

A Retrospective Comparative Study of Two Anastomotic Techniques for Safer Pancreaticogastrostomy: Anastomosis with and without Gastrotomy

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Summary. To determine the more reliable and safer technique for pancreaticogastrostomy (PG), we compared two anastomotic techniques: one with and the other without gastrotomy. Of 23 patients consecutively undergoing PG after surgery for periampullary disease, an anastomotic leak of PG occurred in 2 of the 8 patients with PG with gastrotomy, and in one of the 15 patients with PG without gastrotomy. Anastomotic leaks in PG with gastrotomy resulted in the overflow of massive digestive contents which led to other serious complications. Aggressive suction drainage was performed, but one patient died from intraabdominal infection and bleeding. The anastomotic leak in those patients with PG without gastrotomy did not lead to any other serious complications. Therefore, PG without gastrotomy may be a safer surgical technique than PG with gastrotomy.

Key words—pancreaticogastrostomy, anastomotic leak, periampullary disease.

INTRODUCTION

Complications related to anastomotic failure of the pancreaticoenterostomy after pancreaticoduodenectomy are common^{1,2)} and may lead to serious complications^{3,4)} such as intraabdominal bleeding and infection. Therefore, anastomotic integrity is one of the most important factors which influence short-term outcome after surgery. In order to reduce the high frequency of anastomotic leaks of the pan-

creaticojejunostomy, various procedures have been proposed: a drainage tube with a circumferential knot for a stent,^{5,6)} biologic adhesive,⁷⁾ and pancreaticogastrostomy (PG). PG has been viewed as a safer reconstructive technique with fewer postoperative complications as compared with a pancreaticojejunostomy.⁸⁻¹⁰⁾ In addition, PG has become more popular and useful since the development of the pylorus-preserving pancreaticoduodenectomy (PPPD) for the preservation of the digestive function in patients with periampullary disease.^{11,12)}

It has also been reported that more serious complications occur with an anastomotic leak of the PG if a gastrotomy is also performed, due to the large amount of digestive contents overflowing from the functional, whole stomach.¹³⁾ This method requires opening the posterior gastric wall (gastrotomy) to implant the pancreatic stump into the gastric lumen. Contrarily, Takao et al. have reported the reduced occurrence of anastomotic failure (2%) and subsequent complications with PG without gastrotomy using a pancreatic tube.¹⁴⁾ However, to our knowledge, there is no comparative study between PG with and without gastrotomy in a review of available world literature.

More reliable and safer reconstructive techniques for pancreaticoduodenectomy have led to more aggressive surgery for periampullary malignancy. The purpose of this study was to compare retrospectively these two anastomotic techniques of PG in view of their technical safety and postoperative complication; namely, PG with gastrotomy and PG without gastrotomy (schematized in Fig. 1 and 2).

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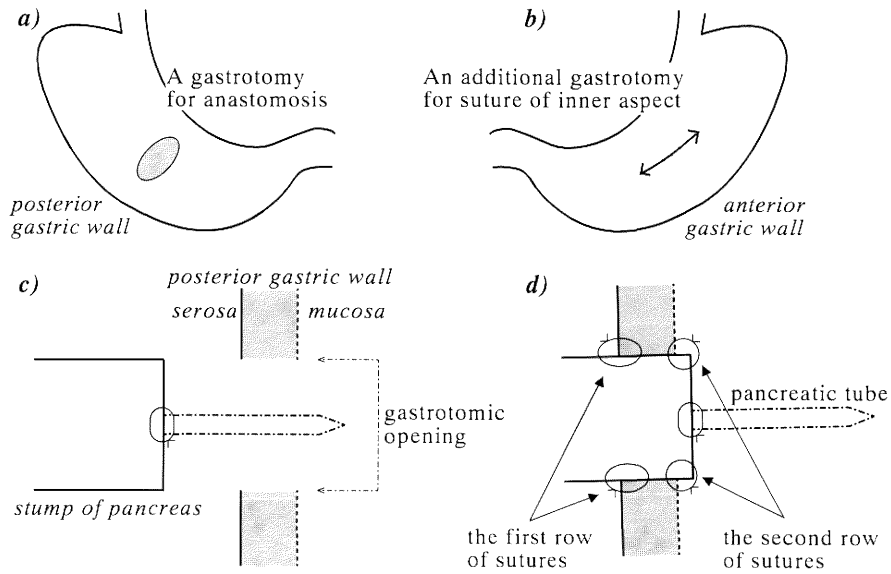


