EUS-guided drainage of a diverticular abscess as an adjunct to surgical therapy
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Diverticular disease is common in the United States. Nearly two thirds of the population have diverticulosis by age 90 years; a minority will develop acute diverticulitis. The presentation of the latter varies from limited inflammation with localized abscess to frank peritonitis with fecal soiling.1 Traditional surgical management is a multiple-staged approach involving open drainage and diverting colostomy, with or without colon resection, followed by subsequent re-anastomosis. During the past 2 decades, this approach has been modified significantly by advances in surgical technique and antibiotic therapy. Preoperative abscess drainage has become a useful adjunct to surgery, allowing a subset of patients to stabilize or recover before undergoing a simpler operation. Drainage via percutaneous, transrectal, and transvaginal approaches has been successful.2-4 Multiple modalities, including digital examination, CT, transabdominal US, and direct endoscopic visualization, have been used to guide drainage.2,5,6 This report describes a new technique of endoscopic drainage of a diverticular abscess with EUS and fluoroscopic guidance, which subsequently allowed a one-staged operation to be performed successfully.

CASE REPORT
A 61-year-old Indian man presented with worsening lower abdominal pain of 2 weeks' duration and the recent onset of fevers and chills. The medical history included an amoe bic liver abscess 30 years earlier and an appendectomy. The patient appeared ill. His temperature was 38.4°C, and vital signs were normal. The abdomen was soft but tender to palpation over both lower quadrants. Digital rectal examination with anoscopy revealed a fluctuant, tender posterior rectal wall at 10 cm from the anal verge. The white blood cell count was 14,000/mm³ (normal: 4,000-11,100/mm³) with a leftward shift. Stool tests for ova and parasites were negative. CT of the pelvis demonstrated sigmoid diverticula; a 6-cm fluid collection, with an enhancing wall and an air-fluid level approximating the rectosigmoid junction; localized bowel wall thickening; and fat stranding (Fig. 1).

The patient was hospitalized and levofloxacin and metronidazole were administered intravenously. The fluid collection was not amenable to percutaneous drainage because of overlying bowel and bladder. A transluminal approach was not pursued because of the relative risks of the spread of infection and patient discomfort. However, drainage under EUS guidance was thought to be feasible, and informed consent was obtained for this procedure. The Colorado Multiple Institutional Review Board reviewed the protocol for the proposed procedure and
determined that formal approval was not necessary based on federal standards.

The patient was sedated by intravenous administration of midazolam, fentanyl, and droperidol. (The procedure antedated the Food and Drug Administration restriction on the use of droperidol. An electrocardiogram was not obtained before droperidol administration. The patient had no history of cardiovascular disease.) Limited sigmoidoscopy revealed a subepithelial bulge in the wall of the distal sigmoid colon and proximal rectum, with partial luminal collapse. A linear array echoendoscope with a 2.8-mm diameter accessory channel (GF-UC30P; Olympus America Corp., Melville, N.Y.) was introduced and advanced to the sigmoid colon. EUS demonstrated a heterogeneous anechoic mass with internal hyperechoic stranding and foci consistent with a diverticular abscess (Fig. 2). The mass was located posteriorly about 13 to 20 cm from the anus and measured 70 × 50 × 40 mm; the thickness of the sigmoid/abscess wall was 7 mm. A 19-gauge needle (Wilson-Cook Medical Inc., Winston-Salem, N.C.) designed for use with the echoendoscope was inserted into the abscess cavity under EUS guidance (Fig. 3). Viscous, foul-smelling fluid was aspirated and submitted for cultures. A 0.035-inch hydrophilic-tipped guidewire (Jagwire; Microvasive Endoscopy, Boston Scientific Corp., Natick, Mass.) was inserted through the needle and into the abscess cavity, with fluoroscopic assistance to confirm placement (Fig. 4). A triple-lumen needle knife
(Microvasive Endoscopy, Inc., Natick, Mass) was then passed over the guidewire, and a small incision was made through the rectosigmoid wall. Two 5F, 3-cm–long double-pigtail biliary stents (Zimmon; Wilson-Cook) were inserted over the guidewire and into the abscess cavity, with simultaneous endoscopic, fluoroscopic, and EUS guidance. Pus emanated from the stents. Thirty minutes after the procedure, the patient experienced transient chills and fever (39°C). Otherwise there was no complication.

There was dramatic improvement in the clinical status of the patient within 48 hours. Fever, abdominal pain, and leukocytosis resolved, and he was able to tolerate a regular diet. Treatment with orally administered clindamycin and levofloxacin was continued for 2 weeks. Cultures of the aspirated pus grew mixed gram-negative rod species and *Streptococcus anginosus*. The output via the drains was not recorded, but a CT 4 days after placement of the drains demonstrated a nearly 50% reduction in the size of the abscess. The patient was discharged on hospital day 7, with both stents in place. A CT 11 days after drainage revealed resolution of the fluid collection with minimal sigmoid wall thickening and fat stranding (Fig. 5). On the same day, sigmoidoscopy identified a single pigtail stent in good position, which was retrieved with a snare. The second stent was not seen endoscopically. EUS demonstrated an ill-defined 1.9 × 3.2-cm hypoechoic area posterior to the sigmoid colon. The second missing stent was identified extraluminally at this site, suggesting that it had migrated into the abscess cavity (Fig. 6).

