injecting 1% lidocaine with 1:100,000 epinephrine solution circumferentially at the junction of the mass and normal mucosa (Fig. 91.2). Use needle-tip electrocautery to elevate and resect the mass with a full thickness mucosal resection and a 5-mm circumferential margin. Identify and transect the distal bile duct and its surrounding muscular fibrous tissue, including these with the specimen.

Bile Duct Sphincteroplasty

Identify the orifices of the bile duct and the pancreatic duct. Open the distal common bile duct 1 cm in the vertical direction at the 12 o'clock position using Potts scissors and electrocautery, giving access to the glistening mucosa of the distal common bile duct (Fig. 91.3). Then, approximate the edges of the duodenal mucosa and the bile duct using interrupted 5-0 or 6-0 absorbable suture such as polydioxanone (PDS). We find it best to commence these sutures inferiorly and to advance cephalad to the apex of the sphincteroplasty (Fig. 91.4). Gather the sutures in a hemostat to provide retraction. Once a No. 4 Bakes dilator is passed through the sphincteroplasty and up the common bile duct with ease, place the apex suture and tie it. The length of the sphincteroplasty will vary depending on the reason for the procedure

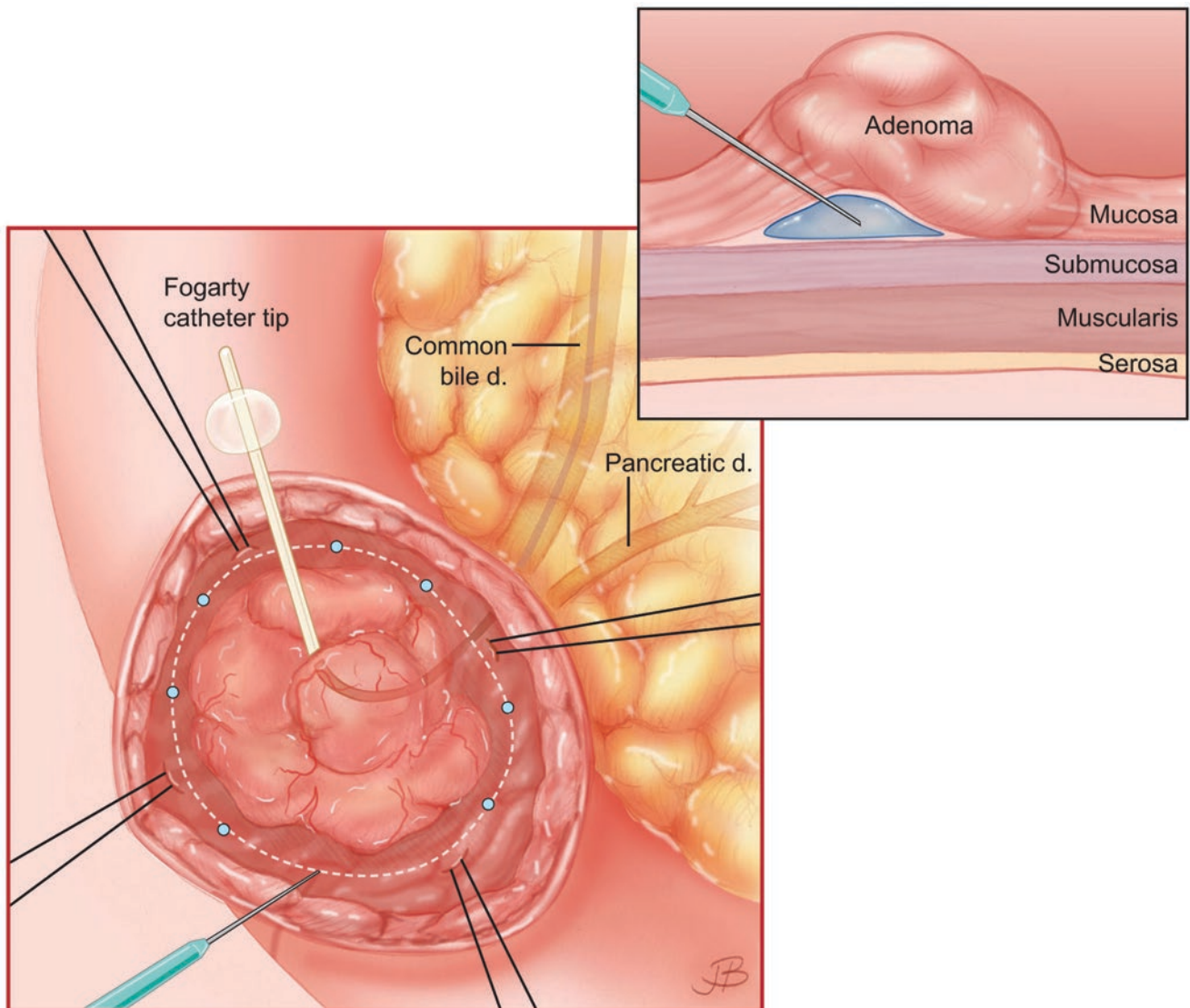


Fig. 91.2

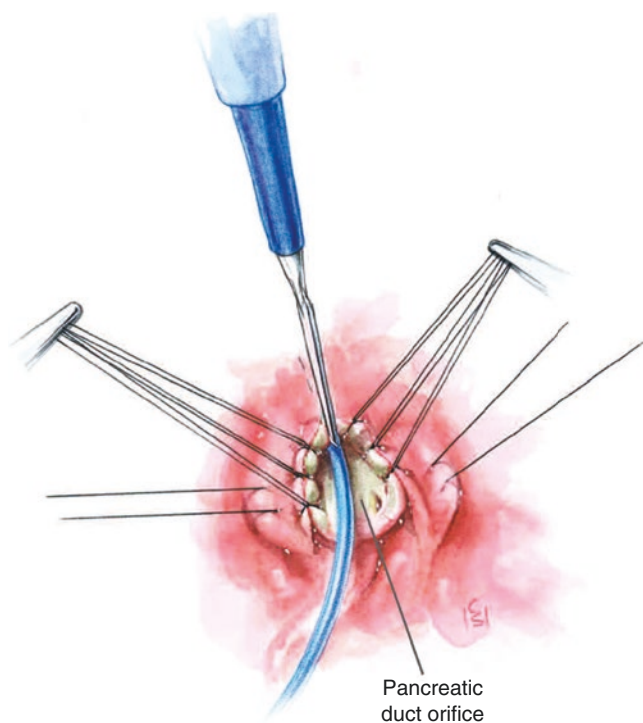


Fig. 91.3 (Reprinted from Cameron and Sandone 2007, p. 34. Copyright © 2008 by PMPH-USA, Ltd. Reprinted with permission)

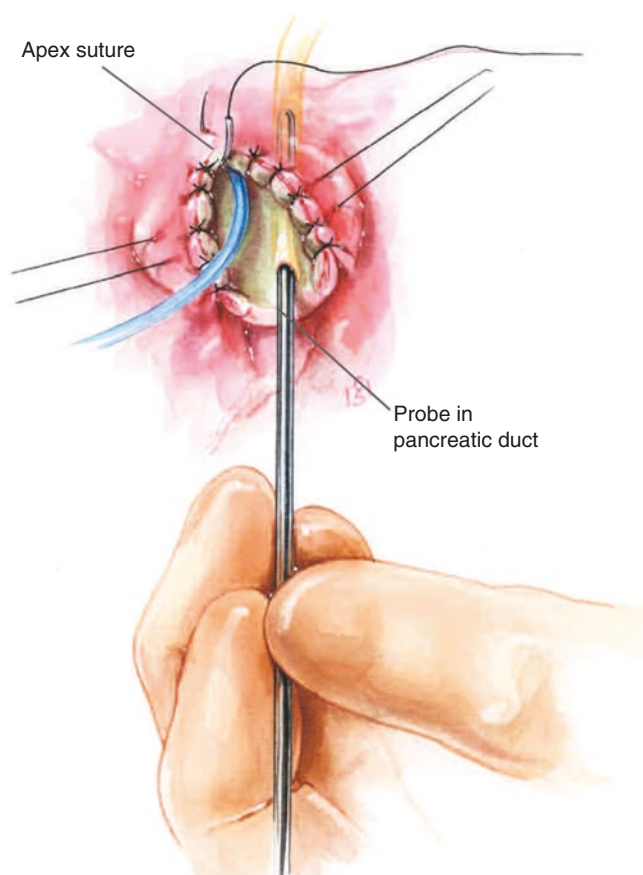


Fig. 91.4 (Reprinted from Cameron and Sandone 2007, p. 34. Copyright © 2008 by PMPH-USA, Ltd. Reprinted with permission)

and the length of the muscular sphincter. However, the sphincteroplasty should not be extended beyond the shared common wall of the duodenum and bile duct to prevent intra-peritoneal and retroperitoneal leaks (Cameron and Sandone 2007).

