[CASE REPORT]

Successful Endoscopic Treatment of Severe Pancreaticojejunostomy Strictures by Puncturing the Anastomotic Site with an EUS-guided Guidewire

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Abstract:
Pancreaticojejunostomy stricture (PJS) is a late complication of pancreaticoduodenectomy. The endoscopic treatment of PJS is very challenging due to the difficulty of locating the small anastomotic site and passing the stricture using a guidewire. We herein report two cases of severe PJS. These patients could not be treated using only double-balloon endoscopy or endoscopic ultrasound-guided puncture of the main pancreatic duct because of severe stenosis at the anastomotic site. However, we could treat them by the rendezvous technique using the rigid part of the guidewire to penetrate PJS. This method was useful and safe for treating severe PJS.

Key words: pancreaticoduodenectomy, late complication, pancreaticojejunostomy stricture, endoscopic ultrasound, rendezvous technique

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Introduction
Pancreaticoduodenectomy is a common surgical treatment for malignant diseases of the pancreatic head and periampullary regions (1). Refinements of the technique, along with advances in anesthesia and critical care, have reduced the morbidity and mortality associated with this operation (2-4). However, it is crucial to address the late complications of pancreaticoduodenectomy to improve the survival rate after pancreaticoduodenectomy. Pancreaticojejunostomy stricture (PJS) forms after pancreaticoduodenectomy at a frequency of 2-11% of the total patients undergoing pancreaticoduodenectomy (5-8). It can cause recurrent obstructive pancreatitis, pancreatic fistula, and bleeding, leading to the requirement of a second operation. Despite recent advances in endoscopic techniques and devices for PJS, the success rates remain poor (9). Although passing a guidewire through the anastomotic site is the most critical factor for the successful treatment of PJS, there is no useful established method for passing a PJS due to severe stenosis. We herein describe two cases in which severe PJS was successfully treated by puncturing the anastomotic site with the rigid part of a guidewire.

Case Reports

Case 1
A 55-year-old man underwent right hepatectomy and subtotal stomach-preserving pancreaticoduodenectomy for diffuse bile duct carcinoma in 2012. He was referred to our hospital for abdominal pain in April 2014. CT revealed massive ascites and a dilated main pancreatic duct (Fig. 1a). He was diagnosed with pancreatitis and the rupture of a pancreatic pseudocyst associated with PJS. Although we could in-
sert a double-balloon endoscope through the anastomotic site of the pancreatojejunostomy, it could not pass through or dilate the PJS because of a membranous obstruction (Fig. 1b). We chose conservative medical treatment. However, the patient was readmitted with similar symptoms in August 2015. The patient’s laboratory data showed anemia and elevated levels of pancreatic enzymes. CT showed fluid collection with high density from the pancreatic tail to the perirenal cavity (Fig. 1c, d) due to rupture and bleeding of the pancreatic pseudocyst. After obtaining written informed consent, endoscopic ultrasound (EUS) was performed. The pancreatic duct was visualized using a curved linear EUS device (GF-240UCT; Olympus, Tokyo, Japan) from the gastric body and punctured using a 19-gauge needle (Expect™ 19ga Flex Needle; Boston Scientific Japan, Tokyo, Japan) (Fig. 2a). We carefully inserted a 0.025-inch guidewire (RevoWave; Piolax Medical Devices, Yokohama, Japan) and the catheter to the anastomotic site along the guidewire. However, the guidewire and contrast medium could not pass through the anastomotic site due to the severe stricture (Fig. 2b). The guidewire was therefore removed from the catheter and inserted backwards and the anastomotic site was punctured using the rigid portion of the guidewire (Fig. 2c). The guidewire was then changed to the flexible portion, and was advanced to the jejunum along with the catheter. The communication between the pancreatic duct and the jejunum was confirmed using flow contrast media (Fig. 2d). After the placement of the guidewire, we changed the EUS device to a double-balloon endoscope, which was advanced to the pancreatojejunostomy, to perform the rendezvous technique. Balloon dilation of the anastomotic site was performed using an 8-mm balloon dilator (ZARA; Century Medical, Tokyo, Japan) (Fig. 2e). A 5-Fr endoscopic nasopancreatic drainage catheter (ENPD) was placed into the main pancreatic duct through the anastomotic site (Fig. 2f). No adverse events occurred during the procedure. The patient was discharged after the removal of the ENPD. No symptoms were detected at a 6-month follow-up examination, and a CT scan showed no signs of recurrence.