Fig. 1. Pancreaticogastrostomy with gastrostomy.

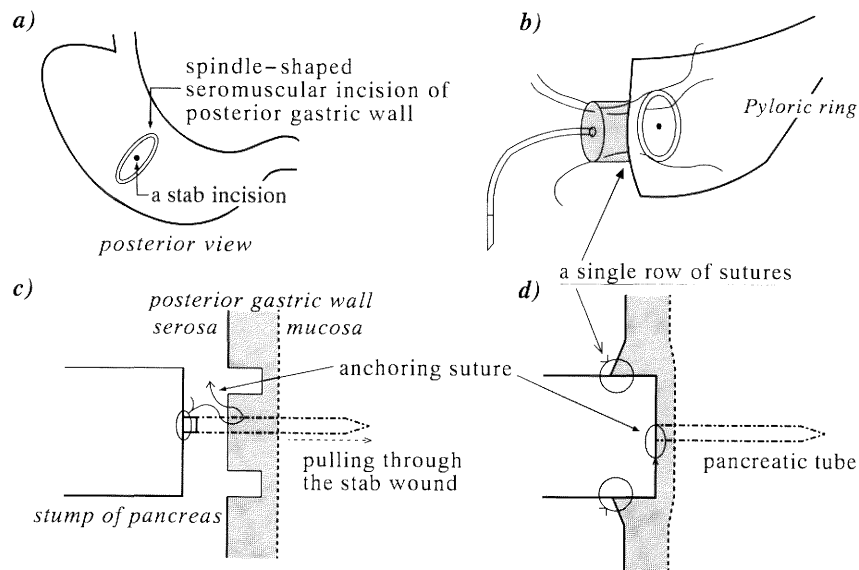


Fig. 2. Pancreaticogastrostomy without gastrostomy.

PATIENTS AND METHODS

Between April 1993 and July 1995, 23 patients consecutively underwent PG after 20 PPPDs, two pancreatic head resections (duodenum preserving) and one segmental resection of the pancreatic body, all at a single institution (Niigata Prefectural Center Hospital). The diseases and surgeries performed are listed in Table 1. Eight patients underwent PG with gastro-

tomy, and the remaining 15 patients had a PG without gastrostomy. In the PG with gastrostomy group, there were four men and four women with a mean 58 years of age, and in the PG without gastrostomy group, there were eight men and seven women with a mean 67 years of age.

The postoperative complications of the two groups classified according to reconstructive technique were retrospectively evaluated based on the relevance of the PG to the complication.

Table 1. Diseases and operations performed on 23 patients
—Pancreaticogastrostomy with gastrotomy, 8 patients—

Case	Age	Sex	Diseases	Operation	Outcome
1	76	F	MPT of pancreas body	Segmental pancreatectomy	Alive
2	37	M	Chronic pancreatitis	PPPD	Alive
3	69	F	Lower bile duct cancer	PPPD + Resection of PV	Relapse and death
4	23	F	SCT of pancreas head	DpRPH	Alive
5	64	F	Cancer of pancreas head	PPPD	Alive
6	67	M	Middle bile duct cancer	PPPD + Major hepatectomy	Relapse and death
7	59	M	Chronic pancreatitis	DpRPH	Alive
8	65	M	Middle bile duct cancer	PPPD	Operative death

