CHAPTER 22

# Role of ERCP in complicated pancreatitis

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**KEY POINTS**

- Patients with severe, acute gallstone pancreatitis may benefit from early ERCP and stone extraction.
- ERCP can be technically challenging in the setting of early AP due to edema within the duodenum.
- Delayed local complications of AP include pancreatic pseudocysts, pancreatic abscess, and walled-off pancreatic necrosis.
- Endoscopic intervention for complicated pancreatitis is optimally performed in a tertiary care setting.

## Introduction

Acute pancreatitis (AP) can take two forms: interstitial and necrotizing. Both forms can have the same etiologies but usually result in divergent clinical outcomes. Clinically severe acute pancreatitis (SAP) is almost always due to necrotizing pancreatitis and/or necrosis of surrounding peripancreatic fat [1]. The early management of SAP relies on critical care support. Some patients with acute gallstone pancreatitis may benefit from early endoscopic retrograde cholangiopancreatography (ERCP). Most patients survive the early phase of systemic inflammatory response syndrome (SIRS) and multisystem organ failure. Most have a prolonged course of sterile necrosis while others develop delayed infection. Fluid collections may form after AP and include acute peripancreatic fluid collections, pancreatic pseudocysts, acute necrotic collections, and walled-off necrosis. Endoscopy can be used to manage each of these entities [2, 3].

*ERCP: The Fundamentals*, Second Edition. Edited by Peter B. Cotton and Joseph Leung.

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## Acute interstitial pancreatitis

In patients who present with interstitial acute pancreatitis (IAP), morbidity and mortality are low and care is supportive. Acute SIRS is absent and pancreatic parenchyma is preserved. The main goal is to identify the etiology. Gallstone pancreatitis is suspected based upon the presence of cholelithiasis and elevated serum transaminases in the absence of other risk factors for pancreatitis (such as heavy alcohol abuse, hypertriglyceridemia, and drugs). ERCP and biliary sphincterotomy are used when there is a high probability of bile duct stones based upon persistently elevated liver tests (particularly serum bilirubin) and a dilated biliary system. The vast majority of patients will have already passed stones and the mainstay of therapy is laparoscopic cholecystectomy. Intraoperative cholangiography is used to identify persistent bile duct stones, which can be managed laparoscopically, or with post-operative ERCP. ERCP and biliary sphincterotomy are reserved for secondary prevention of acute gallstone pancreatitis in those with prior cholecystectomy, those who are prohibitive operative candidates based upon age and/or comorbid illnesses, and as a bridge to laparoscopic cholecystectomy in selected patients.

## Severe acute pancreatitis

SAP is nearly always due to necrotizing pancreatitis with loss of parenchyma of at least 30% and/or due to surrounding peripancreatic fat necrosis. Patients with SAP are recognized by acute severity of illness and SIRS. These patients are best managed in the intensive care unit (ICU) with appropriately aggressive fluid resuscitation. Early ERCP is often considered for patients with severe gallstone pancreatitis as a way of minimizing loss of pancreatic parenchyma by relieving outflow obstruction at the level of the ampulla. Despite early studies in this field showing promise, the data have not supported early ERCP in these patients. In addition, early ERCP carries risks of sedation, perforation, and introduction of infection into pancreatic necrosis if an inadvertent pancreatogram is performed in the setting of a pancreatic ductal disruption. Studies show that only patients with underlying cholangitis (evidenced by persistent or progressive jaundice) benefit from early ERCP in the setting of SAP [4]. It may be difficult to differentiate acute cholangitis in the setting of SAP as fever, leukocytosis, and abnormal liver function tests (LFTs) may be present as a result of the inflammatory process. Indeed, any cause of SAP can result in edema in the head of the pancreas as the bile duct courses through it. This can cause jaundice due to obstruction, though this type of biliary obstruction often occurs several days to a week after onset of AP rather than at initial presentation.

