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Endoscopic Ultrasound-Guided Cystogastrostomy

■ ***The aim of the Expert Approach section is to contribute to the dissemination and standardization of new endoscopic procedures. Authors from three distinct geographic areas combine forces, sharing their experience to form a consensus of opinion. Readers' comments are welcome and will be published in the Mailbox which appears at the end of each Expert Approach article.*** ■

Objectives

The management of pancreatic pseudocysts (PPC) has traditionally been surgical. Although highly effective, surgery may be associated with a complication rate of 35% and a mortality of 10%. This has encouraged the development of nonsurgical approaches. Percutaneous puncture and aspiration under ultrasonographic or computed tomography (CT) guidance has been used, but aspiration alone has been found to be ineffective, with high recurrence rates of up to 71%. Continuous percutaneous drainage with indwelling catheters reduces the relapse rates, but may be associated with a complication rate ranging from 5% to 60%. Complications include fistula formation, infection, and bleeding.

Endoscopic transmural drainage of PPCs is an alternative nonsurgical approach. Since the first reports by Sahel et al. [1] and Cremer et al. [2], endoscopic drainage of PPCs has become an established procedure. It entails the creation of a fistulous tract between the PPC and the gastric lumen (cystogastrostomy) or duodenal lumen (cystoduodenostomy). Endoscopic access to the PPC is established, and a nasocystic catheter or a stent is placed for continuous drainage. The obvious limitation of endoscopic transmural drainage of PPC is its relatively "blind" approach. The risk of perforation is particularly high when endoscopically visible intraluminal bulging is absent. A major risk of endoscopic cystoduodenostomy or cystogastrostomy is hemorrhage (6% of cases) [1,2].

The ideal approach for PPC puncture combines endoscopy with real-time endosonography using an interventional echo endoscope. Several authors have described the use of endoscopic

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ultrasound (EUS) longitudinal scanners for guidance of transmural punctures [3–5] and drainage procedures. Using this technique, puncture of cysts under direct endosonographic control is possible even where there is no bulging of the gastric or duodenal wall. This improves the safety of PPC puncture, and increases the number of patients in whom endoscopic transmural drainage is appropriate. In this review, we descibe the different techniques of EUS-guided cystogastrostomy or duodenostomy, and the complications and outcomes of this new technical approach.

Basic Principles

It is reported that between 10% and 20% of patients with acute and chronic pancreatitis have the complication of PPC. The majority of these PPCs are asymptomatic and do not require treatment. Spontaneous regression of the PPC is reported to occur in 7–60% of cases. Indications for drainage of PPCs will differ, depending on whether the cyst develops in the setting of acute or chronic pancreatitis. For PPCs that complicate acute pancreatitis, drainage is indicated when pancreatitis fails to resolve with conservative measures. PPCs that are not associated with persistent pancreatitis should be observed, as there is a high probability of spontaneous resolution. A 6-week observation period is generally recommended before decompression is considered; spontaneous regression after persistence of more than 6 weeks is thought by some to be unlikely. In fact, in the current literature considerable doubt has been expressed concerning the 6-week observation period, and large pseudocysts (greater than 4 cm in size) should be treated.

For PPC complicating chronic pancreatitis, drainage is indicated to relieve symptoms associated with a space-occupying mass, including compression of neighboring organs. Such patients have chronic cysts that remain unchanged over a period of months. Patients typically complain of a dull and constant pain and may develop symptoms of gastric outlet obstruction or jaundice from bile duct compression.

Multiple or multiloculated PPCs sometimes cannot be adequately treated by an endoscopic approach and warrant surgical resection. It should be remembered that an endoscopic approach contaminates the cyst and risks infection if the contents of the PPC cannot be completely drained.

