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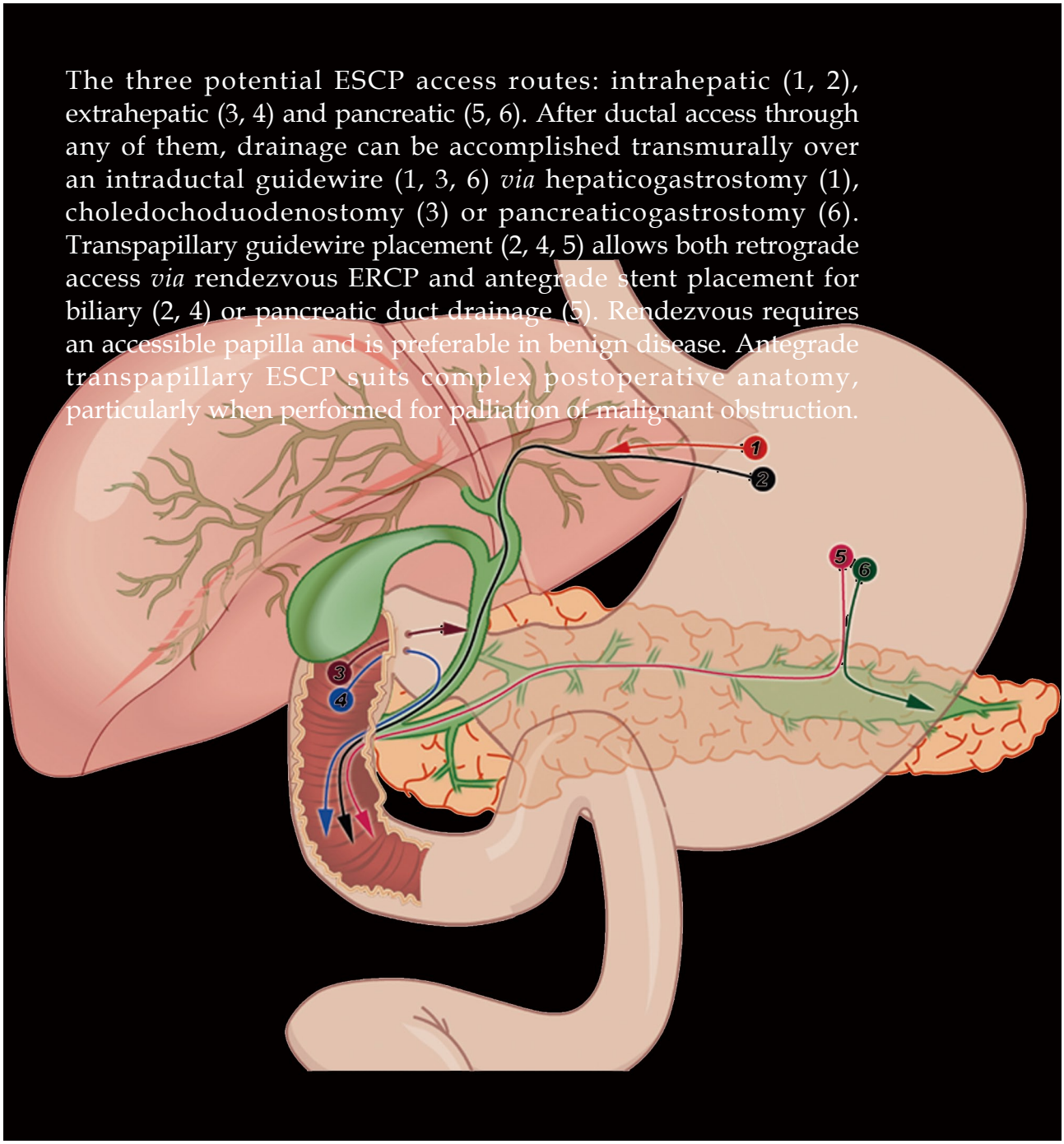

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EDITORIAL

Pancreatic pseudocyst drainage guided by endoscopic ultrasound

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Abstract

Pancreatic pseudocysts can be managed conservatively in the majority of patients but some of them will require surgical, endoscopic or percutaneous drainage. Endoscopic drainage represents an efficient modality of drainage with a high resolution rate and lower morbidity and mortality than the surgical or percutaneous approach. In this article we review the endoscopic pseudocyst drainage procedure with special emphasis on technical details.

Key words: Endosonography; Pancreatic pseudocyst; Drainage; Endoscopy; Digestive system; Therapeutics

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INTRODUCTION

Endoscopic ultrasonography (EUS) guided pseudocyst drainage has been widely used since it was first reported[1]. Endoscopic pseudocyst drainage has been developed in order to avoid the morbidity and mortality associated with surgical and radiological drainage. The success rate of endoscopic drainage ranges from 87%-97% with a complication rate of up to 34% and a mortality rate of 1%[2,3]. These outcomes compare favourably with the complication rate of 35% and the mortality rate of 10% associated with the surgical treatment and the complication rate of the percutaneous approach of up to 60%[4].

In this article we describe the technical steps we follow to perform EUS-guided pseudocyst drainage. Since EUS controlled drainage is only necessary in the transmural approach, the transpapillary technique is not described here.

TECHNIQUE

Basically, there are two possible techniques for performing EUS-guided drainage: the EUS-Endoscopy technique, where the EUS is used only to perform the initial puncture of the pseudocyst, and the EUS-single step technique, where the whole procedure relies on the EUS exploration.

EUS-ENDOSCOPY TECHNIQUE

As has been mentioned before, this technique requires the use of endosonography, endoscopy and fluoroscopy. We always do the exploration with the patient under general

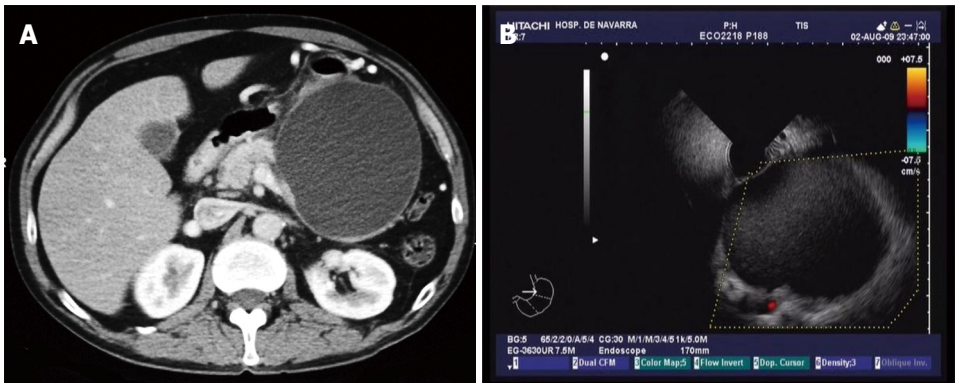

Figure 1 Images of a 14 cm diameter pseudocyst in a patient with an alcoholic chronic pancreatitis. A: CT; B: Endoscopic ultrasonography (EUS) with doppler, the pseudocyst can be seen in close contact with the gastric wall without intervening vessels.

anaesthesia and in a left lateral decubitus position using antibiotic prophylaxis with ciprofloxacin or levofloxacin. This antibiotic treatment is maintained for 7 d after the procedure. We like to start the exploration with the radial echoendoscope, in order to evaluate the diameter and characteristics of the pseudocyst. These include distance to the gut wall, presence of solid debris inside the cyst, portal hypertension vasculature, relationship of the cyst to the splenic artery, communication of the cyst with the pancreatic duct and presence of biliary disease such as common bile duct stones (Figure 1A and B).

Taking into account the radial EUS findings and previous radiological results, the best approach to drain the pseudocyst is decided. When the best choice is to perform a transmural drainage, we then introduce the linear array echoendoscope as far as the stomach or duodenum, and search for an adequate point to puncture. This point must not have intervening vessels and the distance between the gut lumen and the pseudocyst must be less than one centimetre.

Once the best point to puncture is identified, a 19 G needle (Echo-Tip, Wilson-Cook medical, Inc., Winston-Salem, North Carolina, USA) is introduced through the working channel of the endoscope. Afterwards, we proceed to puncture with the endoscope in a fixed and straightened position (Figure 2A and B). After removing the needle stylet, we aspirate at least 30 cc of pseudocyst contents and send specimen for culture and analysis for determination of amylase and CEA levels.

Afterwards, we introduce a guide wire (Jagwire, Boston Scientific Corp, Natick, MA, USA) through the needle and check with the ultrasonography and the fluoroscopy view that the wire is correctly placed inside the cyst (Figure 2C). Without losing the endoscope position we remove the needle, leaving the guide wire in place, and then introduce a biliary balloon dilatation catheter (Hurricane Rx, Boston Scientific Corp, Cork, Ireland) over the wire.

Once the dilatation catheter is inserted through the fistula, we change to the endoscopy view and proceed to dilate up to 8 or 10 mm, under endoscopic control. After one minute of dilatation, the balloon is deflated and a large amount of pseudocyst contents usually drains to the stomach and must be aspirated (Figure 2D). Once there is a clear vision of the fistula, a double pigtail stent (Solus, Cook Medical, Limerick, Ireland) is inserted over the wire and placed through the fistula, connecting the pseudocyst and the gastric lumen (Figure 2E and F).

In order to insert more stents, we have to recannulate the fistula and again insert the guide wire into the cyst to be able to introduce a second stent or a nasocystic catheter. We repeat this manoeuvre as many times as the number of stents we want to place.

Normally we place no less than 3 stents, 10F diameter and 5-7 cm long (Figure 2G). When we decide to insert a nasocystic catheter because of the presence of solid debris inside the cyst, we use a 6F catheter (Nasal Biliary Drainage Set, Cook Medical, Limerick, Ireland) and perform nasocystic lavage with continuous perfusion of 1000-1500 cc of saline over 3-5 d (Figures 3 and 4A).

The patient resumes oral feeding several hours after the exploration and is discharged 24 h later if there are no procedure-related complications. Between 4 and 6 wk after the drainage procedure we perform a CT scan and remove the stents if the resolution of the pseudocyst is confirmed (Figure 4B).

EUS-SINGLE STEP TECHNIQUE

For performance of this technique there is a commercially available device for use with large-channel echoendoscopes without the need for any exchanges, using the Needle-Wire Oasis System. This is an all-in-one stent introduction system, containing a 0.035-inch needle-wire suitable for cutting current, 5.5F guiding catheter and a pushing catheter with a back-loaded straight stent (8.5 or 10F, 5 cm long).

This procedure can be performed with the patient under conscious sedation by using standard monitoring in the left lateral position. Intravenous broad-spectrum antibiotics must be used before and after the procedure. The optimal location for carrying out the procedure is the fluoroscopy suite, since in some cases the radiologic view can be helpful either for insertion of the stent at a better angle or for completing the drainage with cyst irrigation and/or additional stent placement.

First thing to do is locate the cyst with the linear array echoendoscope, looking for an optimal contact with the gastric or duodenal wall. Doppler assessment is included to eliminate interposition of large vessels. The needle-wire is then introduced into the intestinal

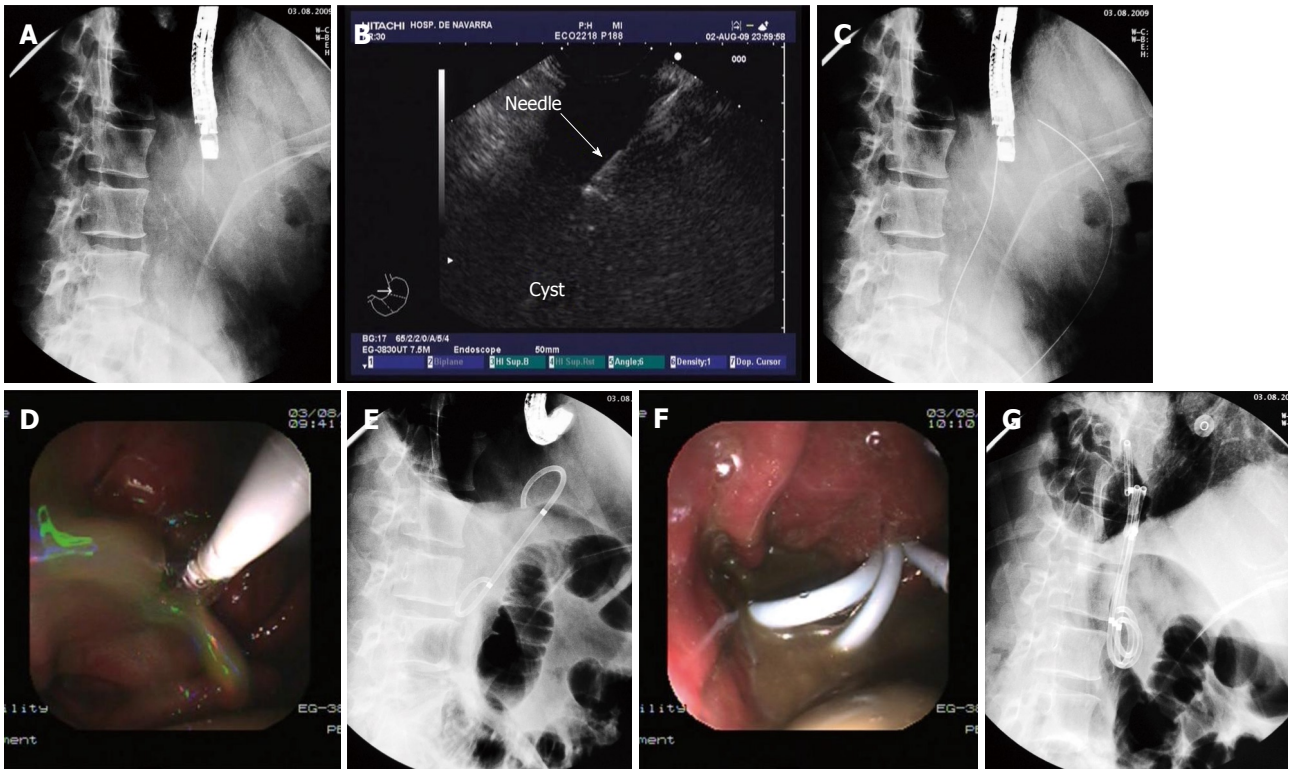

Figure 2 Approach to drain the pseudocyst. A: In this fluoroscopic image the linear array echoendoscope is inside the gastric lumen in a stable and straightened position, with the needle coming out of the working channel; B: EUS image with linear array echoendoscope in which the needle can be seen inside the cyst once the puncture has been made; C: The guidewire is inserted through the needle and curled inside the cyst cavity; D: With deflation of the balloon dilator the pseudocyst contents spurts through the fistula into the gastric lumen; E: Fluoroscopic view of the first double pigtail stent inserted through the fistula connecting the gastric lumen and the cyst cavity (Dimensions of the stent: 5 cm long and 10 F diameter); F: Three double pigtail stents can be seen draining the cyst contents into the gastric lumen; G: The three double pigtail stents are placed transmurally. The gastric and cyst lumen can easily be seen on the X-ray image.

wall and the cyst wall is penetrated under continuous pressure and cutting current. Once inside the cyst, the internal rigid part of the needle-wire is removed and it becomes a soft wire that can be easily inserted into the cyst followed by the dilator catheter and finally the straight plastic endoprosthesis under endoscopic and ultrasound monitoring.

DISCUSSION

Transmural endoscopic pseudocyst drainage was initially described as a blind technique, without the aid of EUS[4]. Although some authors still support this classic endoscopic approach[5], EUS guided drainage offers important advantages. It improves the safety of the procedure as the risk of bleeding is reduced by avoiding intervening vessels identified with the color doppler It also increases the number of patients amenable for endoscopic drainage since non-bulging cysts are also amenable to drainage. This has been proved in a prospective study performed by Varadarajalu *et al*[6], in which, the EUS-guided approach was successful in all patients with a rate of pseudocyst resolution of 95%, while the endoscopic blind approach was successful in only 57% of patients with a similar rate of pseudocyst resolution (90%). Noticeably, in this study, 43% of patients in whom the blind approach was attempted required an EUS-guided drainage because of failure of the blind procedure[6]. Furthermore, the only clinically meaningful episode of bleeding occurred with the blind endoscopic approach. Taking these results into account, and in agreement with other authors[4,7], we think that the EUS guided procedure allows more accurate drainage of cysts, with a lower risk of complication.

In addition to its safety and therapeutic success rate, EUS also allows a diagnostic evaluation of the pancreatic cystic lesions. Thus, based on the EUS findings, the management plan is changed in 5%-9% of patients since EUS identifies other cystic lesions misdiagnosed as pseudocysts[6-8].

From the technical point of view, the EUS-guided approach has two crucial steps. The first is the identification of an optimal point to puncture without intervening vessels and with a short distance between the cyst and the gut wall. Once this point is identified, the endoscope should be straightened as much as possible in a stable position. The second critical step is that once the puncture has been performed and the guide wire is curled inside the cyst cavity, the wall dilator must be introduced without losing the endoscope position and under ultrasonographic view. Once the dilator has been inserted through the parietal fistula, the ultrasonographic view is no longer needed, and the dilation and stent insertion can be made under endoscopic view. In our

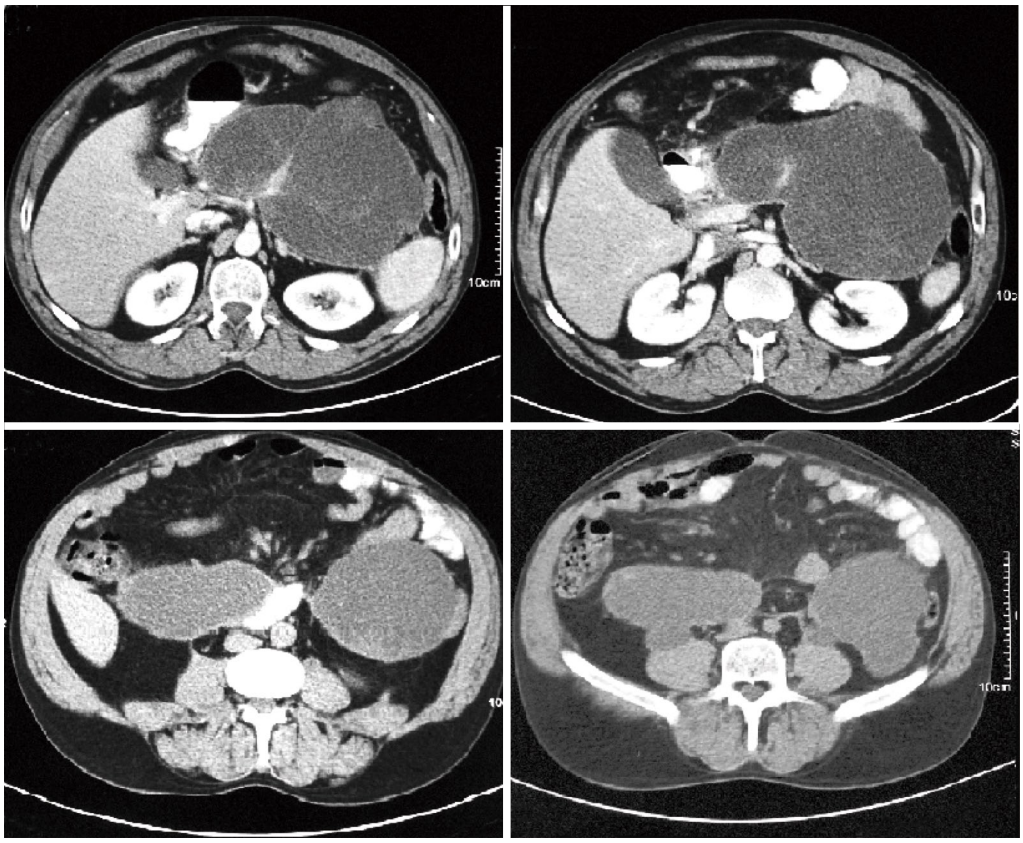

Figure 3 In this case, a large cyst of 18 cm in diameter with a horseshoe morphology going down bilaterally as far as the pelvic cavity can be seen on the CT scan.