From a technical standpoint, ERCP in patients with SAP is often difficult due to the diffuse edema that occurs in the second part of the duodenum from the surrounding inflammation. This makes identification of the papilla and/or cannulation difficult, if not impossible. Endoscopic ultrasound (EUS) or magnetic resonance cholangiopancreatography (MRCP) may allow determination of bile duct stones and allow ERCP to be avoided. If a bile duct stone is confirmed and ERCP fails, options include percutaneous transhepatic cholangiography with or without catheter placement for subsequent ERCP, with or without rendezvous. EUS-guided approaches to the bile duct can also be considered.

## Local complications of acute pancreatitis

The nomenclature of AP has recently been modified [2]. Several local complications can arise, for which ERCP can be helpful. These include acute peripancreatic fluid collections, acute pancreatic pseudocysts, pancreatic abscesses, and walled-off pancreatic necrosis (WON).

### Acute peripancreatic fluid collection

These fluid collections develop in the early phase of pancreatitis (less than 4 weeks after onset of AP), do not have a well-defined wall, are homogeneous, and may be multiple. Most acute fluid collections remain sterile, usually spontaneously resolve, and rarely require intervention. Since these are composed of fluid, drainage can be performed by a transmural (transgastric or transduodenal approach) when rapidly progressive in size and/or development of infection. EUS guidance is usually undertaken to endoscopically drain these collections. While a transpapillary approach is theoretically possible, it has not been used for management of these collections.

## Pancreatic pseudocyst

A pancreatic pseudocyst is a peripancreatic fluid collection surrounded by a well-defined wall and is devoid of solid material. The collection must present at least 4 weeks after onset of AP to be defined as a pseudocyst. Acute pancreatic pseudocysts arise from disruption of the pancreatic duct or side branches in the absence of parenchymal necrosis. Thus, these collections occur as a consequence of IAP or very limited, focal pancreatic necrosis. These collections can be drained by ERCP using a transpapillary approach or a transmural approach. Since these are composed of liquid, it is not imperative to use large transmural tracts for successful drainage.

## Acute necrotic collection

Collections occurring within the first 4 weeks of an episode of acute necrotizing pancreatitis are referred to as acute necrotic collections. They are composed of variable amounts of liquid and solid (necrotic) material. These collections can be located within the pancreas and/or peripancreatic areas. Ability to endoscopically drain such collections is based upon whether any semblance of organization is present. Need for drainage is based primarily upon the presence of severe infection. If endoscopic therapy is undertaken and the collection is at least partially organized (walled off), initial transmural drainage of infected fluid can improve acute sepsis. However, for removal of necrotic material, large transmural drainage routes are usually required.

## Walled-off necrosis (WON)

WON is an encapsulated collection of pancreatic and/or peripancreatic necrosis that has a well-defined wall (Figure 22.1). Necrosis does not usually become walled off earlier than 4 weeks after the onset of acute necrotizing pancreatitis.

## Timing and indications for endoscopic intervention of necrosis

It is accepted that for patients with sterile necrosis any intervention should be delayed as long as possible from the onset of AP and for a minimum of 4 weeks. Most patients with pancreatic necrosis can be managed with medical therapy until resolution. Endoscopic management cannot be undertaken until the

