

ORIGINAL ARTICLE

Duct-to-mucosa pancreaticojejunostomies with a hard pancreas and dilated pancreatic duct and duct-to-mucosa pancreaticojejunostomies with a soft pancreas and non-dilated duct

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*Department of Surgery, Bell Land General Hospital, Sakai City, Osaka, Japan***Abstract**

Background. We performed duct-to-mucosa pancreaticojejunostomy with resection of jejunal serosa in 55 patients, and here compare the clinical results between duct-to-mucosa pancreaticojejunostomies with a non-dilated pancreatic duct and those with a dilated duct. **Patients and methods.** In the period 1999 to 2005, 55 patients (27 F, 28 M; mean age 63.4 years) underwent duct-to-mucosa pancreaticojejunostomy with resection of jejunal serosa. A non-dilated pancreatic duct was observed in 29 patients in group A and a dilated pancreatic duct in 26 patients in group B. Clinical characteristics (age, gender, benign or malignant condition, presence of diabetes mellitus, anastomotic time) were analyzed in both groups and postoperative complications were compared between groups. **Results.** In a comparison of clinical characteristics, all factors were similar between groups. In group A, the postoperative complication occurred in 4 (wound infection in 2, pulmonary embolism in 1, gastric ulcer in 1) of 29 patients (13.8%), and in group B in 1 (pneumothorax) of 26 patients (3.8%). No pancreatic leakage was observed in either group. The difference between group A and group B in the rate of postoperative complication was not statistically significant. **Conclusions.** There was no statistical difference in the rate of postoperative complications, including pancreatic leakage, between duct-to-mucosa pancreaticojejunostomies with a dilated pancreatic duct and those with a non-dilated duct. We consider that the diameter of the pancreatic duct is irrelevant to results of duct-to-mucosa pancreaticojejunostomy.

Key Words: *Pancreatic surgery, duct-to-mucosa anastomosis, pancreatic leakage*

Introduction

Pancreaticoduodenectomy is the standard surgical procedure for resecting pancreatic and periampullary neoplasms. Thanks to technical improvements in recent years, the mortality rate of pancreaticoduodenectomy has dropped below 5% [1–3]. However, pancreatic anastomotic leakage after pancreaticoduodenectomy remains a major troublesome complication. Pancreatic leakage often results in significant morbidity and mortality. Moreover, it is widely accepted that pancreatic anastomotic leakage is more likely to occur in a patient with a soft pancreas and non-dilated pancreatic duct than in a patient with a hard pancreas and a dilated duct. In this study, we compare between the clinical results of duct-to-mucosa pancreaticojejunostomy with a non-dilated pancreatic duct and duct-to-mucosa pancreaticojejunostomy with a dilated duct.

Patients and methods

In the period January 1999 to December 2005, 55 patients underwent duct-to-mucosa pancreaticojejunostomy (27 F and 28 M; mean age 63.4 years (63.4 ± 10.4, range 33–80)). A non-dilated pancreatic duct was seen in 29 patients in group A and a dilated pancreatic duct in 26 patients in group B. The diseases in groups A and B are indicated in Table I and the surgical procedures of both groups in Table II. Postoperative complications were compared between groups and clinical characteristics (age, gender, benign, or malignant condition, presence of diabetes mellitus, anastomotic time) were analyzed. Diagnosis of the pancreatic leakage was defined from the following findings: the level of amylase in the discharge fluid more than three times the serum level of amylase on the 7th day after operation, or the level of amylase more than 1000 IU/l on the 7th day after

Table I. Disease of the patients who underwent duct-to-mucosa pancreaticojejunostomy.

Disease	P-duct dilation (≥ 3 mm)	
	(+n=26)	(-n=29)
Carcinoma of the pancreas head	21	0
Carcinoma of the Vater papilla	0	7
Carcinoma of the lower bile duct	0	6
Carcinoma of the duodenum	0	5
Carcinoma of the gallbladder	0	3
Intraductal papillary mucinous adenocarcinoma of the pancreas head	2	0
Intraductal papillary mucinous adenoma of the pancreas head	2	2
Tumor-forming pancreatitis	1	1
Carcinoma of the stomach	0	1
Carcinoma of the ascending colon	0	1
Islet cell tumor of the pancreas head	0	1
Duodenal GIST (gastrointestinal stromal tumor)	0	1
Serous cyst adenoma	0	1

surgery. All procedures were performed by the same surgeon using the same technique, same approach and same anastomotic fashion in order to avoid technical bias.

