

Letter to the Editor

Clinical outcomes of endoscopic ultrasonography-guided transmural drainage using plastic stent and nasocystic drain for pancreatic and peripancreatic collections

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To the Editor:

Pancreatic and peripancreatic collections (PCs) develop from acute pancreatitis (AP), chronic pancreatitis, surgery, or trauma. The 2012 revised Atlanta classification [1] of AP classified local complications into the following 4 PC types: acute peripancreatic fluid collection (<4 weeks after the onset of acute interstitial edematous pancreatitis), acute necrotic collection (<4 weeks after the onset of acute necrotizing pancreatitis), pancreatic pseudocyst (PPC; ≥4 weeks after the onset of acute interstitial edematous pancreatitis), and walled-off necrosis (WON; ≥4 weeks after the onset of acute necrotizing pancreatitis). Endoscopic ultrasonography-guided transmural drainage (EUS-TD) has been reported to be a minimally invasive procedure for patients with PCs [2–4]. This study aimed to investigate the clinical outcomes of EUS-TD for PCs.

Between August 2010 and June 2016, 48 consecutive patients who underwent EUS-TD at our institution were included in this retrospective study. Of the 48 patients, 46 patients who underwent PC puncture using a 19-gauge fine needle aspiration (FNA) as the initial puncture were retrospectively analyzed. We distinguished between WON and PPC based on computed tomography (CT), magnetic resonance cholangiopancreatography (MRCP), or EUS imaging. We performed EUS-TD in patients with symptomatic PCs. We finally defined infected PCs as the presence of bacteria in the PC cavity based on a culture during EUS-TD. The following exclusion criteria were applied: PC puncture was performed with a tool other than a 19-gauge FNA needle as the initial puncture needle or issues with the energization device.

A convex array echoendoscope GF-UCT240-AL5 (Olympus Medical Systems Corp, Tokyo, Japan) was used for transmural drainage of PCs in all patients. PCs were punctured from the stomach or duodenum using a 19-gauge FNA needle under EUS guidance. A guide wire was inserted into the PC cavity through a needle under fluoroscopic guidance. The puncture tract was dilated over the guide wire using a dilator. Essentially, a 7-Fr, 4-cm double pigtail stent and a 6-Fr nasocystic drain were inserted into the PC. The

nasocystic drain was inserted during the first 1 to 2 weeks. The follow-up of PCs was performed with CT or MRCP. The stent was removed after the PC resolved based on imaging results.

Primary endpoints were technical and clinical successes of EUS-TD for PCs of AP. Secondary endpoints were adverse events and additional procedures associated with EUS-TD for PCs. Technical success was defined as a successful drain placement in the PC cavity. Clinical success was defined as a resolution of PCs or improvement of infected PCs without the need for additional procedures. As adverse events associated with EUS-TD for PCs, we evaluated bleeding, perforation, stent migration, and free air in the abdomen.

Continuous variables are expressed as the median and interquartile range (IQR). Data were analyzed using the Mann-Whitney *U* test and Chi-square test. Univariate and multivariate analyses to explore risk factors for clinical failure during EUS-TD were performed using logistic regression analysis. Factors with a *P* value of <0.20 in the univariate analysis were included in the multivariate analysis. A *P* value of <0.05 was considered statistically significant. All statistical analyses were performed using JMP software (version 13, SAS Institute Inc., Cary, NC, USA).

Patient characteristics are presented in Table 1. Thirty patients had WON, and 16 had PPC. Thirty-nine (85%) patients had infected PCs. The median period from the AP onset to EUS-TD was 35 (23–75) days.

Technical success of EUS-TD for PCs was achieved in 44 of 46 (96%) patients. Clinical success of EUS-TD for PCs was achieved without the need for additional drainage or necrosectomy in 29 of 45 (64%) patients. The clinical success rate was significantly lower for WON than for PPC (47% vs. 100%, respectively; *P* < 0.001) (Table 1, Fig. 1). In the univariate analysis, WON (relative risk [RR] = 2.14, 95% confidence interval [CI]: 1.46–3.14, *P* < 0.001), a pancreatic head-body-tail location of the PC (RR = 5.16, 95% CI: 0.83–32.00, *P* = 0.005), and infected PC (RR = 1.73, 95% CI: 1.32–2.27, *P* = 0.040) were significantly related to clinical failure during EUS-TD (Table 2). In the multivariate analysis, WON was significantly associated with clinical failure during EUS-TD (likelihood ratio χ^2 , 13.80; *P* < 0.001) (Table 2). One (2%) patient with WON presented with free air in the abdomen during EUS-TD but received moderate relief (Table 1).