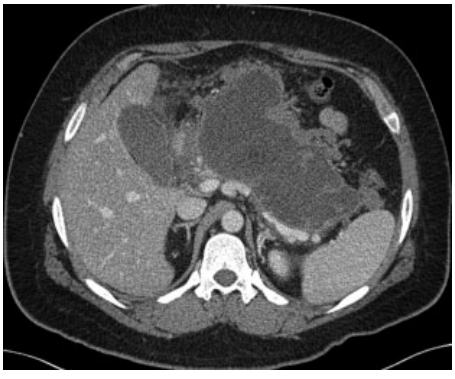


**Figure 22.1** CT findings of walled-off necrosis. This image was obtained 7 weeks after the onset of SAP.

necrotic process has become walled off. This may occur as early as 2–3 weeks but often requires 4 weeks. We offer endoscopic therapy to patients with WON who have had a prolonged course of sterile necrosis, intractable pain, gastric outlet obstruction, inability to eat, or rapidly enlarging collections present at 4 or more weeks after the onset of pancreatitis. It is believed that endoscopic intervention (as described later) will return the patient to a normal health status more rapidly than "watchful waiting" (supportive care), though without clear-cut evidence. Less common indications include the inability to wean from mechanical ventilation due to increased intra-abdominal pressure and documented large, high amylase level pleural effusions or ascites.

The decision to intervene is easier in patients in whom there is a high suspicion for or known infected necrosis, and intervention has been made as early as 3 weeks after the onset of AP and in septic patients with AP and WON (as determined by computed tomography (CT)).

## Necrosectomy methods

### Preprocedural planning/sedation

It is imperative that a cross-sectional imaging procedure (CT or magnetic resonance imaging (MRI)) be obtained within several days prior to planned intervention to best determine the degree of organization (demarcation) and anticipated access points, and for the evaluation of major vessels either within the cavity or between the cavity and gastric or duodenal wall. In addition, one should pay attention to the degree of paracolic extension and communication between what appear to be multiple cavities. Such connections can often be appreciated on coronal CT images. One should be suspicious of a fistula between the lumen and collection when spontaneous air is present. This tract can be used for entry as described later.

A preprocedural international normalized ratio (INR) and platelet count should be obtained and corrected, as necessary.

Preprocedural antibiotics should be administered in patients not already receiving them. Extended intravenous penicillin agents (piperacillin/tazobactam), quinolone agents (levofloxacin), or a carbapenem (meropenem) are recommended agents.

Sedation using anesthesia support is recommended as these patients are often ill, procedures are prolonged, aspiration risk is high, and intraprocedural adverse events (bleeding, pneumoperitoneum) can occur.

### Puncture and access

When endoscopic transmural access is performed, one or more transmural access points are targeted for drainage depending on imaging, most often CT. For WON collections located in the mid-body and tail, a transgastric route is usually

undertaken. A transgastric approach is often a more direct approach to subsequently pass an endoscope directly into the cavity and into paracolic gutter extensions. A transduodenal approach is usually the only and best option for collections confined to the pancreatic head.

The initial transmural puncture can be performed in a variety of ways, with or without EUS guidance. Non-EUS-guided punctures can be performed using an ERCP scope. Advantages to using the duodenoscope are the ability to puncture at a perpendicular angle to the collection, the use of an elevator, and the ability to enter collections in the cardia or fundus in a retroflexed position. The disadvantages are a lack of dedicated large-caliber needles that allow passage of 0.035 in. guidewires and a lack of ultrasound guidance to detect underlying vessels. Using a duodenoscope the puncture is performed "blindly" using electrocautery with a biliary needle knife or cystotome (Cook Endoscopy, Winston-Salem, NC). Alternatively, a sclerotherapy needle can be used which accepts a 0.018 in. guidewire (Marcon-Haber, Cook Endoscopy). The needle, however, is short and not designed for guidewire passage; the wire often does not pass through the sheath after it is angled. Exchanges are difficult, and the small-diameter wire is not sufficiently robust to allow accessories to pass through the thicker gastric wall. In these cases, a triple-lumen needle knife or other cautery device is passed over the wire and into the cavity to allow entry and subsequent upsizing to a 0.035 in. guidewire. Unfortunately, standard EUS needles are not long enough to pass through duodenoscopes.

