EUS 2008 Working Group document: evaluation of EUS-guided pancreatic-duct drainage (with video)

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The principle of endotherapy in chronic pancreatitis is based on the premise that obstruction to the flow of pancreatic juice causes pancreatic-duct hypertension and increased pancreatic parenchymal pressures, which, in turn, induces pain. Strictures, stones, and a disrupted duct are the 3 main causes of obstruction in chronic pancreatitis. Apart from chronic pancreatitis, anastomotic stricture after a Whipple procedure can cause pancreatic-duct obstruction and lead to pain. Decompression of the obstructive pancreatic duct at ERCP leads to complete or partial relief of symptoms in 60% to 80% of patients. Patients who fail treatment by ERCP and those in whom ERCP is technically unsuccessful undergo surgery or are conservatively managed. Recently, EUS has been advocated as a rescue technique for management of patients in whom ERCP is technically unsuccessful. This section of the EUS 2008 Working Group Proceedings evaluates the current evidence and potential role of EUS in the management of symptomatic patients with obstructive pancreatic duct from benign causes in whom ERCP is technically unsuccessful.

CURRENT APPROACHES AND LIMITATIONS TO MANAGEMENT

Endotherapy

ERCP is a highly effective tool for the treatment of patients with an obstructive pancreatic duct in chronic pancreatitis and other benign causes.[1,2] Several interventions, such as pancreatic sphincterotomy, pancreatic-stricture dilation, pancreatic stenting, and pancreatic-stone extraction, can be undertaken at ERCP. The advent of extracorporeal shock wave lithotripsy has further advanced the role of pancreatic endotherapy in patients with chronic pancreatitis.[3] In expert hands, pancreatic-duct cannulation is successful in greater than 90% of patients[4] and intermediate to long-term pain relief can be achieved in 60% to 80% of these cases.[5,6] Because morbidity is low and mortality is almost negligible, endoscopy is considered the first-line treatment modality for management of patients with chronic pancreatitis.

Limitations of endotherapy include the following:

1. Access to the main pancreatic duct can sometimes be unsuccessful in patients with altered surgical anatomy, very tight strictures, complete pancreatic-duct disruption, stenotic minor papilla orifice in pancreas divisum, and severe inflammation.[7,8] These patients may require surgery or be conservatively managed.
2. Approximately 20% to 25% of patients, after endotherapy, experience recurrence of symptoms at long-term follow-up and thereby require multiple endoscopic interventions or surgery.[5,6]

Surgery

Unlike endoscopy, which can only decompress the obstructive pancreatic-ductal system, surgery permits both ductal decompression and, when required, a resection of part of the pancreas. The type of surgery is based on the clinical presentation and anatomy of the pancreatic-ductal system. In patients with a dilated main pancreatic duct, a side-to-side pancreaticojejunostomy is performed to drain the pancreatic duct. When required, a partial resection of the head of the gland is performed to ensure a complete drainage. Resection of the diseased portion of a gland (Whipple procedure or duodenum-preserving pancreatic-head resection) is appropriate when there is clearly focal disease, particularly in the absence of pancreatic-ductal dilatation. Recently, total pancreatectomy with auto islet cell transplantation has been advocated for patients with chronic pancreatitis who have a good endocrine reserve.

Limitations of surgery include the following:

1. Although some investigators report that improvement in symptoms was durable over a follow-up period of 7.9 years after lateral pancreaticojejunostomy,[9] other investigators report that nearly 20% of patients experience persistent pain from inadequate drainage.[10-15]
2. About 5% to 10% of patients experience pain after pancreatic resection because of the development of anastomotic strictures that impede drainage of juice via the main pancreatic duct.[16]
3. The morbidity rates for resection procedures are high, and a substantial cohort of patients have coexisting portal hypertension that precludes major surgery.[17,18]
4. In addition to significant operative morbidity, steatorrhea can develop in 30% to 40% of patients undergoing drainage procedures and in 66% of those undergoing extensive pancreatic resections.[19-21] Diabetes mellitus can occur after pancreatic resection,

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either as a consequence of surgery or secondarily from ongoing disease process.[22]

EUS-GUIDED DRAINAGE OF THE MAIN PANCREATIC DUCT

Two types of interventions have been proposed: (1) EUS-guided transluminal drainage (via the stomach or the duodenum) of the pancreatic duct and (2) EUS-guided transpapillary rendezvous drainage of the pancreatic duct. Prophylactic antibiotics need to be administered before the procedure for all patients.

