# Targeted transgastric drainage of isolated pancreatic duct segments to cure persistent pancreaticocutaneous fistulas from pancreatitis.

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## Abstract

Chronic pancreaticocutaneous fistulas can be difficult to treat. This paper presents a snare-target technique for draining a non-dilated pancreatic duct into the stomach, thus diverting pancreatic fluid away from the pancreaticocutaneous fistula to allow it to heal. Internal or internal/external transgastric pancreatic duct or fistula drains were placed in 6 patients. After an average of 4 months of drainage, all 6 patients had resolution of the cutaneous fistula. 2 patients developed a pseudocyst but no recurrent fistula after drain removal, and the other 4 had no pseudocyst or fistula after an average of 27 months follow up (range 6-74 months).

Keywords: pancreatic fistula, pancreatic duct injury, pseudocyst, transgastric drain, snare

## Introduction

Pancreaticocutaneous fistulas develop after pancreatic duct injury, which can be caused by acute and chronic pancreatitis, pancreatic surgery, and trauma. Most fistulas resolve after 1 month of non-surgical therapy, including jejunal feeds, somatostatin analogues, pseudocyst drains, and endoscopic stent placement in the pancreatic duct (1-3). The fistula is likely to persist if there is complete transection of the pancreatic duct, if there is a downstream ductal stricture, or if it is a high-output fistula (2). If these measures fail, patients are left to endure external drainage. Cystgastrostomy (surgical or percutaneous) is only possible if there is a pseudocyst associated with the fistula. Otherwise, major surgery is required to manage the fistula, either with a distal pancreatectomy or pancreaticojejunostomy.

In cases where the duct disruption cannot be crossed endoscopically, several percutaneous techniques have been described for draining the pancreatic duct, thus providing a less invasive alternative to surgery (4, 5). Limitations of existing techniques include difficulty of accessing non-dilated pancreatic ducts, inconvenience of external drainage, and inability to cross the pancreatic duct injury.

To address these limitations, this paper presents a series of cases where a transgastric snare-target technique was used to drain the pancreatic duct directly into the stomach. The snare-target technique allows percutaneous access to non-dilated pancreatic ducts, using a snare placed through the cutaneous fistula into the pancreatic duct as a target for drainage. A transgastric drain allows for internal drainage of the pancreatic duct, and thus provides an alternative drainage pathway to allow the cutaneous fistula to heal. This paper also presents a case of a transgastric drain that crosses the pancreatic duct injury.

## Methods

The study was approved by the institutional review board. Six consecutive patients (June 2007 to April 2013) who had transgastric pancreatic duct or fistula drains placed were retrospectively reviewed (average age 42, range 15-65). All patients had a pancreatic duct disruption and a persistent pancreaticocutaneous fistula. In all cases, the pancreatic duct disruption was due to pancreatitis, and the fistula persisted despite prolonged percutaneous drainage and a failed attempt at endoscopic pancreatic stent placement.

Using fluoroscopic guidance, the fistula drain was exchanged over a wire for a 10 French vascular sheath (Terumo Medical Corporation, Somerset, NJ). A 5 French Berenstein catheter (Boston Scientific, Marlborough, MA) and a 0.035-inch Glidewire (Terumo Medical Corporation, Somerset, NJ) were then used to cannulate the pancreatic duct through the disruption to gain access to the pancreatic tail duct remnant (Figure 1). Alternatively, the pancreatic duct was accessed through the fistula drain tract using a 21 gauge needle through a gastrojejunostomy cannula (Cook Medical, Bloomington, IN). An 0.018-inch Nitrex wire (ev3 Endovascular) was then passed through the 21 gauge needle, and a FasTracker 325 microcatheter (Boston Scientific, Marlborough, MA) was advanced over the wire through the fistula into the periphery of the pancreatic tail duct remnant. A 10 mm Amplatz gooseneck snare (ev3 Endovascular, Inc. Plymouth, MN) or a microsnare (ev3 Endovascular) was then placed through the catheter or microcatheter into the pancreatic tail duct remnant. Next, the stomach was insufflated, then punctured with a 16-gauge needle to place a gastric anchor (Cook Medical, Bloomington, IN) and an 8 French sheath (Terumo Medical Corporation, Somerset, NJ). Through the sheath, the posterior wall of the stomach was punctured using the pancreatic duct snare as a target, using a 20 cm 18 or 21 gauge needle (Cook medical incorporated, Bloomington, IN). A 0.018 or 0.035 inch guidewire (Cook Medical, Bloomington, IN or Terumo Medical Corporation, Somerset, NJ) was passed through the needle, captured by the snare, and pulled through the pancreatic duct into the fistula drain tract and out through the skin site to provide transgastric access to the duct.

