CHAPTER 37

Diagnosis and Management of Pancreatic Pseudocysts, Pancreatic Ascites, and Pancreatic Fistulas

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PANCREATIC PSEUDOCYSTS

Pancreatic pseudocysts are localized collections of pancreatic secretions that occur as a result of pancreatic inflammation. Pseudocysts may be located within pancreatic parenchyma or in one of the potential spaces that separate the gland from the adjacent abdominal viscera. Pseudocysts may contain bacteria or inflammatory cells, but the absence of liquefaction necrosis distinguishes pseudocysts from pancreatic abscesses. Unlike congenital cysts or cystic neoplasms, pseudocysts lack a true epithelial lining.

Pseudocysts are formed during an attack of acute pancreatitis when inflammation disrupts pancreatic duct integrity and pancreatic secretions accumulate in the interstices of the gland. The diagnosis should be suspected when a recovering patient again develops pain, nausea, fever, elevated serum amylase, or a mass in the abdomen. Alternatively, a patient may fail to improve after an attack of acute pancreatitis and further investigation reveals a pseudocyst. In chronic pancreatitis, ductal strictures, inspissated secretory protein, or intrapancreatic calcifications may obstruct the pancreatic duct or its branches and produce localized dilations. These areas coalesce and lose their epithelial lining as they enlarge to form a pseudocyst. The patient may complain of a change in his usual pain syndrome or of symptoms of an abdominal mass. Frequently, there is no specific history of pain exacerbation or sign of acute inflammation.

Epidemiology

In the United States, approximately 1% of admissions to acute care hospitals (50–100 admissions per 100,000 population) are due to the complications of pancreatitis. Alcohol abuse and gallstone disease are responsible for more than 75% of cases, with trauma and postoperative complications accounting for most of the remainder (1). Pseudocysts occur in a small fraction of patients with pancreatitis. Bradley et al. (2), reviewing the medical records of 923 patients admitted to Grady Memorial Hospital in Atlanta, found that only 10% had a documented pseudocyst despite the high prevalence of ethanol abuse in the patient population. Patients who are referred for special diagnostic tests are far more likely to have pseudocysts. Siegelman et al. (3) found that 41 of 59 patients (69%) referred for computed axial tomographic scan (CT) of the pancreas had pseudocysts, and Anderson and Chapman (4) found 87 patients with pseudocysts (61%)

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in a series of 142 patients with chronic pancreatitis referred to their surgical practice. Table 1 shows the presumed cause of over 1,200 pseudocysts reported since 1972. Ethanol abuse and biliary tract disease account for most of the cases, and men outnumber women 2:1 in most series. Congenital pancreatic disease in infants and children, trauma in adolescents and younger adults, and idiopathic and medication-related problems in the geriatric population widen the age range for development of pseudocysts. However, the average age for discovery of a pseudocyst is approximately 45 years. This reflects the influence of alcohol abuse and biliary tract disease.

Pathophysiology

Pseudocyst fluid is similar to plasma in electrolyte composition, with dramatically elevated amylase and lipase values (20). Albumin and total protein concentration are usually somewhat less than serum levels but reflect the high protein content of pancreatic juice. Trypsin concentration may be greater than 7 μg/ml. Some have suggested that pseudocysts associated with acute pancreatitis are more likely to contain "inflammatory" fluid (21) than pancreatic juice, but there are few data to support the presumption. Transient electrophoretic changes in serum amylase may occur coincident with pseudocyst formation and disappear after cyst resolution. It has been suggested that the presence of this "aged" amylase in amounts greater than 15% of the total amylase in serum could serve as a screening test for pseudocysts (22). Warshaw and Rattner (23) also claimed that the altered isoenzyme pattern was associated with the development of a fibrous pseudocyst capsule and could be used to distinguish candidates for internal versus external surgical drainage (vide infra). Neither suggestion has been widely implemented, probably because of the small size and retrospective nature of the primary studies.

