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Comparison of outcomes between endoscopic ultrasound-guided transcolonic and transrectal drainage of abdominopelvic abscesses

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EUS-guided drainage, diverticular abscess, interventional ultrasonography, pelvic abscess.

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Potential Conflicts of Interest
Jayapal Ramesh—None
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Abstract

Background: Transrectal endoscopic ultrasound (EUS)-guided pelvic abscess drainage has been reported, but data on transcolonic drainage are scant.
Aim: To compare outcomes in patients undergoing transcolonic and transrectal drainage of abdominopelvic abscesses.
Methods: Retrospective study of all patients who underwent EUS-guided drainage of abdominopelvic abscesses over a 7-year period. Abscesses were drained by a standard single-step EUS-guided technique with deployment of double-pigtail stents ± catheters. Technical success was defined as successful placement of stents or drainage catheters within the abscess cavity. Treatment success was defined as resolution of abscess on follow-up computed tomography at 2 weeks with symptom improvement.
Results: Of 38 patients, 11 underwent transcolonic and 27 transrectal drainages. There was no difference in patient demographics, laboratory values, and median abscess size (65 *vs* 70 mm, $P = 0.85$) between the two cohorts. Etiology of abscess was postsurgical in 65.7%, diverticulitis in 13.1%, perforated viscus in 10.5%, and other causes in 10.5%. There was no difference in rates of technical success (100% in each cohort), treatment success (70% *vs* 96.3%, $P = 0.052$), or complications (none). Three patients in the transcolonic and one in the transrectal cohort underwent surgery for failed endoscopic drainage (27.3% *vs* 3.7%, $P = 0.06$). When evaluated by etiology, treatment success for diverticular abscess was significantly lower compared with others (25% *vs* 97%, $P = 0.002$). At a median follow-up of 1228.5 days (interquartile range = 131–1660), all patients with treatment success were doing well with no recurrence.
Conclusion: Except for patients with diverticular etiology, treatment of abdominopelvic abscess under EUS guidance is highly effective and safe for both routes.

Introduction

Abdominopelvic abscesses, a consequence of postsurgical complications, perforated viscus, inflammatory bowel disease, or ischemic colitis, are associated with significant morbidity and mortality.[1] Treatment options include antibiotic therapy, image-guided drainage, or surgical intervention. It is now well accepted that the primary treatment of abdominopelvic abscess is an antibiotic therapy coupled with minimally invasive drainage. Surgery is usually reserved for patients presenting with perforation and those nonresponsive to conservative measures. While postoperative collections respond to minimally invasive interventions that provides curative drainage,[2] abscesses due to perforated viscus may require a multipronged approach to management, including conventional antibiotic therapy, drainage procedure, and surgery.[3]

Access for image-guided drainage include transcutaneous,[4] transvaginal,[5] or transrectal (TR)[6] routes. Technical issues dictate the route of access: transcutaneous drainage is challenging in the presence of intervening organs/vasculature, and the catheter can be a source of discomfort and pain for transgluteal approach. Ultrasound-guided transvaginal or TR drainage can only be employed for abscesses that are physically palpable. Recently, endoscopic ultrasound (EUS)-guided drainage of pelvic abscesses has been shown to be technically feasible and safe with good outcomes even in patients without an abscess-induced luminal compression.[7,8] The advantages of EUS-guided drainage are real-time access to the abscess cavity, avoidance of intervening structures, and internalized fistula with transluminal stent placement. However, in published series, most abscesses were located in close proximity to the rectum with only individual cases being pericolonic.[7,9,10] As the colon is located above the peritoneal reflection

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and its walls are thinner compared with the rectum, the risk for perforation is higher, and consequently, experience with transcolonic (TC) drainage is minimal.

In this study, we aim to compare and contrast the outcomes of TC and TR routes of access for EUS-guided abscess drainage.