Twenty-three days after the EUS-guided drainage procedure, the patient underwent uneventful sigmoid colectomy with primary anastomosis. The retained stent was removed at surgery. Histopathologic evaluation of the resection specimen revealed acute and chronic diverticulitis with a localized perforation but no abscess or neoplasia. The patient was well at 1-year follow-up.

**DISCUSSION**

Management of diverticular abscess is controversial but generally relates to the size and location of the abscess and the degree of peritonitis. The goals of treatment are abscess drainage, removal of the diseased colonic segment, and restoration of colon continuity. Traditionally, surgery involved a 3-staged approach: (1) drainage of the abscess with diverting colostomy, (2) partial colectomy with removal of persistent inflammation or nonviable tissue, and (3) take-down of the colostomy with re-anastamosis. This 3-staged approach rarely is used today because of prolonged hospital stay, increased morbidity, and improvement in surgical techniques.

There is increasing experience with the drainage of diverticular abscesses as either definitive or adjunctive treatment. Preoperative drainage may simplify subsequent surgery by decreasing the degree of inflammation and abscess size. It may result in an improvement in the overall condition of the patient and allows for hemodynamic stabilization and full bowel cleansing after surgery. Thus, an otherwise anticipated multiple-staged operation may be avoided.

The appropriate approach to drainage depends on a number of factors, including abscess size and location, patient gender, and technical experience. Initially, abscess drainage was performed transrectally via direct palpation. Drainage was established by incision or use of a needle-catheter technique. However, the large drains caused patient discomfort, were prone to dislodgement, and interfered with defecation.

Alexander et al. performed transabdominal US-guided transrectal drainage of deep pelvic abscesses.
of various etiologies, mostly appendiceal, in 9 patients. Drainage was successful and precluded urgent surgery in all patients. Gazelle et al. demonstrated CT-guided transrectal drainage to be equally successful and complication free in a series of 9 patients with postoperative pelvic abscesses. In these series, the abscess was directly palpated or imaged by fluoroscopy.

There are numerous reports of percutaneous drainage of diverticular abscesses. Schechter et al. reported an 80% success rate in 133 patients for CT-guided drainage of intra-abdominal abscess of multiple etiologies; surgery was avoided or delayed in 78% of cases. Similarly, Mueller et al. evaluated outcomes for 21 patients who underwent CT- or US-guided percutaneous drainage. All procedures were successful, and two thirds of the patients did well with a subsequent single-stage operation or no surgery. Mueller et al. also reviewed records of 87 patients who underwent surgery without preoperative drainage and found that nearly 50% would have benefitted from drainage. In a similar series, 11 of 16 patients who underwent percutaneous drainage subsequently had a successful single-stage operation.

The transvaginal approach with direct speculum visualization or sonographic guidance has been used successfully to treat gynecologic as well as postoperative and appendiceal abscesses. As with the transrectal approach, it allows direct drainage without traversing adjacent organs. Needle and catheter insertion by this approach is well tolerated by most women. Anchoring the catheter to the vaginal wall with a suture makes it less prone to dislodgement. An additional advantage over transrectal drainage is direct access to the pouch of Douglas in women. One drawback is that presacral lesions may not be drainable by this route, secondary to the interposed rectum.

Baron and Morgan reported a case of successful endoscopic drainage of a diverticular abscess. A duodenoscope was used for visualization and stent insertion under fluoroscopic and transabdominal US guidance. Fluoroscopy also was used to confirm guidewire and drain placement. The procedure was well tolerated and drainage complete. It also allowed for stabilization of the clinical condition of the patient before a cardiovascular procedure.

Preoperative abscess drainage was used to stabilize our patient before definitive surgery and to simplify the surgical approach. Because of the location of the abscess, a percutaneous transrectal approach was not possible. EUS-guided drainage of a pancreatic pseudocyst or abscess under fluoroscopy has been described. In reported series, EUS allowed needle and catheter insertion into cavities that were not palpable or visible endoscopically. EUS may also permit direct access to an abscess cavity while avoiding nearby organs; it facilitates catheter placement and is well tolerated by patients with conscious sedation alone. Nonetheless, drainage of a pelvic abscess by using a linear array echoendoscope has not been reported. EUS-guided pelvic abscess drainage is a single-step technique that appears to provide better visualization of landmarks and may improve procedure safety. The recent availability of large channel echoendoscopes makes simultaneous placement of 10F stents technically feasible.

Given technical similarities with EUS-guided drainage of pancreatic fluid collections and our experience with these pancreatic techniques, direct EUS-guided drainage of an abscess involving the sigmoid colon was chosen in the present case. Fluoroscopy was used to confirm guidewire and stent positions. The procedure technically was successful with minimal complications. Moreover, it was effective and simplified surgical management. One of the two drains (stents) subsequently migrated into the abscess cavity and was removed at surgery. Although not a problem in the present case, stent migration may complicate drainage procedures when subsequent surgery is not planned.

The satisfactory outcome in the present case suggests that EUS-guided drainage of a diverticular abscess potentially is safe and effective. However, prospective studies are needed to assess efficacy, safety, and impact on surgical outcomes.

REFERENCES