Diagn Interv Radiol 2008; 14:57-60

Angiographic embolization of arterial hemorrhage following endoscopic US-guided cystogastrostomy for pancreatic pseudocyst drainage

Jonathan L. Brandon, Nathan M. Ruden, Ülkü Cenk Turba, Uğur Bozlar, Paul Yeaton, Klaus D. Hagspiel

ABSTRACT
Pseudocyst development is a common complication of chronic pancreatitis. Endoscopic cystogastrostomy is an alternative to percutaneous drainage of pancreatic pseudocysts. Endoscopic ultrasound (EUS) guidance is thought to decrease the procedural risk by identifying and avoiding intervening vasculature. With EUS guidance, extreme care should be exercised to identify large gastric vessels in the path of the puncture. Preoperative imaging should be closely scrutinized for the presence of these vessels. In cases of hemorrhage, balloon tamponading is a rapid way to provide temporary control, allowing transfer of the patient for angiographic embolization. We present a case of arterial hemorrhage due to inadvertent puncture of a hypertrophied right gastric artery following EUS-guided cystogastrostomy, which was successfully treated with temporary balloon occlusion and coil embolization.

Key words: • *pancreatic pseudocyst* • *endoscopy* • *hemorrhage* • *ultrasonography*

From the Medical School (J.L.B., N.M.R.), Department of Radiology (Ü.C.T. ✉ *uct5d@virginia.edu*, U.B., K.D.H.), and Department of Gastroenterology (P.Y.), University of Virginia, Charlottesville, VA, USA.

Received 16 June 2006; revision requested 6 October 2006; revision received 11 November 2006; accepted 17 November 2006.

Pseudocyst development is a common complication of pancreatitis, with an incidence as high as 20%–25% in chronic pancreatitis (1). While many pseudocysts are asymptomatic or resolve with conservative management, some can cause intractable pain, become infected, or cause gastric outlet or biliary obstruction, which necessitates intervention (2). Image-guided percutaneous cyst drainage is usually performed, though endoscopic cystogastrostomy was developed over the last 10 years as an alternative non-invasive therapy for drainage of pancreatic pseudocysts. The complication and recurrence rates after endoscopic cystogastrostomy compare favorably to that of the standard surgical approach, with complications arising in 17%–19% of patients in one large trial (3). Complications of this tecnique include infection, severe hemorrhage, pancreatitis, and perforation. The most worrisome of these is severe hemorrhage, which occurs at a rate of 5%–15% (4). This high rate is due to the disease processes associated with pancreatitis, including formation of pseudoaneurysms from extravasation of pancreatic enzymes and extensive extragastric collateral vessels from either cirrhosis, with portal hypertension, or splenic vein thrombosis (4). Endoscopic ultrasound (EUS) was developed to decrease this risk by visualization of the intervening vasculature. In this article, we present a case of arterial hemorrhage due to puncture of a hypertrophied right gastric artery following EUS-guided cystogastrostomy. Methods to prevent hemorrhage during endoscopic drainage of pancreatic pseudocysts, as well as management of this complication, are discussed.

Case report

Institutional review board approval is not required at our institution for case reports of this type; however, informed consent was obtained for all procedures.

A 54-year-old male presented with abdominal pain and an enlarging pseudocyst 3 months after an episode of severe pancreatitis. Computed tomography (CT) examination during the acute phase of his pancreatitis showed changes consistent with severe pancreatitis, without fluid collections. Magnetic resonance cholangiopancreatography performed 2 weeks later demonstrated multiple extrapancreatic and intrapancreatic fluid collections, with normal ducts. On a follow-up CT 3 weeks later, an 8.3 × 3.4-cm retrogastric fluid collection consistent with a pancreatic pseudocyst was found.