Methods

All patients undergoing abdominopelvic abscess drainage were entered into a prospectively maintained, institutional review board-approved database. The database comprises of 64 variables, including patient demographics, clinical information, procedural details, and clinical outcomes. Included in the study were patients who underwent EUS-guided drainage of abscesses that were drained via the TC or TR routes. Excluded were patients with alternative diagnoses, abscess drained via the upper gastrointestinal tract, cases of frank perforation, rectocele, multiloculated collections, and abscess >1.5 cm from the bowel wall. Some patients presented in this study were reported in a prior series, a majority of which were comprised of TR drainage procedures.[6] All patients provided informed consent for undergoing the procedures, and the study was approved by the institutional review board of our hospital.

Patient preparation. All patients had a dedicated computed tomography (CT) scan of the abdomen and pelvis prior to EUS. Patients were instructed to void urine prior to the procedure to distinguish an abscess from urinary bladder. The bowel was prepared by administration of tap water and phosphate enema. All procedures were performed under conscious sedation with patients in the left lateral decubitus position under fluoroscopic guidance. Patients also received intravenous ciprofloxacin 400 mg at the time of procedure and continued on oral antibiotics for 72 h.

Procedural technique. The curvilinear array echoendoscope (GF-UCT 140; Olympus America, Melville, NY, USA) was advanced to the splenic flexure and slowly withdrawn with careful torquing to identify the abscess cavity. The size of the abscess cavity and its distance from the bowel wall were documented. A 19-gauge FNA needle (Echotip, Cook Medical, Inc., Bloomington, IL, USA; Expect Needle, Boston Scientific Corporation, Natick, MA, USA) was then introduced into the abscess cavity under EUS guidance (Fig. 1) after excluding intervening vasculature. After removal of the stylet, a 20-mL syringe was used to flush normal saline into the abscess cavity and reaspirated to clean out the cavity of as much pus as possible. A sample of the aspirate was then sent for Gram staining and culture. A 0.035-inch guide wire was then coiled within the abscess under fluoroscopic guidance. The transmural tract was then sequentially dilated (Fig. 2) by first passing a 4.5Fr ERCP cannula (Proforma™ HF, Conmed Technologies, Utica, NY, USA) and then a 6–8 mm biliary balloon dilator (Fig. 3). Following dilation, one or two 7 Fr, 4-cm double-pigtail endoprostheses were deployed (Fig. 4). The decision to place one or two stents was made by the endosonographer based on the consistency of the abscess contents. In cases where the abscess cavity measured > 8 cm, a 10Fr TR drainage catheter (Flexima, Boston Scientific Corporation) was deployed in addition to transluminal stents. The drainage catheter exited through the anus and was secured to the gluteal region with tape.

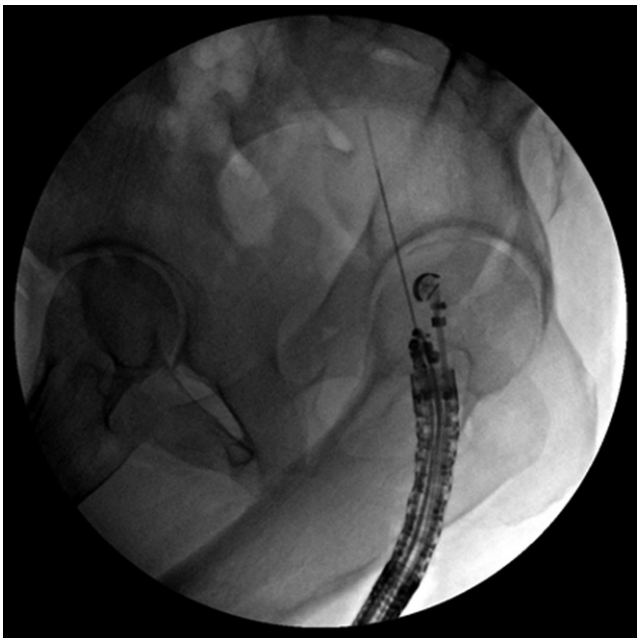

Figure 1 Fluoroscopic image of the echoendoscope with the 19G needle in the abscess cavity.

