Operations for Pancreatic Pseudocyst

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Operative Strategy

Background/Natural History

Pancreatic pseudocyst represents a heterogeneous disease process that may arise as a consequence of either acute or chronic pancreatitis. Pseudocysts are seen less frequently in the setting of acute pancreatitis (AP). Many AP patients develop intraabdominal fluid early in the disease process, but these fluid collections commonly resolve. When fluid collections persist beyond 4 weeks and develop a fibrous wall, they may be accurately termed pseudocyst. In the setting of AP, differentiation must be made between a true pseudocyst and walled-off necrosis (WON), the latter of which is far more common in this disease. The presence of solid necrosis in a peripancreatic collection changes treatment approach dramatically.

Chronic pancreatitis (CP) patients develop pseudocysts that are often different morphologically compared to AP patients – pseudocysts in CP may be simple; however, are just as often multiple, small, and densely involving pancreatic parenchyma (Fig. 99.1). It is critically important for treating physicians to understand the anatomy of both the pancreatic parenchyma as well as the pancreatic duct prior to initiating therapy. Pancreatic pseudocysts may be solitary and large – these cysts are durably treated by drainage procedures. On the other hand, pancreatic pseudocysts may be small or multiple; in this case, resection may be the most appropriate therapy. More thorough understanding of pseudocyst natural history has shown that asymptomatic pseudocysts do not require treatment.

Pseudocyst patients should be evaluated by a multidisciplinary treatment team including both gastroenterologists with experience in advanced endoscopic technique as well as surgeons with experience treating patients with pancreatic inflammatory disease. Development of advanced endoscopic techniques such as endoscopic retrograde cholangiopancreatography (ERCP) and endoscopic ultrasound (EUS) has permitted many pseudocyst patients to be treated durably by these minimally invasive procedures (Fig. 99.2A–C). Indications for surgical intervention in contemporary practice are often reserved for patients with recurrent pseudocyst, more challenging anatomy, or associated problems such as biliary or duodenal stricture.

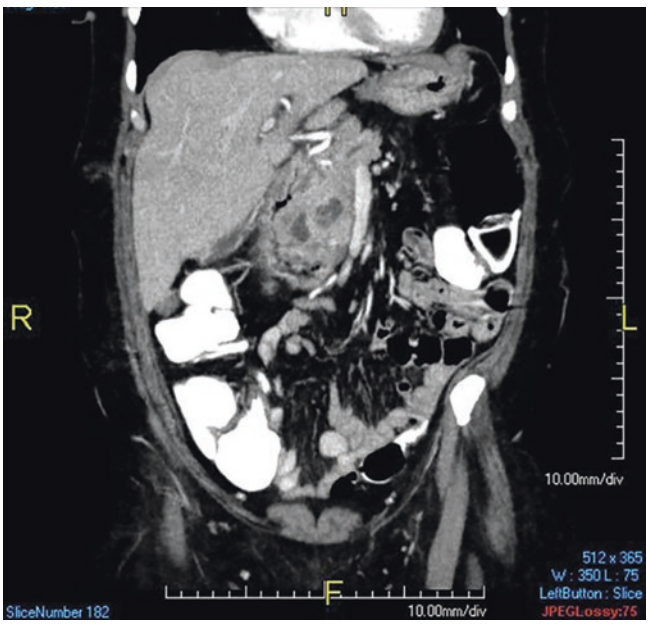

Fig. 99.1 Multiple small, loculated pseudocysts in the pancreatic head caused abdominal pain and recurrent acute pancreatitis. Treatment was by pancreatoduodenectomy

Operative Indications

The predominant indication for treatment of a pancreatic pseudocyst is abdominal pain. The clinician should strive to differentiate abdominal pain caused by mass effect of the

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C. E. H. Scott-Conner et al. (eds.), *Chassin's Operative Strategy in General Surgery*,
https://doi.org/10.1007/978-3-030-81415-1_99