Pancreatic Ductoplasty and Septotomy

Identify the pancreatic duct orifice inferiorly (it may be quite small and difficult to see; look for a tiny bit of clear pancreatic juice egressing). If after careful inspection, the pancreatic duct cannot be properly identified, administer intravenous secretin (1 unit/kg), which causes a brisk flow of clear pancreatic juice (Kelly and Rowlands 1996). Perform the pancreatic duct septotomy by incising the common wall between the anterior surface of the pancreatic duct and the posterior wall of the bile duct. The length of the septotomy is usually 4–5 mm in length at which point the septum thickens as the bile duct and pancreatic duct diverge (Cameron and Sandone 2007). If the orifice of the pancreatic duct is too narrow for the blade of the Potts scissors, insert a metal probe into the pancreatic ductal orifice and incise the anterior wall of the duct using a scalpel against the metal of the probe (Fig. 91.5). Approximate the edges of the duodenal mucosa and the pancreatic duct using interrupted 5-0 or 6-0 absorbable sutures such as polydioxanone (PDS). At the completion of the pancreatic ductoplasty, the orifice should allow passage of at least a No. 2 Bakes dilator. Be careful not to force a larger dilator through what may be a narrow orifice and duct. If a mucosal excision has been performed, approximate the mucosal edges to close the defect as noted above. With large mucosal

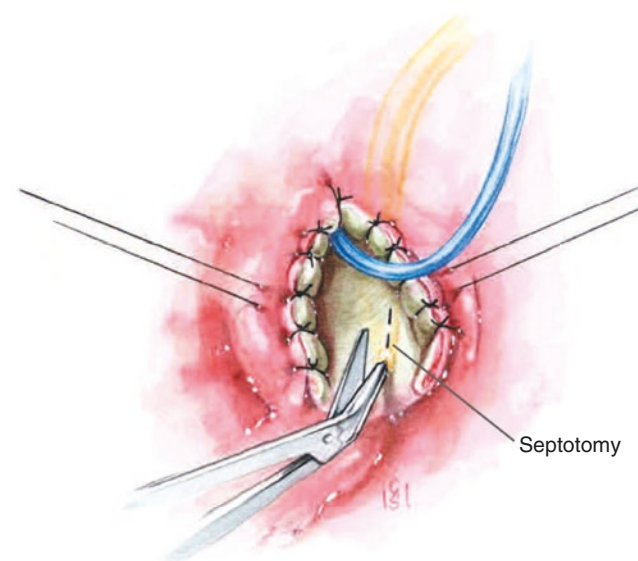


Fig. 91.5 (Reprinted from Cameron and Sandone 2007, p. 35. Copyright © 2008 by PMPH-USA, Ltd. Reprinted with permission)

excisions, the defect cannot be fully closed. In such a case, reepithelialization occurs rapidly as part of the healing process.

Completing the Cholecystectomy and Closing the Duodenotomy

If a biliary Fogarty catheter was used, remove it, tie the cystic duct with a 2-0 silk ligature below the ductotomy, apply a small titanium clip to mark the site, and transect the cystic duct, thus completing the cholecystectomy. Meticulously assess the mucosal resection site, sphincteroplasty, and septoplasty for hemostasis. Advance a nasogastric tube (NGT) through the pylorus and into the duodenum beyond the ampullary area. Close the duodenotomy in a horizontal fashion using a two-layer closure technique. First, use 3-0 Vicryl sutures for the inner layer, inverting the mucosa in a continuous Connell fashion. Then carefully approximate the seromuscular layer with an outer layer of interrupted 3-0 silk Lembert sutures. Place a bowel clamp distal to the duodenotomy closure site and 200 ml of methylene blue diluted in normal saline (10 drops of methylene blue in 200 ml of normal saline) is injected into the NGT to assess for any leak, checking both anteriorly and posteriorly. Once the absence of a leak is confirmed, pull the NGT back into the stomach and secure it to the nose. Return the duodenum to its normal posterior position and may be covered with omentum if so desired.

