Douglas G. Adler MD, FACG, AGAF, FASGE, Series Editor

Transgastric Endoscopic Necrosectomy Using a Dedicated Transluminal Stent

James P. D. Walker

Kyle Eliason

Douglas G. Adler

CASE REPORT

An 87-year-old female was referred to our institution for evaluation of several pancreatic fluid collections that had developed in the context of an episode of severe acute pancreatitis. The patient's pancreatitis was presumed to be due to choledocholithiasis and prior to our evaluation she had undergone an ERCP with sphincterotomy and duct clearance as well as a cholecystectomy. The patient could not tolerate PO intake and was being fed via a nasojejunal feeding tube. The patient had previously been evaluated by surgery and interventional radiology, who did not feel that the patient was a candidate for surgery or percutaneous drainage of this large pancreatic fluid collection, respectively.

Contrast enhanced CT scan revealed multiple pancreatic fluid collections, although attention was mostly centered on a bilobed but internally communicating15x10cm collection causing significant extrinsic compression of the stomach (Figure 1). The patient was offered endoscopic transmural drainage and, after a discussion of risks and benefits, she accepted.

When evaluated by endoscopic ultrasound (EUS) the lesion was found to contain a large amount of solid debris and was thus felt to represent walled off pancreatic necrosis (WOPN), rather than a pseudocyst (Figure 2). EUS guided transmural access to the cyst was obtained with a 19gauge needle via a transgastric route. The cystgastrostomy was dilated to 6mm over a wire. A 15mm wide Axios stent (Xlumena, Mountainview CA) was advanced across the cystgastrostomy and deployed without difficulty (Figure 3). There was immediate drainage of approximately 1L of fluid consistent with cyst contents.

One week later, the patient underwent endoscopic pancreatic necrosectomy through the Axios stent with a standard EGD endoscope. Using a combination of nets, snares, and a rat tooth forceps, a large amount of necrotic pancreatic tissue was mechanically debrided with marked improvement in the appearance of the cyst cavity, although some debris remained (Figure 4). The necrotic cavity was lavaged with copious amounts of hydrogen peroxide mixed with sterile saline. Although the endoscopic portion of the procedure went well, the patient tolerated the procedure poorly from a respiratory perspective and thereafter declined further procedures given her age and overall situation. It was agreed that the Axios stent would simply be left in place to provide drainage of the pancreatic fluid collection.

A CT scan of her abdomen and pelvis obtained 5 weeks later showed essentially complete resolution of the large necrotic collection with the Axios stent still in good position (Figure 5). The patient still did not wish

James P. D. Walker, Kyle Eliason, Douglas G. Adler MD, FACG, AGAF, FASGE, Gastroenterology and Hepatology, University of Utah School of Medicine, Salt Lake City, UT

to undergo further procedures given her age and overall history and the stent was thus left in place.

Discussion

In the treatment of pancreatic fluid collections and walled off pancreatic necrosis (WOPN) from pancreatitis, there are three main approaches: surgical, interventional radiology (IR) and endoscopic. These approaches are effectively used either alone or in tandem based on the specifics of the patient's disease, the comfort level of the care team and the stability of the patient's condition.

All of these techniques can be used in isolation or in combination as required clinically and as the patient's condition and severity changes over time. The first week or phase of disease management is mostly monitoring and supportive/pain control with possible antibiotic prophylaxis and fluid resuscitation.[1] During this time surgery is usually not performed unless it is of an emergent nature due to the fact that surgery in this phase often exacerbates multiple organ failure.[2] The next phase of management over the ensuing weeks typically includes such measures as contrast enhanced CT or MRI to assess fluid collections and necrosis for progression, maturation, and the presence of infection.[3] In this phase, antibiotic treatment may be optimized and determination of sterile or infected pancreatic necrosis can be accomplished using fine needle aspiration cultures of pancreatic tissue if clinically indicated.[4] In weeks four, five and six patients who are still stable typically remain under conservative medical treatment, while patients who are beginning to deteriorate will likely undergo more aggressive interventions.[15] This is the phase of treatment when it is more common to see the minimally invasive surgical and laproscopic procedures as well as endoscopic drainage.