Procedural technique for EUS-guided transluminal drainage of the pancreatic duct

The therapeutic curvilinear echoendoscope is positioned in the stomach or the duodenal bulb, depending on the least distance from which the main pancreatic duct can be accessed. To provide a larger area to target and to facilitate easy antegrade passage of the guidewire, it would be better to orient the echoendoscope parallel to the long axis of the main pancreatic duct. After excluding the presence of intervening vasculature by using color Doppler US, the main pancreatic duct is punctured by using a 19-gauge or 22-gauge FNA needle (Fig. 1A). Once the needle is seen within the main pancreatic duct at EUS, contrast medium is injected to obtain a pancreatogram (Fig. 1B).

A 0.035-inch or 0.020-inch guidewire is then passed via the FNA needle into the main pancreatic duct (Fig. 1C). It is preferable to advance the guidewire antegrade into the duodenum whenever possible. If this orientation cannot be accomplished, then the guidewire is advanced retrograde to the pancreatic-tail region.

The transmural tract is then dilated by using a small-caliber bougie, 4.5F tapered-tip ERCP cannula or by administration of electrocautery by using a diathermic sheath. The transmural tract is then further dilated by using a 4-mm or 6-mm small-caliber balloon dilator. If required, concomitant dilation of intraductal strictures should be undertaken by using over-the-wire balloons. After dilation, 7F stents (with or without a pigtail) of appropriate length should be deployed via the stomach or the duodenum into the main pancreatic duct (Fig. 1D).

Procedural technique for EUS-guided transpapillary rendezvous drainage

In this technique (Video 1, available online at www.giejournal.org), EUS is used to puncture the pancreatic duct solely to advance the guidewire antegrade through the papilla for subsequent rendezvous with ERCP or through the surgical anastomosis site in patients who have undergone pancreaticoduodenectomy. A rendezvous technique is feasible only when the duodenoscope or a colonoscope can be advanced to the papillary orifice or to the site of surgical anastomosis for retrieval of the guidewire to undertake subsequent therapy.

For rendezvous procedures, because the intent is to only pass a guidewire across the native papilla or an anastomotic stricture, a large-channel therapeutic echoendoscope is usually not necessary. As explained above, in the section on transluminal drainage, the main pancreatic duct is punctured for guidewire access (Fig. 2A).

The guidewire is then advanced under fluoroscopic guidance to traverse the stricture and enter the small bowel via the papillary orifice (Fig. 2B). Several loops are formed in the duodenum with the guidewire so as to firmly secure its position in the duodenum. The echoendoscope is then withdrawn and the duodenoscope is passed so that the guidewire can be visualized at endoscopy. The papilla or the anastomotic site is then cannulated alongside the guidewire or the guidewire can be retrieved into the working channel of the duodenoscope with which further endotherapy is undertaken (Fig. 2C).

Summary of published data

Two studies evaluated the role of EUS-guided transluminal drainage of the main pancreatic duct, one study evaluated both the transluminal and the rendezvous approaches, and one evaluated only the rendezvous approach (Table 1). All patients enrolled in the 4 studies[23-26] had a failed ERCP because of (a) an inability to cannulate the main pancreatic duct from severe inflammation or the presence of pancreas divisum, (b) the presence of a tight stricture, occlusive stone, or disrupted main pancreatic duct that precluded endotherapy, and (c) altered postsurgical anatomy that precluded endoscopic access to the papilla or postsurgical anastomotic strictures that precluded cannulation.

With the exception of 1 study in which the main pancreatic duct was accessed via the stomach and duodenal bulb,[23] all other transluminal approaches were undertaken via the stomach.[24,25] In 2 series, dilation of the transmural tract for main pancreatic duct access was performed by using bougies[24,25] and by administration of electrocautery via a diathermic sheath in 1 series.[23] Although a pancreatogram was successfully obtained in most patients, technical failures with stenting were mainly because of (a) difficulty in orienting the echoendoscope along the axis of the pancreatic duct, particularly when the main pancreatic duct was not dilated, (b) an inability to dilate the transmural tract because of dense fibrosis, and (c) the acute angle at which the main pancreatic duct was accessed by EUS made endotherapy technically difficult. Because of the few studies and the small numbers of enrolled subjects, it is not possible to conclude from available data which of the 2 approaches, transluminal or rendezvous, is superior. Although the rate of response to therapy was not systematically evaluated, as in most studies in the ERCP literature, medium-term