Drainage and Abdominal Closure

Copiously irrigate the abdomen with warm sterile antibiotic solution and suction. Closed-suction drain placement is optional. We typically do not place drains. If one opts to place a drainage catheter around the duodenotomy site, the closed-suction plastic catheter (4–5 mm diameter) is brought out through a puncture wound in the right flank, lateral to the right rectus muscle. The drain is secured with two 4-0 surgical steel sutures. Close the midline fascia using running No. 2 nylon. Irrigate the subcutaneous tissue with sterile antibiotic solution and approximate it with running 3-0 Vicryl sutures. Close the skin with 4-0 absorbable monocryl sutures. Apply benzoin and steri-strips to the incision and cover with it a sterile dressing.

Postoperative Care

1. The nasogastric tube placed intraoperatively is removed on the morning of postoperative day (POD) #1 and the patient is started on sips of water and ice chips.
2. Intravenous proton pump inhibitor such as pantoprazole is administered every 12 h to maintain a gastric pH > 5.0.
3. Monitoring of labs (i.e., hepatic function panel, amylase, lipase, complete blood count) at least once postoperatively.

4. Early ambulation at least 3 times per day, with hourly use of incentive spirometry.
5. Foley catheter is removed on POD #1 or #2.
6. Diet is advanced to clear liquids on POD #2.
7. On POD #3, the patient's diet is advanced to a regular house diet.
8. The patient is discharged home on POD #3 or #4.

Complications

Postoperative Acute Pancreatitis

Postoperative ileus, gastric dilation, surgical site infections, pain, and postoperative pancreatitis are common complications of transduodenal sphincteroplasty. Pancreatitis may be due to trauma to the pancreas or pancreatic duct during the Kocher maneuver, excessive manipulation and instrumentation of the pancreatic duct while attempting to identify its location, or iatrogenic coverage of the pancreatic duct orifice with duodenal mucosa during the bile duct sphincteroplasty. In the former two instances, the postoperative pancreatitis is often self-limited (Stefanini et al. 1974; Moody et al. 1991). However, occasionally, patients may have an exaggerated inflammatory response, leading to a significant increase in fluid requirements and hyperamylasemia in the immediate postoperative period. The temporary systemic volume overload and inflammatory response can lead to cardiovascular and pulmonary (such as acute respiratory distress syndrome) complications, especially in the elderly population (Anderson et al. 1985).

Duodenal Leak and Fistula

The posterior surface of the duodenum and the anterior surface of the distal common bile duct share a common wall. If the distal common bile duct is opened beyond the common wall, an open posterior duodenotomy remains after completion of the sphincteroplasty. The anterior duodenotomy closure site is also a potential source of duodenal leak and fistula which is often due to a technical error in closure. In both instances, bile, pancreatic juice, and enteric contents can freely spill into the abdominal cavity, causing a duodenal fistula which should be controlled by image-guided percutaneous drain placement. However, a serious duodenal leak can be life-threatening and may require a reoperative intervention. In such a case, the tissue surrounding the duodenotomy is often too friable and inflamed to be closed primarily. The duodenal leak can be controlled by performing a pyloric exclusion procedure, to include a gastrojejunostomy and omental patch repair of the duodenotomy leak site. Another option would be to patch the duodenal leak with healthy jejunal serosa, brought up as a Roux-en-Y jejunal limb. Multiple

drains should be placed around the duodenum and in the retroperitoneum for wide drainage and to control the leak. An optional jejunostomy tube for feeding purposes may also be placed at the time of the reoperation.

Intraoperative and Postoperative Hemorrhage

The posterior branches of the pancreaticoduodenal arcade (i.e., where the posterior superior and the posterior inferior pancreaticoduodenal arteries meet) run in close proximity with the common wall between the anterior surface of the pancreatic duct and the posterior wall of the distal common bile duct. One should be cognizant of this anatomical relationship and be meticulous and careful when performing a septotomy, so as not to inadvertently cause uncontrollable intraoperative hemorrhage by cutting into the posterior arterial branches (Furukawa et al. 1999). Delayed postoperative hemorrhage may be a sequela of intra-abdominal pancreatic or duodenal leaks that lead to erosion into an arterial branch (usually the inferior pancreaticoduodenal artery) that can cause significant and sudden bleeding (Moody et al. 1991).

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Further Reading

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