

Salvage anastomosis for postoperative chronic pancreatic fistula

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Received: 11 February 2016 / Accepted: 15 July 2016 / Published online: 13 August 2016
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Abstract Salvage anastomosis for postoperative chronic pancreatic fistula is challenging, and its safety and surgical outcomes remain unclear. Four patients with postoperative chronic pancreatic fistulas who underwent surgical interventions in our institute were retrospectively reviewed. A re-pancreatojejunostomy was performed in two patients with a disruption of the pancreatojejunostomy and a dilated main pancreatic duct of the remnant pancreas. A fistulojejunostomy was performed in the remaining two patients with a duct disruption after necrosectomy for necrotic severe acute pancreatitis and non-dilated main pancreatic duct. The median duration from the onset of the pancreatic fistula to the surgical intervention was 4.5 months (range 4–6 months). The median operation time was 151 min (range 38–257 min) and the median blood loss was 200 mL (range 5–350 mL). According to the Clavien–Dindo classification, one patient had grade 0, two patients had grade I, and one patient had grade II (wound infections). The median length of hospital stay was 22 days (range 21–28 days). There were no recurrences of pancreatic fistulas. Salvage anastomosis according to the simple radiologic classification for postoperative chronic pancreatic fistulas is a safe and effective procedure.

Keywords Pancreatic fistula · Surgical management · Fistulojejunostomy · Pancreatojejunostomy

Introduction

Postoperative pancreatic fistula is the leading complication after pancreatic resection and is associated with an increased length of hospital stay and socioeconomic burden. Pancreatic fistulas are managed primarily through conservative treatment. However, when medical or endoscopic interventions fail to resolve pancreatic fistulas, surgical management remains the only viable treatment option [1–8]. Although there are a limited number of cases, we encounter postoperative chronic pancreatic fistulas (POCPFs) as a result of the complete dehiscence of the pancreatocenteric anastomosis or disruption of the main pancreatic duct. Salvage anastomosis (fistulojejunostomy or pancreatojejunostomy) for POCPF is challenging, and its safety and surgical outcomes remain unclear.

Herein, we report our experiences with this difficult anastomosis depending on the radiologic classification and discuss its feasibility and clinical efficacy.

Methods

Between January 2003 and July 2014, 530 patients underwent a pancreatic resection at Ogaki Municipal Hospital. A total of 328 patients (61.9 %) underwent a pancreatojejunostomy after pancreatoduodenectomy (PD), including pylorus-preserving PD and subtotal stomach-preserving PD and hepato-pancreatoduodenectomy (HPD; $n = 28$). Additionally, 168 patients (31.7 %) underwent a distal pancreatectomy (DP). Two patients (0.4 %) underwent a necrosectomy for acute necrotizing pancreatitis. The remaining 32 patients (6.0 %) underwent a partial pancreatectomy.

Patients with postoperative pancreatic fistulas received standard treatment (i.e., effective drainage, antibiotic

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Table 1 Patients' characteristics

Case	Age	Sex	Primary disease	Previous surgery	Main pancreatic duct of the remnant pancreas
1	65	Male	Gallbladder carcinoma	Hepato-ligament pancreatoduodenectomy	Dilation
2	45	Female	Recurrence of colon cancer after right hemicolectomy with PPPD	Jejunal limb resection and pancreatojejunostomy	Dilation
3	26	Female	Acute necrotizing pancreatitis	Necrosectomy	No dilation
4	76	Male	Acute necrotizing pancreatitis	Necrosectomy	No dilation

PPPD pylorus-preserving pancreatoduodenectomy

treatment, and parenteral nutrition). POCPPF was defined as a refractory pancreatic fistula that was present for 4 months or longer and determined to have a surgical indication. Four patients with POCPPFs underwent surgical interventions after radiological classification with/without a dilated main pancreatic duct of the remnant pancreas. The previous surgery of the four patients included an HPD for gallbladder carcinoma ($n = 1$), a jejunal limb resection and pancreatojejunostomy for the recurrence of colon cancer after a right hemicolectomy with PPPD ($n = 1$), and a necrosectomy for acute necrotizing pancreatitis ($n = 2$) (Table 1). According to a radiological workup (i.e., CT, MRI, and fistulography), a re-pancreatojejunostomy was planned in the patients with a disruption of the pancreatojejunostomy and a dilated main pancreatic duct of the remnant pancreas. However, a fistulojejunostomy was planned in the patients with a duct disruption after necrosectomy for necrotic severe acute pancreatitis and a non-dilated main pancreatic duct of the remnant pancreas.

