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Endoscopic Ultrasound-Guided Management of Pancreatic Pseudocysts and Walled-Off Necrosis

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The outcome of endoscopic management of pancreatic fluid collections is dependent on the type of collection being treated. While pseudocysts have an excellent treatment response, the outcomes are modest for walled-off pancreatic necrosis. Recent advances in cross-sectional body imaging have enabled a more accurate distinction of pancreatic fluid collections, which, in turn, facilitates the correct triage of patients to receive the appropriate treatment. Newly described endoscopic techniques and the development of dedicated accessories have improved the clinical outcomes in walled-off pancreatic necrosis, with treatment success rates comparable to that of minimally invasive surgery. This review summarizes the key concepts and provides a concise update on the endoscopic management of pancreatic fluid collections.

Key Words: Pancreatic necrosis; Pseudocyst; Endosonography; Drainage

INTRODUCTION

Important changes to the nomenclature of pancreatic fluid collections have been made recently and newer studies describe technical modifications and device developments that have improved the clinical outcomes. The objective of this review is to focus on these key issues and provide recommendations for patient management.

WHY IS ACCURATE DISTINCTION OF PANCREATIC FLUID COLLECTIONS IMPORTANT?

Pancreatic pseudocysts can occur as a consequence of duct leak or pancreatic inflammation. When the inflammatory process is severe, the liquefied parenchyma matures into a contained collection termed walled-off pancreatic necrosis (WOPN). Although most pseudocysts and WOPN resolve without in-

tervention, those causing pain, gastric outlet, intestinal or biliary obstruction, organ failure, or infection warrant intervention. In a recent study of 211 patients with symptomatic pancreatic fluid collections (PFCs), whereas the rate of treatment success for sterile and infective pseudocysts was 93.5%, it was only 63.2% for WOPN.¹ Therefore, the clinical outcomes are directly related to the type of fluid collection being treated, and hence accurate distinction is important before undertaking any intervention. Whereas computed tomography (CT) continues to serve as a “work horse” for the diagnosis of pancreatitis, for the evaluation of local complications, and as prognostic indicator of disease severity, T2-weighted magnetic resonance imaging (MRI) enables identification of solid debris within a necrotic collection and thereby determines the need for necrosectomy and other interventions.^{2,3} This is particularly relevant because contrast-enhanced CT cannot reliably detect necrotic debris within a PFC and inadvertent transluminal drainage of a WOPN by using conventional endoscopic cystogastrostomy predisposes the patient to infection, with adverse clinical outcomes.⁴ In one study, the sensitivity of MRI for the detection of solid debris was shown to be 100%, compared with only 25% for CT.³

Correct categorization of a PFC is the first step in disease management.

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WHAT IS NEW IN THE ENDOSCOPIC MANAGEMENT OF PANCREATIC PSEUDOCYSTS?

Two randomized trials have conclusively proven that endoscopic ultrasound (EUS)-guided transluminal drainage is associated with significantly higher rates of technical success than conventional endoscopic drainage (95% vs. 60%).^{5,6} Also, a retrospective study and a randomized trial have proven that the clinical outcomes of EUS-guided drainage is comparable to that of surgical cystogastrostomy.^{7,8} Both studies also suggest that EUS-guided drainage is associated with a shorter length of hospital stay and is less costly than the surgical approach. Patients treated with endoscopy also reported a better quality of life at 18 months follow-up.

One technical limitation of the EUS-based approach is the lack of dedicated accessories, which necessitates multiple steps for transluminal stent placement: puncture of the PFC by using a 19 G needle, passage of a stiff guidewire, transmural fistula creation, and then stent deployment. Recently, a novel lumen-apposing self-expandable metal stent has been developed that can be deployed in a single step.⁹ The stent has a dumbbell-shaped configuration that foreshortens on deployment, thereby minimizing the possibility of leak or perforation. Additionally, the wider stent lumen facilitates better drainage of the cyst contents and enables the passage of a gastroscope into the cyst cavity for performing necrosectomy.