An attempt was then made to cross the pancreatic obstruction in order to get across the ampulla of Vater into the duodenum. If successful in crossing the stricture or occlusion, a transgastric transpancreatic catheter was advanced through the ampulla. The skin tract was dilated and a percutaneous drainage catheter (Boston Scientific, Marlborough, MA) was passed over the wire from the anterior abdominal wall, through the stomach, into the tail portion of the pancreatic duct, across the pancreatic duct injury, then into the duodenum, where the loop was formed. Additional side holes in the drain were positioned within the pancreatic duct as well as the stomach, and the tube was capped, thus serving as an internal-external pancreatic drain (Figure 2C). Finally, a drainage catheter was replaced within the fistulous tract to follow the amount of drainage. The fistula drain was removed when it had minimal output. The transpancreatic drain was left in place several weeks to stent the pancreatic stricture and develop a mature pancreatic tract to the stomach as an alternative route of drainage. If the obstruction could not be crossed, the drainage catheter was placed into the isolated duct (Figure 2B).

In 3 patients, the transgastric internal-external pancreatic drain was internalized after a few months by cutting the external portion of the drain before advancing it over the wire, in order to allow further maturation of the tract. The internalized drain was removed transorally using a snare.

Procedures were performed using moderate sedation, and prophylactic antibiotics (typically 1.5 g ampicillin / sulbactam) were administered intravenously pre-procedure. For the initial transgastric pancreatic drain placement, the patient was admitted for overnight observation. Drain exchange was performed as an outpatient procedure. A one-tailed *t*-test, assuming unequal variances, was used to calculate *p* values.

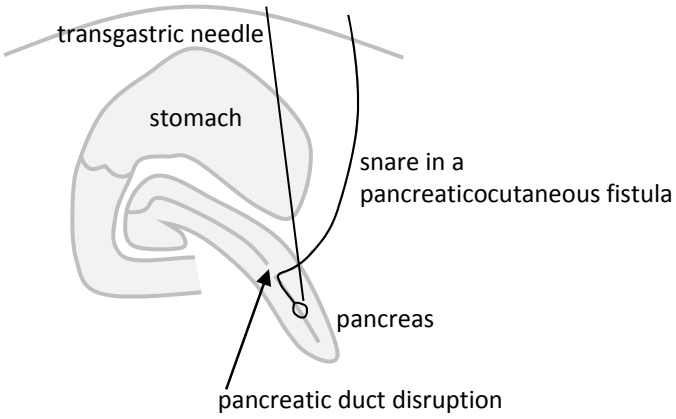


**Figure 1**. Initial steps for transgastric access to the pancreatic duct. The pancreatic duct was accessed through a cutaneous fistula, and a snare was placed within the duct to act as a target. The snare was used to capture a wire placed through a transgastric needle. A drain was then placed to allow both external and internal (into the stomach) drainage of the pancreatic duct (Figure 2).

## Results

The 2 transgastric pancreatic fistula and 4 transgastric pancreatic duct drains are described in Table 1. In two cases, it was difficult get into the pancreatic duct proper, so the origin of the fistula just outside the duct was targeted instead (Figure 2A). In two cases, the upstream pancreatic duct was drained into the stomach (Figure 2B). One pancreatic duct stricture was crossed and stented through the ampulla into the duodenum (Figure 2C). One patient's drain had two connections between the pancreatic duct and the stomach (Figure 2D, Figure 3, Figure 4). The second connection with the stomach allowed the locking loop to be formed in the stomach, as the loop could not be formed within the duct.

The internal / external or internalized drains were kept in place for an average of 4 months (range 3-6) prior to removal. The drain was removed when there was no cutaneous fistula and no pseudocyst on imaging. All 6 patients had resolution of their fistulas, with elimination of the cutaneous catheters and need for bag drainage. After drain removal, there was no clinical or radiographic evidence for recurrent fistula, pseudocyst, or acute pancreatitis in 4 of 6 patients, after an average follow-up of 27 months (range 6-74). In 2 patients, a pseudocyst (but no recurrent cutaneous fistula) was seen 1-6 months after drain removal. One was successfully managed with a percutaneous cystgastrostomy, while the other underwent a surgical cystenterostomy because of the patient's difficulty returning for follow up appointments, due to a change in their social situation. Both treatment failures occurred with pancreatic tail only

drains, and the cutaneous fistulas did not recur. Both treatment failures occurred in patients who had a transgastric pancreatic duct drain in place for 3-4 months. For comparison, the 4 patients who did not develop a pseudocyst had a drain in place for 4-6 months ($p$=0.07).