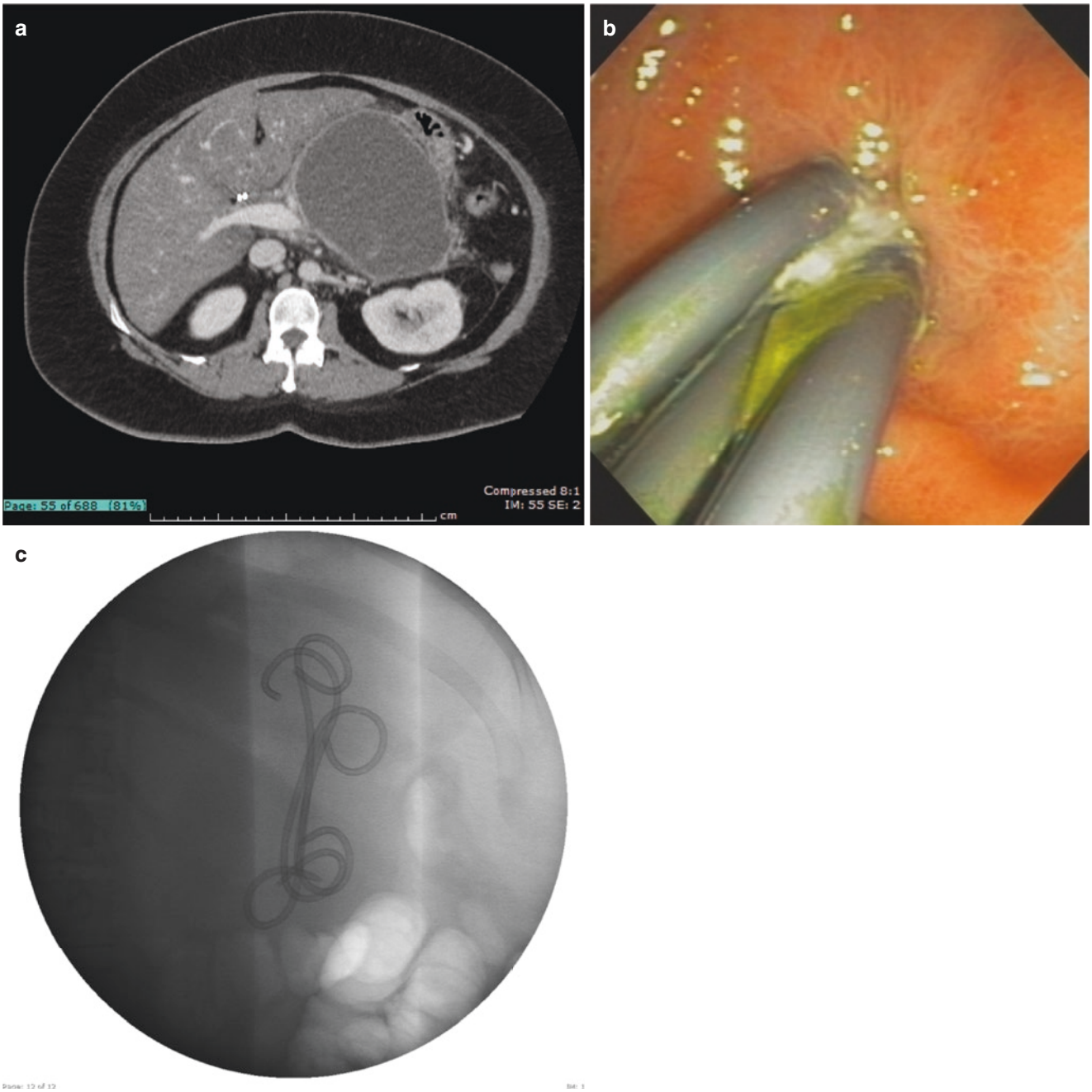

Fig. 99.2 Endoscopic management of pancreatic pseudocyst. (**a**) Computed tomography showing retrogastric pseudocyst (note thickened wall). (**b**) Endoscopic visualization after placing 3 10 French pigtail catheters. (**c**) Postprocedure radiograph documenting position of pigtail catheters

pseudocyst from pain of recurrent acute pancreatitis. Symptoms from mass effect are often described as a constant fullness, with dull pain that may worsen in the postprandial state. Nausea and vomiting are common. Pain related to acute pancreatitis is typically sharp ("knife-like"), and may be more episodic than pain related to mass effect. This distinction is important as draining a pseudocyst will usually relieve discomfort from mass effect, but will not address symptoms caused by recurrent acute pancreatitis (e.g., in patients with a "disconnected" pancreatic tail). Additional indications for treatment include obstruction of the intestinal tract (most often the duodenum) or bile duct and hemorrhage (Table 99.1). Patients who experience sudden increase of pain should be evaluated for the presence of a visceral arterial pseudoaneurysm (Fig. 99.3A–C).