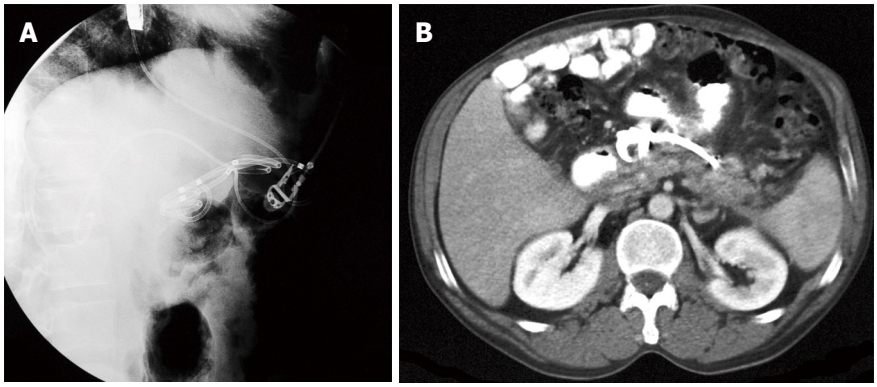

Figure 4 The same patient as previus images. A: The patient was treated with placement of three transmural double pigtail stents, and a thinner nasocystic drainage catheter because of dense cyst contents; B: The pseudocyst has disappeared after 4 wk with the stents. One of the stents has migrated and the other two can be seen communicating between the gastric lumen and the collapsed cyst cavity. Both stents were retrieved uneventfully and the patient remains asymptomatic 6 mo later.

experience, it is normally possible to recannulate the fistula with the echoendoscope in order to insert more stents, although it is sometimes necessary to exchange the echoendoscope for a duodenoscope.

The single step technique was first described in 1998 by Vilmann *et al*[9] and Giovannini *et al*[10]. In a prospective study, Kruger and co-workers[11] evaluated the one-step device for drainage of pancreatic pseudocysts and abscesses (Giovannini Needle Wire Oasis, Cook Endoscopy, Limerick, Ireland). Endoscopic stent placement was successful in 33 of 35 patients (94%), whereas repeated needle passages were unsuccessful in 2 cases. No procedure-related complications, such as bleeding, perforation, or pneumoperitoneum, were observed. All subsequent complications, such as ineffective drainage (9%), stent occlusion (12%), or cyst infection (12%), were managed endoscopically. The overall resolution rate was 88%, with a recurrence rate of 12%, during a mean follow-up period of 24 mo. The author concluded that the one-step EUS-guided technique with a needle-wire device provides safe transmural access and allows effective subsequent endoscopic management of pancreatic pseudocysts and abscesses.

Although the EUS-Endoscopy technique requires both fluoroscopic and endoscopic viewing, we prefer this technique to the EUS single step procedure. It allows the operator to insert more stents trough just one fistula, to insert pigtail stents, to insert stents of a greater diameter, or even to perform more aggressive treatments such as endoscopic necrosectomy whenever there is solid debris within the cyst cavity. Furthermore, new technical developments allow the operator to insert several guide wires in just one step making the insertion of several stents easier[12]. Cahen *et al*[3] reported that the majority

of major complications related to the endoscopic drainage of pseudocysts might have been prevented by using pigtail instead of straight stents, further supporting our preference.

There are still some questions unanswered regarding the endoscopic treatment of pancreatic pseudocysts: How many stents must be placed? What is the optimal duration of stent placement? Regarding the first question, we always try to insert a minimum of three 10F diameter/5-7 cm long pigtail stents. Whenever the pseudocyst content is dense or there is a suspicious of pseudocyst infection, we also insert a naso-biliary catheter. Regarding the second question, there are some data in the literature which suggest a lower pseudocyst recurrence rate in selected patients when the stents are not retrieved[13], although more data are needed draw a firm conclusion.

In summary, EUS-guided pancreatic pseudocyst drainage improves the safety of pancreatic pseudocysts endoscopic drainage and increases the number of patients suitable for this procedure by avoiding percutaneous and surgical drainage which are associated with higher morbidity and mortality. Therefore the EUS-guided procedure seems to be the best and safest technique for transmural endoscopic pseudocyst drainage, and it should be considered the first choice option.

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TOPIC HIGHLIGHT

Juan J Vila, MD, *Series Editor*

Endoscopic ultrasound guided vascular access and therapy: A promising indication

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Abstract

Endoscopic ultrasound (EUS) is an imaging technique that has consolidated its role as an important tool for diagnosis and therapeutics. In recent years we have seen a dramatic increase in the number of EUS-guided therapeutic indications (celiac plexus neurolysis/block, pseudocyst drainage, *etc*). Preliminary reports have suggested EUS may also be used to guide vascular access for both imaging and treating different vascular diseases. This review aims to objectively describe the existing evidence in the field.

Key words: Endosonography; Fine needle aspiration; Endoscopic ultrasound-FNA; Bleeding; Vascular therapy

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Vázquez-Sequeiros E, Foruny Olcina JR. Endoscopic ultrasound guided vascular access and therapy: A promising indication. *World J Gastrointest Endosc* 2010; 2(6): 198-202 Available from: URL: http://www.wjgnet.com/1948-5190/full/v2/i6/198.htm DOI: http://dx.doi.org/10.4253/wjge.v2.i6.198

INTRODUCTION

Although radiology imaging techniques such as computerized tomography (CT) and magnetic resonance imaging (MRI) have dramatically improved their image resolution in recent years and permit detailed anatomic information to be obtained (diagnosis and staging of diseases in a non invasive manner), the endoscopic ultrasound (EUS) technique still has some advantages over them. For example, EUS may allow one to place a biopsy needle into tiny lesions (< 5-10 mm) which are often too small to be identified by these complementary imaging techniques or too well encased by surrounding vascular structures to allow percutaneous biopsy methods to be used[1]. Endoscopic ultrasound guided fine needle aspiration biopsy (EUS FNA) has been classically employed for diagnostic purposes (biopsy of peri-intestinal lymph nodes and masses)[1]. However, in recent years we have seen a dramatic increase in the number of EUS-guided therapeutic indications: celiac plexus neurolysis/block[2], endoscopic drainage of pancreatic pseudocysts[3], common bile duct or pancreatic duct drainage[4], delivery of anti-tumor agents to malignant masses[5] *etc*. More recently, preliminary reports have suggested EUS may be helpful to guide the vascular access for both imaging and treating different vascular diseases[6]. It remains unclear whether or not this novel therapeutic indication of EUS-FNA is safe and effective. This article attempts to objectively describe the current state of knowledge in the field by presenting the limited data available at present time.

EUS-GUIDED VASCULAR ACCESS AND THERAPY

Justification for this new therapeutic approach

After the initial reluctance from the medical community to this type of intervention, there is a growing interest in this field[7]. It is well known that gastrointestinal bleeding is a frequent event and that hospital admission and endoscopy are usually required in the majority of cases[8]. Endoscopy is effective in identifying the cause of bleeding, permitting the delivery of hemostatic agents and preventing surgery in the majority of cases. However, endoscopic therapy may fail in 15%-20% of cases[9]. Lesions refractory to initial endoscopic therapy may benefit from a second endoscopic treatment or a vascular intervention (angiography, embolization with coils or micro-particles, cyanoacrylate/glue sealing, transjugular intrahepatic portosystemic shunt or TIPS)[7]. Vascular interventions are typically performed by interventional radiotherapists under X-ray guidance. However, this type of interventions may also be conducted under EUS guidance as suggested by some preliminary reports[7]. Another potential use for EUS in this setting is to employ Doppler US (available with the linear echoendoscopes and US miniprobes) to identify culpable vessels of bleeding, to help direct therapy into these bleeding vessels (arteries or varices) and to monitor the efficacy of the endoscopic therapy delivered[10-12]. Although initial reports have shown some promise, there is a paucity of data regarding this issue and its clinical impact and safety have yet to be proved.

Instruments required for EUS-guided interventions

Although EUS-FNA has also been described using the radial echoendoscope (elevated risk of serious complications), EUS-FNA should be performed with the electronic curved linear array echoendoscope which permits real-time visualization of the needle as it is advanced into the target area for biopsy or injection[5]. The linear array echoendoscope allows one to image the target area providing high resolution images on a grey scale and to use the pulse and color Doppler for vascular exam. Specifically designed EUS needles are required for vessel puncture and therapy. These needles are available in different diameters (25, 22 and 19 Gauge) and may be visualized from its exit from the biopsy channel. EUS needles are shown on the ultrasound image as a bright/white line. This type of needle is provided with a central stylet that upon removal permits the suction and injection of substances. Another important point is that the EUS-FNA/injection technique entirely relies on the ultrasound visualization (although X-ray aid may be required for certain therapeutic indications). Although it is well known that EUS-FNA is safe (< 1% rate of complications, usually mild inflammation or self-limiting hemorrhage and fever), little is known regarding safety of EUS-guided vascular interventions[1].

Doppler US

There are limited data regarding usefulness of Doppler US for the management of gastrointestinal bleeding[10-14]. Doppler US is readily available with the linear echoendoscopes (good to deliver substances but difficult to use in an acute bleeding patient and therefore difficult to apply in clinical practice) and some dedicated through-the-scope miniprobes (do not allow the delivery of therapy but permit monitoring treatment efficacy and are more likely to be available in clinical practice).

Doppler US monitored therapy has been reported to be successful for recurrent bleeding from peptic ulcers or Dieulafoy's lesions[10-14]. Doppler US may allow one to directly target the bleeding vessel, deliver therapy in a more effective manner and to monitor if blood flow has disappeared after therapy. This Doppler US monitored therapy has been suggested to be more accurate than endoscopic stigmata to predict patient risk of rebleeding after successful endoscopic therapy[7]. The absence of a Doppler US signal after therapy has been associated with a low risk of rebleeding (regardless of endoscopic stigmata)[15]. On the other hand, the presence of a Doppler US signal post-therapy has been associated with an elevated risk of bleeding even in those ulcers that have no visible vessel or clot on endoscopy image[15].

EUS with Doppler US may delineate the anatomy and identify the presence of gastric varices or Dieulafoy lesions to help direct therapy[10-14]. Several case reports and small uncontrolled case series have suggested the potential usefulness of Doppler US for this indication[10-16]. It has been reported that injection of absolute alcohol (under EUS Doppler US control) is feasible and effective for treating refractory Dieulafoy lesions[14]. Furthermore, EUS (without Doppler) may help identify the feeding vessels in these patients and monitor therapy effectiveness with promising results[16]. Unfortunately, the limited number of patients evaluated in the largest series to date (8 patients) limits its credibility and explains its limited impact in clinical practice at the present time.

EUS-FNA of vessels for therapeutic interventions

As we may visualize and target lymph nodes and tumors under EUS guidance[1], it is conceivable that we may also identify and puncture vascular structures in the gastrointestinal tract and surrounding structures (heart, liver *etc*).

Although experience on this is limited, EUS-FNA guided treatment of esophageal-gastric varices appears to be relatively well known. There are at least two prospective and controlled studies demonstrating its safety and effectiveness. A prospective study of 54 patients with gastric varices demonstrated that EUS-guided cyanoacrylate injection permits one to achieve a complete obliteration of varices[17]. Another prospective, randomized comparison of 50 consecutive patients with bleeding esophageal varices suggested that EUS-guided sclerosis of perforating veins is more effective than conventional endoscopic sclerosis of esophageal varices[18]. EUS-guided

injection of perforating veins with cyanoacrylate has also been reported for gastric varices with promising results in terms of safety and effectiveness[19].

The portal venous system may be difficult to access by standard angiographic methods employed by interventional radiologists. Preliminary studies conducted in an animal model suggest that EUS may permit portal vein access, contrast injection and monitoring the portal vein pressure which may be of interest in patients with portal hypertension in order to assess the risk of bleeding and treatment response[20-23]. Similarly, EUS-guided angiography of celiac trunk and hepatic/splenic veins has been reported in the swine model[24]. Unfortunately, the experience with these exciting indications for EUS-guided therapy is limited and restricted to animal models. Questions regarding safety (infections, risk for uncontrolled and non-treatable bleeding) and clinical effectiveness are yet to be answered before it can be applied in humans.

Preliminary experience in humans has been gained in recent years[25]. Patients presenting with refractory GI bleeding from hemosuccus pancreaticus, Dieulafoy lesions or gastrointestinal stromal tumor have been treated under EUS guidance[25]. These patients presented at least 3 bleeding episodes from the aforementioned conditions, required 14-25 units of packed red blood cells and repeated endoscopic and vascular therapies were ineffective. These difficult and refractory patients were treated by EUS-guided injection of absolute alcohol (99%) and/or cyanoacrylate into the bleeding vessel (one of them was a 30 × 50 mm aneurismatic branch of the superior mesenteric artery responsible for feeding the pancreas). The effectiveness of the EUS-guided angiotherapy in these cases was real-time monitored by Doppler US, concluding the injection therapy when no visible flow could be seen in the bleeding vessel. Although limited to 5 selected patients, EUS-guided injection was able to control the bleeding source in all of these refractory cases and no complications were registered. We believe that it is important to remark that although EUS may allow one to effectively deliver cyanoacrylate into esophageal and gastric varices in bleeding circumstances, we have to be aware of two things: (1) Blood may interfere with US imaging and therefore may preclude EUS-guided therapy; and (2) Cyanoacrylate may damage the expensive echoendoscopes.

In the same line of EUS-guided therapy of bleeding lesions, some authors have suggested that EUS may allow one to deliver microcoils to help control certain refractory bleeding episodes[7,26]. Levy *et al*[26] reported the case of a 50 year old woman who underwent a total pancreatectomy and presented with severe bleeding after ERCP dilatation of surgical anastomosis. Bleeding was considered not amenable for angiographic therapy or surgery despite the fact that the patient required a total of 10 units of red blood cells[26]. EUS exam identified that the bleeding source was a cluster of choledochojejunal varices at the level of the anastomosis. The bleeding point was needled under EUS-guidance (22 Gauge needle) and a microcoil (18S-8/4 Embolization Microcoil; Cook Inc, Bloomington, Ind) was advanced into the bleeding varices by pushing the needle stylet. The effectiveness of the EUS-guided microcoil embolization was monitored by Doppler US and demonstrated a complete cessation of blood flow 10 min after therapy. A total of 5 choledochojejunal varices were embolized in 2 sessions. No acute or delayed complications were registered. Other groups have also reported the use of EUS-guided microcoil embolization for treating large gastric varices. Romero *et al*[27] reported their preliminary experience in the field with promising results. For large gastric varices it may be required to place more than 1 coil per varix or to combine coils with cyanoacrylate injection to achieve a complete cessation of flow in the varix[27].

The preliminary experience of our group in this field of EUS-guided microcoil embolization of vessels is also promising and provocative[28]. We have conducted 3 animal experiments with the objective of creating an atrophy of the right hepatic lobe (10 d after EUS-guided selective embolization of the right branch of the portal vein) and a compensatory hypertrophy of the left hepatic lobe. This type of therapy has been classically performed by interventional radiologists in patients who require a right hepatic lobe resection for cure (e.g. large or multiple metastasis in the right hepatic lobe in a colon cancer patient). In these cases, it may be required to increase the residual hepatic mass after surgery (right hepatectomy) and the hypertrophy original of the left hepatic lobe after embolization may be a good alternative. Preliminary results in an animal model suggest EUS-guided embolization with coils of the right portal vein is safe, feasible and produces the intended hypertophy of the left hepatic lobe (Figures 1 and 2). A similar approach was also followed by Matthes *et al*[22] who reported the injection of a polymer (Enteryx) into the main portal vein resulting in thrombosis of the vessel. These anecdotal reports in animal models give the idea that different compounds may be delivered under EUS guidance causing occlusion of small and large caliber vessels. The potential applications in clinical practice are yet to be demonstrated.

In a recent publication, the John Hopkins group reported the first intrahepatic portosystemic shunt (IPSS) performed under EUS-guidance[29]. IPSS may represent an alternative to tranjugular intrahepatic portosystemic shunt (TIPSS) for patients with liver cirrhosis and refractory or ascites. The study was conducted in an animal model (10 animals; 2 of them survived for 2 wk) by using the EUS linear-array and a 19-Gauge needle. The hepatic vein (HV) and then the portal vein (PV) were punctured under EUS guidance, a 0.035-inch guide wire was advanced through the needle into the PV lumen and then the needle was exchanged over the wire and a metal stent was deployed under EUS and fluoroscopic guidance. The distal end of the stent was positioned inside the PV and the proximal end within the HV. EUS-guided portosystemic shunt (IPSS) placement

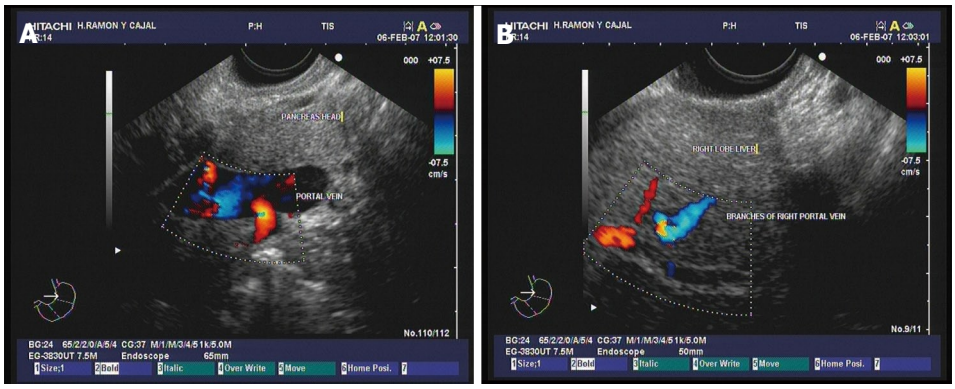

Figure 1 Doppler ultrasound images. A: The main portal vein show adequate blood flow; B: Vein flow is also evidenced by interrogation of the branches of the right portal vein at the intrahepatic level. Images courtesy of Grupo Español de Protocolos en Endoscopia Digestiva.

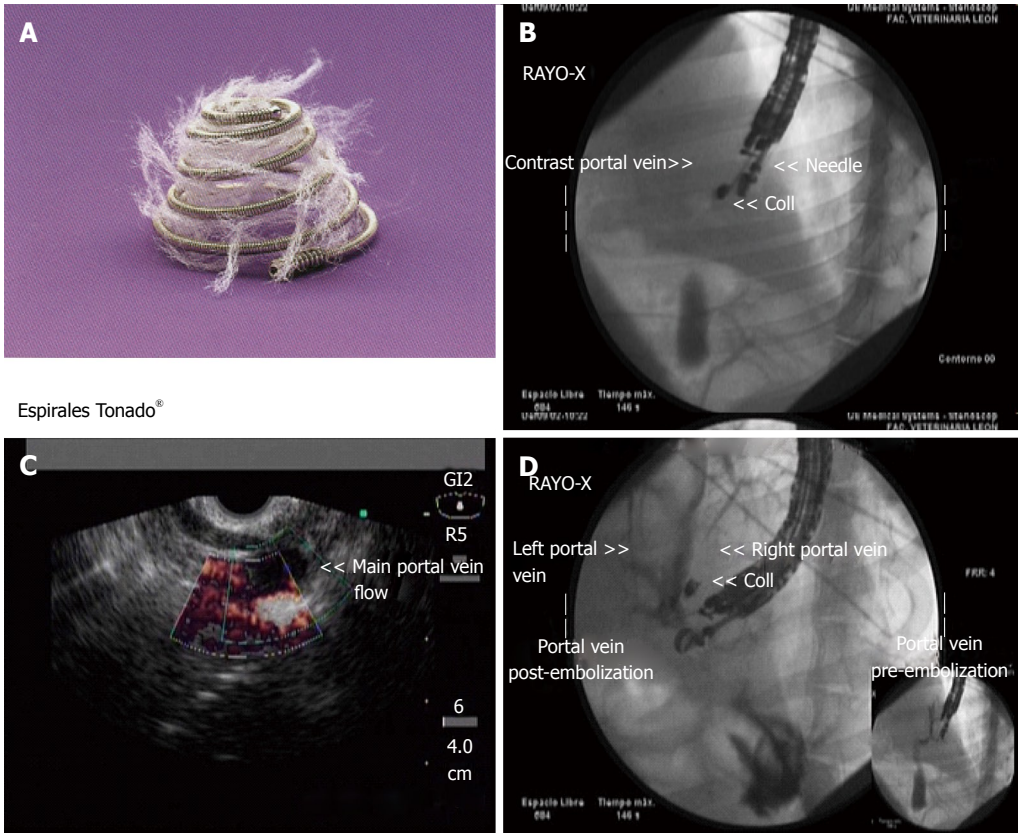

Figure 2 Endoscopic ultrasound-guided embolization with coils of the right portal vein. A: Image of the microcoil used in the experiment that is amenable for EUS-guided delivery[28]; B: The distal end of the echoendoscope is shown, showing the ultrasound transducer, the needle and the coil being deployed; C: EUS image of the right portal vein showing a grey coloured defect within the vessel that represents the coil after deployment; D: After coil deployment, X-ray fluoroscopy showed no filling of the right portal vein territory, with adequate contrast filling of the left portal vein. Images courtesy of Grupo Español de Protocolos en Endoscopia Digestiva.

was successful in all animals. Necropsy performed after acute and survival experiments revealed no evidence of bleeding or damage to any intraperitoneal organs. There were no complications during the follow-up period in the 2 animals that were kept alive. Authors concluded that EUS-guided IPSS creation is technically feasible and may become an alternative to the currently used method of TIPSS placement.