Complications were minimal. One patient was readmitted for less than 24 hours for pain: SIR category B (6). No major complications, bleeding, or acute pancreatitis were seen during the follow-up period.

| History | Procedure | Drainage time (months) | Follow up after removal (months) | Recurrence * |
|---|---|---|---|---|
| 65 F with pancreas divisum and necrotizing pancreatitis, status post necrosectomy ‡ | transgastric pancreatic duct drain (Figure 2C, 8 F) | 6 | 74 | n |
| 50 M with pancreatitis after resection of retroperitoneal ganglioneuroma ‡ | transgastric pancreatic duct drain (Figure 2B, 10 F), internalization | 3 | 6 | y |
| with new pseudocyst after drain removal | Roux-en-Y cystenterostomy | n/a | 17 | n |
| 19 F with pancreas divisum and pancreatitis † | transgastric pancreatic duct drain (Figure 2D, 14 F), internalization | 5 | 12 | n |
| 15 M with gallstone necrotizing pancreatitis ‡ | transgastric pancreatic fistula drain (Figure 2A, 14-16 F), internalization | 5 | 18 | n |
| 60 F with ERCP-induced necrotizing pancreatitis ‡ | transgastric pancreatic duct drain (Figure 2B, 12 F) | 4 | 1 | y |
| with new pseudocyst after drain removal | percutaneous cystogastrostomy (14 F), internalization | 4 | 2 | n |
| 45 M with gallstone necrotizing pancreatitis status post necrosectomy, with a high output pancreaticocutaneous fistula (>600 ml/day) ‡ | transgastric pancreatic fistula drain (Figure 2A, 14 F) | 4 | 6 | n |

**Table 1**. Summary of cases. All patients had a pancreatic duct disruption and a persistent cutaneous fistula originating from the pancreatic tail. All cases had pre-existing drains in the fistula.
* Clinical, biochemical, or radiographic evidence for recurrent fistula, pseudocyst, or acute pancreatitis.
† ERCP pancreatic stent placement did not adequately control the fistula.
‡ Attempted ERCP pancreatic stent placement failed due to inability to cross the pancreatic duct disruption.

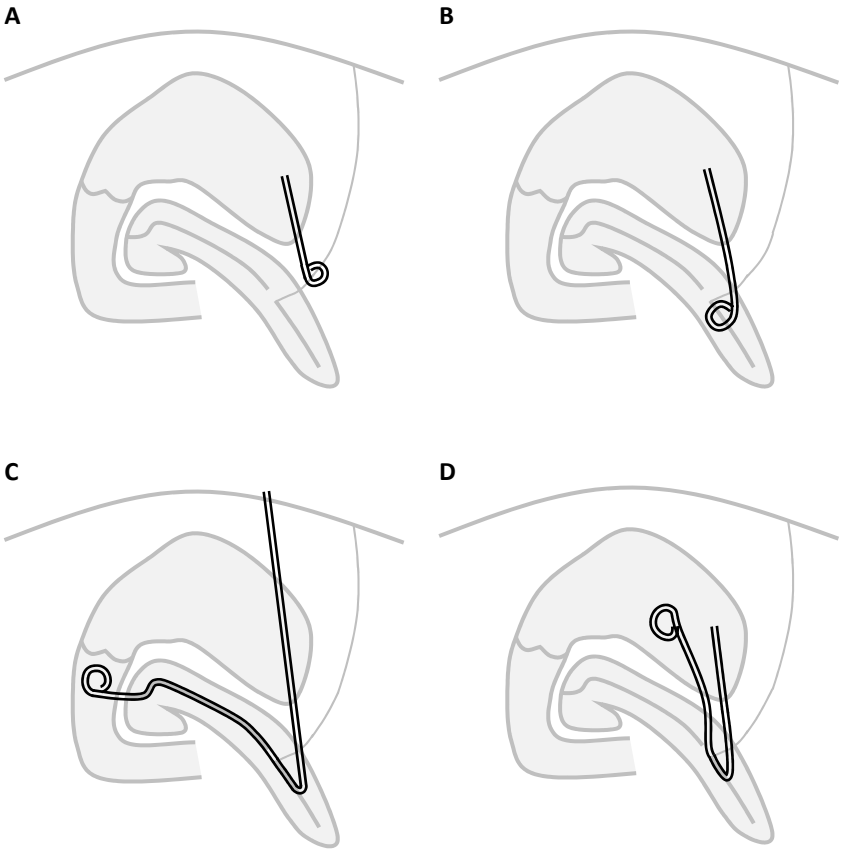


**Figure 2**. Methods for draining the pancreatic duct into the stomach. **A**. Transgastric pancreatic fistula drain. **B**. Transgastric pancreatic duct drain. **C**. Transgastric pancreatic duct drain, crossing the duct disruption. **D**. Transgastric pancreatic duct drain, with two connections to the stomach.

