World J. Surg. 26, 99–104, 2002
DOI: 10.1007/s00268-001-0188-z

WORLD
Journal of
SURGERY

Duct-to-mucosa Pancreaticojejunostomy Reduces the Risk of Pancreatic Leakage after Pancreatoduodenectomy

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Published Online: November 26, 2001

Abstract. The aim of this retrospective study was to analyze the risk factors for pancreatic anastomotic leakage after pancreatoduodenectomy (PD) and to determine whether duct-to-mucosa pancreaticojejunostomy is superior to the total external tube drainage technique. Between 1990 and 1999, 161 patients underwent PD with end-to-side pancreaticojejunostomy at our institution. Fourteen preoperative and ten intraoperative risk factors for pancreaticojejunal anastomotic leakage were analyzed. Pancreaticojejunal anastomotic leakage was identified in 11% (17/161) of the patients. No preoperative parameters were found to have a significant association with the risk of pancreatic leakage. Three intraoperative parameters were identified as significant by means of univariate analysis: anastomotic technique, pancreatic duct size and texture of the remnant pancreas. A duct-to-mucosa pancreaticojejunostomy with total external tube drainage (3% vs. 15%, $p = 0.018$). A pancreas without duct dilatation of soft pancreas was more likely to develop pancreatic leakage than one with duct dilatation or atrophy. A multivariate analysis revealed that only anastomotic technique turned out to be an independent risk factor (Odds ratio: 4.15, CI: 1.1–27.4). Sub-analysis of patients with soft pancreas and non-dilated pancreatic duct further supported the finding that the duct-to-mucosa pancreaticojejunostomy technique is safer for patients at high risk. Results indicate that the status of the remnant pancreas and the pancreaticojejunostomy technique are the substantial risk factors for pancreatic leakage after pancreatoduodenecomy. Duct-to-mucosa pancreaticojejunostomy might well be the procedure of choice.

Pancreatoduodenectomy (PD) is an established surgical procedure in the treatment of malignant and benign diseases of the pancreas and periampullary region. Mortality after pancreatoduodenectomy has been declining dramatically in centers with experienced surgeons and is now reportedly between 0 and 5% [1–10]. Morbidity is still high, however, and varies from 32% to 52% [2, 4, 6, 8]. The most frequent complication is leakage of the pancreatic-enteric anastomosis. Many risk factors previously shown to predispose to pancreatic leakage after PD include advanced age, prolonged operation time, major blood loss, jaundice, soft pancreatic parenchyma, small pancreatic duct, and number of patients per surgeon [6, 11–15]. Most frequently reported were soft pancreatic parenchyma and number of patients per surgeon [14, 15]; however, no definite factor has yet been identified. Various reconstruction methods were developed to diminish pancreatic leakage, such as end-to-end pancreaticojejunostomy, end-to-side pancreaticojejunostomy, pancreaticogastrostomy, the ligation and obliteration method, and their modifications. Several authors have compared the incidence of pancreatic leakage with the type of reconstruction, but they were unable to find any distinct differences among the techniques, which seems to suggest that none is perfect [14, 16]. A duct-to-mucosa pancreaticojejunostomy has been recommended for a dilated pancreatic duct, but a soft pancreas might be better managed by an end-to-end dunking pancreaticojejunostomy or a pancreaticogastrostomy [16]. Reconstruction strategy and the relevance to risk factors remain controversial.

We have previously reported a safe reconstruction procedure after pylorus-preserving PD consisting of an end-to-side pancreaticojejunostomy in conjunction with the total external tube drainage technique [17]. The technique offers complete exteriorization of the pancreatic juice for two to three weeks after the operation, which is thought to minimize the chance of leakage, particularly for soft pancreas. The duct-to-mucosa anastomosis is a theoretically superior anastomotic technique, and if it is performed carefully, it can be used for any size duct and any consistency of pancreas. The aim of this retrospective study was to analyze the perioperative risk factors for pancreatic anastomotic leakage and to determine whether duct-to-mucosa pancreaticojejunostomy is superior to the total external tube drainage technique.