Re-pancreatojejunostomy

The patients were explored via the midline laparotomy. The fistula tract with the previous drain was identified with the surrounding fibrous tissue. The drain was removed and the fistula tract was divided. The dilated main pancreatic duct was identified through intraoperative ultrasonography and incised by a minimum resection of the pancreas. The pancreatojejunostomy was performed using the jejunal limb or Roux-en-Y type of technique (Fig. 1). Duct-to-mucosa anastomosis of the pancreatic duct and jejunal mucosa was performed using absorbable interrupted sutures followed by a seromuscular envelope for end-to-side pancreatojejunostomy using non-absorbable interrupted penetrating sutures.

Fistulojejunostomy

The patients were explored via midline laparotomy. The fistula tract was identified with the surrounding fibrous tissue and isolated under the guidance of the previous drain. The fistula tract was transected as close as possible to the pancreas. The fistulojejunostomy was performed

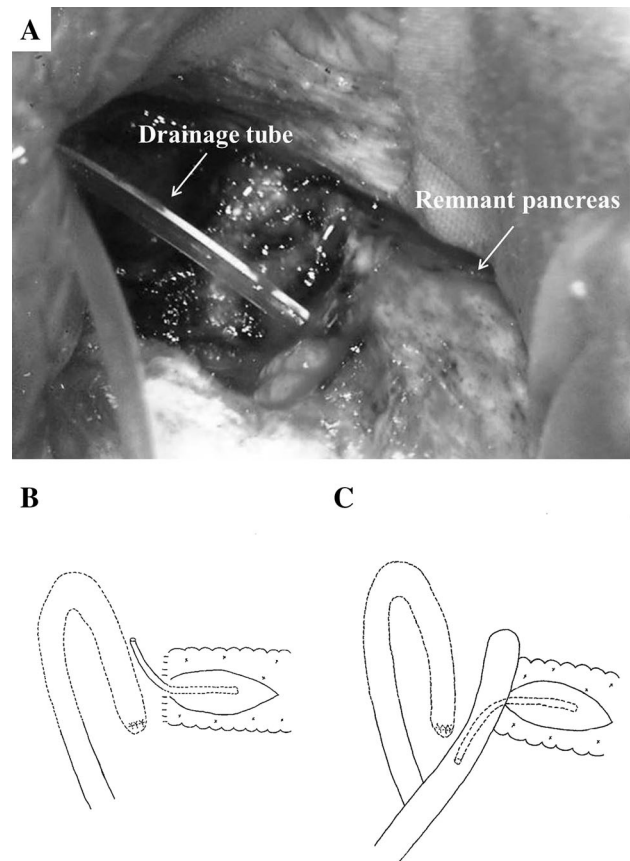


Fig. 1 A case of a dilated main pancreatic duct (case 2). **a, b** The fistula tract was identified and divided. A dilated main pancreatic duct was incised by the minimum resection of the pancreas. **c** A pancreatojejunostomy was performed

using the Roux-en-Y type technique (Fig. 2). The fistula tract and jejunum were anastomosed in an end-to-side fashion using absorbable interrupted sutures.

Results

Overall, the incidence of postoperative pancreatic fistula (\geq Clavien–Dindo classification grade IIIa) was 16.3 % (87/530), and POCPPF was 0.8 % (4/530) after the