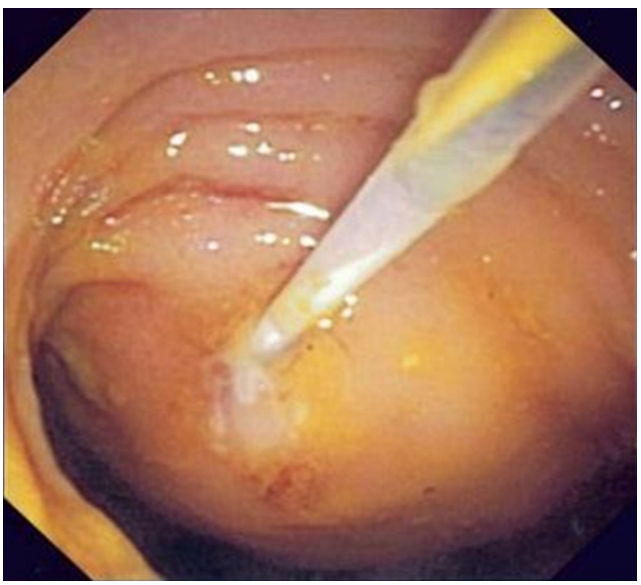

Figure 2 The transcolonic route is sequentially dilated using an ERCP cannula as evident on endoscopy view.

Postprocedure follow-up. The drainage catheter was flushed with 200 cc normal saline every 4 h until the aspirate was clear, following which the drain was removed. A repeat CT scan

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was obtained at 36 h to assess response to treatment. If there was a reduction in size of the cavity by 50% coupled with symptom improvement, the patients were discharged from hospital. The drainage catheter, if present, was removed prior to patient discharge. All patients underwent an outpatient CT scan in 2 weeks to ensure resolution of the abscess followed by endoscopic removal of the transluminal stents. In patients with treatment failure, a repeat EUS-guided drainage or surgery was undertaken after interdisciplinary consultation.

Definitions. *Technical success* was defined as the successful placement of one or two endoprostheses ± drainage catheters through the transmural tract. *Treatment success* was defined as complete resolution of the abscess cavity at 2 weeks on CT scan

Figure 3 Fluoroscopy image showing dilation of the transmural tract using an 8-mm balloon.

Figure 4 Endoscopic view of transcolonic stent with the pigtail in the lumen of the colon.