Waiting until at least four weeks after the onset of symptoms allows fluid collections to become walled-off and develop a mature wall and adherence to the stomach and/or duodenum, which facilitates endoscopic necrosectomy if this approach is chosen.[5,6] After treatment is initiated, patients can have procedures repeated as necessary. Often cholecystectomy or ERCP with sphincterotomy is considered during this time to minimize recurrent biliary pancreatitis and any other gallstone or obstructive disease.[7] Several complications can arise in this phase including vascular complications and pancreatic fistulas. These pancreatic fistulas can often be treated with endoscopic papillary stenting.[8]

Surgical methods to treat pancreatic fluid collections may include open necrosectomy, which was considered the ideal treatment in the past as part of a "step down" approach to therapy of acute pancreatitis. An open necrosectomy is typically performed by creating a midline or subcostal bilateral incision and depending on the extent and locality of the necrosis, a surgeon may

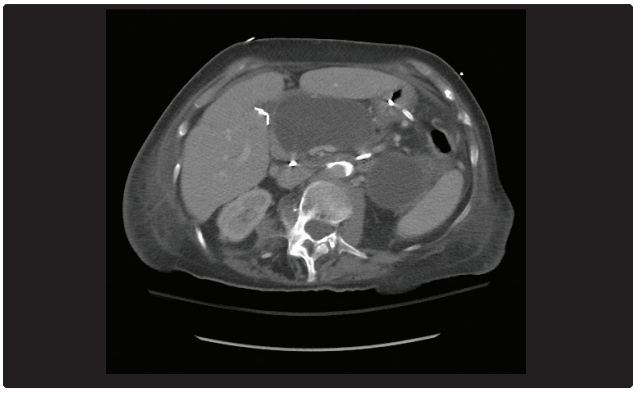

Figure 1. CT scan showing the large, bilobed pancreatic fluid collection that developed following an episode of pancreatitis.

Figure 2. EUS image of the same fluid collection showing extensive solid debris consistent with walled off pancreatic necrosis (WOPN).

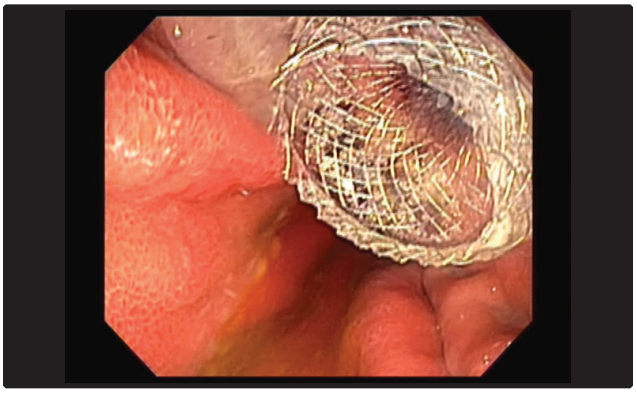

Figure 3. Endoscopic view of Axios stent following placement.

access the pancreas through the lesser sac, gastrocolic omentum or the transverse mesocolon.[9] Manual debridement is performed in one or more sessions. After the initial necrosectomy is complete, the abdominal incision is typically closed around a drain and repeat procedures are performed until the debridement is complete. Alternatively, the patient's abdomen may be left open or a wound-vac may be placed to facilitate drainage and repeated trips to the operating room for debridement in the days ahead.

Another surgical option is a laparoscopic necrosectomy, which has grown in popularity due to its minimally invasive nature. A laparoscopic approach provides excellent access to the pancreas and allows for other maneuvers to be easily accomplished in the same setting i.e. cholecystectomy, feeding tube placement, etc.[1,10] In one study, laproscopic necrosectomy procedures showed promising results although 7.1% were converted to open necrosectomy, 28.6% of patients developed a pancreatic fistula, and there was a wound infection rate of 10.7%.[11] While these numbers may sound high, it should be emphasized that these are aggressive procedures being performed in very ill patients.