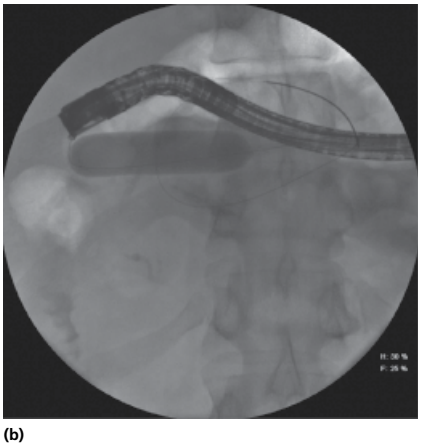
Standard upper endoscopes can also be used to create the puncture but a perpendicular approach to the posterior gastric wall may not be possible unless the collection is massively bulging into the gastric lumen so that an end-on view of the collection is feasible. However, a standard 19-gauge EUS needle will pass through a forward-viewing endoscope and obviates the need for changing endoscopes if direct endoscopic necrosectomy (DEN) is performed.

Most commonly, EUS-guided puncture is performed using an oblique-viewing endoscope. The advantages to EUS guidance are the ability to target the lesion, to potentially avoid blood vessels, and the possibility to assess the degree of underlying necrosis [5]. The disadvantages are the relative inflexibility, the need to have a straight access due to stiffness of the needle, the tangential nature of the puncture, and the tendency of the punctures to be more proximal both because of the access angle and due to the proximal location of the exit site relative to the transducer. Finally, echoendoscope mechanics and optics tend to be less favorable than ERCP endoscopes.

Once the cavity has been successfully accessed (Figure 22.2), the transmural tract is balloon-dilated to allow passage of a forward-viewing endoscope into the cavity. A minimum diameter of 15 mm is required (Figure 22.3). In some cases, 20 mm dilation is performed at the time of initial puncture, though this may be associated with higher risks of bleeding and perforation due to tearing of vessels and separation of the wall of the collection.

**Figure 22.2** Guidewire passage through the medial wall of the duodenum (same patient as Figure 22.1).

(a)



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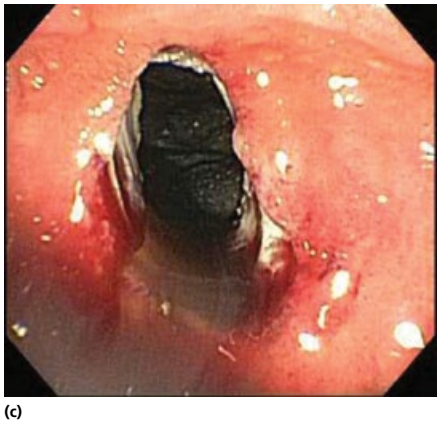

(c)

**Figure 22.3** Large-balloon dilation of tract. (a) 18 mm balloon dilation seen endoscopically and (b) fluoroscopically. (c) Resultant endoscopic view of tract in duodenal wall.

Another approach is to dilate the transmural site to a small diameter followed by the placement of large-bore (16–23 mm mid-body diameter) self-expandable metal stents (SEMS) across the gastric or duodenal wall for maintaining access for DEN [6–10]. In the United States, the only large-diameter fully covered SEMS are esophageal, with the shortest lengths being 6–7 cm. This is still relatively long compared to the distance between the luminal site and the inside of the cavity and results in an excessive stent length inside the lumen or the cavity. Shorter-length devices (2 cm) with larger flanges are available outside of the United States, and at least one is expected to receive Food and Drug Administration (FDA) approval in the near future.

## Necrosectomy

Once the access site is secured, a forward-viewing endoscope is driven into the cavity (Figure 22.4) and DEN is performed. Diagnostic channel scopes have the advantage of flexibility but the small working channel makes suctioning thick secretions difficult and also fills up with debris, making it difficult to pass accessories for debridement. A therapeutic channel endoscope also has water jet capabilities to aid in loosening adherent necrosis. A jumbo channel endoscope with a 6 mm channel and dual suction designed for removal of clots during gastrointestinal bleeding can be used. This endoscope is rather inflexible but large fragments of necrotic debris can be suction once loosened into smaller fragments.