Surgical procedure of duct-to-mucosa pancreaticojejunostomy

The pancreas was sharply transected with a scalpel on a schedule line in pancreaticoduodenectomy. The jejunal serosa was resected a little smaller than the size of the pancreatic stump, and mucosa of jejunum was exposed at the anastomotic point (Figure 1). Serosa resection was thought to promote vascularization and enhance the anastomotic healing process [4]. The dorsal parts of the jejunal seromuscular layer and of the pancreatic capsular parenchyma of the stump were sutured to leave no dead space. Anastomosis between pancreatic duct and jejunal mucosa was then carried out (Figure 2) and a stent tube was inserted into the main pancreatic duct for luminal decompression. The ventral part of both the jejunal seromuscular layer and the pancreatic capsular parenchyma of the stump was sutured (Figure 3).

Table II. Operative procedure of the patients (n=55).

	P-duct dilation	
	(+n=26)	(-n=29)
PD	8	6
SSPPD	12	10
PPPD	4	8
DPPHR	1	4
PHRSD	0	1
SP	1	0

PD = Pancreaticoduodenectomy, PPPD = pylorus preserving pancreaticoduodenectomy, SSPPD = subtotal stomach preserving pancreaticoduodenectomy, DPPHR = duodenum preserving pancreas head resection, PHRSD = pancreas head resection with second portion duodenectomy, SP = segmental pancreatectomy.

Statistical analysis

Continuous variables were reported as the mean \pm standard deviation and compared using the Mann-Whitney U-test. Categorical variables were compared using the Fisher test. A two-sided *p*-value < 0.05 was considered statistically significant.

Results

When comparing clinical characteristics (age, gender, benign or malignant condition, presence of diabetes mellitus, anastomotic time), no difference was observed statistically between groups A and B (Table III). In group A, the postoperative wound infection occurred in 2 of 29 patients (6.9%), the postoperative gastric ulcer with bleeding in 1 of 29 patients (3.4%), and the postoperative pulmonary embolism in 1 of 29 patients (3.4%). In group B, the postoperative pneumothorax was observed in 1 of 26 patients. Moreover, pancreatic anastomotic leakage, which was the most common complication for pancreatic head resection,

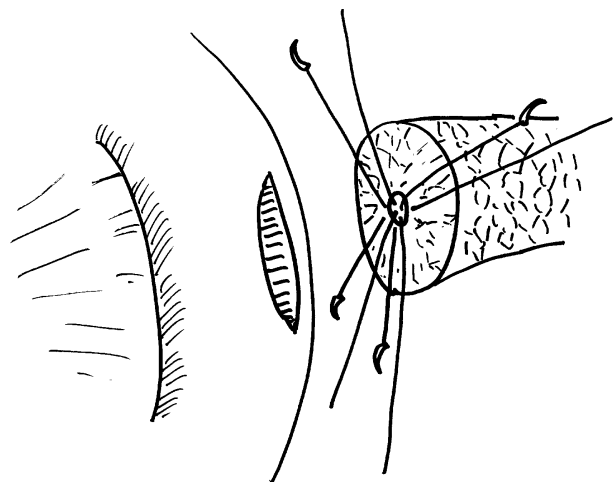


Figure 1. The jejunal serosa was resected at the anastomotic point.

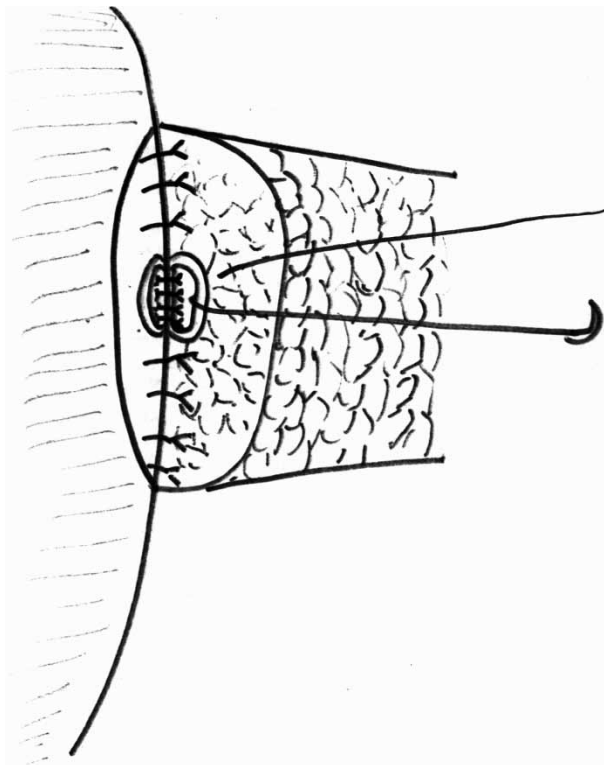


Figure 2. The anastomosis between the posterior wall of the pancreatic duct and the jejunal mucosa was done.