Materials Used

Interventional Echo Endoscopes

Around 1990, the Pentax Corporation developed an electronic convex curved linear-array echo endoscope (FG32UA) with an imaging plane in the long axis of the device that overlaps with the instrumentation plane. This echo endoscope, equipped with a 2.0-mm working channel, enabled fine-needle biopsy under EUS guidance. However, the relatively small working channel of the FG32UA was a drawback for pseudocyst drainage since it necessitated the exchange of the echo endoscope for a therapeutic duodenoscope to insert either a stent or nasocystic drain. To enable stent placement using an echo endoscope, the EUS interventional echo endoscope models FG38X and EG38UT were developed by Pentax-Hitachi. The FG38X has a working channel of 3.2 mm, which allows the insertion of a 8.5-Fr stent or nasocystic drain, and the EG38UT has a larger working channel of 3.8 mm with an elevator allowing the placement of a 10-Fr stent (Figure **1**).

The Olympus Corporation has also developed convex array echo endoscopes. The GF UC 30P has a biopsy channel of 2.8 mm, which enables the placement of a 7-Fr stent or nasocystic catheter, and the instrument is equipped with an elevator. A new prototype, the GF UCT 30, has a larger working channel of 3.7 mm, allowing the placement of a 10-Fr stent. The Olympus instruments are coupled with the Aloca processor or with a smaller processor (Suzie). The main drawback of convex linear-array echo endoscopes is the more limited imaging field (120° using the Pentax and 180° using the Olympus) produced by an electronic transducer.

Needles and Accessories for PPC Drainage

Some authors have used needle-knife catheters, but the needle can be difficult to visualize endosonographically. The Zimmon needle-knife (Wilson-Cook, Winston-Salem, North Carolina, USA) has a large-gauge needle that is easier to visualize. Diathermy is usually required to penetrate the cyst.

Figure 1 The EG38UT with an interventional working channel of 3.8 mm in diameter and a 10-Fr stent.

A standard endosonography fine-needle aspiration (FNA) needle is well visualized sonographically and can be used for pseudocyst puncture. The drawback of this needle is its small caliber (22 or 23 G) which will accept only a 0.018-inch guide wire. Using a 19-G FNA needle (Wilson-Cook), a 0.035-inch guide wire can be inserted through the needle into the pseudocyst.

Recently, Seifert et al. have described a "one-step" instrument for EUS-guided PPC stenting [6,7]. The 19-G stainless steel puncture needle (Grosse, Daldorf, Germany) is loaded with a modified 7-Fr or 10-Fr stent (Wilson-Cook) and a pusher catheter. The stent is 6 cm long and has two side holes and four flaps to prevent dislocation.

Description of Procedure

EUS-guided PPC drainage is performed in the fluoroscopy suite, with the patient under conscious sedation and in the left lateral or prone position. The patient should receive broad-spectrum antibiotics during and after the procedure to reduce the risk of PPC infection. Transabdominal ultrasound should be performed immediately before the intervention to provide, more easily than an endoscopic procedure, important anatomical information (for example, varices, arterial pseudoaneurysms, multiple cysts or extended necrosis, ascites, large or atypically located gallbladder, or pleural effusion).

The steps of the procedure are as follows.

1. Locate the cyst and the contact zone between the gastric or duodenal wall and the cyst wall.
2. Doppler assessment of the stomach or duodenal wall for interposed vessels is carried out. Doppler ultrasonography prior to cyst drainage is now considered mandatory by some authors.
3. After determination of the optimal site for puncture, the PPC is punctured using a 19-G FNA needle, and a sample of the cyst contents is aspirated and submitted for biochemical, cytological, and tumor marker (e.g. CEA) analysis. If infection is suspected, a sample should be sent for Gram stain, and culture and sensitivity testing.
4. Contrast filling of the PPC is carried out under fluoroscopy to document the size and anatomical boundaries of the cyst. Communication of the cyst with the pancreatic duct may be seen. Filling of the cyst can also be verified by EUS, being seen as a visible streamline effect.
5. A needle-knife is introduced through the working channel and used to carry out EUS-guided transgastric or transduodenal puncture of the cyst. The metal part of the needle-knife is withdrawn, leaving the Teflon catheter in the cyst.
6. The tract is dilated using a 6-mm or 8-mm balloon over the wire.
7. A nasocystic drain (Figure **2**) or stent (straight [Figure **3**] or double pigtail) is placed to drain the PPC or acute pancreatitis.