Another minimally invasive surgical approach is the retroperitoneal approach. This is performed in a number of ways, one of which is the video assisted retroperitoneal debridement (VARD). In the VARD procedure, a laproscopic camera is inserted through an incision centered on the 12th rib with insertion of laparoscopic devices as well. Fluid drainage along with debris removal can be accomplished followed by debridement of the necrotic cavity.[1,12]

Due to the more invasive nature of the surgical techniques they are associated with longer hospital stays and more cost to the patient than other procedures. They are therefore typically used in association with a therapeutic "step up" program that usually begins with a less invasive endoscopic or percutaneous IR procedure.[1,13]

IR placement of one or more percutaneous drainage catheters is commonly used in patients who may be too ill for endoscopy or surgery, an immature fluid collection in need of drainage, or with an acutely infected collection. A percutaneous drain can be useful for bridging unstable patients to more definitive procedures performed at a later date. One study showed a 100% success rate in hemodynamically stable patients (n=20) using percutaneous drains to treat necrotizing pancreatitis,

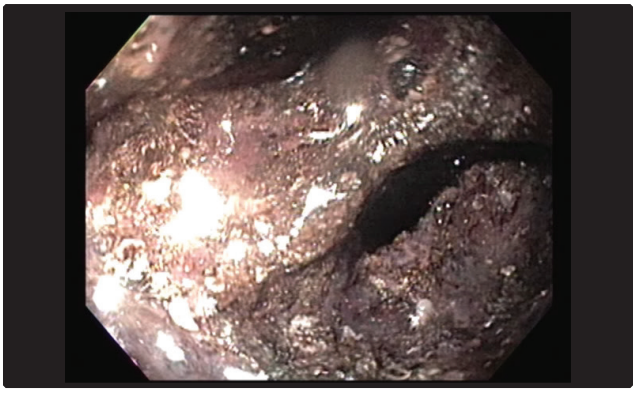

Figure 4a. Endoscopic view of necrotic debris prior to debridement.

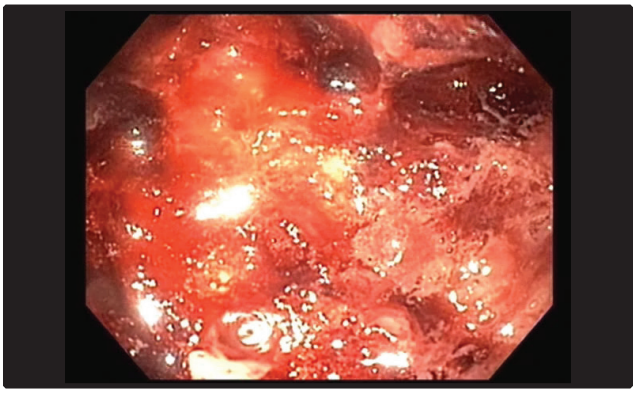

Figure 4b. Same site as Figure 4a after endoscopic debridement. Note good clearance of necrotic tissue and good granulation tissue in the cyst wall.

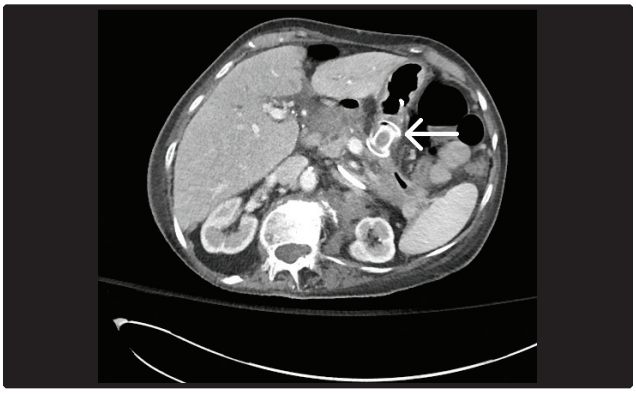

Figure 5. CT scan showing the final appearance of the transluminal stent in situ (arrow) with resolution of her WOPN.

success being defined as resolution of lesions at follow up IR procedures and via CT.[14] Percutaneous drainage carries with it a risk of pancreatico-cutaneous fistulae, especially in patients with disconnected duct syndrome, where it can be as high as 45%.[15] As such, evaluating

ductal anatomy, typically via ERCP with stenting as appropriate, is sometimes helpful in this setting. In a review of percutaneous drainage as a primary treatment for necrotizing pancreatitis, 55% of patients had no need for further necrosectomy (214 out of 384).[16] In patients that need extensive necrosectomy of solid tissue, other techniques are typically preferred over percutaneous drains.[17]

Endoscopic approaches to the drainage and debridement of pancreatic necrosis tend to be the least invasive but are nonetheless high-risk interventions. These approaches and can be used when a necrotic collection abuts the gastroduodenal wall or if the fluid collection communicates with the main pancreatic duct.