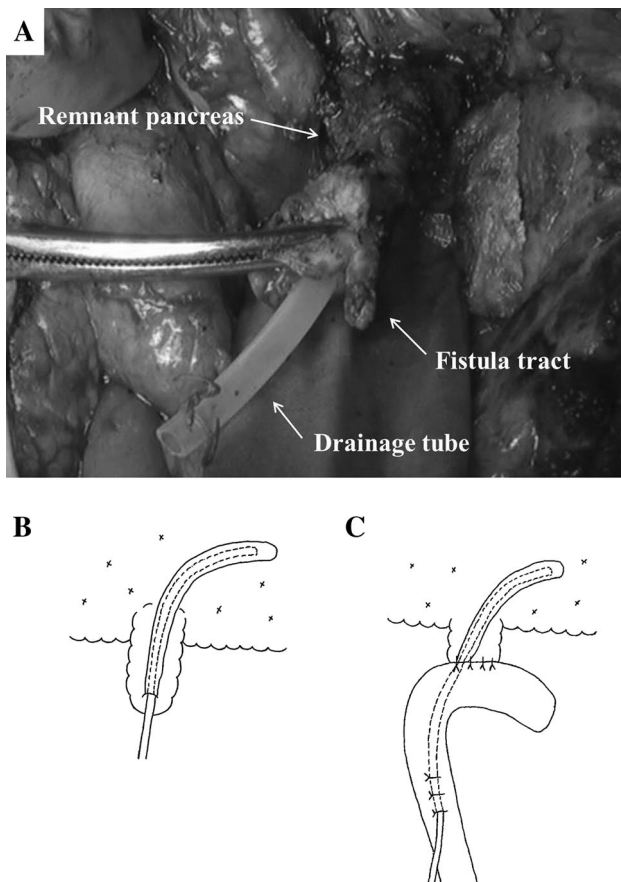


Fig. 2 A case of a non-dilated main pancreatic duct (case 3). **a, b** The fistula tract was identified and transected as close as possible to the pancreas. **c** A fistulojejunostomy was performed

pancreatic resection. The rate of POCPF on postoperative pancreatic fistula was 4.6 % (4/87). A re-pancreatojejunostomy was performed in two patients with a dilated main pancreatic duct of the remnant pancreas (Roux-en-Y, $n = 1$; using the jejunal limb, $n = 1$), and a fistulojejunostomy was performed in the remaining two patients after a necrosectomy without a dilated main pancreatic duct of the remnant pancreas (Table 2). External pancreatic stent was inserted for three patients (cases 1, 3, 4) and the lost stent was inserted for one patient (case 2). The median duration from the onset of the pancreatic fistula to the surgical intervention was 4.5 months (range 4–6 months). The median operative time was 151 min (range 38–257 min) and the median blood loss was 200 mL (range 5–350 mL). According to the Clavien–Dindo classification, one patient had grade 0, two patients had grade I, and one patient had grade II (wound infections). According to our institutional policy, external pancreatic stent removal in patients with POCPF was on postoperative day 21, during hospitalization. Therefore, the median length of hospital stay after surgery was 22 days (range 21–28 days). The median follow-up period was 103 months (range

5–116 months). There was no recurrence of pancreatic fistulas, pancreatitis, or any other delayed complication due to a leakage or stenosis of the anastomosis.

Discussion

Despite the improvements in surgical techniques and perioperative managements, postoperative pancreatic fistula is one of the most common complications after a pancreatic resection. According to the ISGPF, pancreatic fistulas are diagnosed based on the postoperative day 3 amylase levels in fluid collection. Pancreatic fistulas are managed primarily through conservative treatment (i.e., effective drainage, antibiotic treatment, parenteral nutrition, and octreotide). However, patients with a high output pancreatic leak and signs of severe sepsis or hemorrhage that cannot be managed by other methods should undergo surgical interventions. Regardless of the grade of ISGPF, many cases can be cured through conservative treatment or endoscopic/surgical interventions. However, in some cases, we encounter POCPFs as a result of the complete dehiscence of the pancreaticoenteric anastomosis or disruption of the main pancreatic duct. The other one, necrosectomy for necrotic severe acute pancreatitis, can damage the main pancreatic duct, and disrupt the communication between the distal remnant of the main pancreatic duct and the gastrointestinal tract. The distal remnant pancreas is an isolated pancreatic segment draining only into the fistula, and internal drainage or resection is required to close the fistula. In this series, the incidence of POCPF was only 0.8 % after a pancreatic resection. In addition, POCPF (more than 4 months of the chronic condition) is less likely to lead to a fatal condition, such as sepsis, through abdominal abscesses and intra-abdominal hemorrhages from ruptured aneurysms. However, POCPF can lead to prolonged hospitalization, increasing costs of medical treatment, inefficiency of pancreatic exocrine functioning, and a worsening quality of life.