The endoscope is passed into the cavity and necrotic material is removed using mechanical measures. Accessories used include standard polypectomy snares, polyp retrieval nets, and grasping forceps. The most effective forceps

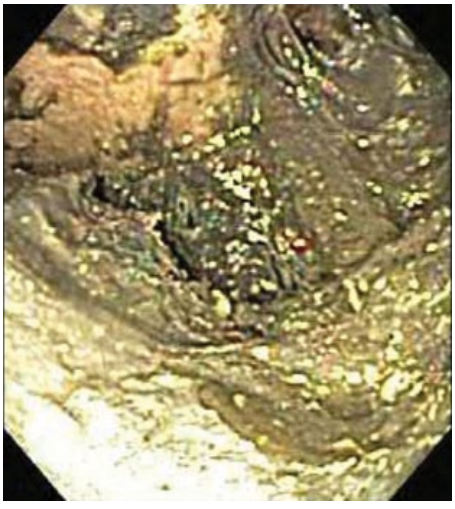

**Figure 22.4** Endoscopic view with WON showing necrotic material.

have large, long prongs (pelican–alligator forceps) rather than shorter, traditional rat-toothed forceps, which tear small pieces of tissue. It is preferable to use spiral snares (Olympus Corporation, Center Valley, PA) to grasp and remove tissue. Unfortunately, these snares deform after many uses and it is not uncommon to use several during the course of one procedure. Once the tissue is grasped, it is withdrawn from the cavity and deposited in the lumen.

DEN can be time-consuming and labor-intensive. Many passages of the endoscope into and out of the WON are necessary. Complete necrosectomy in one session is usually not possible, particularly when there is a large necrotic burden.

If stents were not placed prior to DEN, they are placed at the end of the procedure. Commonly, two or more 7–10 Fr double pigtail stents are placed. A nasocystic irrigation tube is sometimes placed between necrosectomy sessions, though its use is not clear [11].

## Subsequent direct necrosectomy procedures

The timing of subsequent direct necrosectomy procedures is not standardized. One approach is to perform scheduled, repeat procedures [12]. The duration between procedures can be as short as 24 h or as long as several weeks.

## Postprocedural care

Outpatients who undergo necrosectomy can be kept as outpatients as long as the procedure is performed uneventfully and the patient meets discharge criteria. Antibiotics are continued per orally for at least several weeks and in most cases until the necrosis completely resolves. The patient may resume (or initiate) oral intake the day of the procedure, assuming no adverse events occur and there is no nausea, vomiting, or pain. Acid-secretory agents should be withheld, if possible (absence of severe reflux esophagitis), as the presence of acid may reduce infection due to bacteriostatic properties and acid entry into the necrotic cavity could break down necrotic debris.

Repeat cross-sectional imaging is done on a case-by-case basis. Antithrombotic medications can be reinitiated approximately 24–48 h later, based upon the risk of bleeding and thrombosis.

## Management of paracolic gutter extensions

Paracolic gutter extensions can be difficult to treat, particularly when extending well into the pelvis. The central areas of necrosis in the pancreatic bed are accessible and communicate with the paracolic extensions and are thus potentially amenable to percutaneous approaches.

## Adverse events

Adverse events can occur intraprocedurally or postprocedurally. Intraprocedural events include sedation, bleeding, and perforation.

Bleeding most often occurs at the entry site. Fortunately, it is usually self-limited and ceases by the end of the procedure. Uncontrolled or persistent bleeding can be managed by dilute epinephrine injection, balloon tamponade, clips, and electrocautery. Refractory or massive bleeding can be managed by placement of a large-diameter fully covered esophageal SEMS [13, 14]. Intracavitary bleeding is also usually self-limited. Severe intracavitary bleeding can be the most life-threatening and angst-producing for the physician. Hemostatic measures are similar to those for other bleeding including cautery and clip placement. If the bleeding is arterial, emergent embolization can be undertaken. Venous bleeding cannot be treated with interventional embolization techniques and may require surgery.