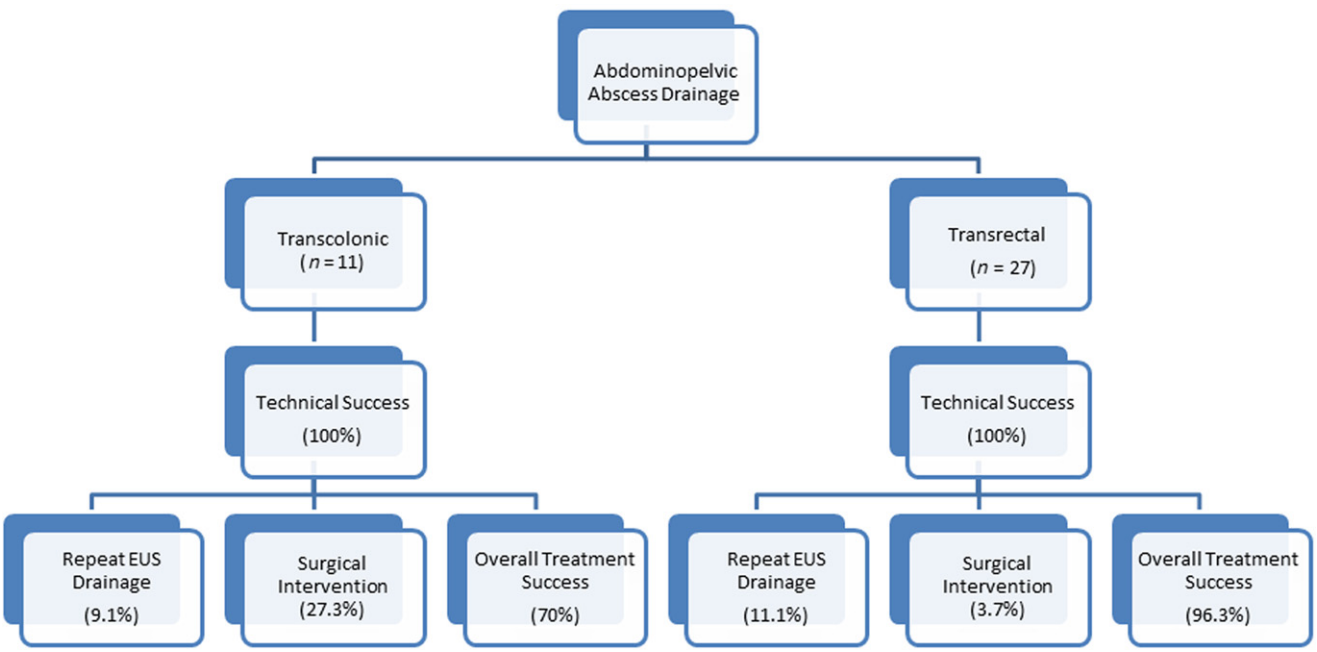

Figure 5 Flow diagram of outcomes of patients who underwent endoscopic ultrasound (EUS)-guided drainage of abdominopelvic abscesses.

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along with symptom improvement. *Complications* were classified as major and minor: all perforations or bleeding that required endotherapy or transfusion was classified as major; self-limited bleeding that resolved without intervention or blood transfusion and endoluminal stent migration were classified as minor. *Procedural duration* was defined as the time between intubation and until withdrawal of the echoendoscope after completion of requisite therapy. *Transrectal* access for drainage was defined as perirectal collection, as identified on CT scan that was drained proximal to the rectosigmoid junction. *Transcolonic* access was defined as pericolonic collection, as identified on CT scan that was drained distal to the rectosigmoid junction.

Main outcome measures. Compare the rates of technical and treatment success and complications between patients undergoing EUS-guided TC and TR drainage of pelvic abscesses.

Statistical analysis. The baseline characteristics of patients and abdominopelvic abscesses were summarized as mean, standard deviation, median, interquartile range, and range for continuous variables such as age, white cell count, albumin, and collection size. Categorical variables, such as gender, race, and etiology, were expressed as frequencies and proportions. Procedure details, including procedure duration, length of hospital stay, and outcome measures (technical and treatment success, complication rates), were also summarized in a similar manner. The datasets were compiled using Microsoft Excel (Microsoft Corp., Redmond, WA, USA) and Stata 10 (StataCorp LP, College Station, TX, USA).

Results

Patient demographics and clinical characteristics. During the study period, a total of 38 patients met criteria for inclusion in the study: 11 patients underwent drainage via the TC route and 27 via the TR route (Fig. 5). Except for etiology, there were no differences in patient demographics, laboratory investigations, or abscess characteristics between both groups (Table 1). The etiology of the abscess was predominantly postsurgical in the

Table 1 Patient demographics and clinical features of patients undergoing endoscopic ultrasound-guided abscess drainage

Parameter	Variable	Transcolonic drainage ($n = 11$)	Transrectal drainage ($n = 27$)	*P* value
Age (years)	Mean (SD)	55.5 (20.1)	51.0 (16.5)	—
	Median	60	54	0.359
	Interquartile range	41–73	39–62	—
	Range	20–84	18–84	—
Gender, *n* (%)	Female	6 (54.5)	14 (51.9)	0.880
	Male	5 (45.5)	13 (48.1)	—
Race, *n* (%)	African American	4 (36.4)	8 (29.6)	0.288
	Caucasian	6 (54.5)	19 (70.4)	—
	Hispanic	1 (9.1)	0	—
Etiology, *n* (%)	Postsurgical	3 (27.3)	22 (81.5)	0.001
	Ischemic colitis	0	1 (3.7)	—
	Diverticulitis	4 (36.4)	1 (3.7)	—
	IBD	0	1 (3.7)	—
	Perforated duodenum	1 (9.1)	0	—
	Perforated appendix	3 (27.3)	0	—
	Endocarditis	0	1 (3.7)	—
	Trauma	0	1 (3.7)	—
Serum white cell count ($\times 10^9$/L)	Mean (SD)	14.5 (5.1)	14.8 (4.8)	—
	Median	15.9	14.2	0.822
	Interquartile range	8.4–18.9	11.8–19	—
	Range	7.4–21.2	6.3–21.8	—
Serum albumin (g/dL)	Mean (SD)	2.8 (0.7)	2.6 (0.6)	—
	Median	3.1	2.6	0.383
	Interquartile range	2–3.4	2.1–3	—
	Range	1.8–3.6	1.8–4	—
Largest diameter of pelvic abscess (mm)	Mean (SD)	68.4 (14.9)	67.1 (17.4)	—
	Median	65	70	0.858
	Interquartile range	60–80	50–80	—
	Range	50–95	40–96	—
Duration of symptoms (days)	Mean (SD)	7.5 (12.6)	5.7 (6.1)	—
	Median	3	3	0.921
	Interquartile range	2–7	2–8	—
	Range	2–45	1–28	—

