# Endoscopic ultrasound-guided pancreatic duct drainage: Ready for the prime time?

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The development of interventional endoscopic ultrasound (EUS) has provided better access to the pancreatic region. Just as pancreatic fluid collections, such as pseudocysts, can be successfully drained from the stomach or duodenum through endoscopic cystenterostomy or cystgastrostomy,[1-3] the same technique could be used to access a dilated pancreatic duct in cases where the duct cannot be drained by conventional endoscopic retrograde cholangiopancreatography (ERCP) because of complete obstruction.

Main indications of EUS-guided pancreatic duct drainage are stenosis of pancreatico-jejunal or pancreatico-gastric anastomosis after Whipple resection, which induce recurrent acute pancreatitis, main pancreatic duct (MPD) stenosis due to chronic pancreatitis (CP), postacute pancreatitis, or postpancreatic trauma after failure of ERCP. The pain associated with CP is caused, at least in part, by ductal hypertension. Both surgical and endoscopic treatments can relieve pain by improving ductal drainage. Endoscopic drainage requires transpapillary access to the pancreatic duct during ERCP. EUS-guided pancreatico-gastro- or bulbostomy offers an alternative to surgery. Despite the advances in endoscopy, EUS-guided pancreatic duct drainage remains a technically challenging procedure. Technical success rates are >70%; however, the average rate of adverse events (AEs) is nearly 20%, which increases to 55% when stent migration is included. Until recently, a significant difficulty with this technique was the absence of dedicated devices.

## TECHNICAL CONSIDERATIONS

Using a linear interventional EUS scope, the dilated MPD was well visualized. EUS-guided pancreatogastrostomy (EPG) was then performed under combined fluoroscopic and ultrasound guidance, with the tip of the echoendoscope positioned such that the inflated balloon was in the duodenal bulb while the accessory channel remained in the antrum. A 19-G needle was inserted transgastrically, or through the bulbus, into the proximal pancreatic duct, and contrast medium was injected. Opacification demonstrated a pancreaticography. A guidewire (0.025 or 0.035 inch) was introduced into the needle; at this time of the procedure, two scenarios are possible.

Option 1: The guidewire passes the stenosis, penetrates the papilla, and travels into the duodenum. A rendezvous technique should be performed by

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exchanging the EUS scope for a duodenoscope and "classic" pancreatic endotherapy could be performed [Figure 1]. This technique should be the first choice when the anatomy of the patient is intact because the complication rate is very low.

Option 2: The guidewire does not pass the stenosis [Figure 2] or the patient has had a previous surgery (Whipple or gastrectomy) [Figure 3]. The needle is exchanged over a guidewire (0.025 or 0.035 inch) for a 6.5F or 8F diathermic sheath (prototype Cysto-Gastro set, EndoFlex, Voerde, Germany), which is then used to enlarge the channel between the stomach and MPD. The sheath is introduced using a cutting current. After the exchange over the guidewire (rigid 0.035-inch diameter), a 7F, 8-cm-long pancreaticogastric stent is positioned. This stent will be exchanged for two 7F or one 8.5F stents 1 month after the first procedure. This technique was first reported in a study on EUS-guided MPD by François *et al*.[4] Other authors reported different techniques. Although the first steps are similar to the puncture of the MPD (pancreatography and guidewire insertion), they[5,6] used a balloon dilatation instead of the cytostome as reported in the PRINCEPS study[4] and also in the work of Tessier *et al*.[7]

Discussion should be focused on the preventive role of pancreatic juice leakage using the diathermic technique compared to the balloon dilation. In our experience, peripancreatic collection occurred more frequently when a balloon dilation was used compared to a diathermic catheter that prevents the creation of fibrosis around the puncturing tract, causing a leak of pancreatic juice.

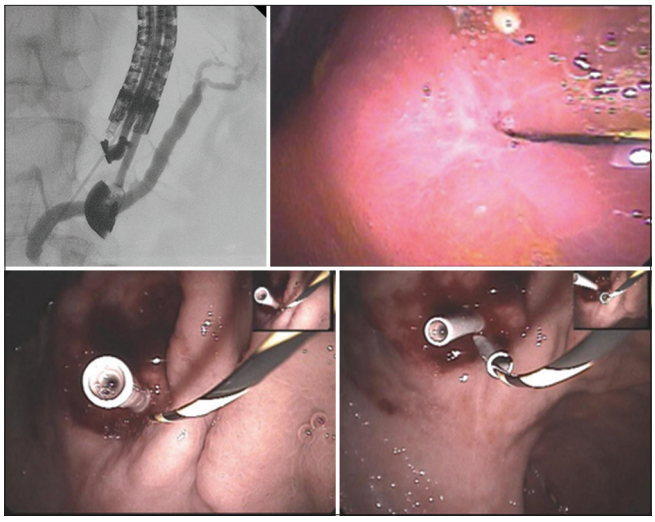

**Figure 1.** Rendezvous technique on pancreatico-gastrostomy/stenosis of a wirsungo-gastro anastomosis after Whipple resection for benign cystic lesion of the head of the pancreas