If the fluid collection does have communication with the main pancreatic duct, transpapillary drainage is often attempted using a plastic stent placed directly into the collection or bridging the communication with the duct.[9] If the fluid collection is felt to be too large, have too much solid component, and/or does not communicate with the duct then transmural drainage can be achieved in many patients via a cystenteroscopy (most commonly a cystgastrostomy, less commonly a cystduodenostomy) created endoscopically and kept open with one or more plastic or metal stents. The cystenterostomy also provides a portal for repeated endoscopic debridement as necessary.

In a systematic review of endoscopic treatment of pancreatic fluid collections through transmural drainage, patients treated with metal stents had a success rate of 81.9% on average for various types of pancreatic fluid collections out of 124 patients treated with metal stents. The authors reported an 83.3% success rate for pseudocysts and 77.9% in patients with walled off necrosis (success being defined as a reduction in size > 50% or complete resolution). These same authors reported an adverse event rate of 23.3% including infection, bleeding, stent migration, occlusion etc (again emphasizing that endoscopic treatments are not low risk procedures). In the same study, plastic stents showed a success rate of 80.7% on average of 702 patients treated (85.1% for pseudocysts and 69.5% for walled off necrosis). The adverse event rate for plastic stents was 16.1%.[18]

There are now commercially available, dedicated transluminal stents with a wide enough bore (15 mm) for an endoscopic necrosectomy to be performed through the stent lumen itself. We use these stents frequently in our practice. These stents are designed for EUS-guided placement and are only now coming into clinical use. A study of one of these dedicated stent (n=22) showed a 100% clinical success rate and 100% technical success rate, with 10% of patients encountering complications, which included stent migration and hemorrhage.[19] The main advantage of these dedicated stents is their wide lumen which both facilitates passive drainage to the GI tract of cyst contents and the fact that they can accommodate an endoscope so that the cavity can be entered as needed for endoscopic necrosectomy without having to remove the stent itself (as is often the case with plastic stents).

Overall, endoscopic treatment appears to be a good choice in the treatment of pancreatic fluid collections. One study of 116 patients (5 acute fluid collection, 8 necrosis, 30 acute pseudocyst, 64 chronic pseudocyst and 9 pancreatic abcess) treated via endoscopic drainage methods showed an 87.9% clinical success rate with resolution of collections and symptoms, and a 93.1% technical success rate of fluid collection resolution with or without resolution of symptoms. Collections recurred in 15.5% of patients and complications occurred in 11.2%. The most common complications were bleeding and pneumoperitoneum.[20]

Overall, methods for treating pancreatic fluid collections that develop following pancreatitis are numerous and allow for a customizable approach to treatment. There are many variables to consider with each patient's management, including the provider's comfort level and experience with some of these procedures. Careful consideration of all factors will be important to the patients' outcomes. ■

References

1. Phillip V, Steiner JM, Algül H. Early phase of acute pancreatitis: Assessment and management. World J Gastrointest Pathophysiol. 2014 Aug 15;5(3):158-68. doi: 10.4291/wjgp.v5.i3.158. Review. PubMed PMID: 25133018; PubMed Central PMCID:PMC4133515.
2. Beattie GC, Mason J, Swan D, Madhavan KK, Siriwardena AK. Outcome of necrosectomy in acute pancreatitis: the case for continued vigilance. Scand J Gastroenterol 2002; 37:1449–1453.
3. da Costa DW, Boerma D, van Santvoort HC, Horvath KD, Werner J, Carter CR,.Bollen TL, Gooszen HG, Besselink MG, Bakker OJ. Staged multidisciplinary step-up management for necrotizing pancreatitis. Br J Surg. 2014 Jan;101(1):e65-79. doi: 10.1002/bjs.9346. Epub 2013 Nov 22. Review. PubMed PMID: 24272964.
4. Rau B, Pralle U, Mayer JM, Beger HG. Role of ultrasonographically guided fine-needle aspiration cytology in the diagnosis of infected pancreatic necrosis. Br J Surg. 1998 Feb;85(2):179-84. PubMed PMID: 9501810.
5. Bollen TL. Imaging of acute pancreatitis: update of the revised Atlanta classification. Radiol Clin North Am 2012;50: 429–445.