The management of POCPF comprises various procedures, such as endoscopic treatment, radiological interventions, and surgery (e.g., fistulojejunostomy and pancreatojejunostomy). During the early postoperative period, a completion remnant pancreatectomy was reported to manage uncontrolled pancreatic fistula and has been associated with high mortality in some series [1]. Moreover, there are concerns regarding impaired pancreatic exocrine/endocrine functioning after a completion remnant pancreatectomy. Completion remnant pancreatectomy is a procedure considered only in case of emergency life-threatening conditions. Therefore, it is not adequate in case of POCPF. Recently, several authors have demonstrated the safety of re-pancreatojejunostomy for POCPF after PD

Table 2 Surgical outcome

Case	Duration of POCPP (months)	Surgery			Postoperative complication ^a	Postoperative hospital stay (days)
		Procedure (reconstruction)	Time (min)	Blood loss (mL)		
1	5	Re-pancreatojejunostomy (Roux-en-Y)	257	350	0	21
2	4	Re-pancreatojejunostomy (jejunal limb)	146	300	I	28
3	4	Fistulojejunostomy (Roux-en-Y)	156	100	I	21
4	6	Fistulojejunostomy (Roux-en-Y)	38	5	II	22

POCPP postoperative chronic pancreatic fistula

^a According to Dindo–Clavien system

Table 3 Pancreatojejunostomy and fistulojejunostomy for chronic pancreatic fistula, review of literature

Authors	Procedure (n)	Time to operation (month) ^a	Complications (n)	Mortality (n)
Paye et al. [2]	Pancreatojejunostomy (7)	4.3 (3–8)	Intra-abdominal abscess (1) Extensive mesenteric ischemia (1)	1
Horvath et al. [3]	Pancreatojejunostomy (7)	5.6 (3.7–8.1)	Insufficiency of the jejunal loop close to the biliary anastomosis (1)	0
Bassi et al. [5]	Fistulojejunostomy (17)	2 (1–5)	Acute pancreatitis (1) Pancreatic fistula (1) Biliary fistula (1) Enteric fistula (1)	0
Howard et al. [4]	Fistulojejunostomy (13)	6.1	Bleeding (1) Ventral hernia (1) Pneumonia (1) Wound infection (2)	1
Shibuya et al. [6]	Fistulojejunostomy (2)	9 (5–13)	Wound dehiscence (1)	0
Nair et al. [7]	Fistulojejunostomy (8)	5.5 (4–7)	Infected fluid collection (2) Wound infection (1)	0

^a Mean (range)

[2, 3]. We also demonstrated the effect of a re-pancreatojejunostomy in two patients with POCPP, resulting in acceptable morbidity and no recurrence of pancreatic fistulas. In contrast, previous studies have evaluated the effect of a fistulojejunostomy for refractory pancreatic fistulas [4–7] (Table 3). This procedure uses the fistula tract that develops around a percutaneous drain and does not require the exposure of the remnant pancreatic tissue. Bassi et al. reported that external pancreatic fistulas resistant to medical therapy in 17 patients were surgically corrected by a fistulojejunostomy [5]. There were four postoperative complications reported (23 %), including one persistent fistula. Thus, whether the best surgical management for POCPP is a fistulojejunostomy or a pancreatojejunostomy remains unclear.

Shibuya et al. reported on a subcutaneous fistulojejunostomy in two patients with intractable pancreatic fistulas [6]. However, compared with conventional

procedures, this method may have the potential risk of anastomotic stenosis because of the long remnant fistula tract. In general, the fistula tract must be dissected as close to the pancreas as possible. In our series, according to a radiological workup, a re-pancreatojejunostomy was planned in patients with a dilated main pancreatic duct of the remnant pancreas. Re-pancreatojejunostomy was technically more demanding and risky than fistulojejunostomy, since it needed the isolation and section of the pancreatic stump. However, duct-to-mucosa anastomosis was not so difficult in patients with a dilated main pancreatic duct of the remnant pancreas. The fistula tract consisted of granulation tissue and had no epithelium. Therefore, there is a potential risk to make a cicatricial stenosis, when a fistulojejunostomy was performed. For this reason, we performed re-pancreatojejunostomy as a first choice procedure of salvage anastomosis in patients with a dilated main pancreatic duct of the remnant pancreas. In contrast, a

fistulojejunostomy was planned in the patients without a dilated main pancreatic duct of the remnant pancreas, because the identification of the main pancreatic duct and anastomosis is not easy under the surrounding fibrous tissue. As a result, this simple radiological classification led to the safety of our salvage anastomosis for POCPPFs.

