Review Article

Endoscopic ultrasound-guided drainage of pancreatic pseudocysts

Adrian Săftoiu[1,2], Andreas Vilmann[1], Peter Vilmann[1]

[1]Department of Endoscopy, Gastro Unit, Copenhagen University Hospital, Herlev, Denmark, [2]Department of Gastroenterology, Research Center of Gastroenterology and Hepatology Craiova, University of Medicine and Pharmacy, Craiova, Romania

ABSTRACT

Pancreatic pseudocysts are fluid collections in the peripancreatic tissues associated with acute or chronic pancreatitis. Endoscopic ultrasound (EUS)-guided drainage has become an established indication, having better results as compared to percutaneous drainage, nonguided endoscopic drainage, or surgical drainage. The aim of this review is to assess critically the current literature concerning EUS-guided pseudocyst drainage and to review the place of the procedure in the clinical decision management algorithms of these patients.

Key words: Endoscopic ultrasound (EUS), necrosectomy, pancreatic pseudocysts

INTRODUCTION

Pancreatic pseudocysts are fluid collections in the peripancreatic tissues associated with acute or chronic pancreatitis, encapsulated by granulation (inflammatory) and fibrous tissue, usually containing amylase-rich fluid.[1] According to the Atlanta classification, acute pseudocysts arise as a consequence of acute pancreatitis or pancreatic trauma while chronic pseudocysts appear in the setting of chronic pancreatitis and usually lack an antecedent episode of acute pancreatitis.[2,3]

Pseudocysts usually form after at least 4 weeks from the debut of an acute pancreatitis and most resolve spontaneously. Nevertheless, when associated with symptoms (epigastric pain, obstructive jaundice, vomiting due to gastric outlet obstruction, sepsis, etc.) they should be drained. The same approach is valid in chronic pancreatitis patients, in whom the symptoms are mostly determinants of the indication for drainage (chronic pain, gastric outlet obstruction, biliary compression, etc.).[4] Size alone is not a unique descriptor of the indication for pseudocyst drainage. Nevertheless, other indications began to be considered after the establishment of EUS-guided drainage including fluid collections that are nonbulging in the gastrointestinal (GI) tract, known left-sided portal hypertension, and/or gastric varices or collaterals, prior failed attempts of nonguided transmural treatment.[5]

Access this article online

Quick Response Code:

Website: www.eusjournal.com

DOI: 10.4103/2303-9027.170424

How to cite this article: Săftoiu A, Vilmann A, Vilmann P. Endoscopic ultrasound-guided drainage of pancreatic pseudocysts. Endosc Ultrasound 2015;4:319-23.

Address for correspondence

Dr. Adrian Săftoiu, 2 Petru Rares Street, Dolj, Craiova - 200 349, Romania. E-mail: adrian.saftoiu@umfcv.ro or adriansaftoiu@aim.com

Received: 2015-08-22; **Accepted:** 2015-10-17

Current clinical management algorithms favor endoscopic ultrasound (EUS)-guided drainage, which has better results as compared to percutaneous drainage, nonguided endoscopic drainage, or surgical drainage.[6] The aim of this review is to assess critically the current literature concerning EUS-guided pseudocysts drainage and to review the place of the procedure in the clinical decision management algorithms of these patients.

ENDOSCOPIC ULTRASOUND EVALUATION

The initial evaluation of patients with pancreatic pseudocysts, both in the setting of acute or chronic pancreatitis, consists of computed tomography (CT) or magnetic resonance imaging (MRI) with cholangiopancreatography (MRCP) sequences, which give an overview picture of the anatomy and position of the pseudocyst in relation to the GI tract structures.[4] Both methods are techniques of choice for the exclusion of cystic pancreatic neoplasms although EUS evaluation also brings significant additional information, especially by the use of EUS-guided fine-needle aspiration (FNA) followed by cytology analysis and tumor markers (CEA, CA 19-9, KRAS, etc.).[7]

EUS is the method of choice for the evaluation of pancreatic pseudocysts because it can establish the distance between the GI tract lumen and the pseudocyst and the presence of vascular elements at the level of the digestive tract wall (varices) or peripancreatic collaterals.[8,9] The fluid content might also influence the choice of stents, with anechoic pseudocysts requiring single drains while pseudocysts containing hypoechoic material (debris or necrosis) may require multiple drains or nasocystic tubes. Evaluation of the wall is also important as pseudocysts have a regular wall while cystic neoplasms have a focally enlarged/thickened wall that might impose puncture by EUS-guided FNA in order to clarify the diagnosis.