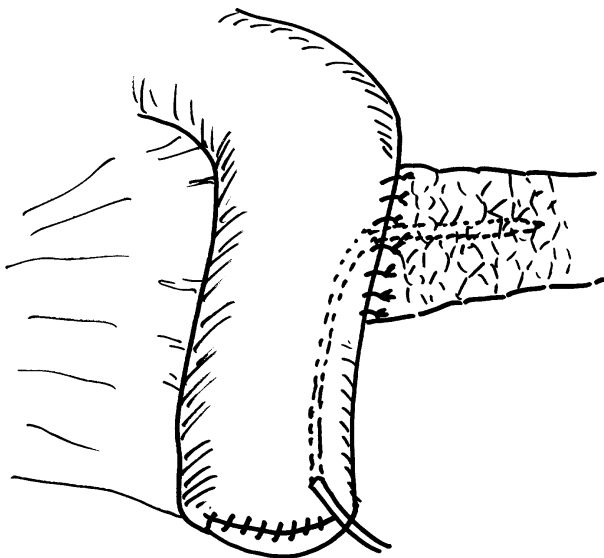


Figure 3. Silicon tube for decompression of pancreatic juice and the completion of the duct-to-mucosa anastomosis.

was not observed in either group. There was no statistical difference in the rate of postoperative complications between groups A and B (Table IV).

Discussion

Pancreaticoduodenectomy has become increasingly safe as a result of continuous technical improvement over the years. However, pancreatic anastomotic leakage remains a major troublesome complication of pancreaticoduodenectomy. The incidence of pancreatic leakage has been reported as ranging between 6% and 24%. Pancreatic anastomotic leakage, with subsequent intra-abdominal abscess, bleeding, and sepsis, remains the major factor of death and complications [5–10]. It has been accepted that a soft pancreas and a non-dilated pancreatic duct make pancreatic anastomosis difficult to perform. Yeo et al. reported that there is a strong association between pancreatic texture and pancreatic leakage [11]. In reviewing 161 patients who underwent pancreaticoduodenectomy, Hosotani et al. reported a pancreatic fistula rate of 11% (17/161), recognizing that the pancreatic anastomotic technique, pancreatic texture, and pancreatic duct size were risk factors for pancreatic leakage after pancreaticoduodenectomy [12].

Tani et al. reported that soft pancreas was a higher risk factor than hard pancreas [13], and Mercuc et al. that male sex was a significant factor predisposing pancreatic leakage [14]. In the study by Yeh et al., jaundice, creatinine clearance abnormality, and intra-operative blood loss were identified as significant risk factors for pancreatic leakage [15]. Matsusue et al. reported that advanced age (over 70 years) was an adverse factor for leakage [16]. Based on the accumulated evidence so far, conclusion might not be easily drawn to estimate a risk factor for pancreatic leakage, since the anastomotic leakage rate is highly related to the operative technique and experience of the surgeon. In this study, a comparison between duct-to-mucosa pancreaticojejunostomies with a soft pancreas and a non-dilated pancreatic duct and duct-to-mucosa pancreaticojejunostomies with a hard pancreas and a dilated duct was performed with respect to anastomotic leakage and other postoperative complications. As for the results of pancreatic anastomotic

Table III. Comparison of demographics and clinical characteristics in patients with a dilated P-duct and patients with a non-dilated duct.

	Patients with a dilated P-duct (n=26)	Patients with a non-dilated duct (n=29)	p-value
Age (years)	63.7 ± 6.9	64.5 ± 12.4	0.8
Gender (M/F)	13/13	15/14	0.9
Benign/malignant	3/23	4/25	0.8
DM (yes/no)	5/21	7/22	0.7
Anastomotic time (mm)	21.0 ± 4.2	23.7 ± 6.3	0.2

Table IV. Comparison of complications in patients with a dilated P-duct and patients with a non-dilated duct.

	Patients with P-duct dilatation	Patients with P-duct non-dilatation	<i>p</i> -value
Wound infection	0	2	
Pneumothorax	1	0	
Gastric ulcer with bleeding	0	1	
Pulmonary embolism	0	1	
Pancreatic leakage	0	0	
Total	1 (/26)	4 (/29)	0.2

Pancreatic leakage: the level of amylase in the discharge fluid more than 1000 IU/l on 7th day after surgery.

leakage, no differences were observed between either group. Regardless of the diameter of the pancreatic duct, duct-to-mucosa pancreaticojejunostomy was recommended since maturation of the surgical technique decreases the risk of pancreatic anastomotic leakage.

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