All the 16 patients with post-EUS-TD clinical failure had WON, 1 received percutaneous drainage, 4 underwent endoscopic

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Table 1

Baseline characteristics and procedural outcomes of patients who underwent EUS-TD for PCs due to AP.

Variables	All (n = 46)	WON (n = 30)	PPC (n = 16)	P value
Age (yr)	59 (48–71)	66 (54–76)	48 (41–59)	0.007
Gender (male/female)	37/9	23/7	14/2	0.463
PC location				0.425
Pancreatic body-tail	30 (65%)	19 (63%)	11 (69%)	
Pancreatic head	9 (20%)	5 (17%)	4 (25%)	
Pancreatic head-body-tail	7 (15%)	6 (20%)	1 (6%)	
Long axis diameter of PC (cm)	7 (6–11)	9 (6–13)	7 (6–7)	0.035
Infected PC	39 (85%)	29 (97%)	10 (63%)	0.005
Period from AP onset to EUS-TD (d)	35 (23–75)	35 (23–67)	39 (23–111)	0.686
Site of puncture tract				1.000
Stomach	45 (98%)	29 (97%)	16 (10%)	
Duodenum	1 (2%)	1 (3%)	0	
Fistula tract dilation method				0.740
Use of a cautery dilator	32 (70%)	20 (67%)	12 (75%)	
Use of a non-cautery dilator	14 (30%)	10 (33%)	4 (25%)	
Drain placement method				0.359
Stent and nasocystic drain placement	41 (89%)	27 (90%)	14 (88%)	
Nasocystic drain placement	4 (9%)	3 (10%)	1 (6%)	
Needle puncture alone	1 (2%)	0	1 (6%)	
Procedure time (min)	30 (21–46)	32 (22–46)	30 (21–38)	0.835
Technical success	44 (96%)	29 (97%)	15 (94%)	1.000
Clinical success (n/total)*	29/45 (64%)	14/30 (47%)	15/15 (100%)	<0.001
Adverse events				1.000
Free air in abdomen	1 (2%)	1 (3%)	0	
Additional procedure				0.003
Percutaneous drainage	1 (2%)	1 (3%)	0	
ETN	14 (30%)	14 (47%)	0	
Surgical necrosectomy	1 (2%)	1 (3%)	0	
Follow-up period post-EUS-TD (d)	1099 (653–1786)	1007 (756–1838)	1174 (545–1683)	0.773
Transpapillary pancreatic stent placement	7 (15%)	2 (7%)	5 (31%)	0.015
PC-related death	2 (4%)	2 (7%)	0	0.536
Recurrence of PC	2 (4%)	1 (3%)	1 (3%)	

*One patient withdrawal after technical failure. EUS-TD: endoscopic ultrasonography-guided transmural drainage; PC: pancreatic and peripancreatic collection; AP: acute pancreatitis; WON: walled-off necrosis; PPC: pancreatic pseudocyst; ETN: endoscopic transmural necrosectomy.

Table 2

Univariate and multivariate analysis of risk factors for clinical failure during EUS-TD.

Variables	Univariate analysis		Multivariate analysis	
	RR (95% CI)	P value	Likelihood ratio χ^2	P value
WON	2.14 (1.46–3.14)	<0.001	13.80	<0.001
Age \geq 60 yr	1.13 (0.72–1.77)	0.755		
Female	1.56 (0.73–3.35)	0.245		
PC location				
Pancreatic head-body-tail	5.16 (0.83–32.00)	0.005	2.83	0.093
Pancreatic body-tail	0.64 (0.36–1.14)	0.105	<0.01	0.993
Long axis diameter of PC \geq 7 cm	1.47 (0.98–2.21)	0.110	<0.01	0.961
Infected PC	1.73 (1.32–2.27)	0.040	0.22	0.637
Period from AP onset to EUS-TD \geq 28 d	1.05 (0.67–1.65)	1.000		
Site of puncture tract in stomach	1.57 (1.26–1.96)	1.000		
Use of a cautery dilator	1.50 (1.03–2.21)	0.094	1.21	0.272
Stent and nasocystic drain placement	1.18 (0.64–2.18)	1.000		
Procedure time \geq 30 min	0.64 (0.40–1.02)	0.065	0.17	0.685