CONCLUSION

EUS-guided vascular therapy is a new field that shows some promise for EUS. Preliminary data, most of them in anecdotal case reports or animal models, suggest EUS guided angiotherapy may be feasible, safe and effective. However, data available are still limited and multicenter, prospective controlled studies have to be conducted before we can firmly recommend this provocative indication for therapeutic EUS. Further research in the field is warranted.

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TOPIC HIGHLIGHT

Juan J Vila, MD, *Series Editor*

Gallbladder drainage guided by endoscopic ultrasound

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Abstract

The gold-standard management of acute cholecystitis is cholecystectomy. Surgical intervention may be contraindicated due to permanent causes. To date, the classical approach is percutaneous cholecystostomy in patients unresponsive to medical therapy. However, with this treatment some patients may experience discomfort, complications and a decrease in their quality of life. In these cases, endoscopic ultrasound (EUS)-guided gallbladder drainage may represent an effective minimally invasive alternative. Our objective is to describe in detail this new and not well-known technique: EUS-guided cholecystenterostomy. We will describe how the patient should be prepared, what accessories are needed and how the technique is performed. We will also discuss the possible indications for this technique and will provide a brief review based on published reports and our own experience.

Key words: Gallbladder drainage; Endoscopic ultrasound-guided; Cholecystenterostomy; Cholecystogastrostomy; Cholecystoduodenostomy; Percutaneous cholecystostomy; Endoscopic transpapillary gallbladder drainage; Acute cholecystitis

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INTRODUCTION

Acute cholecystitis is not an uncommon reason for consultation in general surgery or gastroenterology. The gold-standard management is cholecystectomy. However, surgical intervention may be contraindicated in very elderly patients, patients with high surgical risk due to significant co-morbidities or those with a poor prognosis of their basal disease. In patients with risk of sepsis and without surgical indication, a gallbladder drainage method may be lifesaving. Percutaneous cholecystostomy is the most common approach in patients who are unresponsive to medical therapy[1]. Nevertheless, the percutaneous approach with a catheter draining purulent material into a bag may produce infection of the puncture point, needs special care, is associated with cosmetic disfigurement and discomfort and usually affects the quality of life[2]. An interesting question is when the catheter should be withdrawn in patients without surgical option. Moreover, some patients with advanced hepatobiliary malignancy have a biliary metallic stent that may be a permanent gateway for infective agents into the biliary tree. EUS-guided transluminal drainage methods are speedily gaining acceptance as an effective approach in a variety of conditions such as pseudocyst drainage, abscess drainage, pancreaticogastrostomy and hepatico gastrostomy[3-10]. Therefore, in this context, EUS-guided cholecystenterostomy may be a useful alternative that

might not significantly affect the quality of life of these patients[2,11,12].

PATIENT PREPARATION

In-patients are usually already receiving antibiotic treatment unlike most outpatients. In patients not receiving antibiotics, an intravenous therapy of broad-spectrum antibiotics must be started prior to the procedure as is common in patients with cholecystitis. Once patients are admitted, they must continue with intravenous antibiotic therapy for some days and then with oral antibiotics until the resolution of infection. When the gallbladder is drained, it is better to take sample for culture if possible and to treat the infection according to the antibiogram.

Patients with a severe abdominal infection usually have difficulties with gastric emptying especially if they are not on absolute diet. Therefore, in patients who are eating, a soft midday meal without vegetables and then an exclusively clear liquid diet is recommended. If there is a functional, organic gastric or intestinal subocclusion, it may be advisable to add prokinetic drugs and, in some cases, to place a nasogastric aspiration tube. The goal is to keep the gastric and duodenal lumen clean during the procedure.

Special care must be taken with patients being treated with non-steroidal anti-inflammatory, antiaggregant or anticoagulant drugs. If drainage is necessary, it is compulsory to improve coagulation status prior to the procedure.

The procedures are relatively long and must be performed under conscious-sedation or under anesthesia. A mixture of midazolam and meperidine or propofol and/or remifentanil may be used depending on the patient's characteristics and local expertise. In any case, it is highly recommended to have at least one pulsoximetry and it is advisable to have electrocardiographic recording, capnography and, if necessary, the possibility of patient intubation.

The procedure is usually carried out in two possible positions. If the use of X-ray is not expected, it can be done in left lateral decubitus. When X-ray is used, it is better to perform the procedure in a supine position to obtain a good radiological projection. As patients are usually sedated or anesthetized it is desirable to seek the maximum stability in their posture.

ACCESSORIES

The most useful endoscope to perform an EUS-guided acute cholecystitis drainage is a linear ultrasonic gastrovideoscope with large diameter working channel, forceps elevator and Doppler (usually called therapeutic echoendoscope). In some rare cases, other endoscopes such as a large channel side-viewing endoscope or different kinds of gastroscopes can be useful. In this paper we will refer to conventional therapeutic linear echoendoscopes.

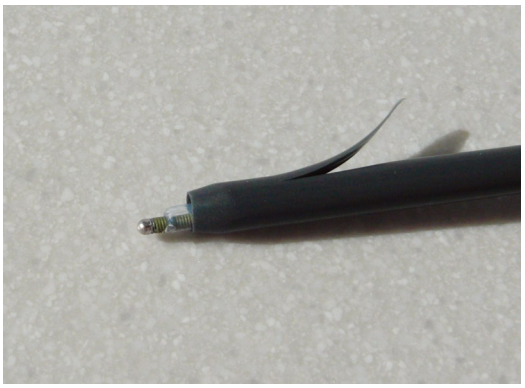

Figure 1 Photo of one-step device making the hole and placing one stent at the same time.

Although by using the one-step system most of the drainage can be performed without radiological control, it is highly desirable to have X-ray equipment at hand. When the procedure is going to be performed using the method in several steps, it must be done with radiological control. If a cutting current is going to be used, it is necessary to have an electrosurgical unit. This unit must be able to use blended cutting and electrocoagulation current.

There are many approaches and many useful devices to make a perfect drainage. We will describe in detail our favorite system (one-step) (Figure 1) and more briefly the other gadgets that are also commonly used in pancreatobiliary endoscopy. The one-step system NWOA (Giovannini Needle Wire Oasis, Cook Ireland Ltd®, Limerick, Ireland) is available in two sizes: 8.5 and 10 fr. Each size is designed to place stents of 8.5 or 10 fr respectively. The 8.5-stent is a modified Cotton-Leung® (Amsterdam) Biliary Stent and the 10-stent is a modified Soehendra® Tannenbaum® Biliary Stent. This system is only adapted to straight stents. Both sizes of stents have their advantages and disadvantages: 8.5 fr stents are placed much more easily but also theoretically more easily blocked.

The system consists of four basic elements that are telescopically positioned. The external element is a plastic positioner-pusher catheter of 8.5 or 10 fr according to the stent size. Within it is a plastic dilator-introducer catheter which overhangs about 90 mm at the tip. The innermost element within the introducer catheter is a long guide wire with a movable core (to regulate the stiffness) and a metallic tip that allows electrosurgical current to be used as a needle-knife. The stent is placed on the tip of the pusher catheter and over the introducer catheter. Stents of 5 cm in length are normally used and when they are placed on the system they must be put with the tapered tip forward. This device was chiefly designed to perform drainage of pancreatic pseudocysts under endoscopic ultrasound guidance (Figure 1).

To perform the procedure in several steps the required devices to puncture the gallbladder are a normal 19-gauge endoscopic ultrasound needle and a 0.035 inch

hydrophilic guide wire. An available 10 fr cystotome that is designed to electrosurgically cannulate the transgastric or transduodenal wall into a visibly bulging pancreatic fluid collection is useful too. A cystotome is a device manufactured by Cook® consisting of a 10 fr catheter with another 5 fr catheter inside it and within this second catheter a 0.038 inch needle-knife wire. The 10 fr external catheter tip has a diathermic ring to extend the initial hole to 10 fr[2]. Cystotomes of smaller caliber (Cysto-Gastro-Set of 6 and 8.5 fr) manufactured by Endo-flex® GmbH (Voerde, Düsseldorf) have recently come on to the market.

If the cystotome is not going to be used to enlarge the hole, a graduated dilation catheter[11] or a balloon dilator[12] has to be used. The stents may be straight or with pigtail ends. Within the procedure in several steps, double pigtail stents are usually preferred (Figure 2). In order to place the stent, a standard stent introducer set is usually utilised.

In some cholecystites with a dense content, lithiasis and pus, it can be useful to place a pigtail end nasobiliary catheter for continuous washing. We prefer a small caliber catheter (e.g. 5 fr) because it is more difficult for accidental looping and strangulation to occur and it is less troublesome for the patient. The outer end of the catheter must be connected to a gravity drip with a normal saline solution.

TECHNIQUE

The procedure starts with a linear therapeutic echo-endoscope because most patients have previously been studied with a transabdominal ultrasound, CT-scan, MRI and/or a radial endoscopic ultrasonography. In this kind of pathology it is not uncommon for the distal gastric antrum, the pylorus and/or the duodenal frame to be inflamed with stiffness and/or strictures. It is necessary to seek the more stable position in which the echoendoscope tip is positioned in front of the gallbladder. In order to do this, in some cases the long route must be taken with the tip positioned forward and upward in the prepyloric antrum. In other cases, it may be necessary to inflate the balloon inside the duodenal bulb to anchor the endoscope tip and then pull the echoendoscope slowly taking the short route. This is a very important maneuver as it will give stability and axial force to puncture. Next, the wall between the gut lumen and the gallbladder is explored, measuring its thickness and the presence of blood vessels. It is recommended that a scan of the wall with color or power Doppler is done. As far as possible, the window where the distance is the smallest and with no vessels between surfaces is chosen[2]. To achieve this, in some cases the echoendoscope is positioned in the duodenal bulb[2,11,12]. The access point usually corresponds to the gallbladder neck or body[11]. Theoretically the risk of leakage into the peritoneum decreases if there are inflammatory adhesions between surfaces. Moreover, there might be other factors related to the procedure

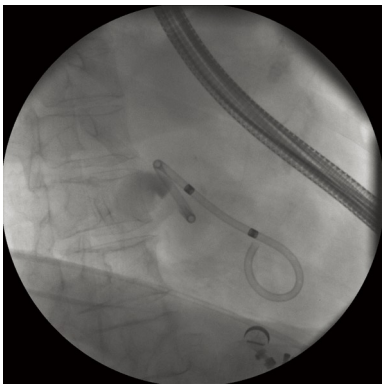

Figure 2 Double pigtail stent of 10 fr between the gallbladder and the gastric antrum.

such as the use of graduate dilators or electrosurgical current. It should be borne in mind that the graduated dilation catheter exerts an axial force that could detach the surfaces. On the other hand, the diathermic effect may help to keep the surfaces together due to the melting of tissues and the inflammatory reaction[2].

In the one-step technique, the use of 8.5 fr stents is preferred because they penetrate more easily through the stomach wall. The stent must be preloaded on the tip of the positioner-pusher catheter and over the dilator-introducer catheter. Care must be taken to place the tapered tip of the stent in a forward position to facilitate penetration. The metallic tip of the internal guide wire must protrude 1mm out of the tip of the dilator-introducer catheter to obtain the needle-knife effect. When this guide wire is correctly positioned, it is fixed by tightening the screw of the contact pin adapter. There is usually not much space between the enteral wall, the gallbladder and the hepatic surface. This might increase the risk of perforation of the contralateral wall of the gallbladder with the needle-knife tip. One trick to avoid this is to place the tapered tip of the stent immediately behind the tip of the needle-knife, to put the tip of positioner-pusher catheter next the end of the stent and to strongly fix the system with a surgical artery clamp placed near the catheter handle.

The kit has a flap positioner sleeve to lay flat the flap during stent introduction inside the working channel of the echoendoscope. However, when 8.5 fr stents are used it is not necessary to use this gadget because the flap in folded back position fits well through the large working channel. The contact pin adapter must be connected to the cable of the electrosurgical unit and the patient must have the electrosurgical patient electrode connected, preferably on the abdominal skin but not in the X-ray field. Usually 250 W of blended (cutting and electrocoagulation) flow current is used with the intention that the needle-knife incision does not slip on the intestinal surface while the fulguration creates a correct size hole.

When the tip of the one-step device appears in the ultrasound image, the best incision angle is found as perpendicular as possible to the wall between the intestinal lumen and the gallbladder. Therefore, the up/down control and the elevator forceps control are used. If the

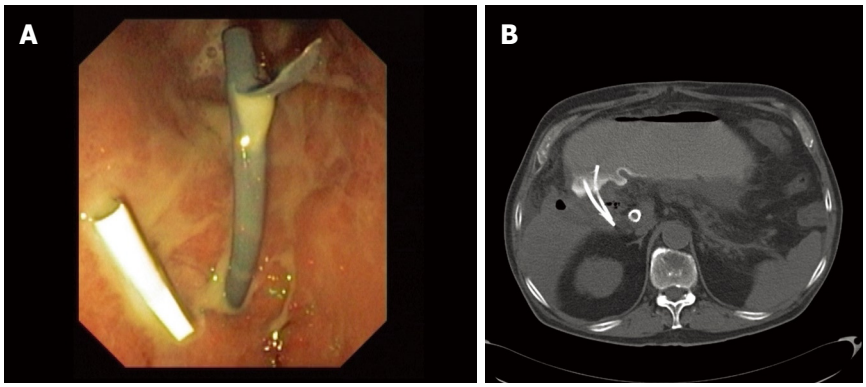

Figure 3 Two straight stents of 8.5 fr draining purulent material between the gallbladder and the gastric antrum. A: From the gallbladder to the gastric antrum; B: CT-scan performed some days after the procedure showing the stents and bubbles of gas in the gallbladder fundus.

incision angle is not the correct one a false way could be caused. When the tip of the device rests on the intestinal surface in the right direction, the cutting pedal of the electrosurgical unit can be stepped on and the one-step system pushed slowly but decisively. With a little effort, the needle-knife, the dilator-introducer catheter and the tapered tip of the stent will penetrate the gallbladder. During all this time it is very important not to separate the tip of the echoendoscope from the wall because otherwise the ultrasound image would be lost and, above all, the axial force. It is usually possible to watch the gallbladder content boiling on the tip of the introducer catheter, and moreover, in some cases, to watch the stent flap inside the gallbladder.

The stent is well positioned when the internal tip and flap are inside the gallbladder lumen. Only at this moment is it possible to separate very carefully and slowly the tip of the echoendoscope from the intestinal surface without losing the direction. Once this is done, the stent can be seen going through the wall in the optical image and its end with the external flap out of the wall and out of the echoendoscope channel. With the positioner-pusher catheter it is possible to control the depth of penetration. Then, the clamp that is fixing the positioner-pusher catheter to the dilator-introducer catheter can be released and then carefully pulled out until the stent is released. The output of gallbladder content through the stent hole can immediately be seen. If the output of liquid is not seen, it should be seen while aspirating with the endoscope. If despite all these maneuvers the liquid does not come out, either the stent is not well placed or there is a dense or solid content. If the liquid is clear bile, one stent may be enough. If the liquid is cloudy, purulent or with small particles of lithiasis, it is better to put more than one stent (usually two) (Figure 3A). The patient is kept under observation for a few days and then followed up as an outpatient. It is desirable to obtain a little quantity of content of the gallbladder in order to perform a culture and an antibiogram.

When there is thick pus and lithiasis it is necessary to place a nasobiliary pigtail end catheter for continuous washing. As argued above, a 5 fr catheter is usually used. This size of nasobiliary catheter has the advantage of perfectly fitting through the 8.5 fr stents. The internal guide wire of the one-step kit or a new hydrophilic guide wire of 0.035 inch and 480 cm in length is used to place it. It is necessary to place this guide wire deeply inside the gallbladder through one of the stents. Then the nasobiliary drainage is cautiously advanced over the guide wire until its pig tail tip is placed within the gallbladder.

By using a slim gastroscope the correct position and functioning of the stents and the washing catheter can be checked. If the system works adequately when saline solution is injected under pressure through the nasobiliary catheter it must come out through the unoccupied stent. Using X-ray control, the nasobiliary catheter also allows a contrast study to be performed with ease, permitting the early detection of leaks[2]. If there are no leaks, the nasobiliary catheter is connected to a gravity drip for washing with normal saline solution. A washing flow no greater than 40 mL/h to avoid leaks is used. In critical patients it is important to cautiously control the balance of liquids to avoid hydric overload. If a leak is detected, it is better to connect the nasobiliary catheter to a vacuum system to aspirate. In our opinion, while aspiration exists the patient will need to remain on absolute diet to avoid contamination of the gallbladder content through the stent.

The patient should be admitted and under continuous washing for at least one week. Then a new CT-scan or MRI is recommended to check the evolution (Figure 3B). If evolution is satisfactory, the removal of the washing catheter should be considered. Otherwise, the permeability of the stents using X-ray control and injecting radiographic liquid contrast through the nasobiliary catheter should be checked. If the stents are obstructed, a new endoscopic procedure to clean the system is needed. In the event that there is ascites, a leak between the wall of the gallbladder and the stomach is likely to be the cause. In this situation the flow of the saline solution should be stopped, an intermittent vacuum system connected to the nasobiliary catheter and oral feeding stopped. At this time, close monitoring of the patient is desirable.

The nasobiliary catheter should be withdrawn with endoscopic control to avoid removing the stent occupied by this. The stent is fixed by holding it with a grasping-forceps by the external flap and then the entire catheter

with visual control of the stent is withdrawn. Finally, the permeability of all the stents is checked by aspirating with the endoscope. These patients must stay for one or two days more and then if there are no complications they must be discharged with oral antibiotic treatment. The technique described here was modeled on our established experience with endoscopic drainage of pancreatic-fluid collections. From a technical point of view, cholecystenterostomy is executed in essentially the same fashion as a cystoenterostomy is made to drain pseudocysts.

To perform the procedure in several steps availability of X-ray equipment is a practical requirement in all the steps. When a window without vessels is selected, the gallbladder is punctured with a 19-gauge endoscopic ultrasound needle as in a standard diagnostic puncture. At this moment, it may be interesting to aspirate a quantity of content of the gallbladder to decompress it and, if necessary, to perform a culture. Decompressing the gallbladder beforehand may be good to be able to inject radiographic contrast medium in order to reduce the risk of leakages. Next, if necessary, contrast is injected and some radiological imaging performed. Then, the needle lumen is washed by injecting saline solution to lubricate its interior to facilitate the advancement of the 0.035-inch hydrophilic guide wire. Now, the guide wire is pushed through the needle lumen deeply into the gallbladder lumen. By using X-ray control it must be confirmed that the guide wire is coiled in the fundus of the gallbladder to provide a suitable anchorage.

Once this is done, the EUS-needle can be exchanged for a 10 fr cystotome to enlarge the initial hole by using blended cutting current[2]. When the procedure is performed in several steps, this device is preferred instead of using different kinds of dilators because it is not necessary to separate the ultrasound probe from the gut wall while the cystotome enlarges the hole. However, the main reason is that the physical force of the dilators might detach the gallbladder whereas the melting of tissue and the inflammatory reaction of the fulguration may help to keep the surfaces together. If there is no cystotome, a graduated dilation catheter or a balloon dilator may be used[11]. But with this kind of devices the ultrasound probe contact and the axial force may be lost. When the hole is dilated and the guide wire within the cavity, the endoscope is slowly separated and a stent placed using a 10 fr standard introducer catheter. In these cases 10 fr double pig-tail end stents are usually used (Figure 3A). If it is necessary to place a new stent or a nasobiliary catheter, the procedure is started again from the beginning. To avoid this, advantage is taken of the possibility that two guide wires can be inserted simultaneously into the 10 fr cystoenterostome in parallel position[2]. This procedure takes longer than the one-step method and in our opinion it is less safe as we may lose access at any time, especially if the patient moves, because the time between the initial puncture and stent placement is too long.

