Endoscopic Ultrasound-Guided Drainage of Pelvic Fluid Collections

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KEYWORDS

- Endoscopic ultrasonography • Drainage • Pelvic abscess
- Therapeutic endoscopic ultrasound • Intra-abdominal abscess
- Transrectal drainage

KEY POINTS

- Pelvic collections can result from surgical complications, or from diseases involving the reproductive organs or alimentary tract.
- Endoscopic ultrasound (EUS) provides an effective, low-risk alternative to surgical and percutaneous methods for drainage of pelvic collections.
- Successful treatment involves a multidisciplinary approach with proper surgical backup and careful patient selection.
- Because of its many advantages and low risk for adverse events, EUS drainage has been increasingly the preferred first line option for these collections.
- Options for drainage include either stent/drain placement or aspiration and lavage depending on the etiology, maturity, and size of the cyst.

INTRODUCTION

Fluid collections in the pelvis occur following surgery, or as a result of perforation of pelvic viscera due to medical conditions involving the alimentary tract (eg, diverticulitis, appendicitis, or inflammatory bowel disease), or reproductive tracts (prostate, gynecologic organs).[1] Drainage of pelvic collections is essential for source control of infection, and can be achieved via 1 of 3 approaches: surgical, percutaneous, and transluminal. Advances in endosonography equipment and techniques have allowed the endoscopist to safely and reliably access structures adjacent to the gastrointestinal tract under direct visualization.[2] More recently, the advent of lumen-apposing stents with integrated dilation and deployment systems have further simplified the

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technique of endosonographic drainage. As such, endoscopic ultrasound (EUS)-guided transluminal drainage in the pelvis is increasingly viewed as the first-line, least-invasive approach. EUS offers certain advantages over competing approaches, in particular decreased pain at the puncture site, and the ability to dilate and achieve a widely patent tract for rapid drainage. This article summarizes appropriate patient selection, safety considerations, technique, and the available evidence on outcomes of EUS-guided abscess drainage in the pelvis.

INDICATIONS AND PREPROCEDURE CONSIDERATIONS

Careful preassessment and anatomic evaluation are essential for safe and effective EUS-guided drainage in the pelvis. Dedicated imaging via contrast-enhanced computed tomography (CT) of the abdomen and pelvis or MRI should be undertaken to delineate the relationships between the collection, surrounding structures, and the rectosigmoid lumen. Although transvaginal ultrasound-guided drainage is an option in female patients and may afford easier access to anterior pelvic collections, it is outside the scope of practice of most gastrointestinal endoscopists. Hence this article will focus on the transrectal approach.

Imaging characteristics of the pelvic collection should be taken into consideration, including location, size, loculation, maturity, etiology, mucosal disruption, and ascites. These will be discussed in detail in the following sections.

Location

The collection should be in a space that can be brought to within 2 cm of the ultrasound transducer. Extraperitoneal collections adjacent to the rectum are ideally suited for EUS-guided drainage. In both sexes, the pararectal and presacral spaces are easily accessed. Anterior to the rectum, the rectouterine space in females and the rectovesical space in males are also suitable. Collections that are anterior to the uterus in women and anterior to the bladder in men are best accessed via alternative routes. Abscesses that are superior to the peritoneal reflection, often sequelae of sigmoid diverticulitis, can be drained through the sigmoid colon; however, this poses greater technical challenges, and limited data are available on outcomes; as such, the role of EUS for these collections remains uncertain, and may require a forward-viewing EUS scope that is not readily available to many endosonographers. Perineal collections that are located inferior to the dentate line are best drained via the percutaneous (transgluteal) approach.

Size

The EUS technique is best suited to collections larger than 4 cm. Smaller collections may be drained endoscopically, but can often resolve with antibiotics alone.

Loculation

Multiple loculations reduce the likelihood of successful drainage, as does high-density debris.

Maturity

A well-circumscribed rim around the collection is necessary to support the creation of a fistula with stents and minimize the risk of free wall perforation. Aspiration alone, without leaving a stent, may be considered for immature collections if urgent drainage is indicated in the setting of clinical instability (**Fig. 1**).