Perforation can also be at the entry site or in the cavity. Intraprocedural perforation can result in tension pneumoperitoneum, a life-threatening emergency that requires prompt needle catheter decompression [15]. Similar to bleeding, perforation may occur at the entry site and be managed with clips, diversion (in addition to internal pigtail stent placement), and placement of a large-caliber SEMS [16]. Large intracavity perforations often require surgical or percutaneous management.

Air embolism can be silent or result in procedure-related death [17]. It is believed to be preventable by the use of carbon dioxide for insufflation rather than air.

Introduction of organisms (bacteria and fungi) inevitably occurs during endoscopic intervention and may result in infectious complications. Thus, the need for removal of fluid and solid debris and administration of antibiotics are essential.

## Outcomes

There are now many series demonstrating the efficacy of DEN [18, 19]. However, one must be careful in interpreting the literature. Successful resolution can be defined as complete nonsurgical resolution, including the use of adjuvant percutaneous therapy, or successful when only flexible endoscopic measures are used. Patients with WON are a heterogeneous group based upon size of collection, total necrotic burden, paracolic gutter extension, nutritional status, comorbid medical illnesses, and time from onset of necrosis to intervention. This makes it difficult to compare outcomes between centers and between disciplines.

In a systematic review of more than 1100 endoscopic necrosectomies in 260 patients, the overall mortality was 5% with a procedure-related morbidity of 27% [20]. Complete resolution of pancreatic necrosis using endoscopy alone was achieved in 76%. However, these studies include all types of endoscopic interventions.

**Table 22.1** Types of pancreatic fluid collections complicating acute pancreatitis (AP).

| Term | Definition |
|---|---|
| Acute peripancreatic fluid collection | A collection of enzyme-rich pancreatic juice occurring early in the course of AP, located in or near the pancreas, and always lacking a well-defined wall of granulation tissue or fibrous tissue. |
| Acute pseudocyst | A collection of pancreatic juice enclosed by a wall of nonepithelialized granulation tissue, requires at least 4 weeks to form, and is devoid of significant solid debris. |
| Acute necrotic collection | An intrapancreatic collection containing a variable amount of liquid and solid, typically associated with peripancreatic fat necrosis. Occurs less than 4 weeks after the onset of AP. |
| Walled-off pancreatic necrosis | Evolution of early necrosis to a partially encapsulated collection of pancreatic juice and necrotic debris. Well-defined inflammatory wall. Requires at least 4 weeks to form. |

**Table 22.2** Endoscopic approaches to walled-off pancreatic necrosis.

| Endoscopic approach | Advantages | Disadvantages |
|---|---|---|
| Single or multiple transmural entry with nasocystic irrigation | Technically easy | Discomfort of nasal tube |
| Single-entry transmural with percutaneous endoscopic gastrostomy/jejunostomy (PEG-PEJ) for irrigation | Avoids nasal tube | Technically more difficult than nasocystic irrigation<br><br>External tube |
| Transmural entry with direct endoscopic necrosectomy | Avoids external drains | Technically difficult<br><br>Time-consuming<br>Labor-intensive |
| Hybrid percutaneous irrigation endoscopic transmural approach | Minimal endoscopic procedures | Requires both interventional radiologist and gastroenterologist<br><br>External tube |
| Hybrid percutaneous–endoscopic direct necrosectomy using external/internal large-diameter stents | Allows endoscopic access to areas not accessible translumenally | Requires both interventional radiologist and gastroenterologist<br><br>External stent<br>Abdominal wall pain<br>Stent cost |

## Conclusions

In patients with AP, a variety of complications may occur. Early ERCP for gallstone pancreatitis does not appear to alter outcome, except in those patients with coexistent acute cholangitis. Endoscopic interventions for local complications can be technically difficult and associated with severe adverse events.

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