The patient was admitted for endoscopic retrograde cholangiopancreatography and pseudocyst drainage. Preoperative CT performed the night before the procedure showed a pseudocyst in the body of the pancreas and hypervascularity in the gastric wall anterior to the pancreas (Fig. 1). Biliary and pancreatic sphincterotomies were performed, followed by a cholangio-pancreatogram. This demonstrated multiple areas of extrava-

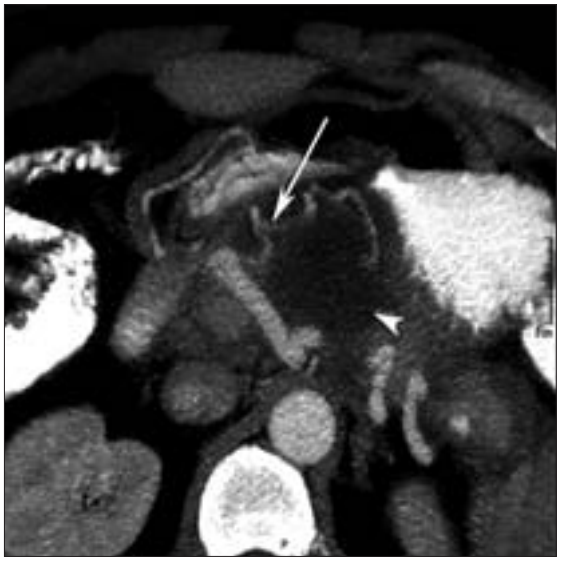

Figure 1. Sub-volume maximum intensity projection (MIP) of the pre-endoscopic contrast-enhanced CT demonstrating the enlarged and tortuous right gastric artery *(arrow)* between the stomach and the pancreatic pseudocyst *(arrowhead)*.

Figure 2. Common hepatic angiogram prior to embolization shows a large right gastric artery *(arrow)* with the dilation balloon *(arrowhead)* tamponading the site of hemorrhage. The guidewire is coiled within the pancreatic pseudocyst.

sation into the pancreas. The pancreatic duct was dilated and stented with a 7F × 23-cm stent. An echoendoscope was used to image a 4.5 cm hypoechoic collection in the pancreatic body. Color Doppler US was used to identify regional vasculature. Fine needle aspiration of the pseudocyst was accomplished by introducing a 19-gauge Cook needle into the collection. Then, a 0.035" Teflon guidewire was introduced into the collection. Pulsation was observed and color Doppler US demonstrated arterial hemorrhaging. There was rapid arterial bleeding into the stomach, which required immediate control for the survival of the patient. A 6-mm Maxforce® single-use biliary dilatation balloon (Boston Scientific Corporation, Natick, MA, USA) was centered in the tract and inflated to tamponade the arterial bleeding. The patient was transferred to interventional radiology for arterial embolization.

After performing an abdominal angiogram, the celiac trunk was selectively catheterized and a catheter was placed into the common hepatic artery. An angiogram showed hypertrophy of the right gastric artery with retrograde filling and communication with the left gastric artery (Fig. 2). The dilation balloon was situated across the endoscopic gastrocystostomy site. After multiple angiographic projections were performed without showing evidence for extravasation, the dilation balloon was deflated and the angiogram showed massive contrast extravasation from the right and left gastric arteries into the lumen of the stomach (Fig. 3). After balloon reinflation, the catheter was advanced into the distal left gastric artery using a 2.3F microcatheter (Cordis, Miami, FL, USA) and coil embolization was performed using 0.038" platinum Nester embolization coils (Cook, Inc., Bloomington, IN, USA). The catheter was then withdrawn into the distal right gastric artery with the placement of additional Nester embolization coils. Post-embolization arteriography following dilation balloon deflation showed no further extravasation (Fig. 4).

After successful embolization, the patient returned for completion of his endoscopic procedure. The dilation balloon was removed and a 10F × 4-cm double pigtail stent was used to create the gastrocystostomy. A percutaneous endoscopic gastrostomy/jejunostomy tube was placed for nutritional support.

The patient was admitted to the intensive care unit and was given a proton pump inhibitor and antibiotic prophylaxis (Cefazolin 1 g, intravenous) in accordance with the institutional protocol. Blood and urine cultures were negative and the patient remained afebrile after 3 days of hospitalization. The patient remained hemodynamically stable and did not require transfusion throughout his hospital stay. The patient was discharged in stable condition after 10 days of hospitalization. He was continuing to do well at the 3-month follow-up visit.

Discussion

Many pancreatic pseudocysts resolve on their own or with medical management. Indications for intervention include intractable pain, increase in size, fever with suspected infection, and gastric outlet or biliary obstruction. The standard therapy has been surgery. Surgical options include cystogastrostomy, cystoduodenostomy, and a Roux-en-Y cystojejunostomy. These surgical procedures carry morbidity rates of 10%–30%, mortality rates of 1%–5%, and recurrence rates of 5%–20% (5, 6). Three less invasive techniques have been developed to decrease morbidity and expense: radiologic, laparoscopic, and endoscopic.