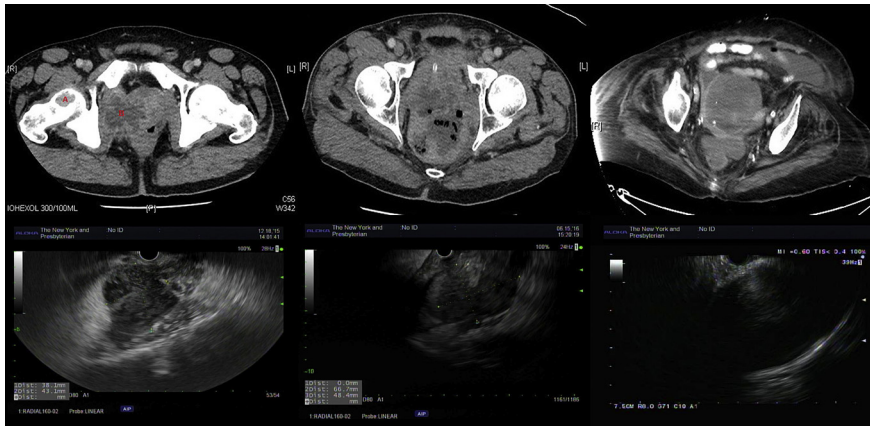

Fig. 1. (*Left*): Lytic bone lesion (A) with a pelvic collection (B) caused by multiple myeloma and osteomyelitis successfully drained with aspiration and lavage with corresponding EUS image below. (*Middle*): A multiloculated fluid collection with EUS imaging below showing a solid mass. Pathology consistent with prostate cancer. (*Right*): Pelvic abscess due to a gynecologic procedure with mature wall.

Etiology

The organ from which the collection arises is not always evident radiologically; however, attention should be paid to etiology and differential diagnosis of the collection before draining it. The most common cause of a pelvic collection is an anastamotic leak following colorectal surgery, and most abscesses arise from perforation of the gastrointestinal tract. The technique is, however, also applicable to other etiologies of pelvic collection, and successful EUS-guided drainage of collections arising from the prostate, uterus, tubo-ovarian organs, and bone/periosteum has been reported. There is some evidence that success rates for drainage of diverticular abscesses are lower than for other etiologies.[3]

Mucosal Disruption

Inflammation or ulceration in the vicinity of the access site should prompt consideration for drainage via an alternative route. Active inflammatory bowel disease involving the rectum or perianal region may predispose patients to local complications if transrectal drainage is attempted. Although EUS-guided pelvic drainage has been successfully reported in patients with Crohn disease, there are insufficient data to evaluate its safety in this patient population, and the technique should be employed with caution. Abscesses and collections that appear to invade or involve the bowel wall should raise concerns, as they may indicate a malignant etiology, and may increase the risk of free wall perforation if drainage is attempted.

Ascites

The presence of intervening ascites is a contraindication to transluminal drainage.

PATIENT PREPARATION

Septic patients should be stabilized with fluids and antibiotics prior to attempting drainage. Antibiotics should be administered prior to the procedure and for several

days thereafter. The specific antibiotic agent should be tailored to the suspected etiology and local antibiotic resistance patterns.

Coagulation parameters should be checked prior to the procedure and coagulopathy reversed, as per society guidelines for high-risk endoscopic procedures.

Bowel preparation, either with oral lavage solutions or enemas, is essential to allow for optimal endosonographic visualization, and to minimize the risk of soiling in the event of a perforation. The availability of surgical backup in the event of a perforation is recommended, and it is essential to work within a multidisciplinary team with colorectal surgery, interventional radiology, and, as applicable, urology and gynecology.

Patients should empty the bladder, or a urinary catheter should be placed prior to the procedure, to minimize the risk of inadvertent bladder puncture. The balloon of a Foley catheter can be easily visualized endosonographically and can help to distinguish the bladder from the collection of interest. Puncture with a 19-gauge needle has not been reported to result in injury to the bladder unless the tract is dilated.