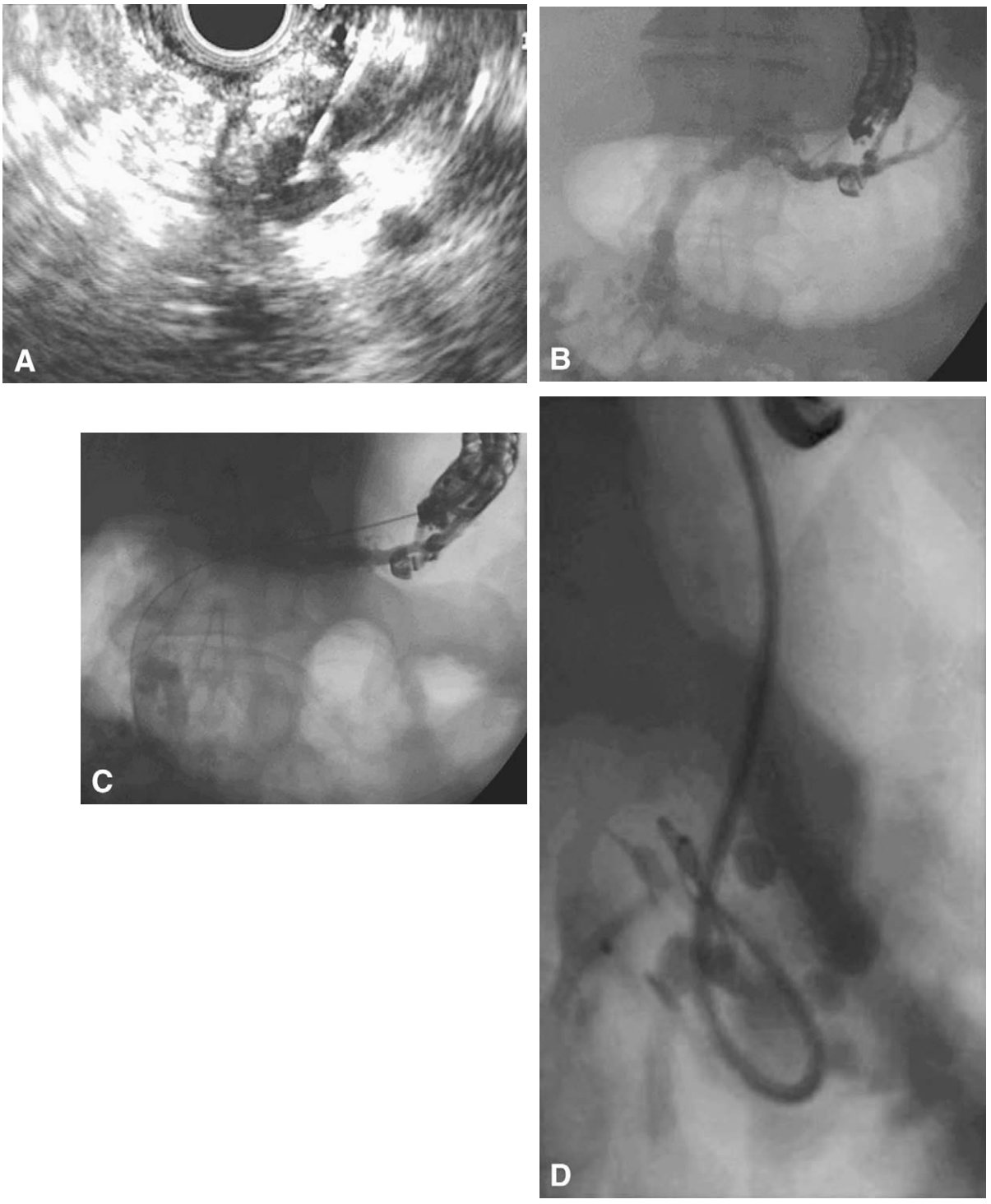

Figure 1. A, Pancreatic duct accessed with a 19-gauge FNA needle under EUS guidance. **B,** EUS-guided pancreatogram. **C,** Passage of a guidewire into the main pancreatic duct. **D,** Placement of a transmural stent into the main pancreatic duct. (Courtesy of Michel Kahaleh, MD)

pain relief was experienced by 60% to 70% of patients. With the exception of 1 study,[24] stent migration and occlusion appear to be a major problem in 20% to 55% of cases transluminally drained,[23,25] and stent-induced pancreatic-duct strictures were observed on follow-up.[23] The rates of procedural complications in the 4 series vary between 5% and 44%, and there appears to be no difference in the rate of complications based on the modality used for dilating the transmural tract or the technique adopted to facilitate pancreatic drainage. Although all series report that the procedure is technically challenging, none of them reported on the procedural duration,