Despite the increasing enthusiasm for the placement of metal stents, there are no data to justify their routine placement during pseudocyst drainage. In a meta-analysis that was presented at Digestive Diseases Week 2014, 14 studies involving 698 patients were evaluated and no difference was detected in the rates of treatment success between patients managed with multiple plastic stents versus metal stents at 89% (95% confidence interval [CI], 87 to 91) vs. 87% (95% CI, 76 to 91; $p=0.22$), respectively.¹⁰ Also, there was no difference in the rates of adverse events or pseudocyst recurrence between the two cohorts.¹⁰ In another retrospective study of 122 patients with pancreatic pseudocysts, who underwent placement of single or multiple 7- or 10-Fr plastic stents, the overall treatment success was 94.3% with no relation between the size/number of stents placed and the number of interventions required for treatment success.¹¹

Given the high technical success rates, EUS is the endoscopic modality of choice for the drainage of pancreatic pseudocysts, with treatment outcomes comparable to that of surgery. Also, despite its increasing use, current evidence does not support the routine placement of metal stents for drainage of pancreatic pseudocysts.

WHAT IS NEW IN THE ENDOSCOPIC MANAGEMENT OF WALLED-OFF PANCREATIC NECROSIS?

Historically, a subgroup of patients with PFCs had poor clinical outcomes for unclear reasons. It is now becoming apparent that WOPN was erroneously misclassified as pseudocysts and inadequately treated with transmural stenting alone. Although endoscopic necrosectomy was advocated as a definitive treatment measure in patients with WOPN, the procedure is associated with high morbidity and mortality, is labor intensive, is resource consuming, and lacks technique-specific devices. In the multicenter GEPARD study, a procedure-related adverse event rate of 26% was observed with 2.1% mortality, 5.3% perforation, 14% bleeding, and clinically significant air embolism in two patients.¹² There is now growing evidence suggesting that aggressive irrigation and drainage of WOPN yields comparable outcomes to, while avoiding the major complications of, direct endoscopic necrosectomy.¹³ In a randomized trial that compared a minimally invasive step-up approach to open surgical necrosectomy, one-third of patients managed with percutaneous drainage did not require surgery.¹⁴ In our opinion, the treatment approaches to WOPN must improve clinical outcomes while avoiding deterioration. Superior outcomes can be achieved by tailoring the endoscopic approach to the specific characteristics of each collection.

While small collections (<12 cm) with minimal debris can be managed by means of transluminal nasocystic drainage catheter placement, larger collections and those with extensive necrosis require placement of multiple internal conduits that are performed under EUS guidance for better drainage. In a study of 60 patients with WOPN, the treatment was successful in 91.7% of patients treated with multiple internal conduits compared with only 52.1% in patients treated by using standard transluminal drainage.¹⁵ In our clinical practice, in patients with WOPN measuring >12 cm and extending to the paracolic gutters, we place a 24-Fr percutaneous catheter and create multiple internal conduits under EUS guidance to serve as gateways for efflux of the necrotic contents. This yields successful treatment outcomes in >90% of patients, and precludes the need for endoscopic or surgical necrosectomy in most patients.¹⁶

EUS facilitates the creation of multiple internal conduits for better drainage of necrotic debris in patients with WOPN. However, management of WOPN involves multidisciplinary care with close collaboration between endoscopists, surgeons, and interventional radiologists.

CONCLUSIONS

Correct categorization of pancreatic fluid collection is the first appropriate step in the treatment algorithm. While patients with pseudocysts can be drained by straight-forward skat placement, walled-off necrosis requires multi-disciplinary treatment approach.

Conflicts of Interest

The authors have no financial conflicts of interest.