Adequate procedural sedation, administered either by an anesthesia specialist or by the endoscopist, is essential. Although EUS-guided pelvic drainage is similar to flexible sigmoidoscopy, sedation is more important, as manipulating a therapeutic echoendoscope adjacent to an infected pelvic collection may cause significant discomfort. Moreover, patient movement after puncture can cause dislodgement and loss of access to the collection, with attendant risk for perforation and adverse outcomes.

Appropriate surgical backup is essential. Management of patients with pelvic collections should involve input from colorectal, urologic, or gynecologic surgeons as appropriate. Surgical colleagues should be aware of the decision to proceed with endoscopic drainage, and ideally be in-house to manage emergent complications, should they arise.

The procedure is typically performed with the patient in the left lateral decubitus position, as with flexible sigmoidoscopy.

EQUIPMENT

EUS-guided pelvic drainage requires the use of a therapeutic echoendoscope with a working channel of at least 3 mm caliber in order to permit the passage of a 19-gauge fine-needle aspiration (FNA) needle. Currently available therapeutic curvilinear-array echoendoscopes include the Olympus GF-UCT140/160/180 range (Olympus Corporation, Tokyo, Japan) with a 3.7 mm channel, and the Pentax EG 38UT (Pentax Medical, Tokyo, Japan) with a 3.8 mm channel, both of which afford the passage of a 10 F stent. The Pentax FG 38UX (Pentax Medical, Tokyo, Japan) has a smaller 3.2 mm channel that will permit only an 8.5 F stent. There is limited experience with the use of recently developed forward-viewing echoendoscopes; however, it appears they may offer advantages in obtaining optimal positioning and maintaining visualization during the procedure.[4] The Olympus XGIF-UCT160J-AL5 has a 3.7 mm working channel and has been reported to have been used successfully for pelvic abscess drainage in 1 series.[5] CO_2 insufflation is preferred over air to minimize the risk of cardiopulmonary distress from tension pneumoperitoneum and/or compartment syndrome.[6]

Accessories required for pelvic abscess drainage vary by intended drainage technique and will be addressed.

TECHNIQUE

With the development of drainage devices with integrated deployment systems, several alternative techniques for EUS-guided pelvic abscess drainage have emerged. The traditional wire-guided technique is described here.

Needle Aspiration and Wire-Guided Access

Inspection

Following ultrasound visualization of the collection, the endoscopist should maneuver the endoscope into a stable position and apply color Doppler to exclude the presence of intervening vasculature. Consideration should be given to distinguishing the collection from the urinary bladder.

Puncture

In the traditional wire-guided technique, access is gained to the collection using a 19-gauge FNA needle and confirmed with injection of contrast on fluoroscopy (**Fig. 2**). The needle stylet is then removed and the abscess contents aspirated and sent for cytology, Gram stain, and culture. Thick purulent debris may limit fluid return. If no fluid is obtained, then the cavity should be irrigated with 10 to 20 mL of normal saline followed by repeat aspiration. For small collections, or circumstances in which creation of a fistula is undesirable, aspiration and lavage alone may be sufficient to achieve source control and stabilization of sepsis, at least temporarily.

Wire access

For more definitive drainage, a 0.035 mm guidewire is passed into and coiled at least twice within the collection. Initial access to the tract over the wire may then be performed with a 5 F endoscopic retrograde cholangio-pancreatography (ERCP) catheter or a needle knife followed by passage of an 8 to 10 mm biliary or through-the-scope (TTS) dilation balloon. Electrocautery-assisted advancement of a 10 F cystotome over the wire under EUS control is an alternative to balloon dilation.[7]

Stenting

The tract may then be maintained using one or more double-pigtail plastic stents (typically 7–10 F outer diameter, 4–5 cm long). A 10 F, 80 cm single-pigtail transrectal