The choice between a nasocystic catheter or a stent for drainage will depend upon the appearance of the cyst contents. A chronic cyst with clear liquid contents can be drained with a 8.5-Fr or 10-Fr stent alone or with two 7-Fr stents. If the cyst is infected, irrigation by nasocystic

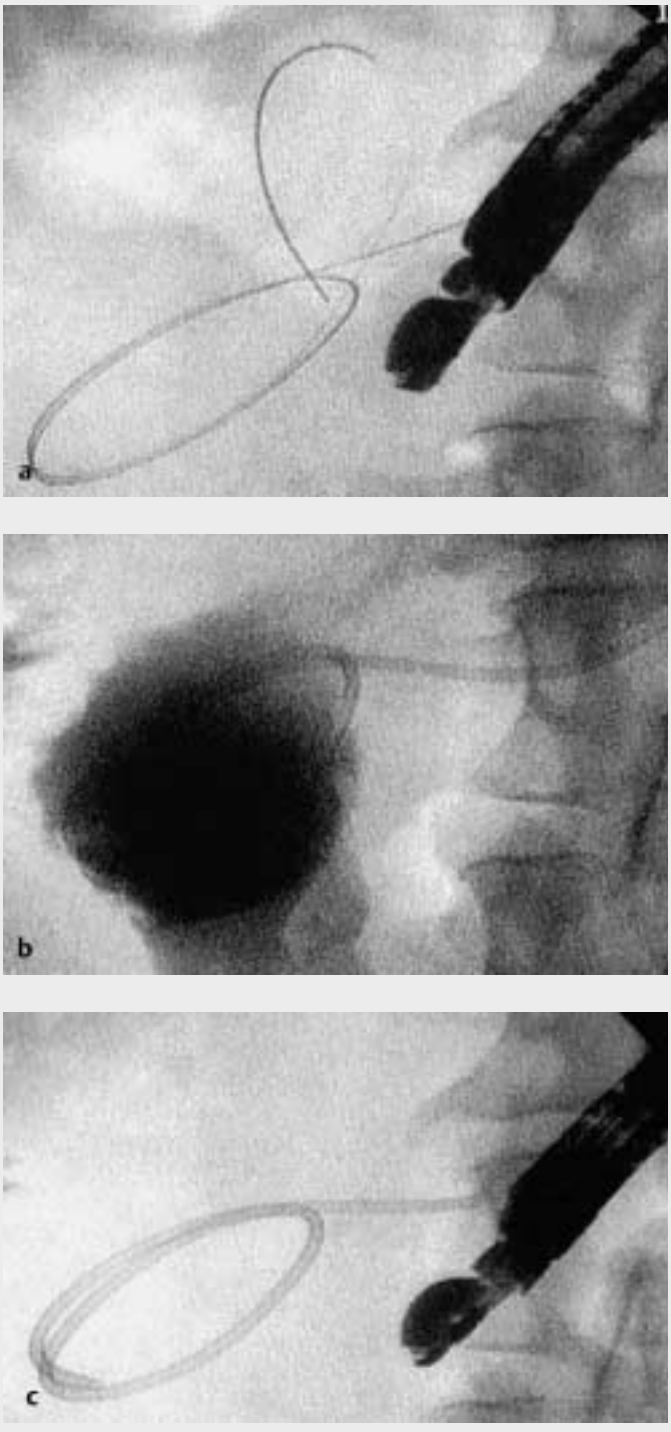

Figure 2 Endoscopic ultrasound (EUS)-guided drainage of a pancreatic pseudocyst (using a 7-Fr nasocystic drain). **a** A 0.035-inch guide wire is introduced into the pseudocyst. **b** A 7-Fr nasocystic catheter is inserted on the guide wire into the pseudocyst. **c** The injection of contrast medium permits good positioning of the nasogastric catheter.

catheter is required or a 10-Fr stent and nasocystic drainage can be put in place. The nasocystic catheter can be removed after 7 days and exchanged for a large-bore stent. Pancreatic cysts complicating necrotizing pancreatitis can be managed endoscopically, but require aggressive irrigation and drainage over an extended period.