**Case 2**

A 21-year-old woman underwent subtotal stomach-preserving pancreatectoduodenectomy for carcinoma of the duodenal papilla in June 2013. The tumor was classified as Stage IVb according to the TNM classification (Unio Internationalis Contra Cancrum, UICC; pT4N2M0). Although TS1 adjuvant chemotherapy was performed after surgery, the chemotherapy was changed to gemcitabine and cisplatin after 6 months due to the detection of multiple liver metastases. Imaging studies revealed that stable disease progression was maintained for approximately 2 years; however, she was referred to our hospital with pancreatitis and pancreatic leakage from the pseudocyst due to PJS in August 2015 (Fig. 3a, b). Her laboratory data showed anemia and elevated levels of pancreatic enzymes. She was admitted to our hospital due to acute pancreatitis and a ruptured pancreatic...
Figure 2. Pancreatic duct drainage using the rendezvous technique in case 1. (a) A 19-gauge needle was used to puncture the pancreatic duct. Pancreatography, with the injection of contrast medium through the 19-gauge needle revealed a dilated pancreatic duct. (b) A 0.025-inch guidewire and catheter were advanced but the guidewire and contrast medium did not reach the jejunum (arrow). (c) The rigid portion of the guidewire (arrowhead) was used to puncture the anastomotic site. (d) The guidewire and contrast medium confirmed the communication between the pancreatic duct and the jejunum. (e) After changing the EUS device to a double-balloon endoscope in order to perform the rendezvous technique, the anastomotic site was dilated using a balloon catheter (arrow). (f) A 5-Fr endoscopic nasopancreatic drainage catheter was placed into the main pancreatic duct through the anastomotic site.

Figure 3. (a) CT revealed the dilation of the main pancreatic duct (arrow). (b) CT also revealed a pseudocyst in the pancreatic body (arrowhead) due to the leakage of pancreatic juice. (c) Double-balloon endoscopy showed the membranous pancreaticojejunostomy stricture (arrow).
Figure 4. Pancreatic duct drainage using the rendezvous technique in case 2. (a) A 19-gauge needle was used to penetrate the pancreatic duct. Pancreatography with the injection of contrast medium through the 19-gauge needle revealed a dilated pancreatic duct. (b) A 0.025-inch guidewire and catheter were inserted, but the guidewire and contrast medium did not reach the jejunum (arrow). (c) The rigid portion of the guidewire (arrowhead) was punctured through the anastomotic site. (d) The passing of the guidewire and contrast medium confirmed the communication between the pancreatic duct and the jejunum. (e) After changing the EUS device to a double-balloon endoscope for the rendezvous technique, the anastomotic site was dilated using a balloon catheter (arrow). (f) A 5-Fr endoscopic nasopancreatic drainage catheter was placed into the main pancreatic duct through the anastomotic site.

Discussion

Pancreaticoduodenectomy is a complex, high-risk surgical procedure. While the rate of perioperative mortality has been decreasing, the rate of overall morbidity remains high (40%) in Japanese nationwide surveys (10). In addition to the major short-term complications, including bile leakage, anastomotic leakage, and pancreatic fistula, late complications, such as PJS, affect the prognosis (11). If conservative treatment is ineffective, percutaneous drainage or repeated surgery should be selected for the treatment of PJS. Secondary surgeries for PJS include two-layer duct-to-mucosa anastomosis (5-8), lateral pancreaticojejunostomy (5-8), and the dunking method (8). Although 26-78% of patients experience the resolution of abdominal symptoms after the resolution of PJS (5-8), in many cases, it is not possible to

pseudo-cyst. Double balloon endoscopy (DBE) was initially attempted to treat the PJS; however, it failed because of a membranous obstruction (Fig. 3c). After obtaining informed consent, the pancreatic duct was detected using a curved linear EUS device from the stomach was and punctured using a 19-gauge needle (Expect™ 19ga Flex Needle; Boston Scientific Japan) (Fig. 4a). We carefully advanced a 0.025-inch guidewire (VisiGlide2; Olympus Medical Systems) and the catheter to the anastomotic site (Fig. 4b). However, the guidewire and contrast medium could not pass the anastomotic site due to the presence of a severe stricture. We punctured the anastomotic site using the rigid portion of the guidewire, which enabled the guidewire to pass through (Fig. 4c). The guidewire was then reversed to the flexible portion, and advanced along with the catheter to the jejunum. The communication of the pancreatic duct with the jejunum was confirmed using contrast medium (Fig. 4d). To perform the rendezvous technique, we changed the endoscope from a curved linear EUS device to a double-balloon endoscope after placement and inserted the guidewire in the pancreateojejunostomy. Balloon dilation of the anastomotic site was performed using a 6-mm balloon dilator (ZARA; Century Medical) (Fig. 4e) and a 6-Fr ENPD was placed into the main pancreatic duct through the dilated anastomotic site (Fig. 4f). No adverse events occurred during the procedure. The patient was discharged 2 weeks after the procedure without any symptoms. No symptoms were detected at a 6-month follow-up examination and no signs of recurrence were observed on CT.
achieve technical success without recurrence (6, 12).