IBD, inflammatory bowel disease; —, not applicable.

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Table 2 Procedural details and technical outcomes of patients undergoing EUS-guided abscess drainage

Parameter	Variable	Transcolonic drainage ($n = 11$)	Transrectal drainage ($n = 27$)	*P* value
Procedure duration (min)	Mean (SD)	27.7 (14.3)	20.6 (14.8)	—
	Median	20	16	0.149
	Interquartile range	15–45	15–22	—
	Range	8–45	7–85	—
Treatment success, *n* (%)		7 (70)†‡	26 (96.3)§	0.052
Gram stain, *n* (%)	Positive	4 (36.4)	9 (33.3)	0.999
	Negative	7 (63.6)	18 (66.7)	—
Culture results, *n* (%)	Positive	4 (36.4)	8 (29.6)	0.714
	Negative	7 (63.6)	19 (70.4)	—
Duration of hospital stay (days)	Mean (SD)	10.1 (15.6)	4.1 (4.4)	—
	Median	3	2	0.844
	Interquartile range	1–12	2–4	—
	Range	1–42	1–20	—
Repeat intervention, *n* (%)		1 (9.1)	3 (11.1)	0.999
Follow-up duration (days)	Mean (SD)	814 (697)	1178 (658)	—
	Median	1178	1279	0.148
	Interquartile range	131–1529	458–1660	—
	Range	1–1562	190–2264	—

†One patient who underwent transcolonic drainage died 1day postprocedure following a cardiac arrest and therefore was excluded from treatment success analysis.
‡Three patients who failed EUS-guided transcolonic drainage required surgical drainage of the pelvic abscess.
§One patient who failed EUS-guided transrectal drainage required surgical drainage of the pelvic abscess.
EUS, endoscopic ultrasound; —, not applicable.

TR cohort, while diverticulitis and perforated viscus predominated in the TC group.

Procedural and clinical outcomes. EUS-guided drainage was technically successful in all cases in both cohorts, with no difference in procedural duration between cohorts (Table 2). At 2-week follow-up, there was no difference in rates of treatment success between patients who underwent TC or TR drainage, 70% *versus* 96.3% ($P = 0.052$), respectively. There were no procedural complications in either cohort in this study. At follow-up CT scan at 36 h, there was inadequate response to treatment in six patients. Four patients underwent repeat EUS-guided drainage and two underwent surgery because of worsening presenting symptoms. The two patients who underwent surgery, without repeat attempt at EUS-guided drainage, had pericolonic diverticular (Hinchey stage Ia) phlegmon. One patient with diverticular phlegmon (Hinchey stage Ia) in the TC cohort and three (postsurgical = 2, Hinchey stage Ia diverticular phlegmon = 1) in the TR cohort underwent repeat EUS-guided drainage, 9.1% *versus* 11.1% ($P = 1.0$), respectively. Repeat intervention was unsuccessful in the one patient in TC cohort and in one patient with diverticular phlegmon in the TR cohort. A total of three patients in the TC cohort and one in the TR cohort who failed to respond to EUS-guided drainage underwent surgery. One other patient in the TC cohort died from cardiovascular disease 72 h postprocedure. When the treatment outcomes were evaluated based on disease etiology, patients with diverticular abscess had poor outcomes compared with other causes (25% *vs* 97%, $P = 0.002$). Only one patient with diverticular abscess had a successful treatment outcome, and this patient had a confined pericolonic abscess (Hinchey stage Ib). At a median follow-up of 1228 days (interquartile range [IQR] = 312–1618), all patients with treatment success were doing well with no disease recurrence.