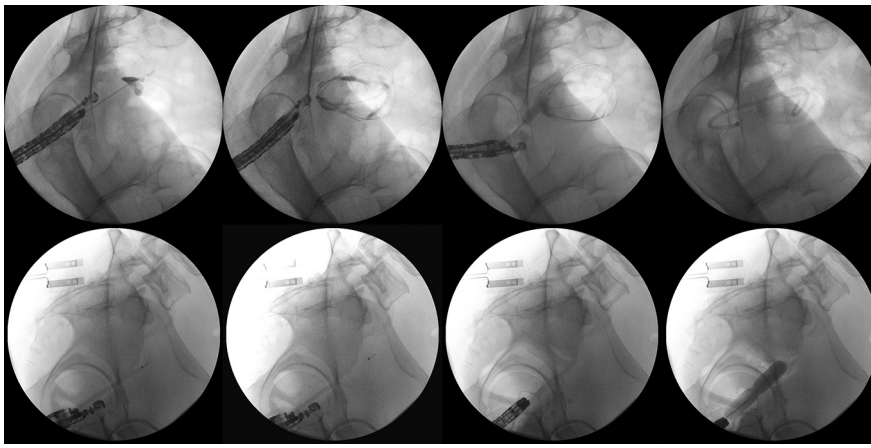

Fig. 2. (*Top images from left to right*) EUS FNA of the abscess cavity with contrast injection. Wire is then advanced into the cavity. After initial needle knife cautery of the tract, dilation of the tract is performed with a TTS dilation balloon. A 10 F double-pigtail catheter is then deployed over the wire. (*Bottom images from left to right*) EUS access to the cyst cavity is obtained with Hot Axios cautery. The inner flange is then deployed with gentle retraction. The stent is then fully deployed. Dilation of the lumen of the stent was performed to increase drainage.

drainage catheter can also be deployed, especially for collections with thick or loculated contents that may benefit from frequent irrigation with 50 mL of sterile normal saline every 4 to 6 hours.

Integrated Systems

Integrated puncture, dilation, and stent deployment systems have emerged to streamline the process of EUS drainage. The Giovannini Needle-Wire Oasis system (Cook Medical, Bloomington, Indiana) comprises 3 devices: a needle-wire, a 5.5 F dilator catheter, and an 8.5 F stent. The system allows for 1-step puncture, dilation, and stenting, and has been successfully reported for pelvic abscess drainage.[8]

Lumen-Apposing Stents

More recently, short fully-covered metal stents with accentuated, dumbbell-shaped flanges have emerged. These lumen-apposing metal stents (LAMS) exert radial forces that dilate the tract at the same time as the flanges apply compressive force to appose the cavity and lumen walls together, limiting the risk of migration. LAMS have been rapidly adopted for drainage of pancreatic fluid collections, where they have been shown to be easy to use, safe, and effective.[9] In the United States, the Axios stent (Boston Scientific, Natick, Massachusetts) is currently available, and comes in 2 sizes: 10 mm and 15 mm luminal diameters, with 21 mm and 24 mm flange diameters respectively, and a common saddle length of 10 mm. The Axios is deployed through a 10.8 F TTS catheter under EUS guidance. The initial iteration of the device required wire-guided access to the collection. In the latest iteration, the Axios may be deployed via direct electrocautery-assisted puncture of the cavity, obviating the need for wire guidance altogether, reducing the overall procedure time. LAMS have streamlined the process of stent placement; however, due to their short length, they are not suitable for collections that are located much greater than 1 cm away from the transducer.

TECHNICAL CONSIDERATIONS

Aspiration Alone?

There are circumstances in which leaving a stent or physical drain in the pelvic collection may not be desirable. Some examples include

- If the source of the collection is unclear, and a there is concern regarding formation of a fistulous tract, such as a recto-urethral fistula arising from a prostatic collection
- If coagulopathy or clinical instability limits tract dilation
- If there is a concern regarding a malignant etiology
- If the collection is too small to accommodate a stent
- If the collection is more than 20 mm away from the colorectal lumen

If drainage is still needed for source control or for identification of the causative organism, aspiration alone or irrigation and aspiration with a 19-gauge needle can be performed and may temporize the patient until a more definitive intervention can be arranged. For small collections, aspiration can permit resolution of the collection with antibiotics targeted to culture data, with 4 of 4 patients who underwent aspiration in 1 series experiencing complete resolution.[10] There are no available trials comparing aspiration alone with drain/stent placement; however, within the urology literature, transrectal ultrasound-guided needle aspiration has been reported to have high rates of success.[11,12]

Is Fluoroscopy Necessary?