EUS-TD: endoscopic ultrasonography-guided transmural drainage; RR: relative risk; WON: walled-off necrosis; PC: pancreatic and peripancreatic collection; AP: acute pancreatitis.

transmural necrosectomy (ETN), and 1 received surgical necrosectomy. The median period for ETN was 7 (5–7) days after EUS-TD and 36 (30–77) days after the onset of AP. Fifty-one sessions of ETN were performed on 14 patients. Clinical success of ETN for infected WON was achieved in 13 of 14 (93%) patients. Adverse ETN-associated events occurred in 4 patients. However, these complications were moderately improved (Table 1, Fig. 1).

The median period of stent placement was 4.1 (2.4–6.9) months. Seven (15%) patients with pancreatic duct stricture post-EUS-TD underwent transpapillary pancreatic duct stent placement. After receiving technically successful EUS-TD and necrosectomy, 2 (4%) patients died due to uncontrolled infected WON (1 ETN, 1 surgical necrosectomy). Two (4%) patients suffered recurrences 9 months after EUS-TD (1 PPC, 1 WON) (Table 1, Fig. 1).

Our study demonstrated that WON was independently associated with clinical failure during EUS-TD using plastic stent and nasocystic drain and that patients with uncontrolled infected WON might require ETN as a post-EUS-TD step-up approach. EUS-TD has been reported to be a minimally invasive procedure for patients with PCs [2–4]. However, the PCs reported in previous studies [2–4] were not defined based on the 2012 revised Atlanta classification. In previous reports, the technical success rate of endoscopic transmural drainage for PCs is generally high; however, the clinical success rate of this procedure varies according to the category of PC [5–7]. The clinical success of endoscopic transmural drainage for PPC has been achieved in 92%–100% of patients [5,6]; however, the clinical success rate of endoscopic transmural drainage in patients with pancreatic necrosis is poor.