—Pancreaticogastrostomy without gastrotomy, 15 patients—

9	67	M	Cancer of papilla Vater	PPPD	Alive
10	79	F	Middle bile duct cancer	PPPD	Alive
11	79	F	Cancer of pancreas head	PPPD + Resection of PV	Alive
12	64	F	Benign bile duct stricture	PPPD	Alive
13	64	M	Cancer of pancreas head	PPPD + Resection of PV	Alive
14	76	M	Lower bile duct cancer	PPPD	Alive
15	62	F	Cancer of pancreas head	PPPD	Alive
16	49	M	Cancer of papilla Vater	PPPD	Alive
17	69	M	Cancer of papilla Vater	PPPD	Alive
18	83	M	Lower bile duct cancer	PPPD	Alive
19	76	F	Cancer of pancreas head	PPPD	Relapse and death
20	39	F	Cancer of papilla Vater	PPPD	Alive
21	76	M	Cancer of pancreas head	PPPD+Resection of SMV	Alive
22	72	M	Middle bile duct cancer	PPPD	Alive
23	52	F	MPT of pancreas head	PPPD	Alive

MPT, mucin producing tumor; SCT, solid and cystic tumor; PPPD, pylorus preserving pancreaticoduodenectomy; DpRPH, duodenum preserving resection of pancreatic head; PV and SMV, portal vein and superior mesenteric vein.

Two types of PG

In all twenty-three patients, the stump of the caudal pancreas was anastomosed to the posterior wall of the intact stomach with the pyloric ring. The stump of the pancreas was closed in a fish-mouth shape with 4-0 Prolene interrupted sutures if possible, without obliterating the main pancreatic duct. The duct was freed from the surrounding pancreatic parenchyma for a length of 3 to 5 mm. A vinyl chloride tube with a circumferential knot (pancreatic tube)⁵⁾ was placed into the pancreatic duct for the drainage of pancreatic juice, and the tube was tacked to the pancreatic duct and/or pancreatic parenchyma.

A) PG with gastrotomy (Fig. 1): A transverse opening corresponding to the stump of the pancreas was

made in the posterior gastric wall (Fig. 1a) so that the stump was drawn into the opening (Fig. 1c). The first row of interrupted 4-0 Prolene sutures was placed between the anterior and posterior surface of the pancreas and the seromuscular layer of the posterior gastric wall (Fig. 1c, d). The second row of sutures was placed between the stump and the gastric mucosa from within the gastric lumen (Fig. 1d). An additional opening of 3 to 5 cm in the anterior gastric wall (Fig. 1b) allowed direct visualization of the anastomotic site. The pancreatic tube with its sharp metallic tip was pulled out through the anterior gastric wall. Thus, implantation of the entire stump of the pancreas into the posterior gastric wall was completed (Fig. 1d).

B) PG without gastrotomy (Fig. 2): First, a spindle-shaped incision corresponding to the stump of the

Table 2. Postoperative courses in the 23 patients: Frequencies of anastomotic leakages, duration of drainage, and other complications
—Pancreaticogastrostomy with gastrostomy—

Case	Anastomotic leakage			Period of drainage	Complications unrelated to anastomotic leak of PG
	P-G	B-J	D-J		
1	(-)	/	/	15 days	DGE (Delayed gastric emptying)
2	(-)	(-)	(-)	23	
3	(-)	(-)	(-)	32	DGE
4	(-)	/	/	9	DGE
5	(-)	(-)	(-)	63	DGE/Cholangitis/Liver abscess* Acute renal failure**
6	(+)	(-)	(-)	47	
7	(-)	/	/	63	DGE/intraabdominal infection
8	(+)	(-)	(-)		
2/8 (25%)			Mean 36 days		