Fluoroscopy is needed for wire-tip control, where a wire is used to guide access to the collection. As such, it is obligatory when dilation and stent placement over a wire is anticipated. For aspiration alone, and for cautery-assisted LAMS, fluoroscopy may be considered optional, as these can be performed under ultrasound guidance alone. The authors would suggest, however, that fluoroscopy should be used whenever available, as it permits routine intraprocedural assessment for complications—in particular perforation resulting in pneumoperitoneum—which may not otherwise be readily clinically apparent, especially with the use of CO_2 insufflation.

Transcolonic Versus Transrectal Drainage?

Drainage of collections is feasible through the rectum if the collection is located in the inferior pelvis. Collections that are located at or above the pelvic rim may be inaccessible from the rectum and require the endoscope to be maneuvered more proximally into the sigmoid colon in order the achieve a drainage window. Several challenges arise in conducting transcolonic drainage. First, the sigmoid colon is highly mobile, and achieving a stable position from which to safely access the collection is more difficult than from the rectum. Second, currently available therapeutic curvilinear echoendoscopes have relatively oblique camera visualization and limited tip deflection that make navigating the tortuous sigmoid colon difficult. Third, the sharp angulation of the sigmoid turns may make it difficult to puncture the collection directly en face rather than tangentially, potentially increasing the risk of perforation. There are few data comparing outcomes from transcolonic and transrectal drainage. In the 1 retrospective cohort study that has addressed the issue, a trend toward lower treatment success (70% vs 96%) was seen with transcolonic drainage; however, the difference was not statistically significant, and neither group experienced procedural complications.[3] The study was limited by small sample size, including only 11 transcolonic cases, which limited the ability to detect a difference. There are 2 other reports in the literature of perforations in patients who underwent transcolonic drainage of diverticular and Crohn abscesses, suggesting that there may be a higher risk of complications with transcolonic drainage that may not be conclusively demonstrated in the absence of large series with numerous adverse events.[10,13] Some of the potential challenges of transcolonic drainage may be overcome with the use of forward-viewing therapeutic echoendoscopes as they become more readily available.

POSTPROCEDURE CARE

Recommendations for postprocedure care are based largely on expert opinion rather than evidence. Patients who have successfully undergone transrectal drainage can be resumed on regular oral or enteral feeds; however, they should be maintained on a bowel regimen to reduce the risk of fecal impaction adjacent to rectal prostheses. Follow-up CT should be obtained at 36 to 48 hours to ensure that the collection is responding with a decrease in size. External drainage catheters are typically discontinued in the inpatient setting once symptomatic improvement is achieved and CT response is confirmed, because of their inconvenience. Plastic stents may stay in place after discharge and can be retrieved at follow-up outpatient sigmoidoscopy in 2 to 4 weeks following complete abscess resolution, although spontaneous migration and expulsion are not uncommon. Prompt removal of LAMS is of greater urgency than for plastic stents, as late complications including stent burial, migration, and severe bleeding have been reported with prolonged LAMS placement, beginning 3 weeks after transgastric placement for drainage of pancreatic necrosis.[14,15]

Table 1
Summary of case series on endoscopic ultrasound-guided drainage of pelvic abscesses