Discussion

This study shows that EUS-guided drainage of abdominopelvic abscess that is in close proximity to the rectal or colonic lumen is technically feasible, safe, and effective. Clinical outcomes of the procedure are dependent on etiology of the abscess and not the route of drainage. The colon is located above the peritoneal reflection and, when compared with the rectum, has thinner walls. This anatomical consideration, however, did not contribute to increased adverse events. There are two reports on successful TC drainage of diverticular abscess.[9,10] In both studies, the authors used a needle knife catheter to dilate the TC tract in contrast with the graded dilation technique that was adopted in the present series. Piraka *et al*. encountered stent migration in two patients, one of which was later retrieved after dilation of the transmural tract to ≥10 mm; however, the patient developed a perforation.[9] In our experience, the graded dilation technique is a safer option. When adequate tension is applied over the guidewire, the ERCP cannula can be easily advanced through the colonic wall taking advantage of its inherent thinness. In contrast, the use of a needle knife catheter is associated with two risks: One, the needle cannot always be visualized under sonographic guidance, and therefore, application of cautery can increase the risk for perforation. Two, even if a needle knife catheter is to be advanced over a guidewire, the needle when released deploys tangentially and may not be in line with the guidewire, thereby increasing the risk for perforation.

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The advantage of the graded dilation technique over needle knife has been reported by our group in patients undergoing endoscopic drainage of pancreatic fluid collections.[11] There was no difference in the degree of technical difficulty between patients undergoing TC or TR drainage procedures. This was evident by the lack of difference in procedural duration between both cohorts. However, deploying additional stents in patients undergoing TC drainage can be challenging. Compared with rectum, the colonic lumen is relatively narrow and has several haustra. Therefore, gaining access to the abscess cavity via the fistula for deploying a second stent can be technically difficult. In this study, with the exception of two patients, all others undergoing TC drainage required only a single stent, as the density of the abscess contents was thin and there was free flow of pus following placement of a single stent. While CT-guided percutaneous drainage has been shown to be successful in treating 95.7% of postoperative collections, the treatment failure rate for diverticular collections was 27%.[12] The major reasons for failure are the multiloculated nature of collections and the thick viscosity of abscess contents.[13] The pathogenesis of diverticular inflammatory collection involves formation of a "phlegmonous" inflammation to abscess formation and sometimes peritonitis. The modified Hinchey classification of acute diverticulitis categorizes diverticulitis as 1a (phlegmon), 1b (pericolic abscess), II (pelvic/intraabdominal or retroperitoneal abscess), and III/IV (purulent/fecal peritonitis). While all class III/IV patients require surgery, those with 1b/II disease respond well to percutaneous or endoscopic interventions. Patients with Ia disease should be managed conservatively or by surgery. In this study, the three patients with diverticular disease who failed treatment had type Ia disease. It can sometimes be difficult to classify the abscess accurately by CT scan given the extent of associated inflammation. At EUS, if the wall of the abscess is poorly defined, filled with debris, or if there is poor return of abscess contents on aspiration with a 19G needle, it is unlikely that these patients will respond well to endoscopic drainage. In our limited experience, these three features correspond to type Ia disease and are best managed surgically. Our study has several limitations. One, it is a single-center retrospective study performed by endosonographers with extensive therapeutic experience. Two, the transmural tract was dilated only up to 8 mm because of concern for perforation. It is unclear if dilation with a larger diameter balloon will facilitate better drainage in poor responders. Three, all abscesses were located adjacent to the left colon or rectum, and we did not encounter any patient with abscesses adjacent to the transverse or right colon. Therefore, the safety and efficacy of the technique in such cases is unclear. In conclusion, this study shows that EUS-guided TR and TC drainage of abdominopelvic abscesses is technically feasible and safe with comparable clinical outcomes. The outcome of the procedure, however, is dependent on the etiology and is suboptimal in patients with diverticular disease.

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