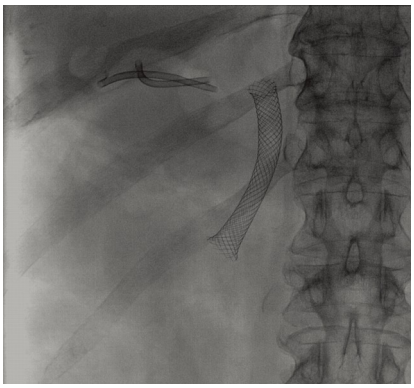

Figure 4 Detail of two straight stents of 8.5 fr draining the gallbladder, and a metal stent in the common bile duct.

DISCUSSION

Cholecystectomy must be the standard management for acute cholecystitis in the majority of patients. In patients unresponsive to conservative measures and without indication for urgent surgery, percutaneous cholecystostomy can be a bridge treatment toward elective surgery. However, there is also a group of patients that due to their clinical characteristics will never be candidates for surgery. These may mainly be very elderly patients, patients with high and permanent surgical risk or patients with an oncological disease and a limited life expectancy.

To date, percutaneous cholecystostomy is the most commonly used alternative to decompress the gallbladder. However, in some patients with important comorbidities, significant complications may occur with the percutaneous approach, including intrahepatic bleeding and sepsis[13,14]. Tube dislodgement is a frequent event, needing repeat procedures[1,13,15]. Moreover, attempts at definitive removal of the catheter are associated with a high recurrence rate of cholecystitis[1,14,16], above all, in patients with a permanent gateway of infective agents (Figure 4). Therefore, an interesting question is when the catheter should be withdrawn in patients without surgical option and while the cause is present. From the patient´s perspective, to have a permanent catheter draining purulent material from the body to a bag may lead to a distortion of self-image and may impose significant physical restrictions[2]. Discomfort, local pain and infection of the puncture point are not infrequent. To minimize these undesirable effects maintenance of the system is required, including irrigation, dressings and bag and catheter changes. This severely impacts on the quality of life of the patients with a terminal malignancy[2]. Endoscopic transcystic drainage by retrograde route may be a valid non-surgical alternative[17] but this technique is difficult in some patients and practically impossible with the presence of previously placed metal biliary stents (Figure 4)[2]. In our opinion, this group of patients could benefit from an EUS-guided cholecystenterostomy.

We have performed four EUS-guided cholecystenterostomies on four different patients; one patient with advanced Alzheimer's disease and three patients with advanced malignancies that involved the hepatobiliary region and biliary stents (Figure 4). All these patients

had a complicated acute cholecystitis with perforation and perigallbladder abscess. The first procedure was performed with the several steps technique using a 10 fr cystotome because this is a well-contrasted technique commonly used in other drainage procedures. The other three procedures were performed with the one-step system NWOA of 8.5 fr without X-ray guidance and they took significantly shorter than the several steps technique. In the last procedure we placed three stents due to the fact that the first stent migrated inside the gallbladder. This problem was caused by the large thickness and rigidity of the wall to be passed through; the gastric peristaltic movements caused the stent to enter the gallbladder. The two following stents were correctly placed.

The technique described is based on our established experience with endoscopic drainage of pancreatic-fluid collections: i.e. more than 25 cases. We prefer the one-step technique due to several reasons. We believe that the several steps technique takes too much time from the moment the needle reaches the gallbladder until the stent is released. During this time access may be accidentally lost and the procedure needs to start again from the beginning. This is an undesirable situation that could jeopardize the procedure. To perform the procedure in several steps, X-ray guidance and several different kinds of devices are absolutely necessary. By using the one-step system, the puncture and the stent placement are a simultaneous action which brings with it great advantages. The time that passes from the puncture until stent release is minimal and reduces considerably the risk of an accidental loss of access and possible complications due to this eventuality. Additionally, as argued above, the tissue fulguration created by an electrosurgical device may result in a more avid tissue reaction with better adhesion between surfaces and superior long-term fibrotic patency of the tract than can be achieved with only physical disruption by dilation. However, this point of debate is yet to be proven in a systematic fashion[2]. In the future, our own technique will probably change due to accumulated experience, the introduction of new tricks and the development of new devices.

EUS-guided cholecystenterostomy has been performed successfully in two published series and in a brief report with a single patient with a total of 13 patients[2,11,12]. All these patients showed rapid clinical improvement and they did not experience major complications. There were two minor complications without clinical relevance: a minor intraprocedural bile leak[2] and a pneumoperitoneum[11]. In our short experience we have had no relevant complications and our patients progressed satisfactorily. To avoid complications it is important to correctly select patients. We believe that an adequate inflammatory adherence between the gallbladder and gastric wall in the window that we are using is a guarantee of success.

One important issue is when to remove the stents. Based on our experience in the drainage of pancreatic fluid collections, we believe that in most cases it is not necessary to remove them. In our small series, the patient with Alzheimer's disease spontaneously expelled the stent after approximately two months. This patient had no new episodes of cholecystitis for more than a year of follow-up possibly due to the formation of a permanent mature fistula. The development of a fistula between the gallbladder and the intestine is one of the natural ways of spontaneous resolution of an acute cholecystitis. The other three patients, including the patient whose stent migrated into the gallbladder, still have their stents without complications related to them but it is too early to draw conclusions. Probably these patients will die due to their basal disease and the stents will have no negative impact.

FINAL CONSIDERATIONS

EUS-guided cholecystenterostomy is technically feasible. In expert hands it seems safe, effective and relatively easy. In the cases described in the literature all the patients have progressed adequately in a short period of time without significant complications related to the procedure. We are absolutely convinced that, in patients with terminal malignancies, this procedure might offer a better quality of life than other non-surgical techniques such as percutaneous cholecystostomy.

Future developments in this area should probably include devices to fix the gallbladder to the site of the puncture or special stents that seal the surfaces to prevent leaks. This might reduce risks and extend the application of this new approach. In our view, new accessories should be developed, preferably in one-step modality, so that the procedure becomes even safer, easier and quicker.

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TOPIC HIGHLIGHT

Juan J Vila, MD, *Series Editor*

Endoscopic ultrasonography-guided common bile duct stone removal

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Abstract

Endoscopic ultrasonography has become an important diagnostic and therapeutic tool in endoscopy units. It has a great impact on biliary and pancreatic disease management and its application to retrograde cholangiopancreatography is appealing, although very challenging with current devices. In this article we describe our initial experience with this technique.

Key words: Endosonography; Endoscopic retrograde cholangiopancreatography; Choledocholithiasis; Therapeutics; Biliary tract diseases

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INTRODUCTION

Over the past few years, there has been a steady increase in reports of therapeutic interventions using endoscopic ultrasonography (EUS) for a wide variety of indications including alcohol ablation of pancreatic cysts, celiac plexus neurolysis and several others[1]. We have previously reported the feasibility of performing therapeutic interventions in the bile duct under EUS guidance alone, such as cannulation and gallstone removal without fluoroscopy and contrast medium injection[2]. Other investigators have previously reported removal of gallstones using an echoendoscope, albeit under fluoroscopic guidance. We hypothesized that common bile duct (CBD) stone removal could be safely performed under EUS guidance alone, thus obviating fluoroscopy use. If feasible, such a strategy could be an alternative to Endoscopic retrograde cholangiopancreatography (ERCP), which entails injection of contrast medium and exposure to radiation. Furthermore, CBD stone removal could be carried out in the same setting as diagnostic EUS, eliminating the need for a follow-up ERCP procedure. We therefore prospectively investigated clinical outcomes following EUS-guided CBD cannulation and stone extraction versus ERCP-directed intervention.

TECNHIQUE

A therapeutic duodenoscope (TJF-140, Olympus), 4.4F sphincterotome, 0.035-inch guidewire, dormia basket (Boston Scientific) were used for cannulation and CBD

stone extraction in ERCP utilizing the "wire-guided" cannulation technique as described earlier[3]. Following wire-guided cannulation of the CBD, endoscopic sphincterotomy and stone extraction was carried out in the usual fashion. Fifty-two patients with uncomplicated CBD stones were prospectively randomized to CBD cannulation and stone removal under EUS or ERCP guidance.

A single endosonographer with proficiency in both EUS and ERCP performed all the procedures. EUS and ERCP were both performed with patients in the left lateral or semiprone position with the left hand over the head. This allowed adequate endoscopic and US views of the bile duct. Needle-knife sphincterotomy was necessary in 3 patients, 1 in the EUS group and 2 in the ERCP group. The time required for the procedures was less than 27 minutes from the start of CBD cannulation to completion for both EUS and ERCP. Doppler US was used as needed to confirm structures and avoid adjoining vessels. Additionally, Doppler US was also used to identify the CBD and avoid accidental pancreatic duct cannulation.

DISCUSSION

Cannulation in the current study was hampered in cases of ampullary diverticulum, which increases the complexity and decreases the likelihood of CBD access. Even so, rates of successful cannulation of the bile duct in our study were comparable to reported ERCP cannulation rates of 90% or greater when performed by expert endoscopists using advanced techniques such as precut sphincterotomy. Standard ERCP cannulation techniques can be easily adopted when using an oblique side-viewing echoendoscope. In our experience, cannulation with an EUS endoscope is not more challenging than cannulation during ERCP. After cannulation, therapeutic interventions on the CBD by using standard accessories are also feasible with the echoendoscope, albeit under fluoroscopic guidance, as reported earlier[4]. On the other hand, EUS-related adverse events were similar to those following ERCP.

We have demonstrated for the first time that it is feasible to perform therapeutic interventions of the CBD under EUS guidance alone. At the same time, EUS is becoming widely available and its range of indications is expanding. For example, EUS is being used for therapeutic interventions in the pancreaticobiliary system. We expect that this strategy will be adopted by some endosonographers, albeit somewhat selectively. This is because, despite the feasibility of therapeutic intervention with an echoendoscope, pragmatic considerations such as reimbursement and "wear and tear" to the endoscope may limit its widespread usage for therapeutic indications. Furthermore, not all endosonographers perform conventional ERCP, which may limit their enthusiasm for performing "an ERCP-like procedure" with an echoendoscope. Larger studies are also required to further ascertain the utility and safety of this technique.

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TOPIC HIGHLIGHT

Juan J Vila, MD, *Series Editor*

Endosonography-guided cholangiopancreatography as a salvage drainage procedure for obstructed biliary and pancreatic ducts

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Abstract

Endoscopic ultrasound allows transmural access to the bile or pancreatic ducts and subsequent contrast injection to provide ductal drainage under fluoroscopy using endoscopic retrograde cholangiopancreatography (ERCP)-based techniques. Differing patient specifics and operator techniques result in six possible variant approaches to this procedure, known as endosonography-guided cholangiopancreatography (ESCP). ESCP has been in clinical use for a decade now, with over 300 cases reported. It has become established as a salvage procedure after failed ERCP in the palliation of malignant biliary obstruction. Its role in the management of clinically severe chronic/relapsing pancreatitis remains under scrutiny. This review aims to clarify the concepts underlying the use of ESCP and to provide technical tips and a detailed step-by-step procedural description.

INTRODUCTION

Endoscopic retrograde cholangiopancreatography (ERCP) has become the mainstay of therapy for biliary or pancreatic duct disease. ERCP is increasingly available, safe and effective[1]. Despite all this progress, there remains a patient subset in which ERCP is not possible (e.g. bariatric biliopancreatic diversion, duodenal stent across an intact papilla) or highly challenging (e.g. Roux-en-Y, gastric outlet obstruction[2]). In addition to these circumstances, which can be anticipated and may lead to alternative ductal decompression options from the outset, ERCP can fail unexpectedly for technical reasons, such as failed cannulation (owing to diverticula, tumor infiltration or with a normal papilla), failed guidewire access beyond a stricture, or even failed stent insertion despite adequate guidewire access. Finally, unfavorable clinical outcomes may occur following an apparently technically successful ERCP, such as persistent jaundice after stenting of malignant hilar strictures[3].

The full spectrum of ERCP failure (patients not

amenable to ERCP, technical failures and clinical failures) is therefore broader than just "failed cannulation". Its incidence can be estimated at 3%-5% of all ERCPs, even in expert settings. This puts a considerable burden on patients, since alternative ductal decompression options involve either percutaneous transhepatic cholangiography (PTC) or surgery[4]. PTC and surgery carry higher morbidity and mortality rates than ERCP, and are not a viable option for all patients (e.g. for the percutaneous approach, those with ascites and/or nondilated bile or pancreatic ducts; high risk surgical candidates). Thus, the common statement that unsuccessful ERCP leads to either PTC or surgery is not always borne out in practice, and some patients are inevitably left without optimal treatment.

A salvage drainage technique for failed ERCP is therefore most welcome. Endoscopic ultrasound (EUS) has been used over the last decade to accomplish this goal. Using linear-array echoendoscopes, either a needle or a diathermy catheter can be advanced into the biliary or pancreatic duct under real-time ultrasound guidance. Contrast injection under fluoroscopic monitoring allows cholangiography or pancreatography, a technique originally named endosonography-guided cholangiopancreatography[5] (ESCP). Once the ductogram is obtained, ERCP accessories (guidewires, dilators, stents) are used through the echoendoscope working channel to carry out drainage. ESCP thus represents a hybrid between EUS-guided fine-needle-aspiration (EUS-FNA) and ERCP in terms of equipment, devices and operator skill set. Whereas these two backgrounds are critical to the success of this challenging procedure, it is debatable which one contributes more. It can be argued that ductal access under EUS is just the beginning and the easier part of the procedure[6]. Patient population, sedation requirements, procedure room set-up, and assistant(s) expertise also make ESCP belong in the ERCP realm, as opposed to EUS-guided injection therapies.

ESCP: ORIGIN, EVOLUTION AND DEFINITION OF A UNIFIED CONCEPT

The concept of ESCP as a salvage procedure after failed ERCP was formally proposed in 1996 by Wiersema *et al*[5]. It was also implicit in three other contemporary reports on EUS-guided pancreatography[7-9]. These authors demonstrated the feasibility and safety of ductal puncture and contrast injection under EUS guidance in 11 patients, with success in 7 out of 10 attempted transduodenal cholangiographies, and one transgastric pancreatography. While the main patient selection criterion for ESCP was failed cannulation, most had only mild obstructive symptoms, final diagnoses that can nowadays be reached at by either MRCP or EUS itself, and eventually successful repeat ERCPs when the diagnosis afforded by ESCP warranted it. This important study however, laid the ground for the subsequent therapeutic use of ESCP.

Giovannini *et al*[10] were the first to report what later became known as "EUS-guided choledochoduodenostomy", that is, transmural placement of a biliary stent across the duodenal and distal common bile duct (CBD) walls. Their patient had a pancreatic head mass and two prior ERCPs with failed cannulation. The CBD was imaged from the duodenal bulb with a linear echoendoscope, and entered under EUS guidance with a needle-knife, through which a guidewire was advanced into the CBD under fluoroscopy. The needle-knife was replaced over the wire by a dilator, and the echoendoscope removed over it and exchanged for a duodenoscope, through which a 10F plastic stent was eventually deployed transmurally.

Table 1 The nine different ESCP approaches as defined by the first 39 patients reported from 9 institutions

	Transpapillary		Transmural
	Rendezvous	Antegrade	
Pancreatic duct	1 Bataille *et al*[11] 4 Mallery *et al*[16] 1 DeWitt *et al**[18] 1 Will *et al*[22]	2 Kahaleh *et al*[13]	4 François *et al*[12]
Intrahepatic bile duct	5 Kahaleh *et al*[21]	1 Puspok *et al*[20]	2 Burmester *et al*[15] 1 Giovannini *et al*[10]
Extrahepatic bile duct	2 Mallery *et al*[16] 1 Lai *et al*[19] 4 Kahaleh *et al*[17]	1 Puspok *et al*[20]	1 Giovannini *et al*[14] 2 Burmester *et al*[15] 4 Puspok *et al*[20] 1 Kahaleh *et al*[17] 1 Kahaleh *et al*[21]

Numbers before each author's name express number of patients reported with a given individual ESCP approach by the author in the referenced article. A total of 19 patients were drained by transpapillary ESCP rendezvous (7 pancreatic, 12 biliary) and 16 transmurally (4 pancreatic, 12 biliary). The dominant approaches were pancreatic rendezvous (7 patients from 4 centers) and chole-dochoduodenstomy (9 patients from 4 centers). *Methylene-blue EUS-guided pancreatography with subsequent non rendezvous ERCP.

Within four years of this pioneering report, a handful of case reports from a few tertiary referral institutions (six in Europe and three in the USA) described all the 9 different approaches used for ESCP nowadays all over the world[11-22] (Table 1). A total of 39 patients were reported, 13 with chronic/relapsing pancreatitis or transected pancreatic ducts of various etiologies, and 26 with biliary obstruction of predominantly malignant origin (only 6 had benign disease: 3 CBD stones, 2 transected ducts, and 1 primary sclerosing cholangitis). Examining their differing patient populations, minor variations in technique, and the confusing plethora of terms they used to refer to this new procedure, a clear picture emerges of the variables that currently define ESCP. These relate to the patient characteristics, the location of the EUS entry point into the duct, and the access route for ductal decompression - retrograde, antegrade or combined.

It is important to recognize the common ground in which the seemingly different approaches encompassed by ESCP are rooted. This common ground is ductal (biliary or pancreatic) access from the gastrointestinal

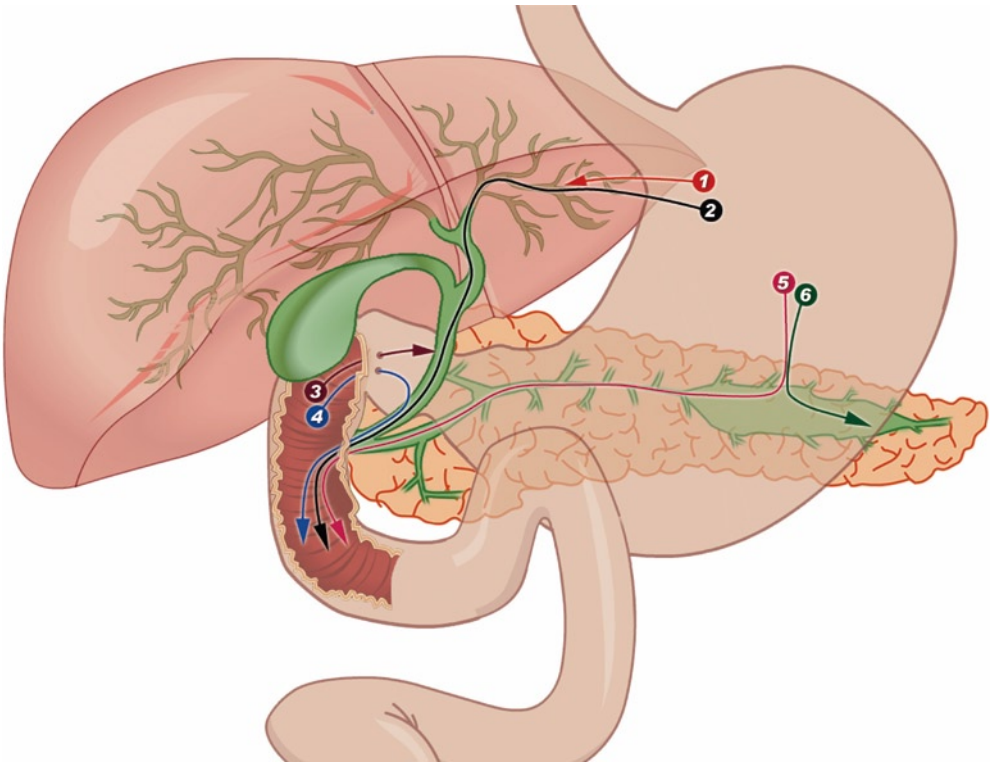

Figure 1 The three potential ESCP access routes: intrahepatic (1, 2), extrahepatic (3, 4) and pancreatic (5, 6). After ductal access through any of them, drainage can be accomplished transmurally over an intraductal guidewire (1, 3, 6) *via* hepaticogastrostomy (1), choledochoduodenostomy (3) or pancreaticogastrostomy (6). Transpapillary guidewire placement (2, 4, 5) allows both retrograde access *via* rendezvous ERCP and antegrade stent placement for biliary (2, 4) or pancreatic duct drainage (5). Rendezvous requires an accessible papilla and is preferable in benign disease. Antegrade transpapillary ESCP suits complex postoperative anatomy, particularly when performed for palliation of malignant obstruction.