—Pancreaticogastrostomy without gastrostomy—

9	(-)	(-)	(-)	47 days	DGE (Delayed gastric emptying)
10	(+)	(-)	(-)	88	DGE
11	(-)	(-)	(-)	36	
12	(-)	(-)	(-)	28	
13	(-)	(-)	(-)	39	
14	(-)	(-)	(-)	26	Liver abscess*
15	(-)	(-)	(-)	19	
16	(-)	(-)	(-)	25	Liver abscess***/DGE
17	(-)	(-)	(-)	24	DGE
18	(-)	(-)	(-)	23	DGE
19	(-)	(-)	(-)	19	DGE
20	(-)	(-)	(-)	24	Catheter infection
21	(-)	(-)	(-)	19	
22	(-)	(+)	(-)	39	
23	(-)	(-)	(-)	31	Wound infection, DGE
1/15 (7%)			Mean 33 days		

P-G, Pancreatico-Gastrostomy; B-J, Hepatico-Jejunostomy; D-J, Duodeno-Jejunostomy; *, percutaneous transhepatic abscess drainage; **, hemodialysis; ***, antibiotics only.

pancreas was made on the serosa of the posterior gastric wall (Fig. 2a). This incision was limited to the muscle layer of the stomach (Fig. 2c). In addition, a small stab incision with a spindle shape was made in the island of the intact serosa (Fig. 2a) in order to place the pancreatic tube into the gastric lumen (Fig. 2c). The anastomosis was composed of two procedures: first, a single row of sutures on the outer aspect of the posterior gastric wall, (Fig. 2b, d) and then fixation of the main pancreatic duct to the gastric wall with an anchoring suture (Fig. 2c, d). If the main pancreatic duct was dilated to more than 4 mm in diameter, the duct was directly anastomosed to the gastric wall with a few interrupted absorbable

sutures. The stump of the remnant pancreas was well approximated to the dent on the posterior gastric wall (Fig. 2d).

RESULTS

Complications related to the PG (Table 2)

In two of the 8 patients reconstructed by PG with gastrostomy, anastomotic leaks occurred within seven days after surgery. These leaks led to the overflow of a massive amount of digestive contents with pancreatic juice from the preserved whole stomach, and a

diffuse intraabdominal infection in the upper abdominal cavity. Aggressive suction drainage of both the upper abdominal cavity and the stomach was initiated. One patient (No. 8 in Table 2) who underwent PPPD for lower bile duct carcinoma with lymph node metastases died of acute hepatic failure, following massive, repeated intraabdominal bleedings from multiple pseudoaneurysms of the common and hepatic artery. The bleeding was successfully controlled by the transarterial embolization with coils. In the remaining one (No. 6 in Table 2) who underwent PPPD with major hepatectomy for advanced carcinoma of the bile duct, a chronic fistula was developed and successfully treated with aggressive suction drainage; the fistula was closed in approximately two months.

Of the 15 patients reconstructed by PG without gastrotomy, only one (No. 10 in Table 2) developed an anastomotic leak on the 26th day after surgery, which was due to accidental obliteration of the pancreatic tube. The pancreatic tube became nonfunctional when the patient changed position and inadvertently turned the cock of the tube. Fifty to 100 ml/day of pure pancreatic juice containing no digestive contents drained through a fistula from the anastomotic site to the upper midline wound, with no other complication following. The amount of exudate gradually declined and the fistula spontaneously closed two months after surgery while the patient was an outpatient. No pancreatic juice or digestive contents were detected in the drain discharge in the remaining 14 patients.

Although there were no significant differences between the frequency of the anastomotic leak of PG with gastrotomy and without gastrotomy, consequent complications were more critical in the PG with gastrotomy group than in the PG without gastrotomy group.

The pancreatic tubes were removed four to six weeks after surgery in all surviving patients.

Complications unrelated to the PG (Table 2)

In the twenty patients who underwent PPPD, there was no anastomotic leak of the duodenojejunostomy, and the one anastomotic leak of the hepaticojejunostomy was spontaneously closed within two weeks. Delayed gastric emptying developed in five of seven patients who underwent PG with gastrotomy and seven of the 15 patients who underwent PG without gastrotomy, with no significant differences. Liver abscess occurred in three patients. Two patients required percutaneous transhepatic drainage of the abscess and the remaining patient was managed

conservatively with antibiotics.