Several large surgical series (9–13, 15, 17) totaling 483 patients demonstrated that one-third of the cysts were located in the head and two-thirds in the body or tail of the gland. Extension into the lesser sac, perirenal spaces, or retroperitoneum is not unusual, and pseudocysts have been found within the liver and spleen or extending into the mediastinum. Multiple cysts were found by surgeons in approximately 10% of the operations documented, although imaging studies show multiple cysts in almost twice as many patients. Pseudocysts associated with acute attacks of pancreatitis tend to be irregular in contour and may be difficult to distinguish from inflamed parenchyma, particularly in the earliest stages. Chronic pseudocysts are more likely to be smoothly rounded and may be separated from other structures by a fibrous granulation tissue capsule that enhances with intravenous contrast on CT scan.

Clinical Presentation

Most patients with pancreatic pseudocysts have abdominal pain (Table 2). Nonspecific symptoms, such as nausea, vomiting, jaundice, and weight loss, may be related to peptic ulcer disease, hepatitis, or pancreatic inflammation, but may also reflect gastric outlet obstruction or common bile duct obstruction from an expanding pseudocyst. Detection of pseudocysts with barium studies of the gastrointestinal tract depended upon indention or displacement of a hollow viscus, and was notoriously insensitive. In addition, it was impossible to distinguish a pseudocyst from an inflamed pancreatic mass (phlegmon). The revolution in diagnostic radiology that occurred as a result of ultrasonography (US) and CT scanning has dramatically improved diagnosis. Bradley et al. (26) found that only 52 of 92 patients with a clinical diagnosis of pseudocyst had a positive US examination (56%). Twenty-three examinations were normal (25%), and 17 revealed a pancreatic phlegmon (19%). Sandy et al. (14) showed that diagnostic accuracy was improved, from 60% based on clinical suspicion to 90% following US, in 64 patients operated upon for surgically proved pseudocysts. Similarly, Crass and Way (13) found preoperative US to be 90% sensitive and 98% specific in their surgical series of 42 patients.

<table>
<thead>
<tr>
<th>Symptom or sign</th>
<th>Number of patients with symptom/sign</th>
<th>Number of patients reviewed</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain</td>
<td>868</td>
<td>1,005</td>
<td>86</td>
</tr>
<tr>
<td>Nausea/vomiting</td>
<td>398</td>
<td>555</td>
<td>72</td>
</tr>
<tr>
<td>Palpable mass</td>
<td>482</td>
<td>978</td>
<td>49</td>
</tr>
<tr>
<td>Weight loss</td>
<td>243</td>
<td>725</td>
<td>35</td>
</tr>
<tr>
<td>Jaundice</td>
<td>93</td>
<td>726</td>
<td>13</td>
</tr>
<tr>
<td>Ascites</td>
<td>64</td>
<td>567</td>
<td>11</td>
</tr>
<tr>
<td>Internal</td>
<td>27</td>
<td>405</td>
<td>7</td>
</tr>
<tr>
<td>hemorrhage</td>
<td>60</td>
<td>412</td>
<td>15</td>
</tr>
</tbody>
</table>

Data from various sources (refs. 5–15,17,18,24,25).
CT scanning is more sensitive and specific than US and has the additional advantages of superior resolution and more precise localization. Abdominal gas, obesity, and displacement of intraabdominal structures from prior surgery do not impair CT images, particularly after simultaneous administration of intravenous and oral contrast agents. Disadvantages include relatively high cost compared to US, exposure to ionizing radiation, and the need for intravenous contrast agents, which may compromise renal function in elderly, diabetic, or critically ill patients. CT scanning is the imaging modality of choice for initial evaluation of patients suspected of having pseudocysts; US should be reserved for follow-up examinations.

Diagnostic endoscopic retrograde pancreatography (ERP) also has been used before operation to provide anatomic information about pseudocysts, but it should not be done routinely (27). It is indicated in a jaundiced patient to differentiate between common bile duct compression by the cyst and stricture of the common duct caused by a fibrotic pancreas (28,29). Cyst drainage alone should relieve the jaundice in the former case while, in the latter instance, a separate procedure to relieve the biliary obstruction would be required. Infrequently, ERP may introduce bacteria into a previously sterile fluid collection (27). Therefore, diagnostic ERP should be performed only when cyst drainage is to be done within 24 hours.