Table 99.1 Operative indications

Pain (must distinguish between pain from mass effect and that of recurrent acute pancreatitis)
Gastrointestinal obstruction
Biliary obstruction
Bleeding (visceral arterial pseudoaneurysm)

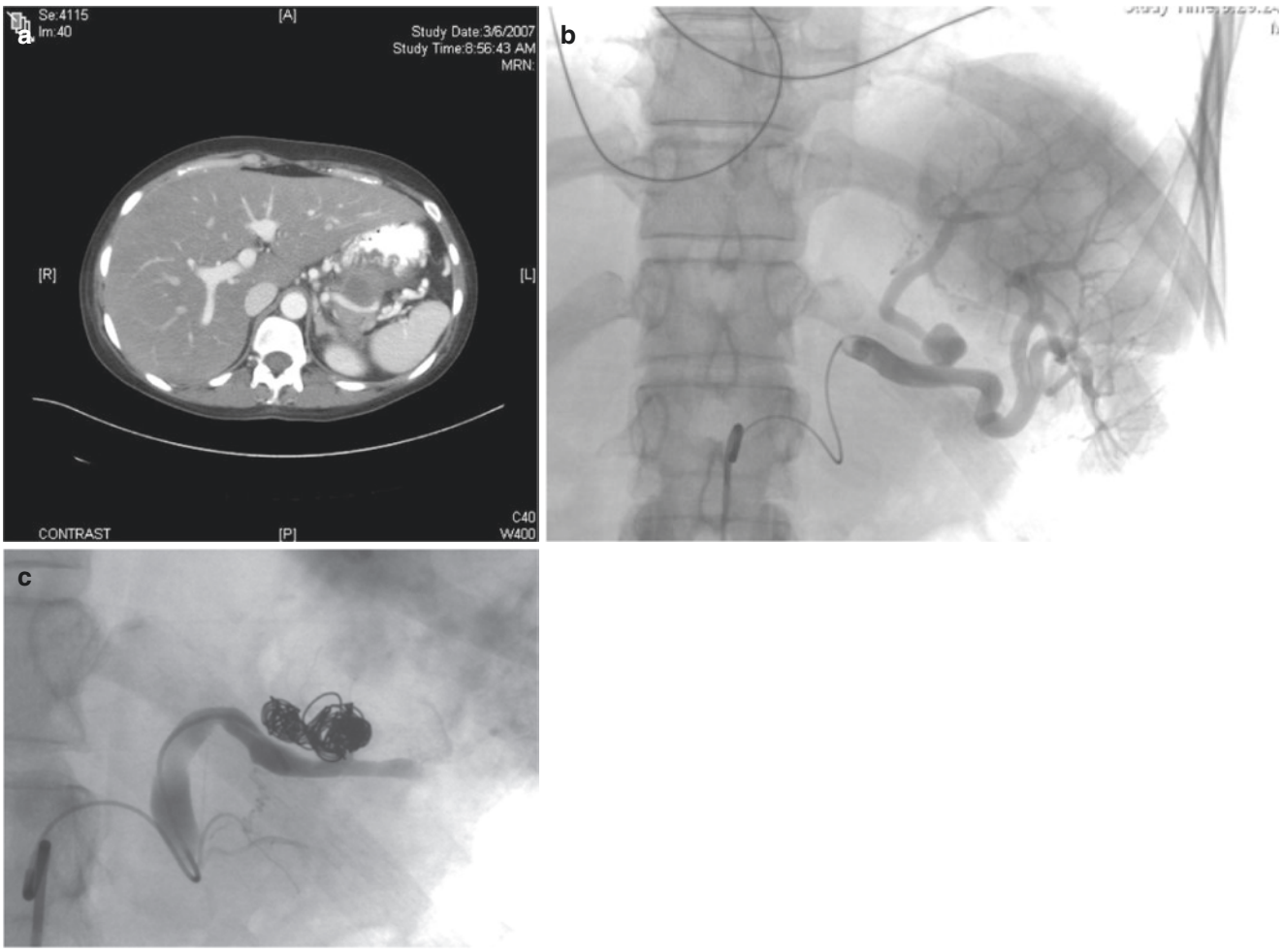

Fig. 99.3 Pseudoaneurysm arising from the splenic artery in a pancreatic tail pseudocyst caused by chronic pancreatitis. (**a**) Axial computed tomography image documenting splenic artery with pseudoaneurysm coursing through pseudocyst. (**b**) visceral angiogram demonstrating splenic artery pseudoaneurysm before and (**c**) after treatment by coil embolization

Preoperative Preparation and Perioperative Considerations

Selecting the proper intervention for pseudocyst depends critically on understanding the pancreatic ductal and parenchymal anatomy. Ideally, pseudocyst patients should undergo multidisciplinary evaluation by a team that includes experienced ERCP endoscopists and surgeons with experience in managing patients with pancreatic inflammatory disease. The first branch point in treatment algorithm is endoscopic versus surgical therapy. A pseudocyst forming simply from disruption of a branch duct or incomplete disruption of the main pancreatic duct may be treated effectively with endoscopic techniques (Fig. 99.4A, B). On the other hand, if the main pancreatic duct is completely disrupted or severely strictured, endoscopic treatment is far less likely to provide durable therapy and therefore surgical treatment should be considered.

