The endoscopic management of pancreatic pseudocysts (with videos)

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In the United States, acute pancreatitis is the most common cause of hospitalization related to GI disease.[1] The incidence of acute pancreatitis is between 9.8 and 32 per 100,000, with a 30- to 90–day mortality rate of 7%.[2,3] Pancreatic pseudocysts are a well-known adverse event of acute and chronic pancreatitis.[4] Pseudocysts develop in 6% to 34% of cases of acute pancreatitis, but only a proportion are symptomatic, and many resolve spontaneously.[5-7] Endoscopic drainage has become standard treatment at many centers, with similar efficacy, shorter hospital stays, fewer adverse events, better physical and mental health outcomes, and greater cost effectiveness compared with surgical cystogastrostomy.[8,9] It is therefore considered as first-line treatment.

This review highlights the techniques used for endoscopic management of pseudocysts. It provides background into the current definition and the indications for and timing of endoscopic intervention, and it describes the various drainage techniques, adverse events, recommended before- and after-procedure management, and areas of uncertainty.

DEFINITION OF PANCREATIC PSEUDOCYST

Our understanding of pancreatic fluid collections (PFCs) has evolved considerably with the development of high-resolution, cross-sectional imaging and EUS.[10] The revised Atlanta classification system[11] (Table 1) defines an acute fluid collection with no necrosis and without a well-defined wall, developing in the first 4 weeks of interstitial edematous pancreatitis as an acute peripancreatic fluid collection, which is best managed conservatively. This can mature into a pseudocyst, generally after 4 weeks. A pseudocyst is an encapsulated collection of fluid with a well-defined inflammatory wall, which contains minimal to no necrosis. In contrast, pancreatic walled-off necrosis (WON) develops from acute necrotizing pancreatitis and contains both liquid and solid or semisolid necrotic material (Fig. 1A-D). Infection and abscess can develop in both. Pseudocysts also can develop secondary to trauma and pancreatic surgery, and although the etiology differs, management is similar to those arising in the setting of pancreatitis.

Differentiation between types of PFCs can be challenging and relies on high-quality imaging and an understanding of the natural history and physiology of the disease.[12] Adding to this, medical nomenclature has changed over time.[11,13] Many studies reporting management outcomes of PFCs or pseudocysts describe what today would be recognized as a heterogeneous group encompassing acute fluid collections, pseudocysts, WON, and abscesses[14] (Figs. 2A to 4B). However, even with improved imaging and classification, it is important to recognize that the different collection subtypes overlap substantially, and clear categorization can be challenging. For example, differentiating between *pseudocyst with debris* and *WON* relies on judgment on the amount of debris and type of acute pancreatitis. When the different types of collections are defined, successful endoscopic treatment response occurs in 86% to 100% of pseudocysts, compared with 63% to 81% in WON.[8,9,15-21]

The most common initial imaging modality for diagnosis of PFCs is a contrast-enhanced CT scan of the abdomen, because it is widely available, relatively inexpensive, and can determine the extent of necrosis in WON. Magnetic resonance imaging (MRI) may have superior sensitivity and specificity for detection of PFCs and is more accurate for determining pancreatic ductal integrity and characterizing collection contents than are CT scans.[22-24]

Abbreviations: CTD, conventional transmural drainage; ERP, endoscopic retrograde pancreatography; FCSEMS, fully covered self-expandable metal stent; MRI, magnetic resonance imaging; PD, pancreatic duct; PFC, pancreatic fluid collection; WON, walled-off necrosis.

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TABLE 1. Revised Atlanta classification of acute pancreatitis-associated fluid collections[11]

Pancreatic fluid collection	Type of pancreatitis	Time frame, wk	Well-defined wall	Contains solid necrotic debris
Acute peripancreatic fluid collection	Interstitial edematous	<4	No	No
Pseudocyst	Interstitial edematous	>4	Yes	No*
Acute necrotic collection	Necrotizing	<4	No	Yes
Walled-off necrosis	Necrotizing	>4	Yes	Yes

*Minimal or no necrosis.