Complications

The most feared complications of pseudocyst are hemorrhage, rupture, and infection. In 10 series (6,8–11,13,14,17,25,30) that included 596 patients with pseudocysts, preoperative hemorrhage occurred in 39 patients (6.5%), rupture into the gastrointestinal tract or peritoneal cavity in 41 (6.8%), and infection in 86 (14%). Other complications included obstruction of the gastrointestinal tract in 15 patients (2.6%) and common bile duct obstruction in 38 (6.3%).

Hemorrhage, from erosion of pseudocysts into vascular structures, is associated with increased morbidity and mortality rates (31–38). Stabile et al. (36) reviewed reports on 126 patients with hemorrhage and found male gender (84%) and alcohol etiology (84%) to predominate. Trauma (12%) was a minor contributor, but no cases of biliary pancreatitis leading to pseudocyst hemorrhage were reported. Almost half of the pseudocyst hemorrhages (45%) were localized to the splenic artery, with the gastroduodenal and pancreatoduodenal arteries (18% each) the next most likely sources. Hemorrhage results from aneurysmal dilation of arterial vessels owing to contact with activated pancreatic enzymes or from pressure necrosis as an enlarging cyst encroaches on adjacent vascular structures. Stroud et al. (35) recorded a mean transfusion requirement of 21 units of red blood cells in a series of 7 patients, and Eckhauser et al. (34) noted a mean loss of 8 units in 5 patients with pseudocyst hemorrhage. Arteriography is the initial diagnostic procedure of choice, offering the opportunity for selective infusion of vasopressors or embolization with autologous blood clots, sponge pledgets, or wire coils (32,37,38). Embolization therapy may be definitive or may allow resuscitation of a critically ill patient and permit surgery to proceed on an urgent rather than emergency basis. Frequently blood loss may be so rapid as to preclude diagnostic procedures, and emergency operation is required. Mortality is prohibitive (90% in 21 cases) in patients treated conservatively and remains high (28%) even with aggressive surgical management (36).

Acute rupture of a pseudocyst is an uncommon event. If the cyst ruptures into the peritoneal cavity, the patient may develop symptoms and signs of acute peritonitis. Rupture into the gastrointestinal tract may produce vomiting or diarrhea. Pseudocyst rupture is a serious complication, particularly it if is accompanied by hemorrhage (6,8,9,32). In these reports, 40 patients with uncomplicated pseudocyst rupture into the gastrointestinal tract, genitourinary tract, or peritoneal cavity were reported, and 6 patients (15%) died of complications of cyst rupture. When rupture was accompanied by hemorrhage, 10 of 21 (47%) patients died.

Documentation of pseudocyst infection and sepsis have been reported frequently (6,8,11,13,17,25). Sankaran and Walt (6) found bacteria in 5 of 30 cysts (16%) cultured at operation but could not demonstrate an association between results of culture and clinical status. Crass and Way (13) noted 5 positive cultures in 36 patients who were “clinically uninfected.” No complications occurred following internal drainage. Conversely, Boggs et al. (17) found 7 positive cultures in a series of 20 patients (35%), and each had postoperative complications despite the use of external drainage. It is not clear from these reports if “infection” represented uncomplicated bacterial colonization or development of abscess and liquefaction necrosis. In the former situation, drainage into the gut should solve the problem, whereas, in the latter, any type of drainage procedure might be associated with increased postoperative morbidity.