The next branch point relates to drainage versus resection: at this point, understanding the pancreatic parenchymal situation is important as well. When considering a drainage procedure, the remnant gland must produce a sufficient volume of pancreatic digestive juice in order to keep a cyst enterostomy patent. In the case of a small pancreatic remnant (i.e., tail), resection is preferable, as recurrence of a pseudocyst will be high if drainage is attempted. The quality of the pancreatic parenchymal remnant should be considered as well. If the pancreatic remnant has signs of severe chronic pancreatitis, that is, stricture or irregularity of the main pancreatic duct, dilation of the side branches, atrophy of the gland, etc., the patient may best be served by resection. As mentioned above, it is important to take a detailed history with respect to symptoms – often times with careful questioning the clinician can distinguish between symptoms of recurrent left-sided pancreatitis (often left-sided pain radiant to the left shoulder; episodic nature of "attacks") as opposed to constant discomfort and gastrointestinal (GI) symptoms such as nausea and vomiting that are associated with pseudocyst impinging on the gastrointestinal tract.

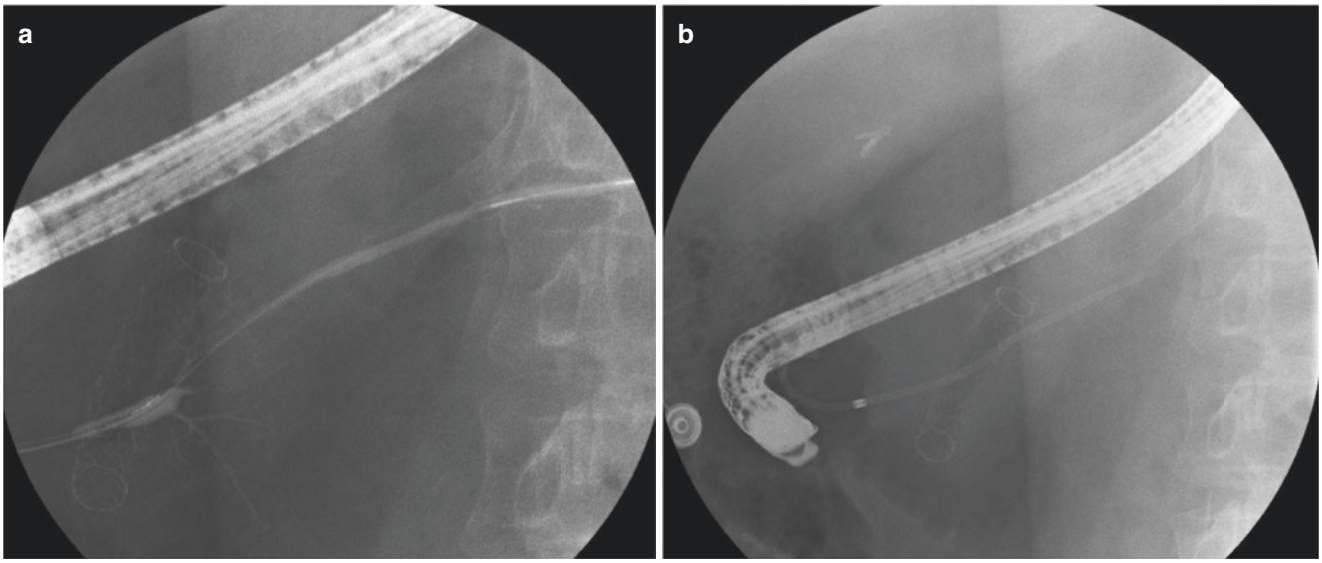

Fig. 99.4 Endoscopic treatment of pancreatic duct disruption. (**a**) Endoscopic retrograde cholangiopancreatography demonstrating stricture and leak in main pancreatic duct at pancreatic neck. (**b**) after stent placement bridging leak in main pancreatic duct

Cross-sectional imaging is an important step in the preoperative work-up. Both computed tomography (CT) and magnetic resonance imaging (MRI) are useful to evaluate pseudocyst size, location, pancreatic parenchyma volume and quality, duodenal stricture, biliary stricture, and vascular anatomy. The presence of splanchnic venous thrombosis often results in collateral venous transformation, which complicates operative conduct particularly if the operation is necessary in the area of the pancreatic head. The presence of bile duct stricture and duodenal stricture should also be considered – careful history and physical exam may suggest both duodenal and biliary stricture, findings that may be confirmed by thorough review of cross-sectional imaging.