Author, Year	Origin	# Cases	Abscess Etiology	Mean Maximum Diameter	Technique	Technical Success (%)	Treatment Success (%)	Complications
Manvar,[a] 2017	United States	11	5 postoperative 6 other	70 mm	4 LAMS 7 cautery-assisted LAMS	100	100	None
Poincloux,[10] 2017	France	37	31 postoperative 6 other	60 mm[b]	29 double pigtail stents 4 aspiration 4 LAMS	100	87	1 perforation 1 rectal pain
Ratone,[17] 2016	France	7	5 postoperative 2 other	71 mm	Double-pigtail stents	100	n/a	None
Puri,[16] 2014	India	30	15 postoperative 5 diverticular 4 prostatic 6 other	49 mm	17 double-pigtail stents 5 aspiration 5 aspiration, dilation	100	93	None
Hadithi,[7] 2014	Holland	8	4 diverticular 2 postoperative 2 other	73 mm	Double-pigtail stents	100	100	None
Luigiano,[18] 2013	Italy	2	1 postoperative 1 diverticular	—	FCSEMS	100	100	None
Ramesh et al,[3] 2013	USA	38	25 postoperative 5 diverticular 8 other	68 mm	Double-pigtail stents	100	86	None

Ulla-Rocha,[8] 2012	Spain	3	Postoperative	47 mm	NWOA	100	100	None
Puri,[19] 2010	India	14	9 post-op 3 diverticular	73 mm	9 double-pigtail stents 3 aspiration 2 aspiration, dilation	100	93	None
Piraka,[13] 2009	USA	3	1 postoperative 1 diverticular 1 Crohn	65 mm	2 double-pigtail stents 1 aspiration alone	100	100	1 perforation
Varadarajulu,[20] 2009	United States	25	17 postoperative 3 diverticular 5 other	69 mm	25 double-pigtail stents 10 double-pigtail stents + transrectal catheter	100	96	None
Trevino,[21] 2008	United States	4	2 postoperative 2 other	93 mm	Double-pigtail stents + transrectal catheter	100	100	None
Varadarajulu,[22] 2007	United States	4	4 postoperative	72 mm	Transrectal catheter	100	100	None
Giovannini et al,[23] 2003	France	12	11 postoperative 1 other	49 mm	9 straight plastic stents 3 aspiration	100	89	None

Abbreviations: FCSEMS, fully-covered self-expanding metal stent; NWOA, needle-wire oasis system, Cook Corporation.

[a] Unpublished data, to be presented at DDW 2017 courtesy of Dr. Sammy Ho and Dr. Amar Manvar.

[b] Median.

OUTCOMES

Despite over a decade of cumulative experience worldwide with EUS-guided drainage of pelvic collections, there have been no large multicenter cohort studies published evaluating the technique. **Table 1** provides a detailed summary of the literature to date on outcomes of EUS-guided drainage of pelvic collections. Based on the limited available evidence, the technique appears to be safe and effective, with near-perfect rates of technical success (albeit in carefully selected cohorts), and favorable clinical outcomes, with treatment success as defined by the authors of the original studies ranging from 86% to 100%.

The highest-quality data available come from a prospective cohort study performed by Ramesh and colleagues,[3] who enrolled 38 consecutive patients who underwent lower EUS-guided drainage of abdominopelvic collections over a 7-year period at 1 center. Most collections were either postsurgical (66%) or diverticular (13%) in etiology. The procedural technique in all cases involved puncture with a 19-gauge FNA needle, followed by aspiration, and access to the collection with a 0.035 inch wire. Dilation was then performed over the wire using a 4.5 F ERCP catheter, followed by a 6 to 8 mm biliary balloon. Following dilation, 1 or 2 7 F, 4 cm double pigtail plastic stents were placed. In addition, for large (>8 cm) collections, a 10 F drainage catheter was placed and flushed every 4 hours with 200 mL of normal saline until clear aspirate was returned, at which point the catheter was removed. The study explicitly compared outcomes of transcolonic (11 cases) and transrectal (27 cases) drainage, finding no difference in rates of technical success (100% for each). There was a trend toward lower treatment success in the transcolonic group (70% vs 96%, $P = .053$), and higher rate of surgical intervention (27% vs 4%, $P = .06$) due to failure of EUS-guided drainage to resolve the collections. No serious complications were noted in either group.