(GI) tract under EUS guidance, followed by instrumentation under fluoroscopy with the intent to effect drainage, usually - but not necessarily - by means of stent insertion. Initial access is most commonly achieved by needle puncture (EUS-FNA component of the procedure). A guidewire is passed into the duct through the FNA needle, which is then exchanged over the access-keeping wire for the flexible ERCP devices used for drainage. There is a clearer demarcation for access to the bile duct than for pancreatic duct access, between the extrahepatic (CBD) and intrahepatic site. The CBD is best imaged and accessed from the duodenum or distal antrum[5,15-17,19,20], whereas for the left intrahepatic bile duct this is best accomplished from below the cardia[14,15,20,21] (proximal stomach, or jejunum in patients with total gastrectomy and esophago-jejunostomy). Access to the main pancreatic duct (MPD) is usually gained from the stomach[7-9,11-13,16,18,22], although individual operator preference or patient anatomy may make transduodenal MPD puncture the favored option[23]. Whatever the needle entry point into the duct, the guidewire may or may not go through the papilla (or bilio-enterostomy) into the duodenum (or small bowel). Depending on a number of factors, a transpapillary wire thus placed under EUS ductal puncture may be used for retrograde cannulation of the duct of interest through the papilla, and decompression achieved with standard ERCP techniques *via* the so-called "rendezvous"[4,11,16,17,21,22]. Alternatively, "antegrade" stent insertion through the puncture site and across the papilla is also possible[13,20]. An intraductal guidewire (i.e. not exiting antegradely from the puncture site through the papilla) can be used to decompress the duct towards the GI lumen from the access site by transmural (across the duct and GI walls) stent placement. Transmural stent placement is given a variety of names depending on the anatomic location (i.e. the organs whose walls the stent pierces). The three most common ones are "choledocho-duodenostomy"[24-30], "hepatico-gastrostomy"[14,31,32] and "pancreatico-gastrostomy"[12,23,33].

Although patient selection, intraprocedural technical steps, success and complication rates may vary greatly depending on the target duct (biliary or pancreatic), the concepts and definitions outlined above remain constant. All different ESCP approaches reported to date can be easily categorized with the transmural versus transpapillary drainage route, regardless of the target duct and initial EUS access site. Although transpapillary drainage is most commonly accomplished retrogradely *via* rendezvous ERCP, antegrade transmural stent insertion also results in transpapillary drainage when the stent is deployed across the papilla or intraductally (i.e. above the papilla) across a distal stricture[20,34,35]. Antegrade transmural intervention combines the ESCP challenges of both transpapillary retrograde access (i.e. guidewire passage across the papilla and/or stricture) and transmural drainage (i.e. puncture tract dilation). Antegrade transmural ESCP might thus be considered a third hybrid category on its own. However, the more defining variable of guidewire placement across the papilla, allows it to be classified as a variant approach for transpapillary drainage. As stated above, the second defining variable is intrahepatic versus extrahepatic access to the bile duct. These two entry routes can, again, be used with transmural and/or transpapillary drainage, giving rise to six possible combinations (Figure 1).

This taxonomy and nomenclature are far from perfect. The most obvious inconsistency is that some patients typically drained by ESCP do not actually have a papilla, but a duct-enteric anastomosis (e.g. MPD after Whipple resection or hepatic duct after hepatico-jejunostomy), and hence "transpapillary" is not semantically accurate. Aside from that, this is a comprehensive and clear categorization of ESCP as a unified concept for ductal access and drainage. The many alternative terms put forward are perhaps more confusing.

To further complicate matters, transpapillary drainage, wheter antegrade or *via* rendezvous, is occasionally combined with transmural stent placement, again with two possible variations. A single long plastic stent bridges both the papilla and the transmural puncture site[13]. Alternatively, dual drainage can be carried out by serially inserting one transpapillary stent (usually metal) and a second transmural stent (usually plastic) or drain[20,32]. Transmural stent placement may be the end result of either failure to maneuver the guidewire across the papilla[27,34,36,37], or the initially chosen approach[24,38]. In the former case, temporary transmural stenting can be converted at a follow-up session to transpapillary drainage[17,20,35].

PATIENT SELECTION

Patients reported in the various ESCP series share two important features: (1) Symptomatic disease of proven biliary or pancreatic ductal origin; and (2) Impossible ERCP despite thorough cannulation attempts, including pre-cut, by highly experienced endoscopists. ESCP should not therefore be used for diagnosis in certain settings where ERCP might still be rightly considered (e.g. high level of suspicion of CBD stones in a patient with a low risk of post-ERCP complications)[36]. In patients with low-grade or transient biliary obstruction, complete imaging work-up, including diagnostic EUS and MRCP, is warranted before proceeding to ESCP[37]. Similarly, pancreatic patients subjected to ESCP have been highly selected, based both on the anatomy (pancreatic duct dilation, transection or fistula) and on clinical grounds (intractable pain, recurrent pancreatitis). In other words, since the threshold for ERCP is lower, ESCP is not necessarily justified in all patients in whom ERCP has been unsuccessful. The threshold for ESCP should at least be the same as for PTC, and clinical follow-up as opposed to aggressive repeat attempts at ductal access is advisable in those patients with mild symptoms and negative or inconclusive imaging work-up.

ESCP should not be used as a shortcut for gaining ductal access in the setting of only moderately difficult cannulation. This is in contrary to some optimistic views based on the fact that the papilla is not manipulated during ESCP, which have led to speculation that it may offer a potentially less invasive biliary drainage option than ERCP[20,39]. This view underestimates the difficulty and risks of ESCP. The toughest ERCP might be preferable to the easiest ESCP. The anatomic problems precluding ERCP in the ESCP literature range from complex postoperative anatomy (Roux-en-Y, Whipple) and severe tumor infiltration with or without duodenal stenosis, to high-grade hilar strictures and complete duct transections. Patients with lesser degrees of difficulty may be better served by a repeat attempt at ERCP, whether this is performed by the same or by a more experienced operator.

Biliary versus pancreatic indications

Biliary ESCP has been reported in well over 300 cases [10,15-21,23-35,39-42], whereas approximately only 130 pancreatic ESCP cases have been published[11,13,16-22,43-46]. This is despite the fact that percutaneous duct access with or without rendezvous is more readily available for biliary than pancreatic duct decompression. There is a fourfold explanation for this. Firstly, biliary obstruction is a more frequent and usually more pressing clinical problem than pancreatic duct obstruction, the latter typically presenting as chronic or relapsing pain in the setting of chronic pancreatitis. Secondly, the technical challenges in accessing the MPD through a hard, fibrotic pancreatic parenchyma, and successfully negotiating a guidewire through a tortuous duct with many side branches, are much greater than those involved in biliary ESCP. Thirdly, the risks involved in pancreatic ESCP appear to be greater than those of biliary ESCP[45]. Finally, whereas the clinical response to drainage is easily assessed for biliary obstruction (resolution of jaundice or stone removal), it is less obvious for refractory pain caused by chronic pancreatitis, just as the clinical outcomes of pancreatic ERCP are somewhat less favorable than those of biliary ERCP.

These factors are reflected in the relative clinical success and complication rates for biliary (75%-100% success and 10%-36% complications) versus pancreatic (25%-100% success and 15%-50% complications) ESCP. These are summarized in Tables 2 and 3. Whereas biliary ESCP is gradually gaining acceptance in many tertiary endoscopy units, pancreatic ESCP remains confined to very select units with special expertise in pancreatic endotherapy[37].

Most patients drained by ESCP have had malignant biliary obstruction not amenable to standard ERCP palliation[6,38,39]. A minority of those with malignant jaundice has been decompressed preoperatively, and fewer still have had benign disease - stones or strictures. There are two obvious explanations for this. Firstly, severe anatomic distortion (caused by tumor infiltration or by prior pancreaticobiliary/upper GI surgery) is more frequently associated with malignancy, and hence the chances for unsuccessful ERCP are higher. Secondly, surgery may have been preferred as a more definitive salvage therapy after failed ERCP in operative candidates with benign strictures or CBD stones and in situ gallbladders.

General requirements and patient preparation

As mentioned above, the procedure room and assistant

Table 2 Major series on EUS-guided biliary drainage

Year	Author	*N* (malignant/ benign)	Access route	Drainage success - Drainage route	Complications
2009	Horaguchi[35]	16 (15/1)	8 EH 8 IH	15/16 (94%) - 8 TD - 6 TG - 2 TE	2 (12. 50%) - 1 bile peritonitis - 1 stent migration
2009	Brauer[26]	12 (8/4)	12 EH	11/12 (92%) - 7 TP - 4 TD	2 (10%) - 1 pneumoperitoneum and peritonitis - 1 cardiopulmonary failure
2009	Maranki[25]	49 (35/14)	35 IH 14 EH	Overall: 41/49 (84%) IH: 29/40 (73%) - 26 TP, 3 TG EH: 12/14 (86%) - 8 TP, 4 TD	Total: 8 (16%) IH: 5/35 (14%) - pneumoperitoneum (3) - bleeding (1) - pneumonia (1) EH: 3/14 (21%) - bile peritonitis (1) - pain (1) - pneumoperitoneum (1)
2008	Tarantino[24]	8 (7/1)	9 EH	8/8 (100%) - 4 TP, 4 TD	Not procedure related - 1 death after 15 d (hepatic failure, cirrhosis)
2008	Yamao[32]	5 (5/0)	5 EH	5/5 (100%) - 5 TD	1 (20%) - pneumoperitoneum
2008	Itoi[33]	4 (4/0)	4 EH	4/4 (100%) - 4 TD	1 (25%) - bleeding and bile peritonitis
2007	Bories[30]	11 (8/3)	11 IH	10/11 (91%) - 10 TG	4 (36%) - ileus - early stent occlusion - biloma - cholangitis
2007	Will[31]	8 (7/1)	8 IH	6/8 (75%) - 1 TE, 4 TG, 3 TJ	2 (25%) - cholangitis, pain
2005	Püspök[20]	6 (4/2)	5 EH 1 IH	5/6 (83%) - 3 TB, 1 TD, 1 TJ	1 (17%) - cholecystitis
2003	Burmester[15]	4 (4/0)	2 EH 2 IH	3/4 (75%) - 1 TD, 2 TJ, 1 TG	1 (25%) - cholangitis, sepsis death (failed procedure)

TG: Transgastric; TD: Transduodenal, TP: Transpapillary; TE: Transesophageal; TJ: Transjejunal; EH: Extrahepatic; IH: Intrahepatic.

Table 3 Major series on EUS-guided pancreatic duct drainage

Year	Author	*n*	Access route	Technical success - Drainage route	Clinical success	Complications
2009	Brauer[26]	8	TG – TD	7/8 (88%) - 3 TG, 1 TD, 3 TP	4/8 (50%)	No complications - Pain evaluation: non significant improvement
2007	Tessier[43]	36	29 TG 7 TD	33/36 (92%) - 26 TG, 7 TD	25/36 (69%)	5 (13%) - 2 severe (5%): hematoma, pancreatitis - 3 mild (8%)
					Total or significant pain relief	Stent dysfunction: 20 pt (55%) = 29 new endoscopic procedures
2007	Kahaleh[44]	13	13 TG	10/13 (77%) - 10 TG	10/13 (77%) < score pain < pancreatic duct diameter = narcotic use	2 (15%) - bleeding, perforation
2007	Will[45]	12	12 TG	9/12 (75%) - 5 TG, 4 TP	- 5 pt (42%): pain relief, fistula closure - 4 pt: surgery - 3 pt: endoscopy	6 (43%) - 2 severe (14%): bleeding, perforation - 4 mild (29%): pain
2004	Mallery[16]	4	4 TG	1/4 (25%) - TP	1/4 (25%)	2 (50%) - mild pancreatitis - fever
2002	Francoise[12]	4	4 TG	4/4 (100%)	3/4 (75%)	No complications

TG: Transgastric; TD: Transduodenal; TP: Transpapillary.

expertise requirements are the same as those for ERCP. Although ESCP has occasionally been performed with small channel EUS scopes, large-channel therapeutic echoendoscopes are clearly preferable[37,38]. Similarly, EUS needles of a smaller calibre than 19G represent an unnecessary burden, since the 0.018-inch wires they allow are strongly associated with failed ESCPs, repeat 19G punctures for larger wire passage, and the need for cautery access due to insufficient support for mechanical dilation. The endoscopist's background expertise must include proficiency in EUS-FNA (preferably with a large 19G needle) and a high-volume ERCP practice. Ideally, before attempting ESCP the endoscopist should have gained some experience with EUS-guided pancreatic pseudocyst drainage. The two procedures are technically related[39] although pseudocyst EUS-guided drainage is less challenging, since its target for drainage is a much larger anatomic structure, usually adherent (by virtue of its inflammatory nature) to the GI wall[40]. Nonetheless, EUS-guided pseudocyst drainage still entails a learning curve, estimated at 25 cases for endosonographers with prior therapeutic ERCP training[41].

Whereas most authors have so far used anesthesia back up, endoscopist-directed propofol sedation has been used by others[38]. Whatever the sedation choice, it is important to remember that standard conscious sedation with midazolam and meperidine may well fall short of the requirements. Minor degrees of patient movement that might not represent a problem during standard ERCP or EUS-FNA, may result in guidewire dislodgment during ESCP and jeopardize the whole procedure since reattempted guide wire access is not as straightforward as in ERCP.

The coagulation status of the patient should be che-

cked, and prophylactic oral or intravenous antibiotics are customarily given. Subcutaneous octeotride is administered by some authors selectively after failed pancreatic duct access[16]. The aim is to minimize pancreatic secretion and prevent retroperitoneal leakeage through the puncture track. Although its efficacy has not been proven, this pharmacologic strategy seems very sensible. The consent process is increasingly being incorporated into the consent for ERCP, especially in cases of anticipated difficulty at centers where ESCP is becoming common. Otherwise, it requires a separate discussion considering alternative drainage options.

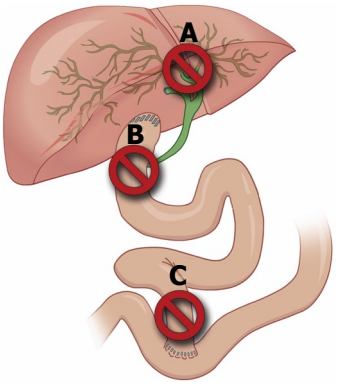

Figure 2 A hilar stricture with dilatation of the left ductal system (A) requires intrahepatic access. Extrahepatic access is suitable for distal biliary obstruction in patients with native antroduodenal anatomy despite the presence of ascites or non-dilated intrahepatic ducts (B). Any prior surgery involving distal gastrectomy with gastrojejunostomy (C) precludes EUS imaging of the CBD. Some of these factors are present in 80% of carefully selected ESCP candidates, which limits the issue of "operator's choice of approach" to 20% of cases.

CHOICE OF APPROACH AND TIPS ON TECHNIQUE

Choice of access site

There is a choice between intrahepatic or extrahepatic bile duct puncture in about 20% of biliary ESCP patients. For the remaining 80% the EUS access site is determined by the level of obstruction (hilar versus distal), and by the feasibility of imaging the CBD under EUS (difficult to impossible in patients with prior gastrectomy or indwelling duodenal stents) or the intrahepatic bile duct (which needs some degree of dilatation) (Figure 2)[25,37,38]. Similarly, for the pancreatic duct there is limited choice between transgastric access, usually the most straightforward[43,44], and transduodenal (impossible in those with prior pancreatoduodenectomy). To a great extent, this is influenced by the location of the obstruction and the reason for unsuccessful ERCP (cannulation versus access across a duct disruption/stricture), as well as by the intended route for drainage (transpapillary rendezvous versus transmural pancreatigastrostomy).

Choice of drainage route

The choice between transpapillary and transmural drainage is also determined to some degree by the patient's anatomy and diagnosis (e.g. CBD stone versus malignant stricture). It is obviously also influenced by the operator's preference.

Transpapillary drainage: For rendezvous, endoscopic access to the papilla is unanimously considered a prerequisite[4,16]. For any kind of transpapillary drainage (antegrade or rendezvous) antegrade guidewire passage from the puncture site into the small bowel is usually necessary, requiring a non transected duct. As an exception, successful rendezvous drainage of a transected bile duct overcome with cautery has been reported in a single case[17].

The limiting step for transpapillary drainage is guidewire manipulation[38,39]. A needle does not allow the same free interplay over a guidewire as flexible ERCP catheters do. The needle is rigid and has a sharply cutting edge. If to and fro movements of the needle over the wire are attempted either briskly or repeatedly, the needle may easily puncture its way out of the duct or shear the guidewire and render it useless. Therefore, when aiming for rendezvous, EUS and fluoroscopy should be used to seek an access site as close to the papilla as possible, with a tangential needle orientation to the duct, before the actual puncture[4,16]. Post-puncture repositioning of the echoendoscope may also be possible in cases with a largely dilated duct (e.g. CBD above distal malignancy), although this carries the risk of loosing needle access, associated in turn with the need for re-puncture and with procedural failure. Transpapillary guidewire passage is understandably much more demanding from an intrahepatic than an extrahepatic access site[39]. After extrahepatic access, the guidewire can only go either up or down the CBD. In contrast, after intrahepatic access it may go peripherally to another left branch at every confluence, or to the right lobe ducts at the confluence of the right and left main hepatic ducts. So, transpapillary guidewire passage with intrahepatic ESCP often requires dilation of the puncture track to a degree similar to that required for transmural drainage, in order to allow intraductal passage of catheters or sphincterotomes[21,38]. These more manageable devices help to direct the guidewire effectively towards the CBD and across the stricture and/or papilla, a challenging step in itself. Crossing the papilla (or anastomosis) antegradely with a guidewire often takes repeat needle puncture and reorientation, trying different types of guidewires, or even cautery. Despite all this instrumentation, the process may end up in failure[48]. When guidewire passage across the papilla is nevertheless successful, it is customary to advance into the bowel lumen as many (three or four) loops as possible to prevent dislodgement during antegrade or rendezvous stent placement. For rendezvous, the echoendoscope (with the needle attached) is carefully removed while the assistant feeds the wire into the needle at the same rate that the endoscopist removes the scope-needle assembly[16]. The position of the guidewire is monitored fluoroscopically to prevent both looping

in the stomach and dislodgment of the transpapillary looped wire. After EUS scope removal, a duodenoscope is advanced side by side with the guidewire while the assistant holds it under gentle traction from the patient's mouth, again to prevent looping. Once the papilla is reached with a duodenoscope (or a longer endoscope in some cases with altered anatomy)[48], the transpapillary guidewire can be grasped with a polypectomy snare and retrieved through the working channel while the assistant feeds it into the patient's mouth in coordination. Standard ERCP devices can then be threaded over the wire once it has exited from the endoscope channel (classic rendezvous)[4]. Alternatively, once the duodenoscope reaches the papilla, a sphincterotome can be used for cannulation alongside the ESCP placed wire (parallel rendezvous)[16,49]. Parallel rendezvous thus saves the cumbersome step of guidewire retrieval through the endoscope. The disadvantage is that dual traction (from the mouth end and from the endoscope end of the wire) is not possible with parallel rendezvous. Dual traction is usually performed with the wire inside a catheter, to prevent so-called "cheese-cutter" injury to the parenchyma. For some of the very tight strictures (hilar bile duct or MPD) typically stented by ESCP, dual traction is a very useful adjunct technique that saves labor-intensive dilation before stenting[38]. Instances of failed transpapillary stenting after a fastidious pancreatic EUS rendezvous which might have been prevented by using dual traction have been reported[26].

Finally, there is a simpler, still relatively overlooked, approach to achieving retrograde transpapillary ductal access by ESCP. In some cases, either free-hand or standard wire-guided cannulation (i.e. no rendezvous) can be achieved despite prior unsuccessful ERCP once the obstructed duct has been injected by ESCP with contrast medium or a mixture of contrast medium and methylene-blue. Contrast injection ESCP has recently been proposed formally[26] - although the technique was described in prior reports[17]. It consists of a "salvage" repeat ERCP after failed ESCP, coming full circle from use of ESCP after failed ERCP. This is rendered possible after ductal injection by a double mechanism: a) making an inconspicuous (e.g. intradiverticular) papilla patulous and thus more evident; and b) providing a "road map" for cannulation. Methylene-blue injection ESCP has been reported for minor papilla cannulation[18] and in related settings with an unidentifiable MPD orifice[50]. The "road map" strategy is accidental (i.e., not the intended initial approach for drainage). There is no reason why it can not be intentionally combined with methylene-blue injection into the bile duct, perhaps thereby increasing its efficacy.