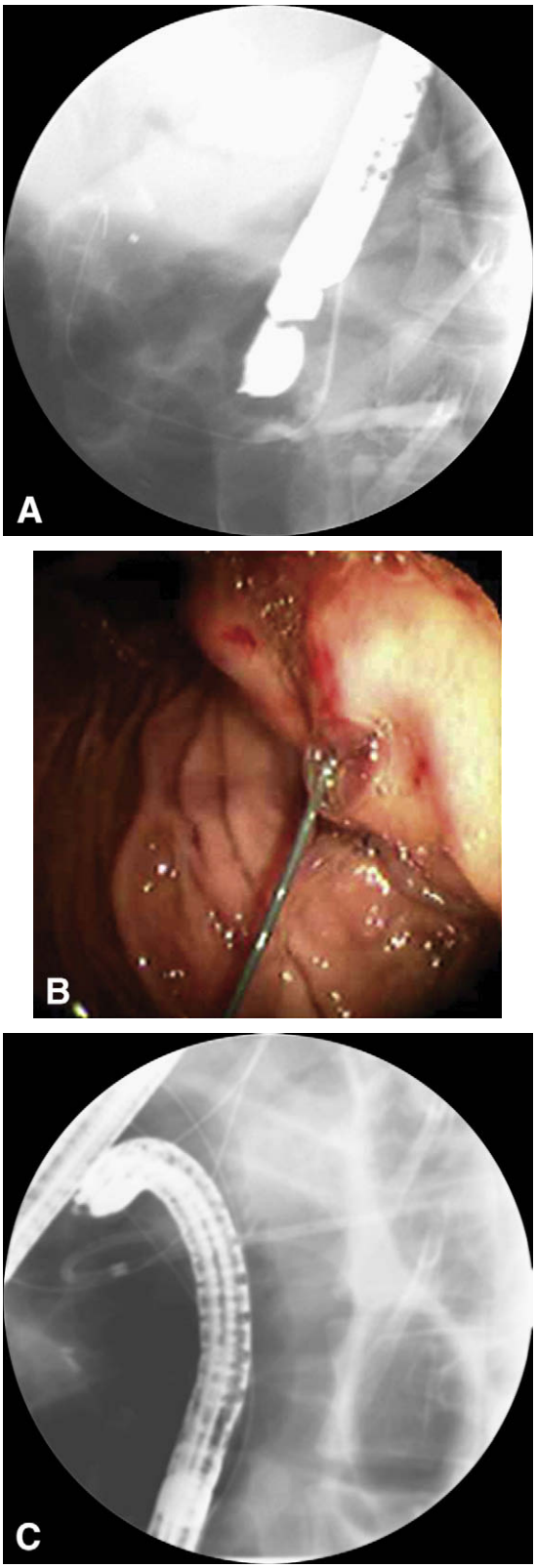

Figure 2. A, EUS-guided pancreatogram followed by guidewire passage. **B,** Guidewire seen exiting the papillary orifice. **C,** Pancreatic stenting by the rendezvous technique. (Courtesy of Martin Freeman, MD)

which could be a surrogate measure for technical difficulty.

Limitations of the EUS approach

1. The procedure can be attempted only when the main pancreatic duct is dilated.
2. The echoendoscope has to be oriented correctly so that it is positioned along the axis of the main pancreatic duct (Fig. 3).
3. Severe parenchymal fibrosis may preclude access to the main pancreatic duct.
4. Placement of stents and other endotherapy may be technically challenging because of the acute angle in which the pancreatic duct is accessed at EUS.
5. Reported procedure-related complications are major, and the rates of complications are high.
6. The rate of stent-related complications appear to be high.