Natural History

Ultrasound and CT have provided critical data about the natural history of pseudocysts, but all studies are compromised by small sample size, imprecise definition of terms, and local differences in indications for intervention. Agha (30) studied the medical records of 100 patients who had serial ultrasound examinations during admissions for pancreatitis at the University of Michigan Hospitals. Twenty developed pseudocysts while in the hospital, and five of those (25%) had spontaneous psu-
docyst resolution. In 1979, Bradley et al. (2) prospectively followed 24 patients with pseudocysts and symptoms for less than 6 weeks (acute pseudocysts), and 30 patients with chronic symptoms and pseudocysts (chronic pseudocysts). Most of the pseudocysts were complications of alcohol-induced pancreatitis, and all were confirmed by US examination. Within 6 weeks, 42% of the acute pseudocysts, but only 3% of the chronic pseudocysts, resolved spontaneously. Seventeen percent of the patients with acute pseudocysts and 23% with chronic pseudocysts developed complications. Nine patients (17%) were lost to follow-up. During the remainder of the study, all patients (23) were considered to have chronic pseudocysts. Complications increased to 48% during the second 6 weeks of observation. These included 3 cases of spontaneous pseudocyst rupture, 2 examples of abscess formation, and 1 case of common duct obstruction. Eight of 12 (67%) patients followed for more than 12 weeks and 3 of 5 patients followed for more than 19 weeks experienced complications from pseudocysts. Eight patients died owing to complications from chronic pseudocysts, but no deaths were noted among the 28 patients who were operated upon electively within 6 weeks of pseudocyst diagnosis. These prospective data and retrospective data from other investigators (13) confirmed the surgical dictum that chronic pseudocysts could be drained without a waiting period, while acute cysts should be observed expectantly for 4–6 weeks until a fibrous capsule formed. Neither report offered clinical clues that could be used to determine which patients were likely to have complications or require urgent intervention.

In a different approach to the problem of determining when to intervene, Yeo et al. (31) at Johns Hopkins followed 75 patients with mostly ethanol-induced pseudocysts, using a protocol in which patients were discharged from the hospital as soon as acute pain had resolved, reliable oral alimentation was obtained, and serial CT scans documented that the pseudocyst was not expanding. Thirty-six (48%) patients improved sufficiently for discharge and treatment as outpatients. Serial CT examinations demonstrated spontaneous resolution in 60% of the patients who improved symptomatically, even though only half of them had an acute episode of pancreatitis that heralded the development of the cyst. Most of the 39 patients who were operated upon had unremitting pain (24) or cyst enlargement (7). Only three patients (7.5%) had pseudocyst infection, two (5%) cyst hemorrhage, and one each (2.5%) cyst rupture, common duct obstruction, or gastric outlet obstruction, respectively. In this series, the classical complications of pseudocysts occurred with only about half the expected frequency, and no patient died of complications of pseudocysts. Three-fourths of the patients operated upon were discharged less than 30 days after surgery. Except for the presence of symptoms and CT findings, there was little that separated the operated upon from the expectantly managed group, except pseudocyst size. Two-thirds of the collections more than 6 cm in diameter remained symptomatic or enlarged on CT scan and required surgical intervention. However, pseudocyst diameter was not an absolute predictor of the need for intervention: 3 of 11 cysts (27%) more than 10 cm in diameter resolved spontaneously.

This study suggests that patients with pseudocysts segregate into two groups based upon the presence of symptoms and whether the pseudocyst is enlarging. Those with symptoms and signs of ongoing disease (approximately one-half) require intervention during their initial hospitalization. The other group can be managed as outpatients and, in over half of them, the pseudocyst will resolve. Complications in the asymptomatic group occur relatively infrequently and can be managed safely, without exposing this low-risk group to prolonged hospitalization.

**Therapy for Pseudocysts**

Until recently, alternatives to surgical intervention in patients with symptomatic acute pseudocysts were temporizing measures intended to allow cysts time to resolve spontaneously in some cases or to develop a fibrous capsule that would permit a safe operation. Previously, most authorities recommended supportive care for 4–6 weeks if a pseudocyst developed during an attack of acute pancreatitis, and elective surgery without delay in patients with chronic symptoms, unless there were compelling reasons to avoid surgery. Because of several recent developments, however, the optimal management of pseudocysts is different today.

First, we know that a large fraction of pseudocysts, especially small (<6 cm diameter) asymptomatic lesions, will resolve spontaneously (2,31) and that symptoms should determine whether intervention will be required (31). Second, the ability to accurately assess pseudocysts repetitively without danger to the patient and at relatively low cost has demonstrated that complications of pseudocysts, while potentially lethal, are rare. Therefore, many patients can be managed outside the hospital. Finally, new radiographic and endoscopic techniques for pseudocyst drainage may be as effective as surgery and may be associated with less morbidity.