Cross-sectional imaging documents the volume of parenchyma and provides clues as to the quality of the parenchyma feeding the pseudocyst. Secretin-enhanced MRI can provide objective data regarding parenchymal function. A small or atrophic pancreatic tail may not provide enough pancreatic digestive juice to maintain patency of a cyst-enterostomy. The cyst location should be noted with thoughts toward drainage. An ideal drainage procedure provides dependent drainage (many pancreatic surgeons favor Roux-en-Y cyst jejunostomy over cyst gastrostomy for just this reason). Finally, it is critical to differentiate an inflammatory pseudocyst from a neoplastic cyst (Fig. 99.5). Neoplastic cysts (mucinous cystic neoplasm, symptomatic serous cystadenoma, intraductal pancreatic mucinous neoplasm, etc.) should be resected and biopsy of the cyst wall should be routine during procedures, draining the presumed inflammatory pancreatic pseudocysts to exclude the presence of neoplastic epithelium. If any suspicion exists for diagnosis of neoplastic cyst, preoperative EUS with sampling of cyst fluid should be mandatory.

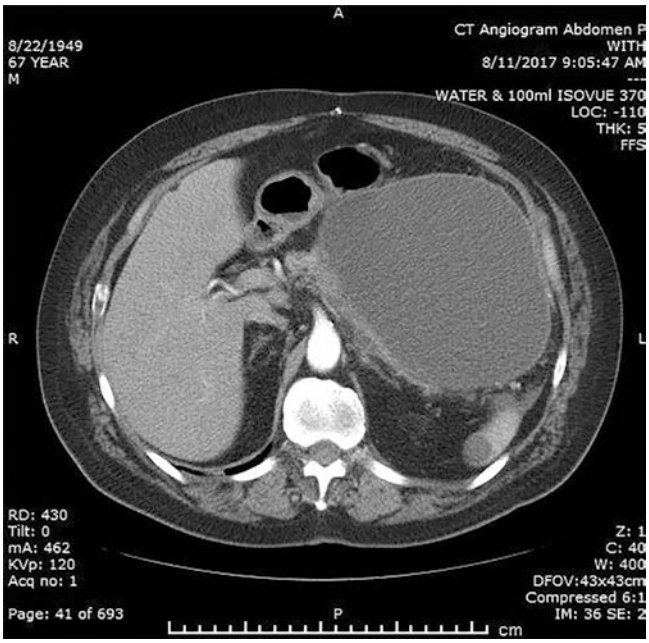

Fig. 99.5 Mucinous cystic neoplasm mistaken for pancreatic pseudocyst (no preoperative fluid analysis was performed). Operative cyst-gastrostomy was performed. Remedial operation included distal pancreatectomy, splenectomy, and partial gastrectomy

Magnetic resonance cholangiopancreatography (MRCP) also provides useful information about the biliary tree – the presence of stricture, biliary dilation, and stones in the gallbladder or bile ducts. It is worth noting that MRCP is not as helpful delineating pancreatic ductal anatomy in the presence of a large cysts or fluid collections. In select patients, endoscopic retrograde cholangiopancreatography is helpful

to delineate pancreatic ductal anatomy. Indeed, ERCP is still considered the gold standard for imaging the pancreatic duct. If necessary, ERCP should be performed close to the time of surgery to minimize any consequence of contaminating the pseudocyst with endoscopic manipulation.

Preoperative laboratory evaluation should include objective nutritional metrics such as serum albumin, prealbumin, and transferrin concentration. Liver chemistry values should be evaluated as well – elevation in the serum alkaline phosphatase concentration may be the first, subtle hint of biliary obstruction.

"Prehabilitation" is routine; this plan includes nutritional supplementation, smoking cessation, and aggressive focus on increasing physical activity.