Patients and Methods

Between January 1990 and December 1999, 164 consecutive patients underwent PD at the Department of Surgery and Surgical Basic Science, Kyoto University, Kyoto, Japan, for a variety of indications (Table 1). End-to-side pancreaticojejunostomy was used for reconstruction in most of the patients, except for one patient with pancreatogastrostomy. Two patients died shortly after surgery because of acute heart failure and were excluded. A net total of 161 patients were thus enrolled in this retrospective study.

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Table 1. Indications for pancreatoduodenectomy.

	No. of patients	Surgery		
		PpPD	PD	HPD
Pancreatic ductal adenocarcinoma	65	22	43	0
Cystic malignancy of the pancreas	16	14	2	0
Endocrine tumor of the pancreas	8	4	4	0
Ampullary carcinoma	17	15	2	0
Bile duct carcinoma	15	12	3	0
Gallbladder carcinoma	8	0	0	8
Other malignant disease	8	2	3	3
Chronic pancreatitis	15	10	4	1
Benign tumor of the pancreas	9	8	1	0
Total	161	87	62	12

PpPD: pylorus-preserving pancreatoduodenectomy; PD: pancreatoduodenectomy; HPD: PD or PpPD with hepatic resection.

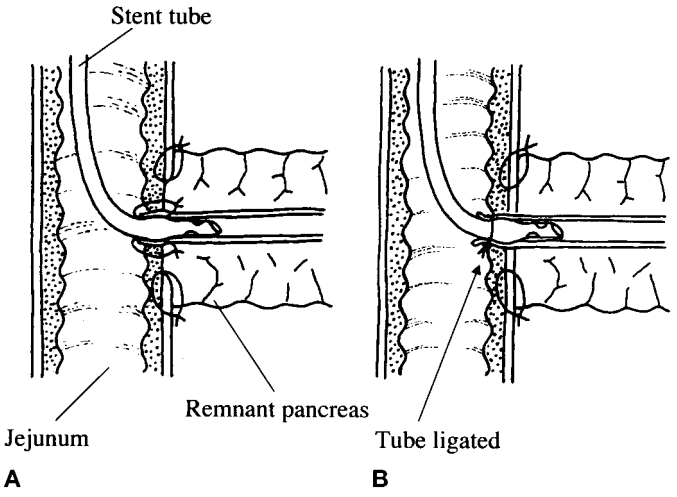

Fig. 1. End-to-side pancreaticojejunostomy with duct-to-mucosa anastomosis (**A**) and with total external tube drainage (**B**).

Surgical Techniques

Pylorus-preserving PD (PpPD) was performed for 87 patients, standard PD for 62 patients, and PD or PpPD with simultaneous hepatic resection for 12 patients (Table 1). Pancreatic resection in patients with ductal adenocarcinoma of the pancreas was routinely accompanied by an extended lymphadenectomy and an extrapancreatic nerve plexus resection; resection of the portal or superior mesenteric vein was performed when necessary [18].

End-to-side pancreaticojejunostomy was performed with either the duct-to-mucosa anastomosis technique or the total external tube drainage technique. For duct-to-mucosa anastomosis, interrupted suture was performed in eight to twelve stitches with 5-0 Prolene, and was followed by a 4-0 Prolene suture for approximating the pancreatic parenchyma to the jejunal seromuscular layer. A pancreatic duct stent tube was inserted transiently (Fig. 1A). For total external tube drainage, a stent tube was cannulated into the pancreatic duct and ligated, and pancreaticojejunostomy was performed by approximating the pancreatic parenchyma to the jejunal seromuscular layer with 4-0 Prolene. The tube was then pulled through the jejunum or the stomach and extruded outside the body, so that the pancreatic juice was totally drained until the tube could be removed 3 weeks after the operation (Fig. 1B). Selection of the anastomotic technique was previously based on the diameter of the pancreatic duct, with total external tube drainage being used for a non-dilated pancreatic duct and duct-to-mucosa anastomosis for a dilated duct; however, since 1997, the duct-to-mucosa anastomosis technique has been preferred regardless of the diameter of the pancreatic duct.