**Surgery**

The three types of surgical procedures used to treat pseudocysts are resection, external drainage, and internal drainage (Table 3). At operation, the interior of the cyst should be inspected for evidence of tumor, and a biopsy of the cyst wall should be obtained to exclude a cystic neoplasm (e.g., cystadenocarcinoma). Resection is
TABLE 3. Postoperative complications following surgery for pseudocysts

<table>
<thead>
<tr>
<th></th>
<th>External drainage</th>
<th>Internal drainage</th>
<th>Resection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients</td>
<td>361</td>
<td>795</td>
<td>117</td>
</tr>
<tr>
<td>Deaths (%)</td>
<td>10</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>Recurrence (%)</td>
<td>16</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Hemorrhage (%)</td>
<td>7</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Infection (%)</td>
<td>10</td>
<td>8</td>
<td><em><strong>a</strong></em>_</td>
</tr>
<tr>
<td>Fistula (%)</td>
<td>17</td>
<td>4</td>
<td><em><strong>a</strong></em>_</td>
</tr>
</tbody>
</table>

Data from various sources (refs. 5–12,15–18,24,25,39).

*a Insufficient data for analysis.

the preferred method of treatment but is usually possible only for cysts in the tail of the gland when the head and body are normal or minimally changed (e.g., traumatic pseudocysts).

External drainage is preferred when the cyst wall is not sufficiently thickened to allow anastomosis to the gut lumen. A large bore tube is sewn into the cyst lumen, and the other end is brought out through the abdominal wall. Pancreatic fistulas occur in about 20% of external drainage operations. Fistulas may drain for years but usually close after 3 to 4 months (vide infra). Fistulas and recurrent cysts are more common when the cyst communicates with the pancreatic duct.

Internal drainage, in which the cyst is anastomosed to a Roux-en-Y limb of jejunum (cystojejunostomy) or to the posterior wall of the stomach (cystogastrostomy) or to the duodenum (cystoduodenostomy), is the most frequently used operation for pseudocysts. Dependent drainage by cystogastrostomy is preferred for collections adjacent to the stomach, and cystojejunostomy can be done for cysts in any location. Obliteration of the cyst cavity usually follows internal drainage within a few weeks. Patients respond rapidly and are usually eating within a week. Infected pseudocysts adherent to the stomach can be drained by cystogastrostomy. Otherwise, drainage should be external because the suture line of a Roux-en-Y cystojejunostomy may not heal in an infected surgical field.

The mortality and frequency of complications following external drainage is about twice that for internal drainage or resection. This is probably because external drainage is primarily used in acutely ill patients, and the alternative procedures are employed whenever patients are clinically stable. The increased mortality and morbidity due to external drainage is likely due to the condition of the patient rather than to the procedure itself.

Percutaneous Drainage (Table 4)

Van Sonnenberg and colleagues (40) successfully drained pseudocysts in 77 patients using a variety of catheters placed percutaneously. Thirty-five patients presented with fever and sepsis, 30 with pain, 3 with obstruction of the biliary tree, and 1 with gastric outlet obstruction. Eight patients underwent drainage because the pseudocyst diameter was greater than 10 cm. Three patients (4%) could not be drained because of the proximity of surrounding vascular structures. In the remainder, coincidental pancreatic inflammation or lack of a pseudocyst capsule were not factors in the decision for drainage. After diagnostic fine needle aspiration, a variety of catheters from 7 to 14 Fr were used to successfully drain 48 of 51 (94%) infected and 43 of 50 (96%) sterile pseudocysts in 74 patients. Complications occurred in 10 patients, including 4 with bacterial superinfection requiring antibi-
Endoscopic Drainage (Table 4)