Indications for percutaneous drainage of infected pseudocysts include an uncertain diagnosis and pseudocysts that are not easily accessible by other routes (7, 8). The percutaneous approach is contraindicated in cases of chronic pancreatitis with abnormal pancreatic duct anatomy, including severe stricture or obstruction, as it invariably results in an external pancreatic fistula (9). Complications include bleeding (1%–2%), inadvertent traversal of the pleural space or other viscera (1%–2%), introduction of secondary

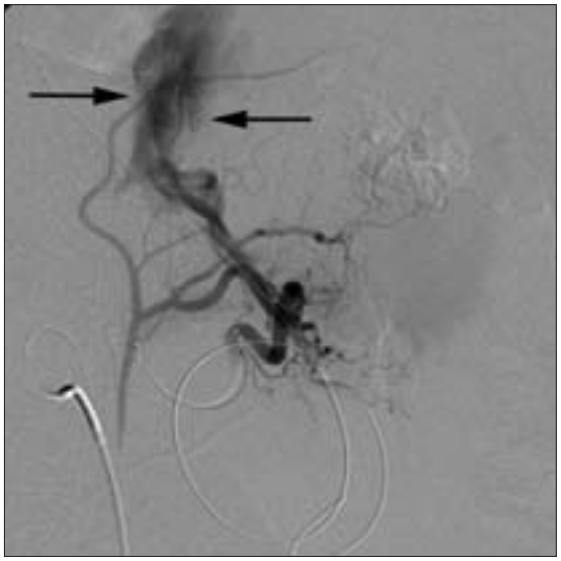

Figure 3. Right gastric arteriogram with the dilation balloon deflated. There is massive extravasation into the stomach *(arrows)*.

Figure 4. Proper hepatic arteriogram following successful coil embolization of the distal right *(arrow)* and left gastric arteries *(arrowhead)* with the dilation balloon deflated shows no further extravasation.

infection (9%), and the development of pancreatic-cutaneous fistula or pseudocyst recurrence (8).

Laparoscopic drainage is an emerging technique. A review of 30 cases revealed a success rate of 89% with no recurrences during follow-ups of 6–32 months (10). Infection occurred in 7% and no other complications were reported. The theoretical advantages of this technique over percutaneous or endoscopic techniques are several. First, the risk of obstructing the communication between the cyst and the stomach is greater and thus less likely to get blocked. In addition, there is generally less risk of hemorrhage than with the other techniques because bleeding vessels can be seen and ligated (10).

Endoscopic therapy is less invasive compared to surgery, and it avoids the potential problem of external fistula formation. A benefit for patients is the fact that there is no communication with the body surface and thus no catheter protruding from the abdominal wall. The most commonly reported complications of endoscopic drainage of pancreatic pseudocysts include hemorrhage, infection of the pseudocyst, pancreatitis, and viscous perforation. Morbidity rates of 5%–24%, mortality rates of 0%–2%, and recurrence of pseudocyst rates of 6%–23% have been reported (11).

While no controlled trial has yet evaluated whether EUS decreases the risk of vascular complications, a review of 99 cases of pancreatic pseudocyst drainage using EUS guidance revealed only 3 cases of hemorrhage that necessitated surgery, indicating a relatively favorable safety profile (4).

Several recommendations have been made to decrease the complications of this procedure (11–13). Allowing 4–6 weeks for the wall of the pseudocyst to mature provides a more secure opportunity for anastomosis formation. The risk of hemorrhage is theoretically decreased by evaluating for pseudoaneurysms and gastric varices, especially in the context of portal hypertension. High-resolution dynamic bolus contrast CT scanning, therefore, is routinely ordered prior to transmural puncture at our institution. If the scan is suspicious for pseudoaneurysms or arterial communications, Doppler US or angiography is performed to further evaluate the vasculature. EUS also allows visualization of the vasculature and may prompt surgical intervention or a change of location for drainage. Before puncture is performed, a small-bore aspirating needle catheter can be used to test for blood.