Reconstruction was completed with end-to-side hepaticojejunostomy and end-to-end or end-to-side gastrojejunostomy or duodenojejunostomy. The order of reconstruction in which the pancreas, bile duct, and stomach or duodenum were anastomosed to the jejunum varied according to the surgeon's preference. To conclude the reconstruction, two Silastic sump drains with irrigation were placed near the biliary and pancreatic anastomoses.

Data Recorded

Medical charts were retrieved and the following preoperative and intraoperative data were collected.

Preoperative Data. The following data were collected: Age; gender; American Society of Anesthesiologists physical status score (ASA score); presence or absence of jaundice and preoperative biliary drainage; cholangitis; preoperative parenteral nutrition; preoperative values for serum albumin, total bilirubin, hemoglobin, white blood cell count, creatinine, creatinine clearance, and oral glucose tolerance test; and preoperative radiation therapy.

Intraoperative Data. The following data were collected: Operative time; blood loss; blood transfusion; type of resection; anastomotic technique of pancreaticojejunostomy; reconstruction arrangement; diameter of the pancreatic duct; texture of the remnant pancreas; number of patients per surgeon; and intraoperative radiation therapy. Diameter of the pancreatic duct was measured with a preoperative imaging technique, such as endoscopic retrograde cholangiopancreatography (ERCP), ultrasound (US), and magnetic resonance cholangiopancreatography (MRCP). Texture of the remnant pancreas was defined as soft or hard in terms of the operative findings, and borderline or intermediate consistency was classified as "soft pancreas."

Treatment of pancreatojejunal anastomotic leakage and other major surgical complications was also recorded. Histologic diagnosis was confirmed by the pathologists.

Study Design and Statistical Analysis

The primary study end point was pancreaticojejunal anastomotic leakage, defined as (1) discharge from the peripancreatic drain with an amylase concentration of more than 1000 IU/ml at postoperative day 7 or (2) radiographic demonstration by fistulography or cholangiogrpahy. From 1993, amylase concentration in the drainage exudate was routinely monitored after pancreaticojejunostomy, but in the early cases in the series, amylase concentration was measured only when anastomotic leakage was suspected. Thirty-seven patients (23%) who had not undergone amylase measurement were clinically diagnosed as fistula-free.

Patients were divided into two groups according to the abovementioned criteria: those who had developed postoperative pancreaticojejunal anastomotic leakage and those who had not. Factors with the potential to affect the incidence of pancreaticojejunal anastomotic leakage comprised 14 preoperative and 10 intraoperative clinical factors. The two groups were first compared by using the standard univariate statistical tests, Student's *t*-test or

Table 2. Preoperative risk factors for pancreatic leakage.

	Leakage group (n = 17)	Nonleakage group (n = 144)	p-value
Age (years)	60.1 ± 3.5	61.1 ± 1.0	NS
Gender			NS
Male	9 (10)	78 (90)	
Female	8 (11)	66 (89)	
History of jaundice			NS
Yes	6 (8)	62 (92)	
No	11 (12)	79 (88)	
Parenteral nutrition			NS
With	1 (4)	27 (96)	
Without	16 (12)	114 (88)	
Preoperative radiation			NS
With	0 (0)	13 (100)	
Without	17 (12)	131 (89)	
ASA score			NS
I	7 (24)	22 (76)	
II	8 (8)	88 (92)	
III	0 (0)	12 (100)	
IV or E	1 (17)	5 (83)	
Laboratory values			
White blood cell (1000/mm^3)	5.4 ± 03	5.3 ± 0.2	NS
Hemoglobin (g/dL)	12.0 ± 0.4	11.9 ± 0.2	NS
Albumin (g/dL)	4.0 ± 0.1	4.0 ± 0.0	NS
Total bilirubin (mg/dL)	1.5 ± 0.6	1.3 ± 0.1	NS
Creatinine (mg/dL)	0.7 ± 0.0	0.6 ± 0.0	NS
Creatinine clearance (ml/min)	89.9 ± 12.7	83.4 ± 3.4	NS
Oral glucose tolerance test			NS
Diabetic	5 (7)	67 (93)	
Normal	8 (14)	51 (86)	
Pathology			NS
Pancreatic ductal adenocarcinoma	7 (11)	58 (89)	
Cystic malignancy of the pancreas	2 (12)	14 (88)	
Endocrine tumor of the pancreas	0 (0)	8 (100)	
Ampullary carcinoma	4 (24)	13 (76)	
Bile duct carcinoma	0 (0)	15 (100)	
Gall bladder carcinoma	3 (37)	5 (63)	
Other malignant disease	0 (0)	8 (100)	
Chronic pancreatitis	0 (0)	15 (100)	
Benign tumor of the pancreas	1 (11)	8 (89)	