Chronic pseudocysts immediately adjacent to the stomach or duodenum are amenable to internal drainage via ERP. Using the indentation of bowel lumen by the pseudocyst as a guide, Cremer and colleagues (44) punctured the cyst with a diathermy needle and then extended the defect to a 10–15 mm incision with an endoscopic sphincterotome. A nasocystic pigtail catheter was introduced to allow fluoroscopic monitoring after endoscopy. Twenty-one of 22 patients with cysts adjacent to the duodenum and all 10 patients with cysts adjacent to the stomach had successful drainage of their cysts into bowel lumen. Only 3 patients (10%) had recurrence and required surgery. One cyst, located more than 1 cm from the duodenal mucosal surface, could not be punctured, and the resulting retroperitoneal infection required surgery. Two cysts became infected and were successfully drained percutaneously, and 1 cyst bled but did not require transfusion or other intervention.

Liguory et al. (45) obtained similar results in a series of 17 patients with acute and chronic symptoms. Sixteen of 17 cysts bulged into the gastrointestinal tract lumen and could be drained, and 11 of them (69%) disappeared completely. The 5 remaining patients were asymptomatic, and the cyst was noted to be stable or decreasing in volume on serial CT scans. One cyst recurred (6%), and surgery was required for 1 patient with peritonitis and 1 with hemorrhage (12%).

Sahel and colleagues (46) successfully drained 18 of 20 chronic pseudocysts that partially compressed the duodenum in 19 patients. Eighteen patients presented with unremitting pain and one with pancreatic ascites. Two patients had cysts that did not indent the bowel lumen, and neither could be successfully drained. Immediate post-procedure complications included two luminal perforations treated without operation, 1 fatal cyst hemorrhage and 1 hemorrhage requiring transfusion, and 1 episode of cholangitis. Thirteen patients were evaluable for more than 6 months. Long-term status included permanent cyst resolution in 9 (47%) and persistence of an asymptomatic smaller cyst in 4 (21%). Three patients required surgery, and 2 had recurrence of their pain.

Kozarek and colleagues (47) used transpapillary drainage via ERP in 7 patients with disruption of the pancreatic duct and no prior interventional therapy, 8 patients who had previously undergone percutaneous drainage, 3 with prior external surgical drainage, and 1 who had undergone both procedures. All of the patients were symptomatic, and all had actively secreting leaks of the pancreatic duct. For pseudocysts, guidewires were extended past the point of pancreatic duct disruption, and the fluid was drained with a nasopancreatic drain. Later, a pancreaticoduodenal stent was used to temporarily bridge the disruption. For fistulas, a stent was used...
alone. Both approaches were designed to provide a temporary, low-resistance conduit to an external reservoir or to the gut, respectively. However, only 3 of 10 patients with acute pancreatitis and ductal disruption and 4 of 8 patients with chronic pancreatitis and leakage required surgery after a median follow-up of 16 months. Twelve of 14 patients with pseudocyst were drained successfully, and 16 of 18 patients were afforded symptomatic relief with endoscopic therapy. Complications of endoscopic therapy, including stent occlusion, infection, and mild pancreatitis, occurred in 4 patients. Two patients had radiographic changes compatible with chronic pancreatitis associated with stenting.

Recommendations for Therapy

Supportive care to restore fluid and electrolyte deficits and pain control should be undertaken in all patients with pseudocyst. Since many pseudocysts occur in the setting of alcohol abuse; thiamine, magnesium, phosphorus, and measures to prevent withdrawal complications and supplement tissue stores of folate should be instituted if appropriate. Parenteral nutrition and measures to decrease gastrointestinal secretions (histamine receptor antagonists and somatostatin analogs) are rational and should be considered. Surgical, radiologic, and gastroenterologic consultations, as well as a baseline CT, are required to plan appropriate therapy. If symptoms are resolving and the volume of the pseudocyst is decreasing, watchful waiting is indicated, probably on an outpatient basis.