ENDOSCOPIC ULTRASOUND TREATMENT

Equipment

The first procedure that opened up the possibility of therapeutic interventions was EUS-guided FNA, which allows direct access to the organs and structures situated in the vicinity of the GI tract including pseudocysts.[10,11] Initial reports also showed favorable results with EUS-guided drainage as compared with non-EUS-guided drainage, especially when using a Seldinger (guidewire) technique as compared with needle knife entry techniques.[12-14] Furthermore, even collections not amenable to direct transmural endoscopic drainage can be safely drained with EUS-guided drainage.[15]

Consequently, the necessary equipment includes linear EUS scopes with a therapeutic channel (over 3.7 mm), coupled with corresponding ultrasound systems with Doppler capabilities.[16-19] Use of color or power Doppler before drainage is essential to check for enlarged vessels or collaterals in the proposed EUS-guided access trajectory, especially in cases complicated by left-sided portal hypertension.[20] Usage of forward-viewing linear EUS scopes has also been described in the past years although the advantages are minor and the absence of an elevator could hamper the procedure.[21] A recent systematic review comparing forward-viewing with conventional oblique-viewing curved linear array echoendoscopes found no statistically significant superiority for pancreatic pseudocyst drainage.[22]

ACCESSORIES

These are variable according to the technique but usually include initial access through 19G EUS-FNA needles followed by sampling of the pseudocyst content and then placement of hydrophilic guidewires (large 0.035-in) under ultrasound and/or radiological control.[23] Various dilation methods have been used over the guidewire, with graded dilatators,[24] balloons,[25] cystotomes[26] or modified needle knives.[27] Direct EUS-guided access with a modified needle wire[28] or even with a cystotome/fistulotome has been advocated by several authors.[29] Multiple techniques have been described for placement of two or multiple guidewires followed by placement of stents and/or nasocystic drains.[30,31]

Newer access devices for one-step drainage have been described recently, containing a trocar used for the initial access, a dual-balloon catheter used to anchor the device inside the pseudocyst and to dilate the tract followed by placement of two guidewires inside the pseudocyst.[32] Various plastic stents are used although most authors recommend the placement of large 8.5 Fr or 10 Fr stents.[4] Newer expandable metallic stents have also been proposed for EUS-guided drainage of pancreatic pseudocysts.[33-35]

DRAINAGE TECHNIQUES

Transmural (transgastric or transduodenal) EUS drainage has been proposed as an alternative for

surgical or percutaneous drainage.[4] Nevertheless, transesophageal drainage has been performed safely, depending on the mediastinal extension of pancreatic pseudocysts.[37-40] Apart from pseudocysts, patients with walled-off pancreatic necrosis (WOPN) can be drained in a similar manner although they require either a combination of plastic stents with nasocystic catheters or an expandable metallic stent, which allows access to the retroperitoneal collection for subsequent debridement and drainage.[36]

After location of the pseudocyst by EUS and check by color or power Doppler EUS for vessels or collaterals, the best location has to be selected, where the pseudocysts is closest to the lumen, preferably less than 10 mm.[4] After the initial EUS-guided puncture with a 19G needle, a hydrophilic guidewire is coiled inside the pseudocyst. Our preferred approach is to further use a small size cystotome (6 Fr or 8.5 Fr) to enlarge the access, with one or two 8.5 Fr stents placed subsequently inside the pseudocyst [Figure 1a-c].

Covered expandable metallic stents are placed in a similar manner with the insertion of plastic stents. The initial EUS-guided FNA access is followed by tract dilation by either a 4-mm balloon or a 6-Fr cystotome, over a guidewire. The stent is then inserted into the pseudocyst and the distal flange is expanded under ultrasound guidance while the proximal flange is expanded under endoscopic guidance.[33] The procedure is slightly different when using expandable stents with cautery on the tip (HotAxios, Boston Scientific, Marlborough, Massachusetts, USA), which allows a single-step approach. The stent delivery system is inserted directly into the pseudocyst using cautery followed by expansion of the distal flange and subsequent expansion of the proximal flange [Figure 2a-c].

CLINICAL RESULTS

EUS-guided drainage of pancreatic pseudocysts is an established procedure with more than 2,000 patients reported in the published literature.[41] The procedure can be used in complicated cases too, without bulging of the pseudocyst inside the GI tract lumen (either at the level of the stomach or duodenum). Cases complicated with left-sided portal hypertension are also managed safely with EUS-guided drainage by avoiding collaterals or through the placement of expandable stents in case of bleedings precipitated by the EUS-guided puncture or subsequent dilation.[42]

Thus, technical success is over 95% while clinical success approaches in 90%, with immediate complications of approximately 5% (bleeding, perforation, etc.).[43] The overall recurrence rate is around 8%[41] while the overall complication rate approaches is 17% including bleeding, perforation, superinfection, and migration of stents. However, procedure-related mortality is quite low, around 2 per 1,000 patients.