The second-largest series from Poincloux and colleagues,[10] retrospectively reviewed 37 patients who underwent EUS-guided pelvic abscess drainage at 2 centers in France. Most (84%) collections were postsurgical in etiology, with the remainder attributed to sigmoid diverticulitis, Crohn disease, and other medical disease. The authors used a variety of techniques. For 4 patients with collections greater than 20 mm from the lumen, aspiration alone was performed. Most patients were stented via puncture of the cavity with a 10 F electrocautery-assisted cystotome, followed by contents aspiration, 0.035 inch guidewire insertion, and deployment of 1 or more double pigtail plastic transmural stents. In place of the plastic stents, a 10×30 mm LAMS was deployed in 4 cases. Some patients underwent 19-gauge needle puncture, wire access, and tract dilation via a needle-knife catheter and over-the-wire balloons, followed by plastic stent placement. The authors reported that stent insertion was technically successful in all 33 patients (100%) in whom stent placement was attempted. Stents were retained for a mean duration of 1.7 months. A second EUS-guided drainage procedure was required in 5 patients because of stent migration or inadequate response; all of these patients had a successful clinical outcome. Long-term clinical success was reported in 32 of 37 patients (87%) over the follow-up period, which averaged 64 months. Complications reported in this series included 2 minor (stent migration, rectal discomfort) and 1 major (perforation) event. The perforation was discovered on day 1 following transcolonic LAMS placement for a diverticular abscess, and required surgery.

Puri and colleagues[16] reported the results of 30 patients with pelvic abscess, of postsurgical (45%), diverticular (15%) and prostatic (12%) etiologies. Of note, 3 patients were excluded from analysis because of unfavorable abscess characteristics,

including organized debris in 2 cases, and distance greater than 20 mm from the transducer in 1 case. The authors reported technically successful drainage in 93% of patients analyzed. However, 2 patients with diverticular abscess who underwent aspiration alone (7%) went on to surgery, and 5 patients (17%) required repeat EUS intervention. No serious adverse events were reported.

In their review of the available evidence, including recent unpublished data, the current authors found a total of 198 cases reported (see **Table 1**). Most studies were small and did not have well-defined or prespecified outcome criteria. The use of LAMS for pelvic abscess drainage is clearly a new and emerging area for which there are few data, with only 15 cases. LAMS also provide a larger lumen that may give an option to debris-filled collections and provide access for endoscopic debridement similar to necrosectomy in pancreatic necrosis. There is certainly a need for higher-quality, systematic prospective studies to evaluate this technique.

COMPLICATIONS

EUS-guided drainage of pelvic collections appears to be safe. Aside from 2 perforations noted by Poicloux and colleagues and Piraka and colleagues, significant complications have not been reported in the almost 200 cases summarized in **Table 1**. Spontaneous migration and expulsion of plastic stents are frequent, and the authors feel it should not be classified as a complication. One series by Hadithi and colleagues[7] reported dislodgement in 6 of 8 patients (75%) who underwent drainage, in part because of placement of small-caliber 7 F stents. All 6 patients who experienced spontaneous stent migration, however, had a favorable clinical outcome. It is likely that involution of the collection is partly responsible for plastic stent expulsion; hence, it does not appear to interfere with the success of the procedure. Serious late complications from LAMS have been reported with their use in drainage of pancreatic collections, and careful attention needs to be paid to prompt removal of these stents.

SUMMARY

EUS-guided drainage has been established as a safe and effective alternative to more invasive percutaneous and surgical approaches for management of pelvic collections, and should be considered first-line in suitable cases. The technique offers advantages including the straightforward nature of the procedure, decreased patient discomfort, rapid resolution due to large-caliber drains, and few reported complications. Although it is appropriate to a variety of clinical scenarios, there are limitations to the technique. In particular, collections that are greater than 20 mm from the EUS transducer may be difficult to access; there may be intervening structures, and transcolonic drainage may present special challenges. It is anticipated that the applications for the procedure will widen with widespread access to forward-viewing therapeutic echoendoscopes.

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