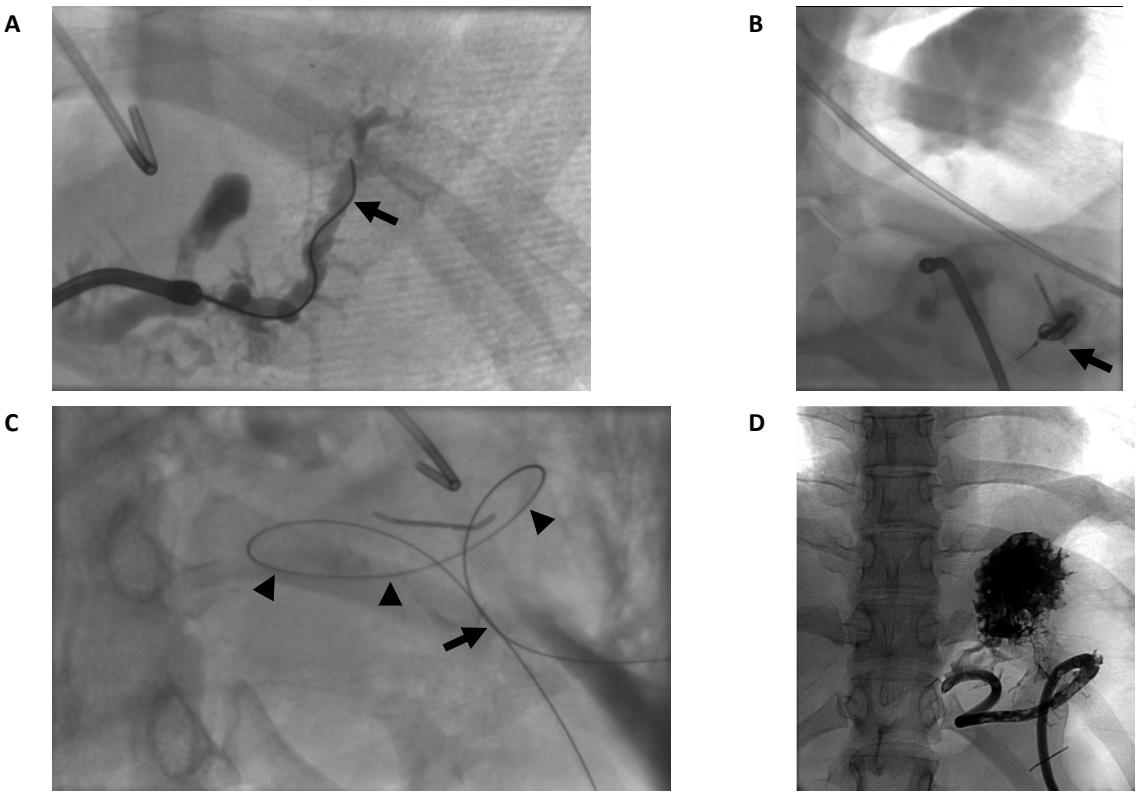


**Figure 3**. Transgastric pancreatic duct drain, with two connections to the stomach. See schematic diagram in Figure 2D. **A**. The pancreatic duct was accessed through an old drain tract. A wire (arrow) followed by a gooseneck snare were advanced into the upstream pancreatic duct. **B**. After gastric insufflation through a Berenstein catheter, a gastropexy suture and a sheath were placed in the stomach. An 18 G trocar needle (arrow) was advanced through the gastric sheath into the snare. A wire was passed through the trocar, and snared out through the old drain tract. **C**. This was repeated to create a second connection between the pancreatic duct and the stomach. Through the gastric sheath, a snare was placed into the isolated pancreatic duct and advanced downstream. An 18 G trocar needle was advanced through the gastric sheath towards the snare. A wire was passed through the trocar needle, and captured by the snare. Arrowheads show the portion of the wire within the pancreatic duct, and the arrow shows both ends of the wire passing through the gastric sheath. **D**. A 14 French biliary-type drain was placed over the wire, through the stomach, into the pancreatic duct, then back into the stomach, with the loop formed in the stomach.