CLINICAL RESEARCH AGENDA

The role of EUS in drainage of pancreatic ducts requires further clarification because the procedure is technically challenging and the rates of complications are high. Unless the technical success rates can be improved and the complication rates minimized, it may not be possible to conduct studies that compare EUS-guided pancreatic-duct drainage with surgery or standard ERCP. Currently, different techniques are adopted by experts for performing pancreatic-duct drainages, and there is no consensus on the type of accessories used to facilitate effective drainage. A recent randomized trial showed that surgery is superior to endoscopy (ERCP) for the management of pain in chronic pancreatitis, and the benefit of endotherapy is only marginal.[27] In view of these findings, the clinical benefit of EUS-guided pancreatic-duct drainage remains unclear. If attempted, the procedure should be undertaken only in a research setting in a carefully selected cohort of patients. This would include symptomatic patients who had a failed ERCP and who are not candidates for definitive surgical interventions. Because ERCP is successful in expert hands in more than 90% of cases, it is likely that only small numbers of patients will qualify to be candidates for EUS-guided pancreatic-duct drainage. Studies that compare the transluminal and rendezvous techniques are required to identify the optimal technique for EUS-guided pancreatic-duct drainage. Long-term follow-up of these patients is required to evaluate a durable response to therapy and the clinical implications of this technique.

DEVICE DEVELOPMENT

Although a EUS-guided pancreatogram can be performed in most patients, accessing the main pancreatic duct to perform endotherapy is technically challenging.

TABLE 1. Major series evaluating EUS-guided drainage of the main pancreatic duct

Study	Design	Approach	No. cases	Technical success (%)	Complications
Tessier et al,[23] 2007	Retrospective	Transluminal	36	91.6	Hematoma (n = 1), severe pancreatitis (n = 1)
Kahaleh et al,[24] 2007	Prospective	Transluminal	13	83	Bleeding (n = 1), perforation (n = 1)
Will et al,[25] 2007	Case series	Transluminal and rendezvous	12	69	Pain (n = 4), bleeding (n = 1), perforation (n = 1), pseudocyst (n = 1)
Mallery et al,[26] 2004	Case series	Rendezvous	4	25	Fever (n = 1)

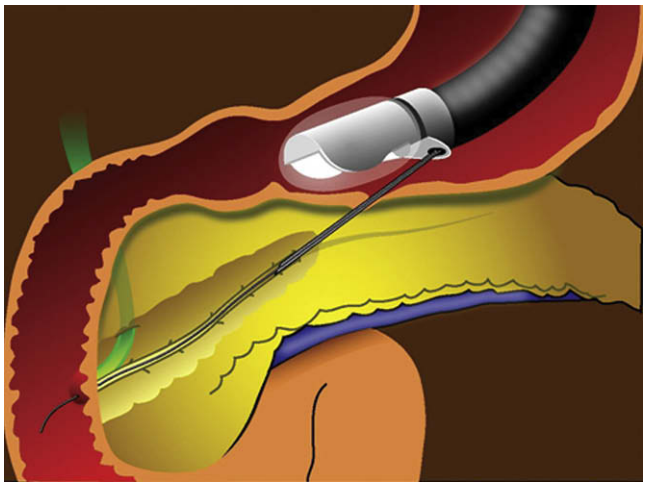

Figure 3. The echoendoscope is oriented parallel to the axis of the main pancreatic duct to facilitate easy access. (Courtesy of Martin Freeman, MD).

Development of accessories to perform transmural dilation and permit safe access to the main pancreatic duct is required. The role of the prototype forward-viewing convex echoendoscope for performing EUS-guided pancreatic-duct drainage requires further investigation.

WORKING GROUP RECOMMENDATIONS

There certainly exists a role for EUS in the management of a subset of patients with chronic pancreatitis who are high-risk surgical candidates and in whom the pancreatic duct cannot be accessed at ERCP. However, the working group sets the priority at low for clinical research in this area, because the technical success rates of EUS-guided pancreatic-duct drainages are marginal and the complication rates are high. Currently available data are from expert centers and involve a small cohort of patients. Also, the long-term benefit of endotherapy for management of pain in chronic pancreatitis remains to be established.

Given the limited data, technical difficulty, and reported procedural complications, the working group recommends that, if attempted, EUS-guided pancreatic-duct drainage preferably be performed under a research protocol in a tertiary-care setting by endoscopists who are technically proficient in both therapeutic EUS and pancreatic ERCP or in collaboration with the endosonographer and therapeutic endoscopist. A dedicated MRCP for assessment of ductal anatomy and surgical input is recommended before the procedure for all patients. The technique should not be used in lieu of a MRCP or other imaging studies for performing only a diagnostic study.

Dedicated accessories are required for performing safe EUS-guided pancreatic-duct drainages. However, because the clinical applications of this procedure may be limited to a small cohort of patients, the working group sets the priority at low for device development.

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