REFERENCES

1. Varadarajulu S, Bang JY, Phadnis MA, Christein JD, Wilcox CM. Endoscopic transmural drainage of peripancreatic fluid collections: outcomes and predictors of treatment success in 211 consecutive patients. *J Gastrointest Surg* 2011;15:2080-2088.
2. Balthazar EJ, Robinson DL, Megibow AJ, Ranson JH. Acute pancreatitis: value of CT in establishing prognosis. *Radiology* 1990;174:331-336.
3. Morgan DE, Baron TH, Smith JK, Robbin ML, Kenney PJ. Pancreatic fluid collections prior to intervention: evaluation with MR imaging compared with CT and US. *Radiology* 1997;203:773-778.
4. Hariri M, Slivka A, Carr-Locke DL, Banks PA. Pseudocyst drainage predisposes to infection when pancreatic necrosis is unrecognized. *Am J Gastroenterol* 1994;89:1781-1784.
5. Varadarajulu S, Christein JD, Tamhane A, Drelichman ER, Wilcox CM. Prospective randomized trial comparing EUS and EGD for transmural drainage of pancreatic pseudocysts (with videos). *Gastrointest Endosc* 2008;68:1102-1111.
6. Park DH, Lee SS, Moon SH, et al. Endoscopic ultrasound-guided versus conventional transmural drainage for pancreatic pseudocysts: a prospective randomized trial. *Endoscopy* 2009;41:842-848.
7. Varadarajulu S, Lopes TL, Wilcox CM, Drelichman ER, Kilgore ML, Christein JD. EUS versus surgical cyst-gastrostomy for management of pancreatic pseudocysts. *Gastrointest Endosc* 2008;68:649-655.
8. Varadarajulu S, Bang JY, Sutton BS, Trevino JM, Christein JD, Wilcox CM. Equal efficacy of endoscopic and surgical cystogastrostomy for pancreatic pseudocyst drainage in a randomized trial. *Gastroenterology* 2013;145:583-590.
9. Gornals JB, De la Serna-Higuera C, Sánchez-Yague A, Loras C, Sánchez-Cantos AM, Pérez-Miranda M. Endosonography-guided drainage of pancreatic fluid collections with a novel lumen-apposing stent. *Surg Endosc* 2013;27:1428-1434.
10. Navaneethan U, Njei B, Sanaka MR. Endoscopic transmural drainage of pancreatic pseudocysts: multiple plastic stents versus metal stents: a systematic review and meta-analysis. *Gastrointest Endosc* 2014;79(5 Suppl):AB167-AB168.
11. Bang JY, Mel Wilcox C, Trevino JM, et al. Relationship between stent characteristics and treatment outcomes in endoscopic transmural drainage of uncomplicated pancreatic pseudocysts. *Surg Endosc*. Epub 2014 May 2. DOI: <http://dx.doi.org/10.1007/s00464-014-3541-7>.
12. Seifert H, Biermer M, Schmitt W, et al. Transluminal endoscopic necrosectomy after acute pancreatitis: a multicentre study with long-term follow-up (the GEPARD Study). *Gut* 2009;58:1260-1266.
13. Ross AS, Irani S, Gan SI, et al. Dual-modality drainage of infected and symptomatic walled-off pancreatic necrosis: long-term clinical outcomes. *Gastrointest Endosc* 2014;79:929-935.
14. van Santvoort HC, Besselink MG, Bakker OJ, et al. A step-up approach or open necrosectomy for necrotizing pancreatitis. *N Engl J Med* 2010;362:1491-1502.
15. Varadarajulu S, Phadnis MA, Christein JD, Wilcox CM. Multiple transluminal gateway technique for EUS-guided drainage of symptomatic walled-off pancreatic necrosis. *Gastrointest Endosc* 2011;74:74-80.
16. Bang JY, Wilcox CM, Christein JD, et al. Endoscopic report card of a 10-year experience in 100 patients with walled-off pancreatic necrosis. *Gastrointest Endosc* 2014;79(5 Suppl):AB373.