Several trials prospectively compared EUS-guided drainage with conventional endoscopic drainage showed clearly the advantages of EUS-guidance, with better rates of clinical and technical successes as well as lower rates of severe complications.[44,45] A small meta-

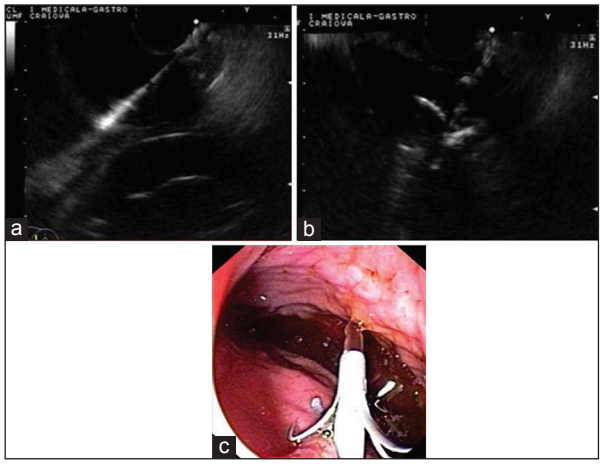

Figure 1. Initial access into the pseudocyst is usually obtained with 19G EUS puncture with placement of a guidewire inside the pseudocyst. The tract is dilated with a cystotome (a) followed by placement of plastic stents under ultrasound (b) and endoscopic guidance (c)

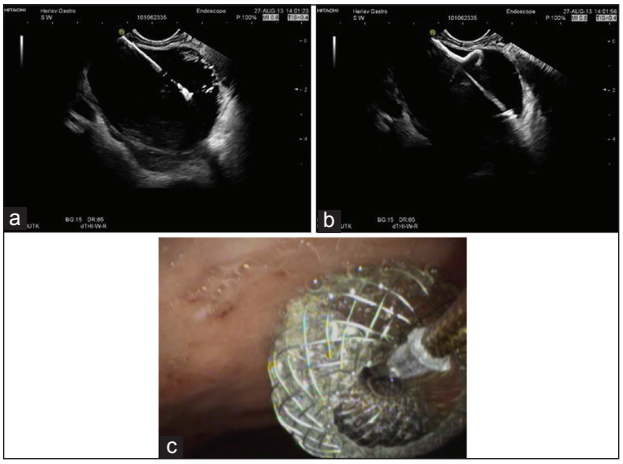

Figure 2. Single-step EUS-guided drainage using a covered expandable metallic stent with cautery on the tip. After initial stent insertion (a) the delivery system allows opening of the distal flange under ultrasound control (b) followed by the proximal flange under endoscopic control (c)

analysis compared the technical success and clinical outcomes between the two techniques in a batch of 229 patients included in 4 studies.[46] Both short-term (4-6 weeks) and long-term (6 months) successes as well as the complication rate were similar between EUS-guided drainage and conventional transmural drainage. Nevertheless, two deaths due to severe bleeding occurred in the conventional drainage arm, leading the authors to suggest that nonbulging pseudocysts and the presence of portal hypertension or coagulopathy should favor EUS-guided drainage.

An initial small randomized trial compared EUS-guided drainage with surgical cyst-gastrostomy and showed similar treatment success and complications or reinterventions.[47] However, the mean length of hospital stay was significantly shorter for EUS-guided pseudocyst drainage, with significant cost savings. A larger study performed further by the same group showed the same results, without any difference in treatment success and complications or reinterventions between endoscopic and surgical cytsogastrostomy.[48] Endoscopic treatment was also associated with a shorter hospital stay and lower costs.

Necrosectomy (debridment of pancreatic necrosis) has been a traditional surgical procedure but several successful reports showed that EUS-guided necrosectomy is a feasible alternative.[41] After the initial EUS-guided access and dilation of the tract, different endoscopic tools are used to remove necrotic tissues. The mean technical and clinical success rates are reported to be 100% and 88%, respectively, with a mean overall complication rate of 28%. Another systematic review and meta-analysis reported the weighted mean number of necrosectomy sessions of 4, with a polled proportion of successful resolution of pancreatic necrosis of 82% with a recurrence rate of 10.88% and complication rate of 21.33%.[49] Expandable metallic stents are becoming a popular option for drainage of pancreatic necrosis as they allow a safe access into the retroperitoneal cavity.[50] The optimal strategy in patients with WOPN at present is a "tailored" minimal invasive approach, which includes a combination of EUS-guided drainage, percutaneous radiology-guided drainage, and laparoscopic drainage, based on the collection size, location, and stepwise response to intervention.[51-53]

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

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