Clinical course of patients after hospital discharge

Three patients with carcinoma of the bile duct or pancreas head died of recurrent the disease. Nineteen patients were alive as of this writing without any signs of recurrent disease or pancreatic insufficiency. In the follow-up period, two patients with carcinoma of the pancreatic head, who underwent aggressive lymph-node dissection around the superior mesenteric artery, complained of intractable diarrhea.

DISCUSSION

It has often been reported^{2,8,15-19}) that PG is a simpler and more secure technique than pancreaticojejunostomy. There are several advantages to PG: anatomic proximity between the caudal pancreas and the posterior gastric wall; technical ease of suturing a solid structure (remnant pancreas) to the lumen of a larger thick-walled hollow organ (stomach); no distortion of the contour of the digestive tract; an acid environment free from activated pancreatic enzymes; and shortened operative time. Two types of anastomotic technique for PG have been reported: implantation with gastrotomy^{2,8,13,15,18-20}) and without gastrotomy.^{9,14,17,21}) PG without gastrotomy is divided into two subtypes: the pancreatic duct to gastric mucosa anastomosis with or without a pancreatic stent^{17,21}) and anastomosis using a pancreatic tube without a duct to gastric mucosa sutures.¹⁴) Since the duct to the mucosa anastomosis is difficult with a nondilated pancreatic duct, we performed the anastomosis in patients with a dilated main pancreatic duct over 3-4 mm in diameter, using the pancreatic tube as a stent in every patient. The anastomotic technique described by Takao et al.¹⁴) using a pancreatic tube without gastrotomy with an anchoring suture between the pancreatic duct and gastric mucosa for continuity is similar to our anastomotic technique. Takao emphasized the safety of this anastomosis because of the low rate of anastomotic leak; in his report, only one patient (N=46) developed a leak due to traumatic removal of the pancreatic tube. No clinical comparative study, however, has been reported between a PG with gastrotomy and without gastrotomy.

Our study clearly demonstrates that anastomotic leaks with PG with gastrotomy may result in serious complications. Although low rates of anastomotic leaks have been reported,^{2,8,16,17}) a large amount of digestive contents from the whole stomach preserved by PPPD may spill diffusely into the upper abdominal

cavity when anastomotic leak does occur.¹³⁾ Recently PPPD has been recommended for malignant diseases of the periampullary region,¹²⁾ and so that skeletonized major vessels may be exposed to the potential massive digestive-fluid leak, resulting in significant intraabdominal infection and bleeding. In this regard, an anastomotic leak of PG without gastrotomy, from which only pure pancreatic juice with no digestive contents is discharged, was not followed by any other serious complications. On the other hand, it has been reported that the majority of complications after PPPD have occurred in patients with malignant disease.¹⁴⁾ Also in our series, all three leaks of PG took place in patients who underwent aggressive lymphadenectomy for advanced bile duct cancer. From the technical view point, PG without gastrotomy does not require an additional gastrotomy of the anterior gastric wall and is performed with only a single row of interrupted sutures between the stump of the pancreas and the posterior gastric wall.

With regard to an anastomotic leak of PG without gastrotomy, careless use of the draining extension tube with a cock was a contributory cause of the anastomotic leak in this patient. Such a cock should be avoided in cases of total drainage of pancreatic juice.

CONCLUSION

The anastomotic leak of pancreaticogastrostomy with gastrotomy may lead to serious intraabdominal infection and bleeding because of a large amount of overflowing digestive contents. From the view point of the severity in early postoperative complications, pancreaticogastrostomy without gastrotomy is a simpler and more secure technique than pancreaticogastrostomy with gastrotomy for accomplishing aggressive surgery.

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