Transmural drainage: For transmural drainage, the limiting step is the creation of a fistulous track between the puncture site on the GI wall and the duct, to allow stent placement (plastic for benign disease and pancreatic ESCP; plastic or metal for malignant biliary ESCP). This requires at least bougie (stepped dilating catheters) or balloon dilation, and sometimes cautery with a needle-knife or a fistulotome. Cautery is felt to pose an increased risk for complications although some authors favor it for transduodenal access to the CBD, particularly when transmural drainage (choledochoduodenostomy) is the final goal[51]. A needle-knife (or fistulotome) is advanced either free-hand or wire-guided into the CBD. In the former case, prior finer (22G) needle ESCP cholangiography may or may not be performed to allow the added benefit of fluoroscopy during access to the CBD (since cautery creates EUS artifacts). In the latter case, ESC is routinely used for intraductal placement of the wire. Since the driving mechanism for fistula formation is cautery (as opposed to mechanical, pushing force), a 0.018-inch or 0.021-inch guidewire is sufficient[24]. Given that 22G needles can take these thiner wires, cautery access obviates the need to use the stiff, larger 19G needles. 19G needles may become cumbersome during transduodenal access, since the echoendoscope is in a longer, looped position compared to intrahepatic access. Whatever the modality, cautery access avoids the somewhat awkward transition from the rigid, sharp needle to the flexible ERCP catheters and dilators, while at the same time providing an initial step for fistula formation. Whereas cautery may be necessary in some select instances for access (e.g. a hardened fibrotic parenchyma), it is probably best avoided[47]. In order to create a tract without cautery, using only mechanical dilation, it is important to maintain the endosonographic plane of view[34,47]. This is a technical tip whose implications have not yet been fully spelled out. The EUS plane is easily lost if the operator shifts from US monitoring of ductal access to endoscopic control once the guidewire is inside the duct, as one would do for transgastric pseudocyst drainage with the classic "blind" (i.e. no EUS guidance) approach. In other words, to keep the US plane and guidewire axis of approach, the echoendoscope tip must remain throughout the processes of fistula track dilation and stent insertion in the same position where it was when the needle first punctured the duct. If this technique is carefully adhered to, only a minority of patients will fail mechanical track dilation and require additional cautery access with an over-the-wire device, be it a needle-knife or a fistulotome[34]. This concept does take, however, some effort on the part of the operator, as there is a deep-seated therapeutic endoscopy impulse to keep in endoscopic view a guidewire over which a device or stent is being advanced. This impulse should be deliberately ignored and re-educated towards EUS monitoring. Only for the final step of stent deployment is the echoendoscope slightly withdrawn to gain an endoscopic view[38]. This allows endoscopic control of the deployment of the intraluminal end of the transmural stent, a step that requires greater care than stent deployment at ERCP. The EUS scope is gently removed (approximately 2-3 cm) by an assistant carefully coordinated with the endoscopist, who is simultaneously advancing the stent-delivery catheter under

fluoroscopy and endoscopy, so as to maintain the half-deployed stent at the exact (fluoroscopic) point inside the duct where it was before scope withdrawal began. The intraluminal (GI) end of a transmural metal stent should be at least 2 cm in length, much longer than in standard transpapillary placement at ERCP. This is a critical point, since metal stents foreshorten (up to 30% in some cases) upon full expansion, which takes hours. If the intraluminal segment is shorter than 2 cm, the stent may easily foreshorten towards the duct beyond the GI wall, resulting in free intra- or retro-peritoneal leakage hours to days after placement[30,38]. Another option is to use forced balloon expansion immediately following initial placement and thus control the otherwise blind process of stent expansion. If after forceful balloon expansion the intraluminal stent end looks too close to the GI wall, an overlapping second metal stent can be placed inside the first one more proximally (towards the EUS scope). A simple additional anchoring technique is to place a 7F double pig-tail inside the metal stent as a safeguard against both postprocedure dislocation and late migration. Adequate traction of the guidewire is needed as the first (biliary) pig-tail goes through the metal stent to prevent its tip impacting against the struts. The nuances of metal stent expansion and foreshortening. the actual distance between the US transducer and the echoendoscope lens, and the potential for the virtual space between the GI wall and the target duct becoming a real space, explain why despite ductal access distances measuring less than 2 cm, metal stents of 6 cm or longer should be used. Shorter metal stents, despite looking adequate immediately after initial "self-expanding" (i.e. non balloon expanded) deployment, may easily result in dislocation (foreshortening and/or migration) after the procedure. When these tedious technical tips are observed, transmural metal stenting provides immediate large-caliber drainage, with the added bonus of a much more effective sealing of the fistulous track than plastic stents[34].

In summary, there are two factors in choosing an approach, patient-related and operator technique-related. The former cannot be altered in a given case other than by abandoning the procedure (i.e. considering ESCP a failure if transpapillary guide wire passage is unsuccessful and rendezvous the only approach considered) and opting for alternative therapies. Technique and operator skill can evolve and improve with practice. Whereas some authors stick to a single approach, such as rendezvous-drainage-only or transduodenal-access-only, those with a modus operandi which includes alternative approaches, may be able to salvage a greater proportion of failed ERCPs by means of ESCP.

ESCP: STEP BY STEP PROCEDURE

Location of entry point

Bearing in mind the patient's anatomy (level of obstruction and type of prior surgeries if any), the closest dilated segment of duct at a position where the echoendoscope is stable and without intervening vessels is sought. These can be readily identified with color Doppler-[37,38]. After a general EUS overview to confirm known patient specifics from prior imaging and to locate the access area, it is useful to have the needle already inside the echoendoscope working channel before focusing on the exact entry point. The preferred 19G needles are stiff and tend to change the position of the echoendoscope tip by a small but significant amount once they are in the working channel. The more obvious the dilatation and the closer the duct is to the echoendoscope, the greater the chances of success. Although ducts as small as 2 mm in diameter have been successfully accessed by ESCP, a minimum size of 4-5 mm within 15-20 mm range of the transducer is more typically associated with success. As stated above, if rendezvous is intended, a puncture site as close as possible to the papilla, and a needle axis tangential to the projected duct course, pointing the needle tip antegradely, is sought by repositioning the echoendoscope under fluoroscopy. This is easier said than done. Despite claims that this was the chosen technique, ductograms published in some reports often show a fairly perpendicular entry angle between the needle and the duct, particulary for transduodenal CBD access[38,41]. This is a telltale sign of the serendipitous factor in rendezvous despite posthoc rationalization.

Puncture and ductography

When the optimal access point has been identified, the needle is advanced into the duct. Once puncture begins, the procedure takes on a rapid pace and no time should be wasted. The lesser the manipulation, the smaller the chance of incurring bile leakage, extraductal needle passage, guidewire dislodgment from the duct or any other potential mishaps. It is advisable that the assistant has all the devices (guidewires, catheters, dilators, stents) ready at hand before puncture. Similarly, fluoroscopy is focused on the echoendoscope and needle tip, to avoid having to move the fluoroscopy table or adjust the zoom once the needle is inside the duct. With current generation EUS needles, removing the stylet does not compromise the ability to puncture a small target. So, it is useful to do this beforehand. Some authors even preflush the needle with contrast medium through a side adaptor and have the guidewire in place[16]. However, having a guidewire in place does not allow aspiration through the needle. Aspiration is a very useful way to have confirmation of ductal access, particularly when smaller calibre ducts (e.g. MPD, intrahepatics) are targeted. In these cases, despite an intraductal ultrasound appearance, the needle might be on a different plane. If aspiration is skipped before injecting there is small but definite risk of intraparenchymal injection. A hyperechoic cloud will then appear, preventing needle access at the selected (optimal) entry point, and thus greatly compromising success. A bloody return may be obtained during intrahepatic access. It is important not to mistake very dark colored bile for blood. Adequate visual inspection of the aspirate in the syringe may require

turning the procedure room lights on. If there is no fluid return, or it is clearly blood, the needle is slightly repositioned (back or forth), or a new needle pass made. After an inadvertent vessel puncture and aspiration of blood, it is advisable to flush the needle with saline into the GI lumen, or the aspirate will clog it. Secondary benefits of fluid aspiration before injection are decreasing intraductal pressure (which might help decrease the risk of leakage) and allowing microbiological sampling (which may be useful to guide antibiotic coverage). After a fluid (bile or pancreatic juice) return, contrast medium is gently injected until the targeted duct is outlined. A complete ductogram is usually not necessary (unless a methylene-blue-like ESCP approach is intended).

Initial guidewire placement

A 0.035-inch guidewire is advanced by the assistant while the endoscopist keeps the needle still (coupled to the patient's respiratory motion) to prevent damage to the guidewire. The restrictions to maneuvering a wire within a needle have been described above. Greater care is needed in smaller calibre ducts, where the needle tip abuts the duct wall more easily than in the CBD. If the targeted duct is small, and the initial length of wire inside the duct is too short or markedly unsatisfactory (e.g. goes towards the more peripheral bile duct), a very cautious attempt at guidewire repositioning from the same puncture site can be made. The wire can be pulled back inside the needle, asking the assistant to stop the backward wire movement if any resistance is met. Once the guidewire is back inside the needle, it may be removed and replaced for a different one (e.g. 0.025-inch wire, Terumo-coated, or angled-tip). Alternatively, insertion of the same wire into the duct may be tried again after changing slightly the angle of the needle tip and, more importantly, the speed with which the assistant feeds the wire into the needle. These are virtually the only adjustments afforded by the needle-wire assembly. Further advancement of the needle over the wire (as one might try with a flexible ERCP device) to change the angle of approach, or forceful removal of the wire through the needle, are strongly discouraged. The opportunity for repeat ductal puncture is limited, particularly after contrast medium has been injected. Again, this limitation is maximal for the intrahepatic access, where small ducts collapse upon the initial puncture and the ultrasound window is quickly lost by contrast extravasation. At the other end of the spectrum, the CBD may be more forgiving to repeat punctures during the same procedure. If at this point in the procedure the guidewire crosses the ductal stricture and the papilla, transpapillary drainage can be carried out *via* rendezvous ERCP in those patients with endoscopically accessible papillae, or antegradelly in those without. However, transpapillary guidewire placement often requires manipulation with a flexible catheter, particularly in the presence of a very tight distal stricture with a massively dilated bile duct above, where the guidewire tends to coil back. The next common procedural step to most ESCPs is thus ductal access over the wire with a flexible catheter (cannula, dilator, sphincterotome, needle-knife or fistulotome).

Guidewire manipulation and fistulous track formation

This is the key step in which the final approach to be used is defined (transpapillary/transmural) and which determines whether the procedure is more likely to result in success or failure. It is a truly defining step, characterized by the transition from rigid and cutting (EUS needles) to flexible (ERCP devices). The bulk of the instrumentation is carried out under fluoroscopy. However, it is crucial to maintain both the ultrasound plane and the guidewire axis throughout. As the endoscopist is looking at fluoroscopy, an assistant at the patient's head holds the echoendoscope in place while watching the ultrasound monitor. If at any point the assistant looses the ultrasound view of the guidewire, he or she warns the endoscopist of this, so that the wire is brought back into view by slight scope repositioning before attempting any further instrumentation. A single ERCP stepped dilating catheter (5 or 6 Fr), followed by a 4-6 mm biliary balloon dilator affords transmural insertion of a metal stent, which can be passed through the echoendoscope working channel. The flexible over-the-wire device may bounce off the GI wall or (more typically) CBD wall/parenchyma, as it lacks the stiffness and cutting tip of a needle, and the support provided by the guidewire is often insufficient. Sticking to fluoroscopy and EUS monitoring only (i.e. no endoscopic view) is, as stated above, crucial at this stage. The tip of the echoendoscope pressing the GI wall serves the double purpose of preserving the access axis and preventing the creation of a space between the CBD, liver or pancreas and the GI wall (which risks extraluminal guidewire looping), or between the EUS scope and the GI wall (risking intraluminal looping). This is just as gastric distention is maintained throughout percutaneous puncture during a percutaneous endoscopic gastrostomy procedure to prevent the separation between the gastric and abdominal walls. To enhance dilation in difficult cases, the endoscopist may resort to a stiffer flexible device and/or try to enhance the coordination with their assistants in a carefully choreographed swift, hard pushing motion. At the count of three, the assistant at the patient's head holds firm inward pressure on the EUS scope shaft, and the second assistant applies maximal traction on the wire (short of ductal dislodgment), while the endoscopist pushes forward the dilating device in a whipping stroke. This can be repeated, taking care to prevent looping at any point (which invariably results in guidewire dislodgment and seriously compromises success) until a yield is felt, and the intraductal position of the dilating device is confirmed by fluoroscopy. If mechanical dilation over the wire nevertheless fails, a needle-knife can be threaded over it, and cautery applied when resistance to advancement is met. It is important that the full length of the needle-knife cutting-wire is not exposed, because it may then bend at a 90° angle and cut through the walls sideways.

A more *ad hoc* device for cautery access is a 6.5Fr wire-guided fistulotome, used for transmural pseudocyst drainage. The cutting piece is a metal cone at the tip and its body firmer than the body of a needle-knife catheter. Once the puncture track has been enlarged by whatever means, a sphincterotome, balloon catheter or any other ERCP device can be advanced into the duct and be used to attempt guidewire passage across the papilla.

Stent insertion and deployment

A stent is advanced over the wire under fluoroscopy (the EUS plane kept in sight by the assistant) through the echoendoscope for both transmural and transpapillary antegrade drainage. The transmural insertion technique has been described above. For antegrade insertion, only fluoroscopic monitoring (as in percutaneous stent insertion) is used. For retrograde stent insertion, rendezvous ERCP is performed as detailed earlier. It is also possible to perform rendezvous with the echoendoscope itself, although it is unclear if this approach is reproducible or less cumbersome than the scope exchange it saves. As it is standard for ERCP drainage, plastic stents are used in benign disease. A 7F calibre is much more manageable through the echoendoscope (especially with a pig-tail design) than the customary 10F which is also possible. Metal stents, partially or fully covered if transmural, are preferred for malignant disease. An initial plastic stent may be exchanged over-the-wire at a follow-up session for a metal one, using a duodenoscope. Free-hand plastic stent removal may result in fistula track disruption when re-attempting guidewire duct access. The longer and curved position of the echoendoscope inherent to the transduodenal access route makes plastic stents easier to insert than the stiffer delivery systems for metal stents. On the other hand, their stiff delivery systems make metal stents better suited for the intrahepatic approach.

CONCLUSION

ESCP is a relatively novel technique that allows biliary and pancreatic duct drainage in a very select patient subset in which this cannot be accomplished by ERCP. ESCP is a hybrid technique requiring expertise in both EUS-FNA and therapeutic ERCP. It has matured over the last decade and is nowadays increasingly replacing PTC in the palliation of malignant obstructive jaundice after failed ERCP. Its role in managing anatomically complex chronic/relapsing pancreatitis is less well defined, but is based on the same technical grounds as biliary ESCP and the same clinical grounds as pancreatic ERCP. The many possible variant ESCP approaches are largely determined by patients' anatomy and, to a lesser degree, by operator preference. Careful planning and attention to minute details concerning needles, guidewires, dilators and stents are advisable before every case. High expectations are placed on the development of newer devices that may potentially simplify ESCP in the future. This should not obscure the fact that ESCP has a significant learning curve, failure and complication rates. However, ESCP successfully provides adequate therapy to very challenging patients in a minimally invasive fashion, and its use is expected to grow in clinical practice with the increasing availability of trained operators in both EUS and ERCP.

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TOPIC HIGHLIGHT

Juan J Vila, MD, *Series Editor*

Endoscopic ultrasound-guided drainage of pelvic collections and abscesses

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Abstract

Pelvic abscesses are usually the end stage in the progression of an infection. They may occur from surgical complications, generalized abdominal infections such as appendicitis or diverticulitis, or from localized infections such as pelvic inflammatory disease or inflammatory bowel disease. Although surgery has been considered as the treatment of choice by some authors, pelvic abscesses can be managed by non-invasive methods such as ultrasound and computed tomography-guided drainage. The development of therapeutic linear echoendoscopes has allowed the endoscopist to perform therapeutic procedures. Recently, endoscopic ultrasonography (EUS)-guided drainage of pelvic collections has been demonstrated to be feasible, efficient and safe. It allows the endoscopist to insert stents and drainage catheters into the abscess cavity which drains through the large bowel. This article reviews technique, current results and future prospects of EUS-guided drainage of pelvic lesions.

Key words: Endoscopic ultrasound; Abscess; Collection; Pelvis; Drainage

INTRODUCTION

Since its introduction some years ago, endoscopic ultrasonography (EUS) has been demonstrated to be a highly valuable technique for the diagnosis and management of both luminal and extraluminal lesions of the mediastinum, retroperitoneum and pelvis. The advent of linear echoendoscopes have allowed the endoscopist to perform fine-needle aspiration (FNA) and therapeutic procedures such as celiac plexus neurolysis[1,2], pseudocysts drainage[3-5] and stent placement[6-8]. EUS-guided pelvic examinations are usually related to colorectal cancer staging[9]. However, a great variety of lesions can also be found outside the rectum such as peritoneal tumors or collections, lymph node metastases, gynecological lesions and urinary tract neoplasias[10-12]. Pelvic abscesses are usually the end stage in the progression of an infection. They may occur from surgical complications, generalized abdominal infections such as appendicitis or diverticulitis, or from localized infections such as pelvic inflammatory disease or inflammatory bowel disease[13-16]. Pelvic abscesses may present a clinical challenge for physicians because their location is usually surrounded by the pelvis, urinary bladder, rectum, prostate, vagina and/or uterus. Moreover,

since pelvic abscesses are considered a life threatening condition, they require intensive medical management including the use of broad-spectrum antibiotics, drainage or even surgery, when patients develop persistent fever, ileus or abscess rupture with septic shock. Although surgery has been considered as the treatment of choice by some authors[13,17-18], pelvic abscesses can be managed by non-invasive methods. In fact, ultrasound (US) and computed tomography (CT)-guided percutaneous drainage of pelvic fluid collections have been used for many years with excellent results[19-23]. However, these techniques have some limitations: (1) Some lesions, due to their location, are not accessible to CT or US probe. The route of CT-guided drainage is usually transabdominal (anterior route) or transgluteal (posterior route) which sometimes do not offer the optimal window due to the presence of organs and structures such as the small bowel, large bowel, prostate, urinary bladder, uterus, nerves and vessels. On the other hand, US-guided drainage routes are transrectal and transvaginal that easily avoid the exposition of the organs and structures mentioned above. However, only lesions within the reach of the US probe (limited in size) can be drained; (2) Depending on the selected route, some patients may experience pain at the puncture site. This is more frequent with the transvaginal approach but can also happen with the transabdominal and transgluteal approaches; and (3) Most of these procedures do not allow deploying stents but drainage catheters that may be uncomfortable and painful for patients, especially those placed using transgluteal and transvaginal routes.