(continued on page 62)

(continued from page 53)

6. Working Group IAP/APA Acute Pancreatitis Guidelines. IAP/APA evidence-based guidelines for the management of acute pancreatitis. Pancreas 2013; 13(Suppl 2): e1–e15.
7. Wu BU, Banks PA. Clinical management of patients with acute pancreatitis. Gastroenterology 2013; 144: 1272–1281.
8. Bakker OJ, van Baal MC, van Santvoort HC, Besselink MG, Poley JW, Heisterkamp J et al. Endoscopic transpapillary stenting or conservative treatment for pancreatic fistulas in necrotizing pancreatitis: multicenter series and literature review. Ann Surg 2011; 253:961–967.
9. Aranda-Narváez JM, González-Sánchez AJ, Montiel-Casado MC, Titos-García A, Santoyo-Santoyo J. Acute necrotizing pancreatitis: Surgical indications and technical procedures. World J Clin Cases. 2014 Dec 16;2(12):840-5. doi:10.12998/wjcc.v2.i12.840. Review. PubMed PMID: 25516858; PubMed Central PMCID:PMC4266831.
10. Wroński M, Cebulski W, Słodkowski M, Krasnodębski IW. Minimally invasive treatment of infected pancreatic necrosis. Prz Gastroenterol. 2014;9(6):317-24.doi: 10.5114/pg.2014.47893. Epub 2014 Dec 30. Review. PubMed PMID: 25653725;PubMed Central PMCID: PMC4300346.
11. Mathew MJ, Parmar AK, Sahu D, Reddy PK. Laparoscopic necrosectomy in acute necrotizing pancreatitis: Our experience. J Minim Access Surg. 2014 Jul;10(3):126-31. doi: 10.4103/0972-9941.134875. PubMed PMID: 25013328; PubMed Central PMCID: PMC4083544.
12. Gambiez LP, Denimal FA, Porte HL, Saudemont A, Chambon JP, Quandalle PA. Retroperitoneal approach and endoscopic management of peripancreatic necrosis collections. Arch Surg. 1998 Jan;133(1):66-72. PubMed PMID: 9438762.
13. Feurer ME, Adler DG. Evaluation and Management of Pancreatic Pseudocysts. Practical Gastroenterology. 2014 Apr (12)
14. Echenique AM, Sleeman D, Yrizarry J, et al. Percutaneous catheter-directed debridement of infected pancreatic necrosis: results in 20 patients. J Vasc Interv Radiol 1998;9:565.
15. Ross A, Gluck M, Irani S, Hauptmann E, Fotoohi M, Siegal J, Robinson D, Crane R, Kozarek R. Combined endoscopic and percutaneous drainage of organized pancreatic necrosis. Gastrointest Endosc. 2010 Jan;71(1):79-84. doi:10.1016/j.gie.2009.06.037. Epub 2009 Oct 27. PubMed PMID: 19863956.
16. van Baal MC, van Santvoort HC, Bollen TL, Bakker OJ, Besselink MG, Gooszen HG;Dutch Pancreatitis Study Group. Systematic review of percutaneous catheter drainage as primary treatment for necrotizing pancreatitis. Br J Surg. 2011 Jan;98(1):18-27. doi: 10.1002/bjs.7304. Review. PubMed PMID: 21136562.
17. Martin RF, Hein AR. Operative management of acute pancreatitis. Surg Clin North Am. 2013;93:595–610.
18. Bang JY, Hawes R, Bartolucci A, Varadarajulu S. Efficacy of metal and plastic stents for transmural drainage of pancreatic fluid collections: A systematic review. Dig Endosc. 2014 Dec 16. doi: 10.1111/den.12418. [Epub ahead of print] PubMed PMID: 25515976.
19. Bapaye A, Itoi T, Kongkam P, Dubale N, Mukai S. New fully covered large-bore wide-flare removable metal stent for drainage of pancreatic fluid collections: Results of a multicenter study. Dig Endosc. 2014 Dec 24. doi: 10.1111/den.12421. [Epub ahead of print] PubMed PMID: 25545957.
20. Hookey LC, Debroux S, Delhaye M, Arvanitakis M, Le Moine O, Devière J. Endoscopic drainage of pancreatic-fluid collections in 116 patients: a comparison of etiologies, drainage techniques, and outcomes. Gastrointest Endosc. 2006 Apr;63(4):635-43. PubMed PMID: 16564865.