The best timing of salvage anastomosis (fistulojejunostomy or pancreatojejunostomy) is still controversial. It is necessary to wait for sufficient fibrosis of the fistula tract. Some authors recommend surgery after more than 6 months [8]. However, Bassi et al. indicated surgery within 1.5–3 months of the fistula onset [5]. In our series, the median duration from the onset of the pancreatic fistula to the surgical intervention was 4.5 months (range 4–6 months). Therefore, after at least 4 months, salvage anastomosis for POCPPF is a safe and effective procedure. Paye et al. reported that long-term endocrine function was unaltered in 66 % of patients who benefited from the salvage anastomosis for POCPPF [2]. Horvath et al. reported that no patient required specific procedures for late complication after re-pancreatojejunostomy with a mean follow-up of 64.2 months. In this study, there was no recurrence of pancreatic fistulas, pancreatitis, or any other delayed complication due to a leakage or stenosis of the salvage anastomosis with a median follow-up of 103 months.

Recently, endoscopic treatments or radiological interventions were reported as an alternative to surgery. Endoscopic treatment has been widely applied for the management of pancreatic fistulas [9]. However, in some cases, it is difficult to endoscopically treat the dehiscence of a pancreatojejunostomy. In addition, the complications of endoscopic treatment include stent migration, stent occlusion, and localized duct inflammation [9]. Some authors showed the efficacy of percutaneous radiologically guided treatment of external pancreatic fistula when catheterization of the pancreatic ducts is obtained [10]. However, this procedure is technically difficult and can be conducted in strictly selected cases. Therefore, another practical and minimally invasive approach is desirable.

In conclusion, the present study reviewed the challenges for POCPPF after a pancreatic resection. Despite the limited number of patients and the long study period because of its rarity, our results support the feasibility of salvage anastomosis, depending on the simple radiological classification, for POCPPF with acceptable morbidity. This outcome

is promising and may encourage surgeons to conduct this difficult re-operation.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflicts of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all individual participants included in the study.

References

1. Smith CD, Sarr MG, vanHeerden JA (1992) Completion pancreatectomy following pancreaticoduodenectomy: clinical experience. *World J Surg* 16(3):521–524
2. Paye F, Lupinacci RM, Kraemer A, Lescot T, Chafai N, Tired E et al (2013) Surgical treatment of severe pancreatic fistula after pancreaticoduodenectomy by wirsungostomy and repeat pancreatico-jejunal anastomosis. *Am J Surg* 206(2):194–201
3. Horvath P, Beckert S, Nadalin S, Königsrainer A, Königsrainer I (2016) Pancreas-preserving surgical management of grade-C pancreatic fistulas after pancreatic head resection by external wirsungostomy. *Langenbecks Arch Surg* 401(4):457–462
4. Howard TJ, Rhodes GJ, Selzer DJ, Sherman S, Fogel E, Lehman GA (2001) Roux-en-Y internal drainage is the best surgical option to treat patients with disconnected duct syndrome after severe acute pancreatitis. *Surgery* 130(4):714–719
5. Bassi C, Butturini G, Salvia R, Contro C, Valerio A, Falconi M et al (2000) A single-institution experience with fistulojejunostomy for external pancreatic fistulas. *Am J Surg* 179(3):203–206
6. Shibuya T, Shioya T, Kokuma M, Watanabe Y, Moriyama Y, Matsumoto K et al (2004) Cure of intractable pancreatic fistula by subcutaneous fistulojejunostomy. *J Gastroenterol* 39(2):162–167
7. Nair RR, Lowy AM, McIntyre B, Sussman JJ, Matthews JB, Ahmad SA (2007) Fistulojejunostomy for the management of refractory pancreatic fistula. *Surgery* 142(4):636–642
8. Ho HS, Frey CF (1995) Gastrointestinal and pancreatic complications associated with severe pancreatitis. *Arch Surg* 130(8):817–822
9. Kozarek RA, Ball TJ, Patterson DJ, Raltz SL, Traverso LW, Ryan JA et al (1997) Transpapillary stenting for pancreaticocutaneous fistulas. *J Gastrointest Surg* 1(4):357–361
10. Igami T, Kamiya J, Yokoyama Y, Nishio H, Ebata T, Sugawara G et al (2009) Treatment of pancreatic fistula after pancreaticoduodenectomy using a hand-made T-tube. *J Hepatobiliary Pancreat Surg* 16(5):661–667