EUS-GUIDED PROCEDURE

As stated before, EUS is a valuable imaging method that offers an excellent approach to pelvic lesions. Since pelvic abscesses are frequently located close to the rectum and left colon wall, they are easily and safely reached by EUS and EUS-FNA. The procedure is quite simple in experienced hands and can be summarized as follows: (1) Firstly, every patient undergoing EUS-guided drainage of a pelvic collection should be treated with prophylactic systemic antibiotics, i.e. 2 gr. of amoxicillin plus clavulanic acid before the procedure. After EUS-guided procedure, antibiotic therapy should be continued orally for 3-5 d; (2) An adequate colon preparation in EUS-guided management of pelvic collections is highly recommended. Water enemas, phosphates, polyethylene glycol, alone or combined, can be administered for that purpose; (3) The target lesion should be well defined by pelvic cross-sectional studies (CT or MRI) prior to EUS-guided drainage (Figure 1A). EUS procedure should be performed under conscious sedation. Propofol, midazolam and meperidine are some of the drugs which are usually administered. Initially conventional EUS study can be performed. Radial echoendoscopes could add valuable information regarding lesion size, location and relationships with pelvic organs and structures; (4) A therapeutic linear echoendoscope is then used. After the target lesion is located (Figure 1B), color Doppler is employed to ensure the absence of vessels at the puncture site (Figure 1C); (5) Once the puncture site is selected, a 19-gauge needle is introduced into the abscess cavity and then aspiration is performed (Figure 1D). Optionally, the abscess cavity can be flushed with normal saline solution (10-20 mL) which makes the aspiration process easier. The aspirate obtained must be sent to the microbiologist for Gram determination and culture in order to optimize the antibiotic therapy; (6) With the needle still placed into the abscess there are 3 options to continue the drainage process: (a) a 0.035 inch guide wire is passed and coiled into the cavity. Then, the tract between the rectum and the abscess is dilated, firstly using a 5F endoscopic retrograde cholangiopancreatography (ERCP) cannula or a needle knife and secondly, using an 8 mm over-the-wire biliary balloon; (b) the needle is withdrawn and the abscess cavity is punctured with a needle knife. Then, the metal part of the needle knife is withdrawn leaving the Teflon catheter into the cavity. A 0.035 inch guide wire is passed through the Teflon catheter and coiled into the abscess cavity. Over the wire, the tract between the rectum and the abscess is dilated with an 8 mm biliary balloon; and (c) the needle is withdrawn and one-step drainage can be performed using the NWOA system designed by Giovannini (Cook Endoscopy®, Winston-Salem, NC, USA). It consists of a 0.035 inch needle-wire suitable for cutting current, a 5.5F dilator and an 8.5 or 10F stent preassembled on the same catheter (Figure 1E-G); (7) Once the tract between the rectum and the abscess cavity has been dilated, straight or double-pigtail stents (up to 10F) combined or not with a 10-F drainage catheter can be deployed into the lesion (Figures 1H and 2); and (8) After four-six weeks, a control CT is performed and if resolution of the abscess is confirmed the stents are endoscopically extracted (Figure 3).

OUTCOME

EUS-guided drainage of pelvic abscesses has been previously well described by Giovannini[24], Varadarajulu[25] and Trevino[26]. Both groups demonstrated that this procedure is feasible, effective and safe and may be an excellent alternative to surgery or CT and US-guided drainage techniques. Results of available studies are summarized in Table 1. The first description of the EUS-guided technique was in 2003 by Giovannini and contributors[24]. They included 12 patients with perirectal abscesses (mean longest axis of 48.9 mm) which were secondary to abdominal surgery in 11 cases. Stent insertion was performed successfully in 9 out of 12 patients (75%) and in 3 patients only aspiration was performed. A straight 8.5F stent was inserted in 5 patients, a 10F double-pigtail stent was inserted in 3 patients and 2 stents (8.5 and 10F) were inserted in 1 patient. The mean duration of stent placement was 4.3 mo. Complete drainage with no relapse was achieved in 8 out of 9 patients with stents (mean follow-up of 10.6 mo) and in 1 out of 3 patients with aspiration. No procedure-related

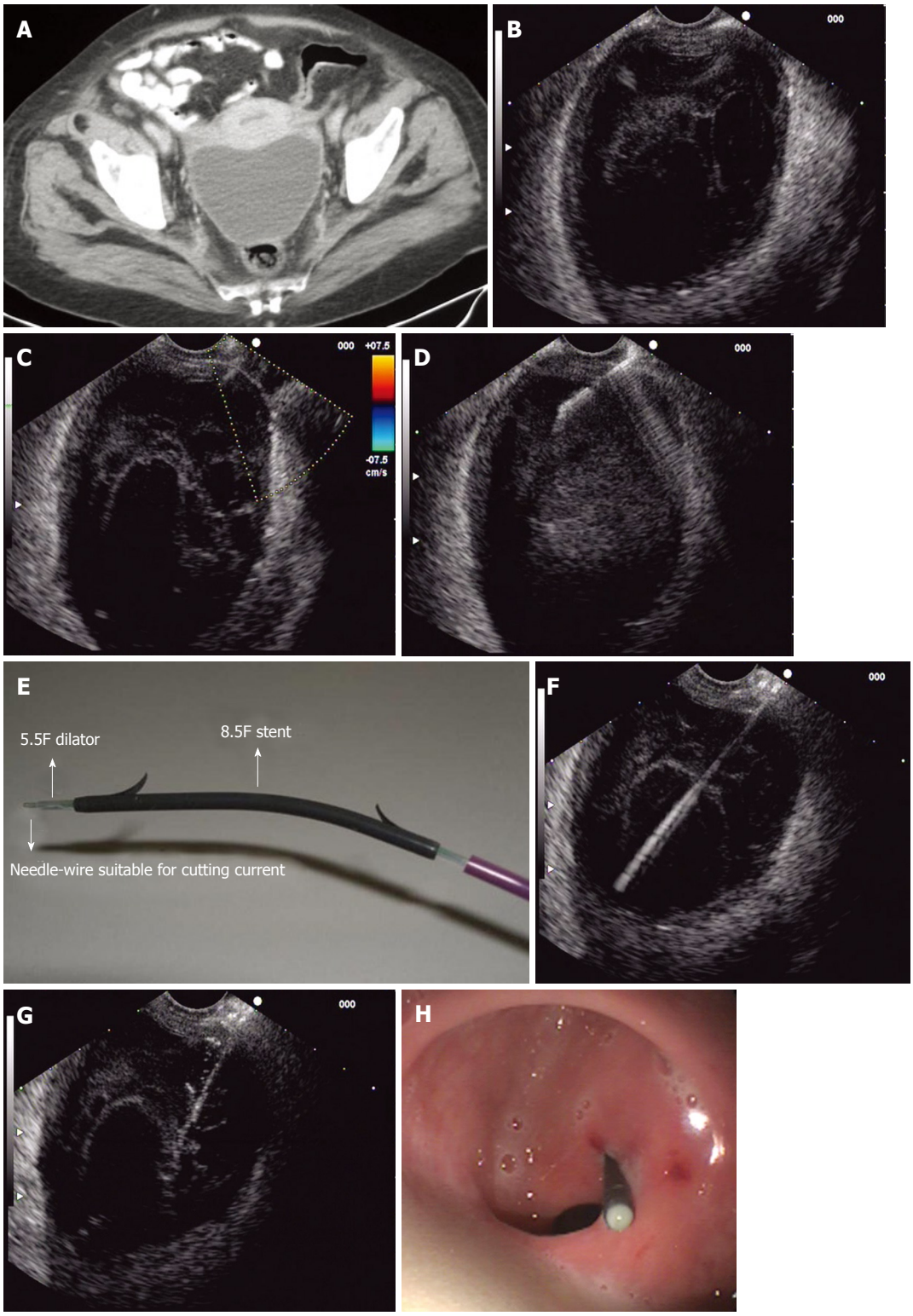

Figure 1 Endoscopic ultrasound (EUS)-guided pelvic abscess drainage procedure. A: CT scan showing a pelvic collection at the Douglas pouch; B: Pelvic abscess detected by linear EUS; C: Color-Doppler showing no vessels between the abscess and the puncture site; D: Fine-needle aspiration with a 19-G needle; E: NWOA system for one-step drainage of fluid collections; F: 0.035-inch needle-wire into the abscess cavity (NWOA system); G: An 8.5-F stent inserted into the abscess (NWOA system); H: Successful drainage.

complications were observed. In 2007, Varadarajulu *et al*[25] published their experience in 4 patients with pelvic abscesses which were secondary to diverticulitis and colorectal surgery in 1 and 3 patients respectively. The mean longest size of lesions was 73.8 mm. They successfully inserted single-pigtail drains (10F and 80 cm) in all 4 patients. Early abscess resolution (mean time until resolution of 6 d) was achieved in 3 out of 4 patients (mean follow-up of 3 mo) and no procedure-related complications were observed. In 2008, the same group published a modified technique for EUS-guided drainage of pelvic abscesses[26]. It is a combined technique which uses drainage catheters as well as 7F stents. They included 4 patients with pelvic abscesses due to colorectal surgery in 2 cases, ischemic colitis in 1 case and endocarditis in 1 case. The mean longest axis diameter was greater than 90 mm. All patients received 1 drainage catheter and at least 1 stent (2 patients received 2 stents). An early resolution of

Table 1 Results of EUS-guided drainage of abscesses in published studies

Author	*n*	Size	Technique	Complete drainage rate (follow-up)	Complications
Giovannini[24]	12	48.9 mm	Aspiration and Stents (8.5 and 10F)	75% (10.6 mo)	None
Varadarajulu[25]	4	73.8 mm	Drainage catheters (10F and 80 cm)	75% (3 mo)	None
Trevino[26]	4	92.3 mm	Drainage catheters (10F and 80 cm) Stents (7F and 4 cm)	100% (7 mo)	None

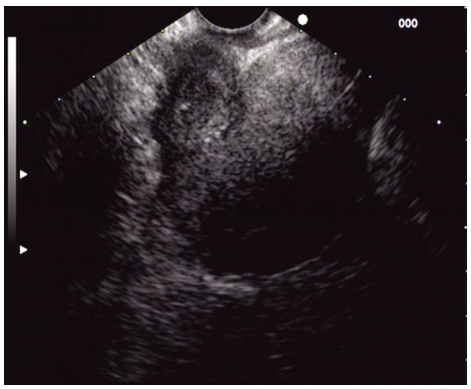

Figure 2 Virtual cavity close to the uterus after 3 wk.

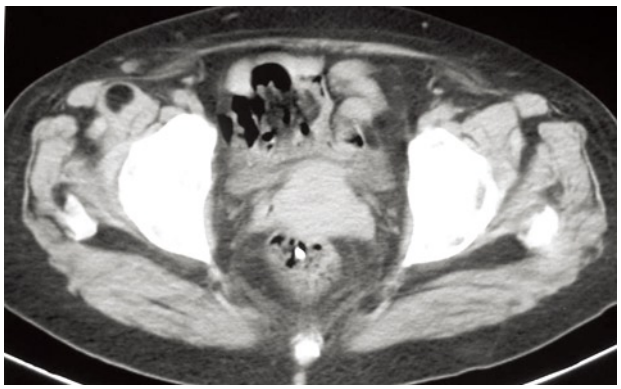

Figure 3 CT scan showing complete resolution of the abscess 4 wk later.

abscesses was achieved in all 4 patients (mean follow-up of 221 d) and drainage catheters were discontinued after 2 d. No complications were registered in any patients.

DISCUSSION

Pelvic collections and abscesses are a frequent complication of colorectal surgery but are also an outcome of abdominal infections[13-16,18,20]. Since pelvic abscesses localization is usually complex (surrounded by structures such as rectum, urinary bladder, uterus, vagina and prostate), they present a clinical challenge for endoscopists, radiologists and surgeons. Current "non-invasive" approaches for pelvic abscesses include ultrasound and CT-guided drainage. These procedures are usually performed with high success rates[19-23]. However, they have some drawbacks and limitations such as patient discomfort and early drainage catheter dislodgement. EUS-guided drainage procedure has been demonstrated to be an efficient alternative to US and CT-guided procedures[24-26]. In fact, it has been demonstrated to be simple, efficient and safe but published long-term data still remain limited. Although there are no comparative studies, the main advantage of EUS-guided procedure over US and CT-guided procedures is that the distance between the probe and the abscess is usually very small (< 1 cm). Therefore there are no organs interposed between the needle and the abscess cavity that are then easily punctured. On the other hand, one or more stents and drainage catheters can be deployed into the abscess for a long time without patient discomfort and no major complications derived from EUS-guided technique have been reported in the literature. Taking into account available published data, a drainage catheter and 1 or 2 stents for each lesion seems to be the best endoscopic approach. The main limitation of the EUS-guided drainage procedure is that only abscesses located close to the rectum and left colon can be treated. Moreover, it is recommended that the distance between the colon and the abscess should be less than 2 cm. However, new echoendoscope prototypes such as the forward-viewing one are being developed. They have been used for pancreatic collections and other abdominal therapeutic interventions and could have an important role in the management of pelvic lesions. Its easier maneuverability could be helpful to reach those lesions such as appendicular collections that are more proximally located. In addition, forward echoendoscopes can overcome the main limitation of the curvilinear echoendoscopes which is that they access the targeted lesions at an acute angle. This sometimes means that it is impossible to insert guide wires, catheters and stents into the targeted lesions and can also mean that the position of the echoendoscopes is lost. On the other hand, whether or not fully covered self expandable metallic stents could be helpful in these situations should be analyzed by prospective and randomized trials. These stents could be beneficial in these lesions; firstly, avoiding early occlusions and secondly minimizing the risk of peritoneal leaks. In conclusion, EUS-guided drainage of pelvic collections has been demonstrated to be a feasible and safe procedure. However, some points such as timing and optimal indications of EUS-guided procedure, type of material to be used (plastic stents, metallic stents or drainage catheters; straight, single or double pigtail stents; fully or non-covered metallic stents, catheter diameter *etc*) and the role of echoendoscope prototypes (forward-viewing) should still be addressed by prospective and comparative studies involving larger cohorts of patients.

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TOPIC HIGHLIGHT

Juan J Vila, MD, *Series Editor*

Endoscopic ultrasound-guided celiac plexus neurolysis

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Abstract

Endoscopic celiac plexus neurolysis (CPN) has become the procedure of choice for the management of patients with pancreatic cancer and abdominal pain unresponsive to medical treatment. It is necessary to differentiate between CPN and endoscopic celiac plexus block performed in patients with benign disease. In this review we describe the technique of this procedure with special emphasis on technical details.

Key words: Endosonography; Pancreatic neoplasms; Pancreatitis, Chronic; Celiac plexus; Therapeutics

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INTRODUCTION

Intra-abdominal malignancies, particularly pancreatic cancer, elicit pain that often necessitates opioid administration[1]. Despite their relative effectiveness for pain relief, opioids are not devoid of adverse effects such as drowsiness, delirium, dry mouth, anorexia, constipation, nausea and vomiting[2]. Therefore, more invasive non-pharmacologic methods such as celiac plexus neurolysis (CPN) have been used to alleviate the pain and consequently reduce the risk of drug-induced adverse effects. CPN is a technique whereby alcohol is injected to "permanently" destroy the celiac plexus in abdominal malignancies, particularly pancreatic cancer. It is important to differentiate CPN from celiac plexus block (CPB) whereby the celiac plexus function is temporally hindered by steroids (or less commonly alcohol) in other non-neoplastic diseases such as chronic pancreatitis. It is also worthwhile mentioning that the splanchnic nerves and the celiac plexus are two distinct anatomical structures. The first is situated superior to the diaphragm and anterior to the 12th thoracic vertebra while the latter is located inferior to the diaphragm surrounding the origin of the celiac trunk. The celiac plexus plays a vital role in the transmission of the pain sensation originating from most of the abdominal viscera (including the pancreas) except the left colon, rectum and pelvic organs[3].

TECHNOLOGY AND TECHNIQUES

As mentioned above, CPN involves the destruction of the sympathetic plexus by injecting alcohol near the celiac axis. Pain is one of the common symptoms in advanced pancreatic cancer reported by up to 90% of patients. In a previously published meta-analysis, radiological CPN was effective in controlling pain in 70%-90% of patients. However, this approach was associated with serious complications such as paraplegia, paraesthesia and pneumothorax in 1% of patients[4]. The advantage of endoscopic ultrasonography (EUS) guided CPN is that EUS can safely access the ganglia anteriorly

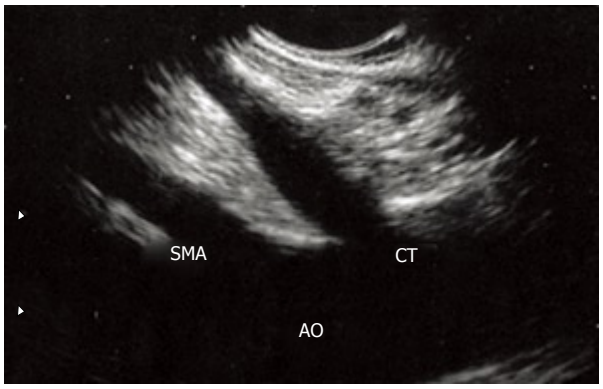

Figure 1 Endoscopic ultrasonography view of the aorta (AO), celiac trunk (CT), and superior mesenteric artery (SMA).

through the posterior stomach wall thus avoiding major arteries, diaphragm and the pleura using real-time imaging and color Doppler[5]. EUS has emerged as the test of choice for imaging the gut wall and surrounding structures. It couples a high frequency ultrasound probe with an oblique viewing endoscopic instrument therefore permitting the endoscopist to obtain good imaging of the pancreatic parenchyma and surrounding structures. This imaging modality is now accepted as the technique of choice for the evaluation of pancreatic disease, diagnosis and staging of pancreatic cancer and pancreatic neuroendocrine neoplasias[6].

The procedure is performed under deep sedation usually under the supervision of an anesthesiologist or a trained gastroenterologist who is well informed about deep sedation and its complications (with nursing assistance). Patients on anticoagulants and/or antiplatelet agents should stop them to allow normalization of hemostasis prior to the procedure. The patient is usually placed on the left lateral decubitus position and given intravenous hydration with normal saline to counteract the orthostasis that may arise from splanchnic blood pooling post-EUS-CPN. Using endoscopic view, the linear EUS is passed into the proximal stomach reaching the lesser curvature. Then the probe is lightly pushed against the stomach wall after posterior rotation to allow the identification of the aorta (anechoic tube structure in a longitudinal plane) and the take-off of the celiac axis (Figure 1). Then the endoscopist can verify these vascular structures using color doppler. The instrument is then advanced and the celiac artery is identified as the first vessel arising from the aorta below the diaphragm. The celiac plexus is not seen as a discrete structure but its location is determined relative to the celiac trunk. However, over the past few years, there has been increasing evidence that the celiac ganglia may be identifiable *via* EUS. These are usually seen anterior to the aorta (slightly to the left), cephalad to the celiac artery take-off and medial to the left adrenal gland. They appear as hypoechoic, oblong or lobulated structures, often with irregular edges and usually contain hyperechoic foci or strands[7-9]. Once the base of the celiac trunk is identified, an EUS-FNA needle is passed through the biopsy channel and secured to the luer-lock assembly. A 22- or 19-gauge needle is usually used, but in some countries a dedicated 20-gauge "spray" needle with multiple side holes (EUSN-20-CPN; Cook Endoscopy, Winston-Salem, NC) is available and allows solutions to be spread over a larger area. The larger caliber of this needle also means that less force needs to be applied to inject the relatively large volumes. The next step is to advance the needle under real-time EUS imaging through the posterior wall of the stomach immediately adjacent and anterior to the lateral aspect of the aorta at the level of the celiac trunk. When in place, the inner sheet of the needle is removed and an aspiration test should be done to rule out vessel penetration before injection. Then the needle needs to be flushed with normal saline to remove any tissue from its tip. Usually 5-10 mL of a local analgesic (bupivacaine 0.25%) is injected followed by 10-20 mL of a neurolytic agent (98% dehydrated ethanol) which will produce an echogenic cloud. Self-limited complications can occur such as transient diarrhea (10%-30%) and orthostatic hypotension (10%-60%)[5,7].

DISCUSSION

In 1914, Kappis first described the classical method of CPN[10,11]. Further attempts have been made to improve the accuracy of needle insertion for better pain control and for minimizing the procedure-related complications. There are different needle-insertion techniques, radiologic guidance and chemical composition of the injectate. Earlier studies on percutaneous CPN showed conflicting results. In one meta-analysis[12], percutaneous CPN resulted in sufficient pain relief while another meta-analysis[13] concluded that the CPN data were insufficient to judge the efficacy and long-term morbidities. In a more recent meta-analysis on CPN[4] where the cancer type was identified in 1117 patients (63% of which were pancreatic), 89% of patients reported good-to-excellent pain relief during the first couple of weeks after the CPN procedure. At 3 mo, around 90% of patients reported partial-to-complete pain relief regardless of the technique used and 70%-90% at the time of death. Local pain (96%), diarrhea (44%) and hypotension (38%) were the adverse effects reported but were mild and transient. Recently, Polati *et al*[14] prospectively randomized 24 patients with pancreatic cancer in a double-blinded study to receive percutaneous CPN. There was a significant reduction in analgesic use and drug-related adverse effects in the study group compared to those who received medical therapy alone. The major drawback of percutaneous CPN is a 1%-2% major complication rate. Among these complications are paraesthesia of lower extremities, paraplegia, injury of adjacent organs, gastroparesis and diarrhea[15,16]. More severe neurologic complications may also occur resulting from spinal cord ischemia due to damage to the arterial blood supply[17,18].