For symptomatic lesions, or cysts that are expanding in size, we recommend endoscopic or radiologic drainage in those institutions where the expertise is available. If the cyst is adjacent to the stomach or duodenum and bulges into the lumen, endoscopic internal drainage may be indicated. Pseudocysts that lie directly behind the stomach may also be drained internally via a percutaneous transgastric approach. Alternatively, if the fluid collection communicates with the pancreatic duct, a temporary endoscopic drain or stent may suffice. For those pseudocysts located at a distance from the pancreas, percutaneous drainage is a rational first step, although the risk of a subsequent cutaneous fistula is increased, particularly if the cyst communicates with the pancreatic duct. Infected pseudocysts where the cyst fluid is of watery consistency and does not contain particulate debris are best managed by percutaneous drainage.

Optimally, surgical intervention should be reserved for those patients who fail to respond to radiologic or endoscopic intervention or who develop pseudocyst rupture or significant pseudocyst hemorrhage. Surgery is required for symptomatic patients whose fluid collection cannot be differentiated from surrounding pancreatic phlegmon or when adjacent vascular structures preclude endoscopic or percutaneous therapy. Similarly, "pseudocysts" with internal septations and debris that have occurred in the absence of any evidence for pancreatitis cannot be differentiated clinically from malignant cysts. These should be treated surgically.

PANCREATIC ASCITES

Ascites may occur when pancreatic secretions collect within the abdomen following disruption of the pancreatic duct or when a pseudocyst continuously leaks into the abdomen. A leak into the retroperitoneum may track some distance from its source, and the fluid collection may appear in the mediastinum, pleural space, or groin. About one-third of patients have concomitant pleural effusions, and some (53,54) have reported pancreatic pleural effusions without ascites. Most patients are male alcoholics with chronic pancreatitis, although ascites may follow pancreatic trauma. Symptoms of a distinct episode of acute pancreatitis are seldom elicited, and patients usually present with increasing abdominal girth, weight loss, and muscle wasting. Although the presentation can be confused with cirrhosis, abdominal paracentesis is diagnostic. The combination of high protein content (>3 g/100 ml) and amylase concentration greater than the serum amylase is pathognomonic.

At the time that the syndrome was first reported, physicians were faced with the dilemma of treating patients with profound metabolic and nutritional deficits who continued to lose large volumes of fluid, electrolytes, and serum proteins into the peritoneal cavity. Treatment with bed rest, diuretics, carbonic anhydrase inhibitors, and periodic paracentesis was unsatisfactory. Addition of parenteral nutrition to the therapeutic armamentarium in the mid-1970s allowed nutritional repletion while surgery was being planned. In up to 40% of cases, the ascites resolved spontaneously during this period, and surgery was unnecessary (53). Sankaran and Walt (54) demonstrated that definitive surgery was facilitated by ERP to define the precise location of the leak. Four patients in whom ductal leak or obstruction was demonstrated preoperatively by ERP did well following surgery, while 10 of 19 patients treated without benefit of ERP or operative pancreateography had recurrence of their ascites. In a follow-up report from the same institution, Weaver et al. (55) showed that the pancreatic duct could be opacified in 13 of 15 patients with suspected ascites by ERP, and both of the remaining patients had operative pancreateography. All of the patients who underwent pancreateography were cured, while 13 of 27 (44%) operated upon without pancreateography had recurrent ascites.
Surgery should be preceded by general metabolic and nutritional repletion, a somatostatin analogue to suppress pancreatic secretions (vide infra), and endoscopic pancreatography. If the ductal disruption is located in the distal pancreas, distal pancreatectomy may be indicated. If the leak is located in the head or body of the gland, internal drainage using a Roux-en-Y limb of jejunum is preferable. The postoperative morbidity in these chronically ill patients is considerable. Combining the data from Johns Hopkins (53) and Wayne State University (55), there were no deaths or recurrences in 14 patients who underwent resection. Internal drainage in 19 patients was accompanied by 4 deaths and 2 recurrences, and external drainage in 9 patients resulted in 4 deaths and 2 recurrences.