The success rate of the endoscopic treatment of PJS re-
 mains low (13-15) because of the excessive length of the a-
 ferent limb, which disturbs the advancement of a con-
 ventional endoscope to the site of pancreaticojejunal anastomo-
 sis. Although DBE has been shown to improve the success
 rate of endoscopic retrograde cholangiopancreatography for
 postoperative pancreaticoduodenectomy (Fig. 5a) and Roux-
 en-Y patients (16-22), several factors remain, including diffi-
culties in detecting the anastomotic site and intubation of
 the catheter due to stenosis (23). Recently, EUS-guided in-
terventions have been developed and used for patients with
dilated pancreatic ducts. These interventions (Fig. 5b) are
categorized into drainage and rendezvous techniques (24). In
the drainage technique, a stent is placed in the pancreatic
duct between the pancreatic duct and stomach through pan-
creaticogastrostomy by an antegrade approach (Fig. 5c).
This technique requires the stent to be regularly exchanged
in order to avoid stent obstruction or migration (25, 26). In
the rendezvous technique, a stent is placed in the pancreatic
duct using a retrograde approach with a guidewire inserted
using the EUS-fine needle aspiration (FNA) method
(Fig. 5d). The rendezvous technique has the advantage of
being a radical treatment. However, in cases of severe PJS,
the guidewire cannot pass through the anastomotic site,
which hinders the use of this technique (25). In the present
cases, we wanted to use the rendezvous technique to dilate
the PJS. To accomplish this, we punctured the PJS from the
pancreatic duct to the jejunum using the rigid part of a
guidewire (Fig. 5e). This technique is associated with sev-
eral risks, including perforation of the jejunum and bleeding
due to vessel puncture. To avoid these risks, we performed
DBE to confirm the state of the PJS as a membrane-like
scar before these procedures. A new plastic stent designed
for PJS using EUS-guided pancreatic duct drainage was re-
cently reported (27). This stent is positioned in the jejunum
by an antegrade approach. However, stent placement by an
antegrade approach through the pancreatojejunostomy is as-
associated with a risk of perforation or bleeding because it is
impossible to confirm the site of pancreatojejunostomy. The
rendezvous technique in these cases was beneficial as it en-
abled to confirm the state of the pancreatojejunostomy after
passing the guidewire through the puncture that was made
using the rigid portion of the guidewire. Furthermore, this
method does not necessitate the exchange of the stent and
can achieve radical treatment. In the future, this procedure
may be an alternative treatment for severe PJS or stricture of
choledochojjunostomy.

The authors state that they have no Conflict of Interest (COI).