Initially, EUS had radial scanning probes providing only scanning planes perpendicular to the longitudinal axis of the endoscopic instrument which limits the ability of the endoscopist to follow the route of a needle device from the opening of the working channel to a target area. This was overcome by the introduction of linear-scanning echoendoscopes in the early 1990s which provide a scanning plane along the same longitudinal axis as the endoscope, i.e. on the same axis of the working channel. The earliest report published on EUS-guided CPN was on 30 patients, 83% of which had pancreatic cancer[19] followed by a prospective study on 58 patients with inoperable pancreatic cancer[10]. 78% reported a drop in pain score 2 wk after the procedure and this pain relief was sustained for a follow-up period of 24 wk. It was noted that if the treatment was combined with chemoradiation or chemotherapy, the decrease in the pain scores was significantly higher compared to patients who did not undergo any additional therapy[10]. Only minor complications were reported and were transient in nature (hypotension 20%, diarrhea 17% and pain exacerbation 9%). A recent meta-analysis revealed that the pooled proportion of patients with pancreatic cancer that showed pain relief with EUS-CPN was around 80%[20]. Recent data suggests that bilateral CPN is more effective than central CPN but on rare occasions can cause trauma to the left adrenal artery[21].

The role of EUS-CPN for chronic pancreatitis pain is not clear. Two studies[22,23] addressed the role of EUS-CPB for chronic pancreatitis. The first study showed a 55% pain reduction of the 90 patients after 7 d[22]. Unfortunately, only 25% continued to be pain-free after 12 wk. The second study compared EUS to CT-CPB[23]. This showed a 40% reduction in pain score at 8 weeks for the EUS-CPB group (30% at 24 wk) and 25% benefit for the CT-CPB group. In chronic pancreatitis, pain is controlled in only 50% of cases and only minority of these patients (10%) show persistent benefit at 24 wk[24].

The possible advantages of EUS-CPN compared to percutaneous CPN is the ability to accurately place the needle in the target area due to the proximity of the posterior gastric wall to the celiac plexus and the availability of color doppler to assess and avoid vascular structures. Relative contraindications to EUS-CPN include anatomical distortion from previous surgeries or congenital malformations that make the access more difficult. Absolute contraindications for EUS-CPN are the same as in any other invasive procedure: coagulopathy, platelets < 50 000 and uncooperative patients.

In summary, EUS-CPN is an easy to perform and relatively safe procedure for the palliation of pancreatic cancer-related pain especially if combined with chemo-radiation therapy. Though many questions remain to be addressed by prospective randomized trials, there is evidence to support the ongoing use of EUS-CPN/CPB and its further development. Randomized trials are required to identify the most optimal technique for performing CPN, the best timing for the procedure and the differences in treatment efficacy between scheduled versus on demand CPN.

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CASE REPORT

Postcolonoscopy appendicitis in a patient with active ulcerative colitis

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Abstract

Complications due to diagnostic colonoscopy are uncommon and acute appendicitis is a very rare complication of colonoscopy. This poses a diagnostic challenge as the presentation of appendicitis is similar to that of other complications of colonoscopy such as perforation or postpolypectomy syndrome. It is hypothesized that postcolonoscopy appendicitis might be associated with obstruction of the appendiceal lumen with fecal matter during colonoscopy. None of the previous reports in the literature have described findings of appendicitis after colonoscopy in a patient with active ulcerative colitis. We present a case of a 28 year-old man with active ulcerative colitis who underwent colonoscopy and subsequently developed acute appendicitis.

Key words: Postcolonoscopy appendicitis; Ulcerative colitis; Complications; Colonoscopy

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INTRODUCTION

We have recently seen an ulcerative colitis (UC) patient with acute appendicitis following colonoscopy. To our knowledge, only two cases of postcolonoscopy appendicitis have been reported in patients with UC and neither occurred while the patient had active colitis.

CASE REPORT

A 28 year-old man with an 8 year history of ulcerative colitis underwent colonoscopy for evaluation of his poorly controlled symptoms of colitis. He complained of 8-10 bowel movements a day with occasional blood and mucus, left lower quadrant abdominal pain, low-grade fevers and chills. The colonoscopy revealed diffuse, mild inflammation characterized by erythema, mild friability and loss of vascular pattern that extended from the rectum to the distal ascending colon. The procedure was uneventful without signs of inflammation in the cecum or around the appendiceal orifice. The terminal ileum was intubated easily and appeared normal (Figure 1). Biopsies were taken with jumbo forceps every 10 cm in 4 quadrants throughout the colon. Histological examination confirmed chronic active colitis in the left colon with normal mucosa in the right colon and terminal ileum (Figure 2).

Two days after the colonoscopy, the patient complained of new-onset fever and admitted to continued

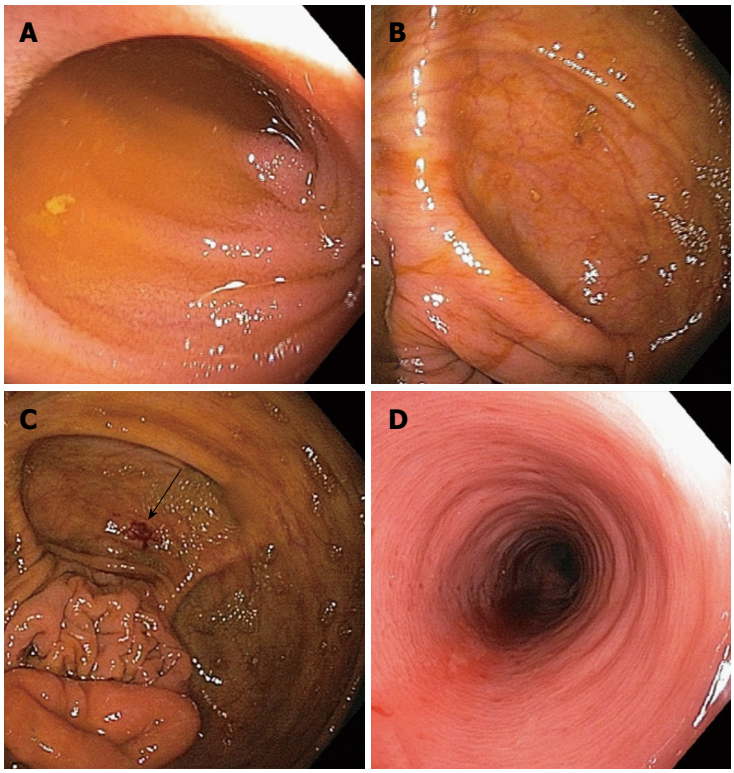

Figure 1 Colonoscopic images. A: Normal terminal ileum; B: Normal cecum; C: Biopsy site in cecum (white arrow), remote from appendix; D: Colitis in left colon characterized by erythema, loss of vascular pattern and friability.

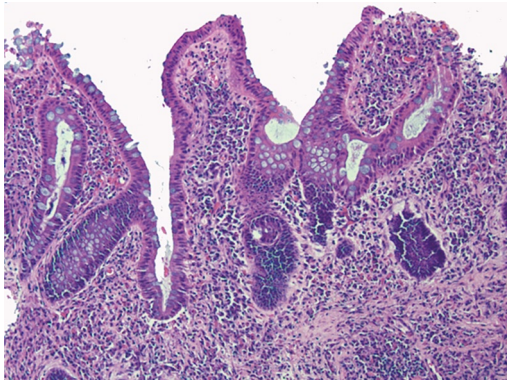

Figure 2 Histopathology: Chronic active colitis characterized by marked inflammation, prominent architectural distortion and a focal surface erosion. No granulomas were noted.

right lower quadrant abdominal pain since the colonoscopy. On examination he was found to have a blood pressure of 139/81, pulse of 105 and a temperature of 98.1°F. Abdominal examination was remarkable for diffuse tenderness to palpation, especially in the right and left lower quadrants, without rebound tenderness. The white blood cell count was 6 100 cells/mm^3. An abdominal CT scan showed an appendix with a diameter of 9 mm and surrounding inflammatory changes consistent with early acute appendicitis. He was treated with antibiotics and underwent laparoscopy. Examination of the peritoneal cavity revealed no evidence of injury; areas of inflammation were noted only in the right lower quadrant. The appendix was removed and histological examination confirmed acute appendicitis without fecalith in the appendiceal lumen. The patient tolerated the procedure well and recovered without incident. He was discharged 1 d after the operation and treated with balsalazide and mesalamine enemas. On follow-up in the clinic the next week, he had improved with 1-2 bowel movements a day and no blood in his stool.

DISCUSSION

The pathogenesis of appendicitis starts with luminal obstruction, usually by fecal material, which causes a rise in intraluminal pressure that compromises blood flow and lymphatic drainage. This results in ischemia, inflammation, bacterial overgrowth and invasive infection. Other causes of appendiceal luminal obstruction include lymphoid hyperplasia, vegetable matter and fruit seeds, intestinal worms and tumors[1].

Iatrogenic causes of appendicitis include barium contrast examinations and colonoscopy. In the case of barium appendicitis, inspissated barium is considered to be the cause of obstruction[1-2]. In the case of post-colonoscopy appendicitis, it has been proposed that gas insufflation of the colon might force material in the lumen to lodge in and obstruct the appendix[3] or that trauma caused by the colonoscope or local intervention performed in or around the appendiceal orifice may cause intramural bleeding and edema that obstructs the appendiceal lumen[4]. In many of the published case reports however, overinsufflation during colonoscopy is not described and no obstructing lesion is identified in the resected appendix. In our patient, there was no obvious overinsufflation of the bowel or apparent trauma to the appendiceal orifice noted during colonoscopy and no fecal matter was found in the ap-

pendix on histopathology. Biopsies were taken in the cecum but in an area distant from the appendiceal orifice.

Our patient is the third of 20 reported cases of postcolonoscopy appendicitis that has been associated with ulcerative colitis. This observation raises the possibility that ulcerative colitis may be a risk factor for this phenomenon. Appendectomy has been proposed as a factor that protects against the development of ulcerative colitis[5-7]. However, in patients with established ulcerative colitis it is not clear whether inflammatory bowel disease influences the development of appendicitis[8]. Conceivably, ulcerative colitis might cause inflammation in the appendix that compromises its blood supply or lymphatic drainage, predisposing to postcolonoscopy appendicitis. Irrespective of the underlying mechanism, appendicitis is a rare but important complication of colonoscopy and should be included in the differential diagnosis for any patient who develops abdominal pain after the procedure. Postcolonoscopy appendicitis may be a particularly important consideration in patients with ulcerative colitis.

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CASE REPORT

Splenic rupture following a diagnostic upper endoscopy

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Abstract

Complications following endoscopic procedures have been rarely reported and spontaneous rupture of a normal spleen is an exceptional complication following a gastroscopy. This paper reports a case of a spontaneous rupture of a normal spleen following a gastroscopy.

Key words: Spleen; Rupture; Gastroscopy; Upper endoscopy

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INTRODUCTION

Some infrequent complications such as perforation of a viscus or gastrointestinal hemorrhage have been related to endoscopic procedures. This is a report of a case of a spontaneous rupture of a normal spleen following a gastroscopy.

CASE REPORT

A 52-year old man with no past medical history was admitted on an outpatient basis for an upper endoscopy because of general syndrome. A tumoral lesion was observed at the esophagogastric junction and biopsies of the lesion were obtained. Two hours later the patient was admitted to the emergency department due to a generalized and sudden abdominal pain and hypotension. An abdominal CT scan revealed a splenic subcapsular hematoma with active peritoneal bleeding related to splenic rupture (Figure 1). Emergency splenectomy and cauterization of vessels were successfully carried out with no postoperative complications. The pathological study of the surgical specimen revealed a normal spleen parenchyma. Several weeks later, surgery of the cardiac neoplasm was performed which showed no sign of extrinsical invasion.

DISCUSSION

Splenic rupture has been described following trauma or related to different conditions involving the spleen consistent in hematological malignancies, infections (Epstein-Barr virus, HIV, malaria), metabolic disorders, splenic tumors, pregnancy, connective-tissue diseases and after some therapeutic and diagnostic procedures such as colonoscopy, extracorporeal shockwave lithotripsy and left-side thoracotomy[1,2]. Serious complications such as perforation of a viscus or gastrointestinal haemorrhage have been rarely reported following endoscopic procedures and spontaneous rupture of a normal spleen is an exceptional complication following a gastroscopy[3]. To the best of my knowledge, only a few cases have been reported to date[3,4].

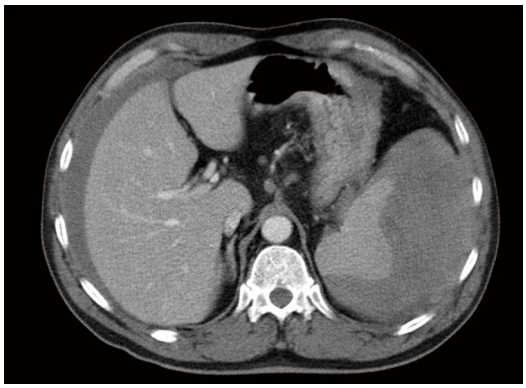

Figure 1 Abdominal CT scan showing a splenic subcapsular haematoma of 15 cm × 9 cm.

In the case of this patient, after having ruled out trauma as a possible triggering etiology of the splenic rupture and taking into account the temporal relationship between the event and the performance of the gastroscopy, it is probable that the nausea experienced during the procedure or the excessive stretching of the spleno-gastric and spleno-diaphragmatic ligaments[5] due to the cardias neoplasm may explain the splenic rupture.

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Meetings

Events Calendar 2010

January 25-26
Tamilnadu, India
International Conference on Medical Negligence and Litigation in Medical Practice

January 25-29
Waikoloa, HI, United States
Selected Topics in Internal Medicine

January 26-27
Dubai, United Arab Emirates
2nd Middle East Gastroenterology Conference

February 11-13
Fort Lauderdale, FL, United States
21th Annual International Colorectal Disease Symposium

February 26-28
Carolina, United States
First Symposium of GI Oncology at The Caribbean

March 05-07
Peshawar, Pakistan
26th Pakistan Society of Gastroenterology & Endoscopy Meeting

March 12-14
Bhubaneswar, India
18th Annual Meeting of Indian National Association for Study of the Liver

March 25-28
Beijing, China
The 20th Conference of the Asian Pacific Association for the Study of the Liver

March 27-28
San Diego, California, United States
25th Annual New Treatments in Chronic Liver Disease

April 07-09
Dubai, United Arab Emirates
The 6th Emirates Gastroenterology and Hepatology Conference, EGHC 2010

April 14-17
Landover, Maryland, United States
12th World Congress of Endoscopic Surgery

April 14-18
Vienna, Austria
The International Liver Congress™ 2010

April 28-May 01
Dubrovnik, Croatia
3rd Central European Congress of surgery and the 5th Croatian Congress of Surgery

May 01-05
New Orleans, LA, United States
Digestive Disease Week Annual Meeting

May 15-19
Minneapolis, MN, United States
American Society of Colon and Rectal Surgeons Annual Meeting

June 04-06
Chicago, IL, United States
American Society of Clinical Oncologists Annual Meeting

June 16-19
Hong Kong, China
ILTS: International Liver Transplantation Society ILTS Annual International Congress

June 20-23
Mannheim, Germany
16th World Congress for Bronchoesophagology-WCBE

August 28-31
Boston, Massachusetts, United States
10th OESO World Congress on Diseases of the Oesophagus 2010

September 10-12
Montreal, Canada
International Liver Association's Fourth Annual Conference

September 11-12
La Jolla, CA, United States
New Advances in Inflammatory Bowel Disease

September 16-18
Prague, Czech Republic
Prague Hepatology Meeting 2010

September 23-26
Prague, Czech Republic
The 1st World Congress on Controversies in Gastroenterology & Liver Diseases

October 07-09
Belgrade, Serbia
The 7th Biannual International Symposium of Society of Coloproctology

October 15-20
San Antonio, TX, United States
ACG 2010: American College of Gastroenterology Annual Scienitfic Meeting

October 23-27
Barcelona, Spain
18th United European Gastroenterology Week

October 29-November 02
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Instructions to authors

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The role of academic journals is to exhibit the scientific levels of a country, a university, a center, a department, and even a scientist, and build an important bridge for communication between scientists and the public. As we all know, the significance of the publication of scientific articles lies not only in disseminating and communicating innovative scientific achievements and academic views, as well as promoting the application of scientific achievements, but also in formally recognizing the "priority" and "copyright" of innovative achievements published, as well as evaluating research performance and academic levels. So, to realize these desired attributes of *WJGE* and create a well-recognized journal, the following four types of personal benefits should be maximized. The maximization of personal benefits refers to the pursuit of the maximum personal benefits in a well-considered optimal manner without violation of the laws, ethical rules and the benefits of others. (1) Maximization of the benefits of editorial board members: The primary task of editorial board members is to give a peer review of an unpublished scientific article via online office system to evaluate its innovativeness, scientific and practical values and determine whether it should be published or not. During peer review, editorial board members can also obtain cutting-edge information in that field at first hand. As leaders in their field, they have priority to be invited to write articles and publish commentary articles. We will put peer reviewers' names and affiliations along with the article they reviewed in the journal to acknowledge their contribution; (2) Maximization of the benefits of authors: Since *WJGE* is an open-access journal, readers around the world can immediately download and read, free of charge, high-quality, peer-reviewed articles from *WJGE* official website, thereby realizing the goals and significance of the communication between authors and peers as well as public reading; (3) Maximization of the benefits of readers: Readers can read or use, free of charge, high-quality peer-reviewed articles without any limits, and cite the arguments, viewpoints, concepts, theories, methods, results, conclusion or facts and data of pertinent literature so as to validate the innovativeness, scientific and practical values of their own research achievements, thus ensuring that their articles have novel arguments or viewpoints, solid evidence and correct conclusion; and (4) Maximization of the benefits of employees: It is an iron law that a first-class journal is unable to exist without first-class editors, and only first-class editors can create a first-class academic journal. We insist on strengthening our team cultivation and construction so that every employee, in an open, fair and transparent environment, could contribute their wisdom to edit and publish high-quality articles, thereby realizing the maximization of the personal benefits of editorial board members, authors and readers, and yielding the greatest social and economic benefits.

The major task of *WJGE* is to report rapidly the most recent results in basic and clinical research on gastrointestinal endoscopy including: gastroscopy, intestinal endoscopy, colonoscopy, capsule endoscopy, laparoscopy, interventional diagnosis and therapy, as well as advances in technology. Emphasis is placed on the clinical practice of treating gastrointestinal diseases with or under endoscopy. Papers on advances and application of endoscopy-associated techniques, such as endoscopic ultrasonography, endoscopic retrograde cholangiopancreatography, endoscopic submucosal dissection and endoscopic balloon dilation are also welcome.

The columns in the issues of *WJGE* will include: (1) Editorial: To introduce and comment on major advances and developments in the field; (2) Frontier: To review representative achievements, comment on the state of current research, and propose directions for future research; (3) Topic Highlight: This column consists of three formats, including (A) 10 invited review articles on a hot topic, (B) a commentary on common issues of this hot topic, and (C) a commentary on the 10 individual articles; (4) Observation: To update the development of old and new questions, highlight unsolved problems, and provide strategies on how to solve the questions; (5) Guidelines for Basic Research: To provide guidelines for basic research; (6) Guidelines for Clinical Practice: To provide guidelines for clinical diagnosis and treatment; (7) Review: To review systemically progress and unresolved problems in the field, comment on the state of current research, and make suggestions for future work; (8) Original Article: To report innovative and original findings in gastrointestinal endoscopy; (9) Brief Article: To briefly report the novel and innovative findings in gastrointestinal endoscopy; (10) Case Report: To report a rare or typical case; (11) Letters to the Editor: To discuss and make reply to the contributions published in *WJGE*, or to introduce and comment on a controversial issue of general interest; (12) Book Reviews: To introduce and comment on quality monographs of gastrointestinal endoscopy; and (13) Guidelines: To introduce consensuses and guidelines reached by international and national academic authorities worldwide on basic research and clinical practice in gastrointestinal endoscopy.

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6 21st century heart solution may have a sting in the tail. *BMJ* 2002; **325**: 184 [PMID: 12142303 DOI:10.1136/bmj.325.7357.184]

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15 Morse SS. Factors in the emergence of infectious diseases. Emerg Infect Dis serial online, 1995-01-03, cited 1996-06-05; 1(1): 24 screens. Available from: URL: http//www.cdc.gov/ncidod/EID/eid.htm

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16 **Pagedas AC**, inventor; Ancel Surgical R&D Inc., assignee. Flexible endoscopic grasping and cutting device and positioning tool assembly. United States patent US 20020103498. 2002 Aug 1

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