INDICATION AND TIMING OF INTERVENTION

The decision to intervene is driven by the presence, severity, and time course of symptoms or local adverse events. Symptoms include persistent abdominal, flank, or back pain and gastric or duodenal outlet obstruction related to a local mass effect. Outlet obstruction may be partial or complete and variably presents with anorexia, loss of weight, early satiety, abdominal distension, vomiting, or worsening gastroesophageal reflux. Biliary compression also can occur. Gastric and biliary obstruction usually resolves with collection drainage, but temporary enteral feeding or biliary stenting may be required. Pseudocyst superinfection is an absolute indication for drainage to prevent development of an abscess. In the absence of prior intervention, gas within the collection is highly suggestive of infection, and a sample should be sent for Gram stain and culture at the time of drainage to guide antimicrobial therapy. Pseudocyst superinfection can be secondary to microbial translocation from the GI lumen or after spontaneous or iatrogenic (endoscopic) fistula formation with incomplete collection drainage. True pseudocysts without any debris have a low risk of superinfection after intervention, because of their rapid collapse on drainage and lack of necrosis as a nidus for infection. The presence of debris increases the risk of superinfection, and this must be limited by ensuring adequate drainage and irrigation pathways. The relationship between pseudocyst size and symptoms is variable. Technical considerations preclude placement of transmural stents into collections <3 cm in size. There is no absolute size at which drainage is mandated, but rapid accumulation on serial imaging or new onset of symptoms in a pseudocyst of any size should prompt consideration.

PREPROCEDURE CONSIDERATIONS

Before endoscopic drainage, clinical history, cross-sectional imaging, and laboratory test results should be reviewed, and a complete pancreatic EUS examination should be performed to confirm appropriate indication and to optimize safety. The international normalized ratio and platelet counts should be corrected if abnormal to <1.5 and at least >50,000/mm^3, respectively.[25] Periprocedural management of anticoagulants and antiplatelets is similar to other high-risk endoscopic procedures such as polypectomy and endoscopic sphincterotomy.[26] Preoperative anesthetic evaluation is obtained,[27] and the procedure usually is performed with the patient under general anesthesia to limit the risk of aspiration. Broad-spectrum antibiotics are given to reduce the risk of pseudocyst infection[28]; our practice is to administer a single dose of ciprofloxacin 400 mg intravenously once an intraprocedural decision is made to proceed with drainage and to continue oral antibiotics for 2 to 5 days.[29]

On cross-sectional imaging, assessing the pseudocyst relationship to the GI lumen, the presence and location of collateral and major vessels, and assessing from where in the pancreas the collection arises identifies potential locations for endoscopic drainage. An immature pseudocyst wall is thin and poorly adherent to the GI lumen, and drainage should be delayed as long as possible to minimize the risk of free perforation. Excluding vessels and structures between the EUS transducer and planned cyst entry also reduces the risk of perforation and bleeding; most pseudocysts that meet these requirements are located within 15 mm of the GI lumen. Ideally, the pseudocyst wall is no more than 10 mm from the GI lumen to minimize the risk of free perforation. Cystic pancreatic neoplasms, benign pancreatic cysts, solid necrotic neoplasms, duplication cysts, and the gallbladder can be mistaken for a pseudocyst and need to be ruled out on cross-sectional imaging or EUS. Pseudocysts also can develop secondary to pancreatic neoplasms,[30] intraductal papillary mucinous neoplasms, and autoimmune pancreatitis, with or without a clear history of acute pancreatitis. These may require adjunctive therapy, and a diagnosis and plan should be made prospectively where possible.

PROCEDURE TECHNIQUE

Pseudocyst drainage can be performed with EUS guidance or by using a forward- or side-viewing endoscope without EUS; this is termed conventional transmural drainage (CTD).