Vascular consequences of pancreatitis include visceral arterial pseudoaneurysm (Fig. 99.3), portal hypertension, and venous thromboembolism. Clinicians must be alert to the presence of visceral pseudoaneurysm, which may occur at virtually any branch of the splanchnic arterial tree. Portal hypertension in pancreatitis typically arises after mesenteric venous thrombosis. Collateral vascular development around the porta hepatis (cavernous transformation) or through the short gastric/gastroepiploic system (left-sided or "sinistral" portal hypertension) may complicate operative conduct substantially; these anatomic problems should always be on the surgeon's radar screen. Finally, pancreatitis patients have a remarkably high incidence of venous thromboembolism; aggressive perioperative chemical prophylaxis should be the norm.

Operative Strategy and Technique

A laparoscopic approach is favored if possible, particularly for patients undergoing drainage procedures. Operative resection of pseudocyst is usually quite challenging due to the dense inflammatory response surrounding the cyst and pancreas; patients who require resection are often approached with open surgery. For open operation, upper midline and low subcostal incisions both provide adequate exposure of the upper abdomen. Intraoperative ultrasound provides a tremendous amount of information, and should be considered standard of care in pancreatic surgical practice.

A thorough abdominal examination includes evaluation of the liver for presence fibrosis/cirrhosis and portal hypertension. The small bowel is evaluated from ligament of Treitz to the ileocecal valve; this maneuver is particularly important in patients who may require Roux-en-Y drainage. Intraoperative ultrasound documents location of the pseudocyst relative to surrounding enteric and vascular structures, presence of any mesenteric venous thrombosis, presence and volume (if any) of solid necrotic debris, and presence of biliary strictures or common bile duct stones. The abdominal exploration should also seek to identify occult metastatic disease; chronic pancreatitis patients have significantly elevated incidence of pancreatic ductal adenocarcinoma, and though rare, necrotizing pancreatitis is occasionally caused by adenocarcinoma.

Cyst-Enterostomy

Large cysts are suitable for drainage procedure if they have enough pancreatic volume to support long-term patency of the cyst enterostomy. In general, the rule of thumb regarding drainage of pancreatic pseudocyst is to "play it as it lies." That is to say, cysts lying immediately behind the stomach maybe suitable for cyst-gastrostomy, cysts abutting the duodenum may be suitable for cyst-duodenostomy, and cysts discreet from the stomach and duodenum maybe best approached with Roux-en-Y cyst-jejunostomy. Some pancreatic surgeons favor Roux-en-Y cyst-jejunostomy for all pseudocysts. Those in this camp suggest that the Roux limb provides more dependent drainage particularly relative to cyst-gastrostomy, and that this dependent drainage may be more durable. In actuality, the volume of pancreatic digestive juice flowing across the cyst-entreric anastomosis is likely a more important factor than anatomic dependency when considering long-term expected patency. Always biopsy the cyst wall for frozen section during the course of operation to exclude the diagnosis of neoplastic cyst.

Cystogastrostomy

Make a midline incision from the xiphoid to the umbilicus. Explore the abdomen. Use intraoperative ultrasound to evaluate the liver, biliary tree, pancreatic parenchyma, and pseudocyst – with particular focus on vascular relationships to the pseudocyst. If the gallbladder contains stones, perform cholecystectomy and cholangiography. Explore the lesser sac by exposing the posterior wall of the stomach from its lesser curvature aspect. If the cyst is densely adherent to the posterior wall of the stomach, cystogastrostomy is the operation of choice. Make a 6- to 8-cm incision in the anterior wall of the stomach (Fig. 99.6) opposite to the most prominent portion of the retrogastric cyst. Obtain hemostasis with electrocautery or ligatures. Then insert an 18-gauge needle through the back wall of the stomach into the cyst and aspirate. Make an incision about 3–6 cm in length through the posterior wall of the stomach and carry it through the anterior wall of the cyst. Excise an adequate ellipse of tissue from the anterior wall of the cyst for frozen-section histopathology to rule out the presence of a neoplastic cyst or adenocarcinoma.

Approximate the cut edges of the stomach and cyst by means of continuous or interrupted 3-0 prolene sutures