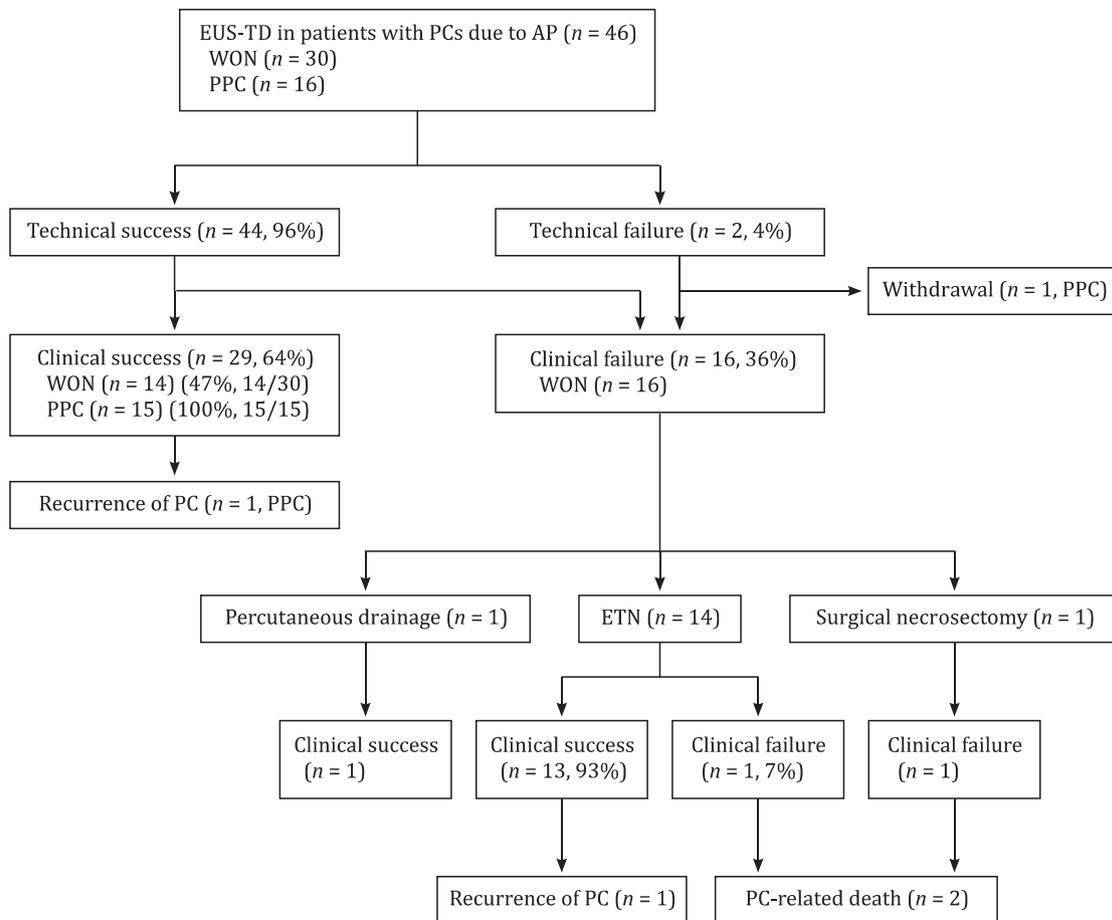


Fig. 1. Flow diagram of the clinical outcomes observed in this study.

EUS-TD: endoscopic ultrasonography-guided transmural drainage; PCs: pancreatic and peripancreatic collections; AP: acute pancreatitis; WON: walled-off necrosis; PPC: pancreatic pseudocyst; ETN: endoscopic transmural necrosectomy.

Baron et al. [7] reported that PCs in 72% of patients with pancreatic necrosis were resolved after performing endoscopic transmural drainage. In another study [6], the clinical success rate of endoscopic transmural drainage for patients with necrosis was only 25%. We previously reported the safety and usefulness of EUS-TD using a cautery dilator as a fistula tract dilation device for symptomatic PCs [8]. The use of these devices may facilitate the EUS-TD procedure.

In our study, the clinical success rate for WON was significantly lower than that for PPC (47% vs. 100%; $P < 0.001$). In the multivariate analysis, WON was significantly associated with clinical failure during EUS-TD ($P < 0.001$). Based on our results, it was suggested that the clinical success of EUS-TD using plastic stent and nasocystic drain for PCs may depend on the presence of necrotic material in the PC cavity.

A novel lumen-apposing, self-expanding, metal stent with bilateral flanges was developed for EUS-TD of symptomatic PCs. Metal stent placement was successful in 98% of patients, and clinical success was achieved in 93% of patients with PPC and in 81% of patients with WON. Major adverse events, including PC infection and perforation, occurred in 9% of patients [9]. Most of the adverse events of EUS-TD for PCs are bleeding, perforation and stent migration, and these events have been reported to occur in a range of 0 to 19% of patients [5,10].

Recently, ETN was performed in patients with pancreatic necrosis. A systematic review of ETN in patients with necrotizing pancreatitis reported that successful treatment was achieved in

81% of patients, and that mortality occurred in 6% and adverse events including bleeding, occurred in 36% [11]. Furthermore, a retrospective multicenter analysis revealed that a step-up approach during minimal invasive drainage and ETN reduced mortality (11% vs. 33%) and adverse events (45% vs. 75%) compared to those of open surgery in patients with necrotizing pancreatitis [12].

There are some limitations of this study including its single-center nature, small number of patients, and retrospective nature. As such, large, multicenter, prospective analysis is needed to confirm our findings.

In conclusion, WON was independently associated with clinical failure during EUS-TD using plastic stent and nasocystic drain. Patients with uncontrolled infected WON might require ETN as a post-EUS-TD step-up approach.

Contributors

KK designed the study. KK, YA, and IY collected the data. KK analyzed the data and drafted the manuscript. KK, YA, IY, MY and YH contributed to the design and interpretation of the study. KK is the guarantor.

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Ethical approval

The study was approved by the Medical Ethics Committee of Showa University Hospital and was registered at the University Hospital Medical Information Network Clinical Trials Registry (UMIN000030123).

Competing interest

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

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