Successful intravenous infusion of pancreatic ascites has been reported in a few cases. In a well-documented report, De Waele et al (56) enzymatically assayed ascitic fluid and detected no proteolytic activity, although trypsin, measured by radioimmunoassay, was present in high concentration. They hypothesized that pancreatic enzymes were present in an inactivated form, bound to protease inhibitors, and could be safely infused intravenously. After first removing most of the ascites to prevent volume overload, they placed a LeVeen peritoneovenous shunt in a 37-year-old alcoholic man whose associated medical problems made him a poor candidate for pancreatic surgery. His ascites resolved within a week, and 6 months later ERP showed closure of the pancreatic leak.

**PANCREATIC FISTULAS**

Pancreatic fistulas follow pancreatic trauma, external drainage of pseudocysts, or operations on the pancreas. Traumatic fistulas usually result from pancreatic duct injury that was overlooked or inadequately treated at initial operation. About 3% of patients operated upon for pancreatic trauma develop fistulas (57), but they do not generally increase postoperative mortality. Fistulas that complicate pancreaticoduodenectomy for periampullary malignancy may increase mortality. Van Heerden et al. (58) reported an 11% incidence of such fistulas in a series from the Mayo Clinic, and Aston and Longmire (59) reported an 18% incidence from Los Angeles. Fistulas seldom occur after surgery for chronic pancreatitis. Probably this is because the pancreatic tissue is firm owing to the chronic inflammatory process, and holds sutures well. Fistulas may occur as a complication of needle biopsy of the pancreas, but thin needle aspiration cytology has minimized this problem (60).

Low output (<200 ml/24 h) pancreatic fistulas usually heal spontaneously, although they may drain for several months. Conservative therapy is directed toward suppression of pancreatic secretions and insuring patency of the fistula tract to avoid infection. Patients are usually managed at home.

High output fistulas present many of the same metabolic problems as pancreatic ascites. They may be less likely to close spontaneously than low output fistulas, particularly if the main pancreatic duct downstream from the leak is blocked. Carbonic anhydrase inhibitors, cholinesterase inhibitors, and histamine receptor antagonists have all been used to reduce the volume of pancreatic fistulas, but none has been successful. Garcia-Puges et al. (61) reported success with oral administration of pancreatic enzymes to take advantage of the feedback inhibition of pancreatic secretion. Five patients with fistula output averaging 500 ml/day who had not responded to conservative measures, including parenteral nutrition, received 21,000 units of lipase, 1,600 units of protease and 300 mg of bovine bile every 6 hours. Four of 5 patients closed their fistulas within 4 days, and the final fistula closed in 12 days. Joehl and Nahrwold (62) demonstrated a marked suppression of secretin-stimulated pancreatic secretion by intravenous terbutaline in normal volunteers. In a single patient, the drug decreased fistula output from 700–1,400 ml/day to 200 ml/day and appeared to produce spontaneous closure. Nevertheless, these methods have not been used widely.

Parenteral administration of somatostatin and its synthetic analogs appears to have accelerated closure of pancreatic fistulas. Somatostatin is a generalized inhibitor of gastrin, CCK, and secretin release. It also inhibits gastric acid production and pancreatic enzyme release through other mechanisms. Pederzoli et al. (63) treated 45 patients with postoperative fistulas (fistula volume >200 ml/day) with parenteral nutrition alone (18) or parenteral nutrition and hormones that inhibited pancreatic secretion, including somatostatin (8), calcitonin (7), and glucagon (12). The fistulas closed in 42 of 45 patients. Although neither patient assignment nor preexisting clinical state was randomized in the study, 7 of 8 patients treated with somatostatin closed their fistulas in less than 1 week. Patients treated with parenteral nutrition alone or parenteral nutrition plus glucagon or calcitonin required from 3 to 4 weeks to close. Similar efficacy using a somatostatin analogue (Sandostatin, Sandoz Ltd., Basel) has been recorded from the United States (64) and Europe (65,66).

If small bowel contents mix with pancreatic juices, activation of the pancreatic enzymes can result in autodigestion of the skin. In those circumstances, care of the skin must be meticulous. When surgical repair of a fistula is necessary, it is usually best accomplished by internal drainage, Anastomosing a Roux-en-Y segment of jejunum to the site of the leak. Recurrences after this operation are uncommon.
REFERENCES