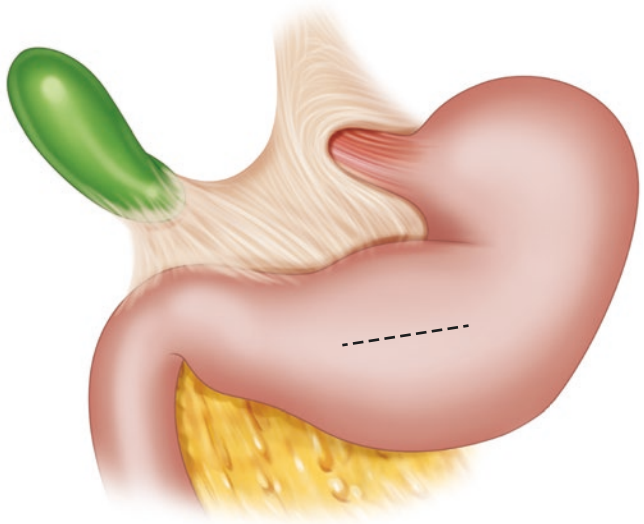

Fig. 99.6 Anterior gastrotomy site illustrated

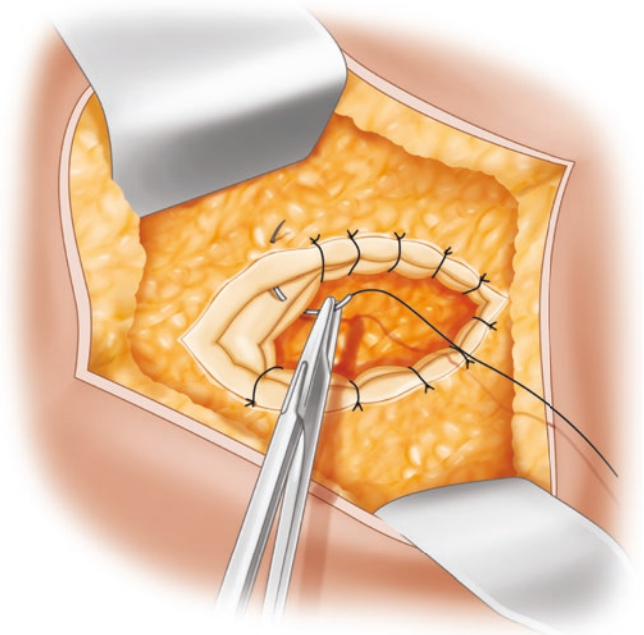

Fig. 99.7 Construction of cyst-gastrostomy

(Fig. 99.7). Close the defect in the anterior wall of the stomach in two layers of suture – running 3-0 vicryl and interrupted 2-0 silk.

Roux-en-Y Cystojejunostomy

Make a long midline incision and explore the abdomen. Check the gallbladder for stones. The first step of the Roux-en-Y cyst-jejunostomy is to prepare the dependent portion of

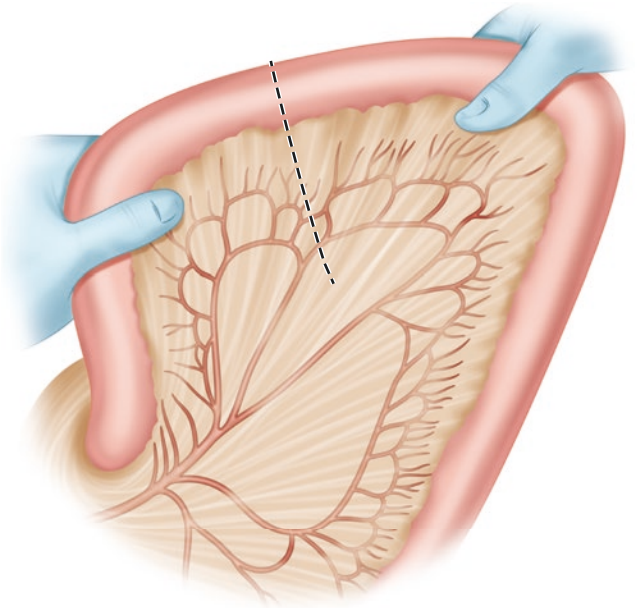

Fig. 99.8 Site of small bowel and mesentery division

the cyst by carefully clearing adherent omentum and small bowel. The cyst's relationship with vascular structures should be assessed, particularly the splenic artery in pancreas body and tail cysts. Prepare a segment of jejunum at a point about 30–40 cm beyond the ligament of Treitz. Divide the jejunal mesentery as illustrated in Fig. 99.8. Then divide the jejunum with a GIA stapler. Liberate enough of the mesentery of the distal jejunal segment to permit the jejunum to reach the cyst without tension. Often times the small bowel mesentery is foreshortened; in this situation dividing the first mesenteric arcade helps to achieve satisfactory length of the Roux limb.

Make a small window in an avascular portion of the transverse mesocolon to the left of the middle colic vessels for body/tail cysts, and deliver the distal jejunal segment into the supramesocolic space. Cyst-enterostomy should include a long cystotomy. Excise a window of anterior cyst wall and send it for frozen-section histopathologic examination. Perform a two-layer anastomosis between the open end of jejunum and the window in the anterior cyst wall. Insert interrupted 3-0 or 4-0 PG Lembert sutures. Then use 3-0 silk sutures to attach the mesocolon to the jejunum at the point where it passes through the mesocolon.