The results of the series[5-11] of patients published do not recommend the use of a wider EPG [Table 1], which in any case should be restricted to tertiary centers specializing in biliopancreatic therapy with a pain relief of 70%. However, the complication rate is still high, around 15%, and includes bleeding, pancreatic collection, and perforation. Nevertheless, the possibility of draining the MPD into the digestive tract through an endoscopically created fistula, with patency maintained by stent placement, might be interesting as an alternative drainage method without the complication of stent occlusion that is associated with transpapillary drainage.

The first large series of EUS-guided pancreatic duct drainage was published by Tessier *et al*.[7] on 36 patients. Indications were CP with complete obstruction (secondary to a tight stenosis, a stone, or MPD rupture); inaccessible papilla or impossible cannulation ($n$ = 20); anastomotic stenosis after a Whipple procedure ($n$ = 12); complete MPD rupture after acute pancreatitis (AP); or trauma ($n$ = 4). EPG or EPB was unsuccessful in three patients; one was lost to follow-up. Major complications occurred in two patients and included one hematoma and one severe AP. The median follow-up was 14.5 months (range, 4–55 months). Pain relief was complete or partial in 25 patients (69%, intention to treat). Eight patients treated had no improvement of their symptoms (four were subsequently diagnosed with cancer). Stent dysfunction occurred in 20 patients (55%) and required a total of 29 repeat endoscopies.

Fujii *et al*.[6] reported their experience in 45 patients, where 37 underwent failed ERCP and 29 had surgically altered anatomy. The median follow-up after initial EUS-guided intervention was 23 months. Two patients underwent EUS for stent removal, and EUS-guided

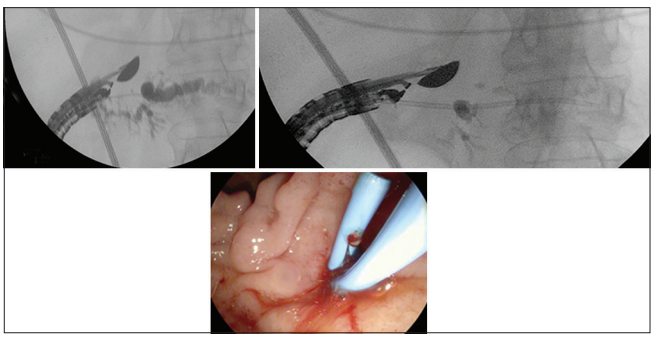

**Figure 2.** Pancreatico-bulbostomy/chronic pancreatitis with thigh stenosis of the main pancreatic duct in the head of the pancreas, failure of endoscopic retrograde cholangiopancreatography

**Table 1. Studies on endoscopic ultrasound-guided pancreatico-gastrostomy**

| Authors | NB PTS | Percentage success | Percentage complication | Follow-up (months) |
|---|---|---|---|---|
| Tessier GIE, 2007 | 36 | 70 | 11 | 16.5 |
| Kahaleh GIE, 2007 | 13 | 92 | 16 | 14 |
| Barkay GIE, 2010 | 21 | 48 | 2 | 13 |
| Ergun ENDOSCOPY, 2011 | 20 | 90 | 10 | 37 |
| Fuji GIE,2013 | 45 | 74 | 6 | 32 |
| Will WJG, 2015 | 94 | 81.9 | 8 | 28 |
| Oh* GIE, 2016 | 25 | 100 | 20 | 5 |

FCSEM: Fully covered self expanding stent, NB-PTS: Number of patients. *Oh used fully covered metallic stent, and the other authors used plastic stent

MPD stent placement was attempted in 43 patients. Technical success was achieved in 32/43 (74%) with antegrade ($n$ = 18) or retrograde ($n$ = 14) stent insertion. Serious AEs occurred in three patients (6%). The patients underwent a median of two (range: 1–6) follow-up procedures for revision or removal of stents, without complications. Complete symptom resolution occurred in 24/29 (83%) patients while stents were in place, with nondilated ducts in six ducts. Stents were removed in 23 patients, who were then followed up for an additional median of 32 months; 4 had recurrent symptoms. Among the 11 failed cases, most had persistent symptoms or required surgery.