Despite these precautions, the risk of complications is always present, as our case demonstrated. The enlarged gastric artery was not diagnosed on the original CT report and EUS failed to detect it as well, thus leading to its puncture. If hemorrhage does occur, the endoscopist must take decisive action. Electrocautery should be attempted first. Balloon tamponading within the fistula tract may stop the bleeding. For definitive treatment, patients can undergo surgery or angiographic embolization (14). As shown in the presented case, it is extremely important in vascular territories like the stomach to embolize both afferent and efferent vessels, as there is always the possibility of the reversal of flow via collaterals. In all vessels other than terminal arteries, such as the renal arteries, embolization proximal and distal to the site of extravasation is absolutely mandatory. EUS may also detect debris or loculation within the pseudocyst, which are associated with increased risk of pseudocyst infection. If endoscopic drainage is attempted in the presence of these findings, a large diameter communication should be created, and a nasocystic catheter for lavage may be placed (4).

The presented case demonstrates the following key points for the management of pancreatic pseudocysts. First of all, a pre-endoscopic contrast-enhanced CT was performed to evaluate the pseudocyst and the surrounding vasculature. A detailed examination of this CT revealed a tortuous artery between the stomach and pseudocyst. In order to detect this abnormality,

radiologists need to be familiar with the pathophysiological changes of the vasculature induced by pancreatitis and pseudocyst formation. Secondly, although EUS is a valuable tool for the evaluation of mural vessels and the selection of a location for puncture, it may not detect some vessels. Finally, when hemorrhage does complicate drainage, control must be gained quickly. In our case, balloon tamponading provided temporary control allowing the patient to be transferred for definitive treatment with transcatheter embolization.

References

1. Vavrecka A, Kuzela L, Novotna T, Hrcka R, Oltman M. Endoscopic therapy of pancreatic pseudocysts. Bratisl Lek Listy 2000; 101:93–96.
2. Cheruvu CV, Clarke MG, Prentice M, Eyre-Brook IA. Conservative treatment as an option in the management of pancreatic pseudocyst. Ann R Coll Surg Engl 2003; 85:313–316.
3. Baron TH, Harewood GC, Morgan DE, Yates MR. Outcome differences after endoscopic drainage of pancreatic necrosis, acute pancreatic pseudocysts, and chronic pancreatic pseudocysts. Gastrointest Endosc 2002; 56:7–17.
4. Vosoghi M, Sial S, Garrett B, et al. EUS-guided pancreatic pseudocyst drainage: review and experience at Harbor-UCLA Medical Center. Med Gen Med 2002; 4:2.
5. Kohler H, Schafmayer A, Ludtke FE, Lepsien G, Peiper HJ. Surgical treatment of pancreatic pseudocysts. Br J Surg 1987; 74:813–815.
6. Huibregtse K, Schneider B, Vrij AA, Tytgat GN. Endoscopic pancreatic drainage in chronic pancreatitis. Gastrointest Endosc 1988; 34:9–15.
7. vanSonnenberg E, Wittich GR, Casola G, et al. Percutaneous drainage of infected and noninfected pancreatic pseudocysts: experience in 101 cases. Radiology 1989; 170:757–761.
8. Neff R. Pancreatic pseudocysts and fluid collections: percutaneous approaches. Surg Clin North Am 2001; 81:399–403.
9. D'Egidio A, Schein M. Percutaneous drainage of pancreatic pseudocysts: a prospective study. World J Surg 1992; 16:141–146.
10. Bhattacharya D, Ammori BJ. Minimally invasive approaches to the management of pancreatic pseudocysts: review of the literature. Surg Laparosc Endosc Percutan Tech 2003; 13:141–148.
11. Chak A. Endosonographic-guided therapy of pancreatic pseudocysts. Gastrointest Endosc 2000; 52:S23–27
12. Brugge WR. Approaches to the drainage of pancreatic pseudocysts. Curr Opin Gastroenterol 2004; 20:488–492.
13. Nealon WH, Walser E. Surgical management of complications associated with percutaneous and/or endoscopic management of pseudocyst of the pancreas. Ann Surg 2005; 241:948–960.
14. Adams DB, Zellner JL, Anderson MC. Arterial hemorrhage complicating pancreatic pseudocysts: role of angiography. J Surg Res 1993; 54:150–156.