References

1. Balcom JH 4th, Rattner DW, Warshaw AL, Chang Y, Fernan-
dez-del Castillo C. Ten-year experience with 733 pancreatic
resections: changing indications, older patients, and decreasing
length of hospitalization. Arch Surg 136: 391-398, 2001.
2. Yeo CJ, Cameron JL, Sohn TA, et al. Six hundred fifty consecu-
tive pancreaticoduodenectomies in the 1990s: pathology, complica-
tions, and outcomes. Ann Surg 226: 248-260, 1997.
3. Cameron JL, Riall TS, Coleman J, Belcher KA. One thousand
consecutive pancreaticoduodenectomies. Ann Surg 244: 10-15,
2006.
4. Adams DB. The pancreatic anastomosis: the danger of a leak,
which anastomotic technique is better? J Gastroint Surg 13:
1182-1183, 2009.
5. Cioffi JL, McDuffie LA, Roch AM, et al. Pancreaticojunostomy stenosis after pancreatoduodenectomy: outcomes after operative revision. J Gastrointest Surg 20: 293-299, 2016.
6. Demirjian AN, Kent TS, Callery MP, Vollmer CM. The inconsistent nature of symptomatic pancreatico-jejunostomy anastomotic strictures. HPB 12: 482-487, 2010.
7. Reid-Lombardo KM, Ramos-De la Medina, Thomsen K, Harmesen WS, Farnell MB. Long-term anastomotic complications after pancreatoduodenectomy for benign diseases. J Gastrointest Surg 11: 1704-1711, 2007.
8. Morgan KA, Fontenot BB, Harvey NR, Adams DB. Revision of anastomotic stenosis after pancreatic head resection for chronic pancreatitis: is it futile? HPB 12: 211-216, 2010.
9. Katanuma A, Yane K, Kin T, et al. EUS-guided pancreatic drainage for anastomotic obstruction in patients with surgically altered anatomy. Suizo (J Jpn Panc Soc) 30: 183-190, 2015 (in Japanese, Abstract in English).
10. Kimura W, Miyata H, Gotoh M, et al. A pancreatoduodenectomy risk model derived from 8575 cases from a national single-race population (Japanese) using a web-based data entry system: the 30-day and in-hospital mortality rates for pancreatoduodenectomy. Ann Surg 259: 773-780, 2014.
11. Yamaguchi K, Tanaka M, Chijiwa K, Nagakawa T, Inamura M, Takada T. Early and late complications of pylorus-preserving pancreatoduodenectomy in Japan 1998. J Hepatobiliary Pancreat Surg 6: 303-311, 1999.
12. Mucci-Hennekinne S, Brachet D, Clouston H, Pessaux P, Hamy A, Arnaud JP. Management of a stenotic pancreatico-digestive tract anastomosis following pancreatoduodenectomy. J Hepatobiliary Pancreat Surg 14: 514-517, 2007.
13. Chahal P, Baron TH, Topazian MD, Petersen BT, Levy MJ, Gostout CJ. Endoscopic retrograde cholangiopancreatography in post-Whipple patients. Endoscopy 38: 1241-1245, 2006.
14. Kinney TP, Li R, Gupta K, et al. Therapeutic pancreatic endoscopy after Whipple resection requires rendezvous access. Endoscopy 41: 898-901, 2009.
15. Farrel J, Carr-Locke D, Garrido T, Ruymann F, Shields S, Saltzman J. Endoscopic retrograde cholangiopancreatography after pancreatoduodenectomy for benign and malignant disease: Indications and technical outcomes. Endoscopy 38: 1246-1249, 2006.
16. Shah RJ, Smolkin M, Yen R, et al. A multicenter US experience of single-balloon, double-balloon, and rotational overtube-assisted enteroscopy ERCP in patients with surgically altered pancreaticobiliary anatomy (with video). Gastrointest Endosc 77: 593-600, 2013.
17. Kawamura T, Mandai K, Uno K, Yasuda K. Does single-balloon enteroscopy contribute to successful endoscopic retrograde cholangiopancreatography in patients with surgically altered gastrointestinal anatomy? ISRN Gastroenterol 2013: 214958, 2013.
18. Siddiqui AA, Chaaya A, Shelton C, et al. Utility of the short double-balloon enteroscope to perform pancreaticobiliary interventions in patients with surgically altered anatomy in a US multicenter study. Dig Dis Sci 58: 858-864, 2013.
19. Yamauchi H, Kida M, Okuwaki K, et al. Short-type single balloon enteroscope for endoscopic retrograde cholangiopancreatography with altered gastrointestinal anatomy. World J Gastroenterol 19: 1728-1735, 2013.
20. Itokawa F, Itoi T, Ishii K, Sofuni A, Moriyasu F. Single- and double-balloon enteroscopy-assisted endoscopic retrograde cholangiopancreatography in patients with Roux-en-Y plus hepaticojejunostomy anastomosis and Whipple resection. Dig Endosc 26: S136-S143, 2014.
21. Katanuma A, Isayama H. Current status of endoscopic retrograde cholangiopancreatography in patients with surgically altered anatomy in Japan: questionnaire survey and important discussion points at Endoscopic Forum Japan 2013. Dig Endosc 26: S109-S115, 2014.
22. Shimatani M, Matsushima M, Takaoka M, et al. Effective “short” double-balloon enteroscope for diagnostic and therapeutic ERCP in patients with altered gastrointestinal anatomy: a large case series. Endoscopy 41: 849-854, 2009.
23. Katanuma A, Yane K, Osanai M, Maguchi H. Endoscopic retrograde cholangiopancreatography in patients with surgically altered anatomy using balloon-assisted enteroscope. Clin J Gastroenterol 7: 283-289, 2014.
24. Itoi T, Kasuya K, Sofuni A, et al. Endoscopic ultrasonography-guided pancreatic duct access: techniques and literature review of pancreatography, transmural drainage and rendezvous techniques. Digestive Endosc 25: 241-252, 2013.
25. Chapman CG, Waxman I, Siddiqui UD. Endoscopic ultrasound (EUS)-guided pancreatic duct drainage: the basics of when and how to perform EUS-guided pancreatic duct interventions. Clin Endosc 49: 161-167, 2016.
26. Fujii LL, Topazian MD, Abu Dayyeh BK, et al. EUS-guided pancreatic duct intervention: outcomes of a single tertiary-care referral center experience. Gastrointest Endosc 78: 854-864, 2013.
27. Itoi T, Sofuni A, Tsuchiya T, et al. Initial evaluation of a new plastic pancreatic duct stent for endoscopic ultrasonography-guided placement. Endoscopy 47: 462-465, 2015.

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