As mentioned above, Seifert et al. have recently reported a "one-step" drainage technique, using a dedicated device [6,7].

Indications

The first report of EUS-guided drainage of a pancreatic pseudocyst was published in 1992 [8]. Wiersema et al. [9] treated a PPC using an interventional EUS scope (FG36X-Pentax), entirely guided by EUS. Binmoeller et al. reported EUS-guided pseudocyst drainage in 27 patients [10].

Figure 3 A "one-step" 8.5-Fr stent is inserted under EUS guidance. **a** The cyst is punctured using the "needle-wire". **b** The needle-wire is inserted into the pseudocyst. **c** A straight 8.5-Fr stent is pushed on the needle-wire into the pseudocyst.

The mean cyst diameter was 11 cm, and pseudocysts were associated with an episode of acute necrotizing pancreatitis in ten patients and chronic pancreatitis in the remainder. Pseudocyst puncture and drainage was successful in 25 patients and failed in two because of procedure-related bleeding. The primary late complication was cyst infection, which occurred in 13 patients due to stent clogging. These patients were treated by stent drainage alone. Pseudocysts resolved in 21 patients , giving an overall success rate for EUS-guided pseudocyst drainage of 78 %.

Giovannini et al. [11] performed EUS-guided drainage of PPC in 35 patients, with a mean cyst size of 7.8 cm. EUS-guided drainage was successful in 31/35 patients (88.5 %); only four patients with cysts related to acute pancreatitis went on to surgery. No major complication occurred; one patient developed a pneumoperitoneum which was managed medically. No bleeding occurred during the period of this study. One recurrence among the 15 chronic and two relapses of the 18 acute pseudocysts were observed during a mean follow-up of 27 months (range 6 – 48 months). A summary of published data is shown in Table **1**.

Table 1 Endoscopic ultrasound (EUS)-guided pancreatic pseudocyst (PPC) drainage

Report	*Number of patients*	*Success rate*
Wiersema et al. [9]	1	1/1
Giovannini et al. [12]	6	5/6
Giovannini et al. [11]	35	31/35
Siefert et al. [6]	6	5/6
Siefert et al. [7]	4	3/4
Binmoeller et al. [10]	27	21/27

Table 2 Comparison between stents and nasogastric tubes

	Nasocystic drain	*Stent*
Advantages	Flushing and fluoroscopy at any time	Easy, quick placement; dislocation rare
		Not disabling: patients stay mobile, feel better
Disadvantages	Discomfort	No flushing
	Easily dislocated	Monitoring requires endoscopic session
	Leads to immobilization of patients, nasal pain	
	Flushing often futile and tedious; no direct monitoring during flushing	

A trial of complete aspiration of the PPC with continuous drainage may be an option in some patients (e.g. those with portal hypertension). This approach provides definitive treatment of the cyst in about 30 – 40 % of cases. If the cyst recurs, continuous drainage by stent or nasocystic catheter can be undertaken. The advantages and disadvantages of nasocystic drainage and stents are presented in Table **2**. A trial puncture with cyst aspiration serves two objectives: first, it provides a generous sample of cyst fluid for biochemical, cytological, and tumor marker analysis; and secondly, it predicts the value of drainage in terms of symptomatic benefit. If there is no symptomatic improvement, continuous drainage may not be warranted.

Conclusion

Curved linear-array echo endoscopes have made transmural pseudocyst puncture under EUS guidance technically possible. Given the ability to "see" pseudocysts through the wall of the stomach or duodenum, pseudocysts should be as accessible to the endoscopist as they have been to the radiologist performing percutaneous drainage. Dedicated pseudocyst drainage accessories and large-channel interventional echo endoscopes, designed for stent placement, will improve the outcomes of EUS-guided pseudocyst drainage.

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