Anastomose the divided proximal end of the jejunum to the antimesenteric border of the descending limb of the jejunum at a point 60 cm beyond the cystojejunal anastomosis. Align the open proximal end of jejunum so that its opening points to the cephalad direction. Make a 1.5 cm incision in the antimesenteric border of the descending jejunum using electrocautery and complete the jejunojejunostomy. Close the mesenteric defect.

Resection

Small cysts, multiple cysts, or cysts arising in a very small remnant pancreatic tail may be considered for resection. These morphologies are typically found in the setting of chronic pancreatitis. Cysts localized to the pancreatic tail should be approached by distal pancreatectomy. Occasionally, the spleen maybe preserved – usually spleen preservation is accomplished in the fashion of Warshaw by dividing the splenic artery and splenic vein proximally and in the splenic hilum. More commonly in the setting of chronic pancreatitis, the splenic vein has thrombosed and left-sided (sinistral) portal hypertension has developed – established sinistral hypertension generally makes splenic salvage impossible from a technical standpoint. In general, ligating the splenic artery as a first step in distal pancreatectomy decreases the risk of hemorrhage. This maneuver is not always possible because of the dense retroperitoneal inflammatory response associated with chronic pancreatitis. Distal pancreatectomy in the setting of sinistral portal hypertension is often quite challenging. It is worth noting that if the operative conduct progresses to medial mobilization of the spleen and pancreatic tail (as in the approach to splenectomy in a trauma situation), oozing type hemorrhage may be quite brisk. Once the surgeon initiates this maneuver (medial mobilization), it is important to continue with some alacrity until the splenic artery has been ligated and splenic venous collaterals have been controlled.

Pancreatic Head Resection

Small/multiple pseudocysts in the pancreatic head or those causing biliary obstruction should be approached by pancreatic head resection. In general, many pancreatic surgeons treating inflammatory pancreatic disease favor parenchymal sparing approaches such as duodenal preserving pancreatic head resection. The caveat to this approach is that the duodenal sweep must not be heavily involved with the inflammatory response. It is possible to perform duodenal preserving pancreatic head resection (such as Frey, Beger, Izbicki type of operation) with choledochoenterostomy in patients with biliary obstruction. Choledochoduodenostomy is a reasonable choice for biliary bypass if necessary. Dividing the bile duct completely and performing end-to-side choledochoduodenostomy minimizes the hazard of sump syndrome.

External Drainage

External drainage is mentioned only to be discouraged in patients with true pseudocysts (which by definition include pancreatic duct disruption). Percutaneous drainage of pseudocyst in communication with the pancreatic duct results in a controlled external pancreatic fistula; however, recurrent pseudocyst is to be expected when the percutaneous drain is removed.

Postoperative Care

Follow-Up

Long-term follow-up is important for any patient having pseudocyst treatment. Despite excellent selection, anywhere from 5% to 15% of patients will experience cyst recurrence. In addition, the natural history of inflammatory pancreatic disease is such that disease progression may present problems such as recurrent acute pancreatitis, biliary or duodenal obstruction, and exocrine or endocrine insufficiency. After satisfactory recuperation from operation, the surgeon may pass care of the pseudocyst patient to a gastroenterologist or primary physician. Excellent communication at this point highlights the need for aggressive medical screening (i.e., for exocrine/endocrine insufficiency, periodic evaluation of liver chemistry function to identify biliary stricture, etc.) as well as supports a low threshold for cross-sectional imaging and return consultation with the pancreatic specialist if recurrent symptoms develop.

Pearls

- Pseudocyst patients are best evaluated in a multidisciplinary setting including experienced clinicians – pancreatic surgeons and gastroenterologists who possess advanced endoscopic skills.
- Pseudocyst may be treated endoscopically or operatively depending on individual characteristics of the cyst and pancreatic duct and parenchyma.
- It is critical to understand underlying pancreatic ductal and parenchymal anatomy prior to undertaking treatment.
- Percutaneous drainage will not provide durable therapy for true pancreatic pseudocysts (those with pancreatic duct disruption).
- Beware of vascular consequences of pseudocyst (and the causative pancreatic inflammatory disease) such as visceral arterial pseudoaneurysm and splanchnic venous thrombosis with portal hypertension/collateral vein development.

Further Reading

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