A larger study was reported by Will *et al.*[12] This study enrolled 94 patients who underwent EUS-guided pancreatography and subsequent placement of a drain. In total, 94 patients underwent 111 interventions using one of the three different approaches: (1) EUS-endoscopic retrograde drainage with a rendezvous technique; (2) EUS-guided drainage of the pancreatic duct; and (3) EUS-guided, internal, antegrade drainage of the pancreatic duct. The technical success rate was 100%, achieving puncture of the pancreatic duct including pancreatography. In patients requiring drainage, the initial drain placement was successful in 47/83 patients (56.6%). Of these, 26 patients underwent transgastric/transbulbar positioning of a stent for retrograde drainage; plastic prostheses were used in 11 and metal stents in 12. A ring drain (antegrade internal drainage) was placed in 3 of these 26 patients due to anastomotic stenosis after a previous surgical intervention. The remaining

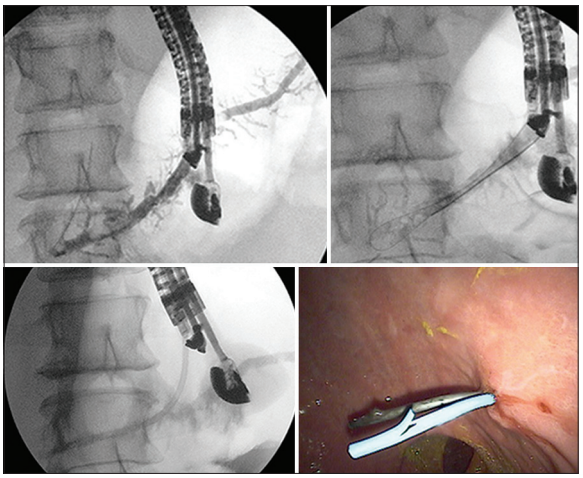

**Figure 3.** Pancreatico-gastrostomy: Stenosis of the wirsungo-jejunostomy after Whipple surgery for a pancreatic neuroendocrine tumor of the head of the pancreas

21 patients with successful drain placement received transpapillary drains using the rendezvous technique; the majority ($n$ = 19) received plastic prostheses and only two received metal stents (covered self-expanding metal stents). Clinical success, as indicated by reduced or an absence of further pain after the EUS-guided intervention, was achieved in 68/83 patients (81.9%), including several who improved without drainage, but with manipulation of the access route.

In 2015, Fujii-Lau and Levy[13] summarized the current literature on EUS-guided PD drainage, reviewing the published experience of 222 patients. Including both the antegrade and rendezvous techniques, technical success was achieved in 170/222 patients (76.6%). A similar review by Itoi *et al.*[14] in 2013 reported a technical success rate of >70% in 75 patients using the antegrade technique and a range of success rates from 25% to 100% in 52 patients using the rendezvous technique.

More recently, Oh *et al.*[15] reported the use of a pancreatic metallic stent (fully covered self-expanding metal stents [FCSEMS]). Twenty-five consecutive patients with painful obstructive pancreatitis underwent EUS-guided MPD with a FCSEMS after failed ERCP. EUS-guided MPD was successful in all the 25 patients (technical success rate, 100%), and symptoms improved in all patients (clinical success rate, 100%). EUS-guided pancreaticogastrostomy ($n$ = 23), pancreaticoduodenostomy ($n$ = 1), and pancreaticojejunostomy ($n$ = 1) were performed. Pain scores improved significantly after FCSEMS placement ($P$ = 0.001). Early mild-grade AEs occurred in five patients (20%), four with self-limited abdominal

pain and one with minor bleeding. No other AEs related to FCSEMS were observed during the follow-up period, including stent migration, stent clogging, pancreatic sepsis, and stent-induced ductal stricture. Mean stent patency duration was 126.9 days during the mean follow-up period (221.1 days).

## CLINICAL ALGORITHM

Regarding the three techniques, the rendezvous technique[10] should be used initially because the complication rate is very low, and EUS-guided pancreatico-bulbostomy is recommended for MPD stenosis in the head of the pancreas because the EUS scope position is stable. EUS-guided pancreatico-gastrostomy should be utilized when the patient's anatomy is altered (Whipple or gastrectomy) and mainly in case of stenosis of wirsungo-jejunostomy anastomosis. However, this technique is the most difficult with a high prevalence of complications due to the instability of the EUS scope into the stomach.[9]

## CONCLUSION

Therapeutic EUS as pancreatico-gastrostomy and EUS-guided biliary drainage currently represent an alternative to surgery or percutaneous biliary drainage when ERCP fails or is impossible due to previous surgery, such as gastrectomy or Whipple resection. Although data have demonstrated that the procedure can be safe and effective, EUS-guided PD drainage remains one of the most technically challenging therapeutic EUS interventions, as evidenced by the multiple considerations on device selection and the risk of severe complications. Therefore, I advocate that this procedure should only be performed in appropriately selected patients by experienced endoscopists trained in both EUS and ERP with well-trained surgical backup available.

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