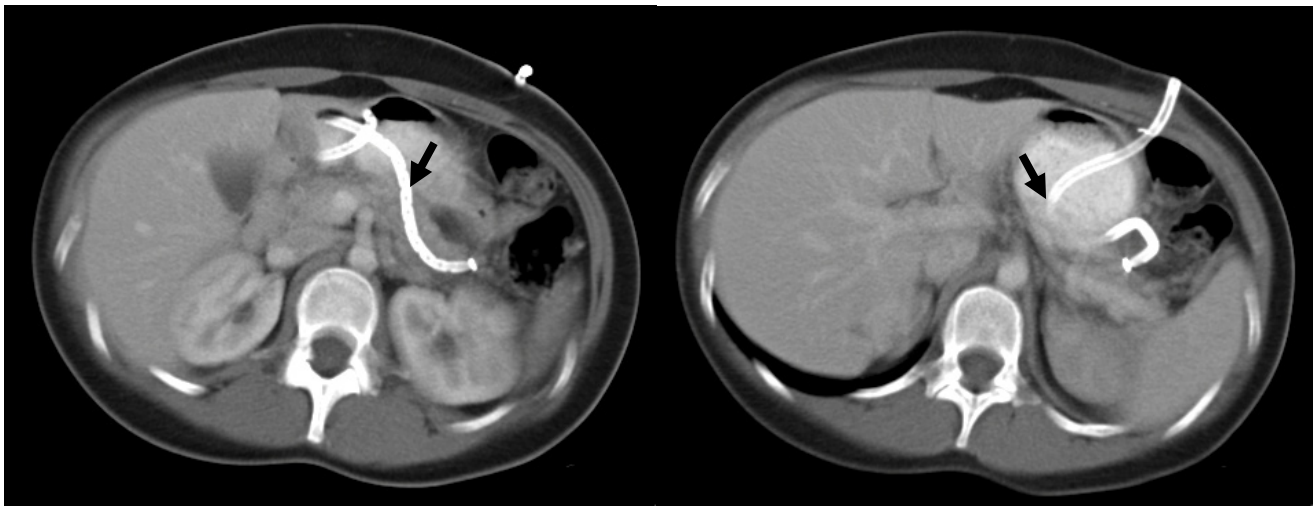

**Figure 4**. Transgastric pancreatic duct drain, with two connections to the stomach (arrows). Making two pancreatic communications with the stomach allowed formation of the locking loop in the stomach, thus providing more stable access to the duct. There was no place within the duct to adequately form the locking loop. See schematic diagram in Figure 2D and fluoroscopic images in Figure 3.

## Discussion

Chronic pancreatic fistulas after pancreatic injury can be difficult to manage, especially if endoscopic stenting is unsuccessful (2). Several percutaneous approaches have been described for reconnecting the gland to the gastrointestinal tract, in order to divert pancreatic fluid away from the fistula and allow it to heal. Percutaneous cystgastrostomy allows a pseudocyst to drain internally into the stomach. A spontaneous pancreaticoenteric fistula can be stented to maintain its patency (7).

If the pancreatic duct is dilated (> 4 mm), then it can be punctured percutaneously, allowing placement of a drain from the pancreatic duct to the stomach or bowel (4). However, the pancreatic duct is frequently non-dilated, as it is decompressed into the cutaneous tract. If the duct is not dilated, then a snare can be placed into the duct via the cutaneous fistula, providing a target for percutaneous puncture and drainage of the duct (5). This snare-target technique was originally described as a method for percutaneous access to non-dilated bile ducts (8).

This paper presents a transgastric snare-target technique for accessing both sides of the pancreatic duct injury, allowing placement of a drain across the pancreatic duct injury, thus restoring continuity of the pancreatic duct. Transgastric drains can be internalized to allow drainage into the stomach, thus eliminating external drainage bags.

Although an attempt was made to cross all of the pancreatic obstructions, the injury could only be crossed in 1 of 6 cases. This failure did not prevent the resolution of the pancreatic fistula, due to the creation an alternative drainage route to the stomach. Our results also suggest that keeping drains in place for at least 4 months might improve the success rate, although this correlation did not reach statistical significance.

In conclusion, pancreatic fistulas refractory to both conventional percutaneous drain placement and endoscopic pancreatic duct stent placement can be successfully managed using transgastric pancreatic duct or fistula drainage with a snare-target technique, thus obviating the need for distal pancreatectomy or pancreaticojejunostomy. Creating an alternative drainage pathway from the pancreatic duct or fistula into the stomach diverts pancreatic fluid away from the pancreaticocutaneous fistula, allowing it to heal.

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