Values in parentheses are percentages. ASA: American Society of Anesthesiologists.

Table 3. Intraoperative risk factors for pancreatic leakage.

	Leakage group (n = 17)	Nonleakage group (n = 144)	p-value
Type of resection			NS
PpPD	9 (10)	78 (90)	
PD	5 (8)	57 (92)	
HPD	3 (25)	9 (75)	
Reconstruction[a]			NS
Type I	1 (7)	13 (93)	
Type II	2 (20)	8 (80)	
Type III	13 (11)	109 (89)	
Type IV	0 (0)	7 (100)	
Anastomotic technique			0.018
Duct-to-mucosa	2 (3)	60 (97)	
Total tube drainage	15 (15)	84 (85)	
Pancreatic duct size (mm)			0.011
≥ 3	4 (5)	82 (95)	
< 3	13 (17)	62 (83)	
Pancreatic texture			0.049
Hard	2 (4)	48 (96)	
Soft	15 (14)	96 (86)	
Intraoperative radiation			NS
With	3 (9)	29 (91)	
Without	14 (11)	115 (89)	
Number of patients per surgeon			NS
101	11 (11)	90 (89)	
44	5 (11)	39 (89)	
8	0 (0)	8 (100)	
5	1 (20)	4 (80)	
3	0 (0)	3 (100)	
Operative time and blood			
Operative time (hours)	8.9 ± 0.4	8.6 ± 0.2	NS
Blood loss (ml)	1879 ± 314	1645 ± 100	NS
Blood transfusion			NS
With	10 (13)	65 (87)	
Without	7 (8)	75 (92)	

Values in parentheses are percentages.
[a]Reconstruction: demonstrated according to the Japan Pancreas Society (JPS) pancreatic cancer classification.

cross-tabulation with the chi-square test or Fisher's exact test, when applicable. Logistic regression was then used to determine the effect of multiple factors on pancreatic leakage. Data are expressed as means ± standard error of the mean. A p-value less than 0.05 was considered statistically significant. All confidence levels were at the 95% level. All statistical computations were done with the SAS personal computer package.

Results

Incidence

Of the 161 patients who underwent pancreaticojejunostomy, 17 (11%) were identified as having leakage from the pancreaticojejunostomy. Other major postoperative complications were leakage from hepaticojejunostomy (11 patients), delayed gastric emptying (8 patients), ascending cholangitis (6 patients), pulmonary complications (6 patients), liver abscess (5 patients), and abdominal bleeding (4 patients). Overall surgical morbidity was 34% (54/161). Four patients died of abdominal bleeding, two of liver abscess, and one of liver failure. The hospital mortality in this series was 4.3% (7/161).

Risk Factors

Preoperative risk factors were compared for patients with and without pancreatic leakage (Table 2). Patient age, gender, ASA score, preoperative laboratory data, and history of jaundice, parenteral nutrition, and preoperative radiotherapy were similar for the two patient groups. Sixty-six patients received preoperative biliary drainage, and severity and duration of preoperative jaundice were not different for the two groups. Patients with ampullary carcinoma or gallbladder carcinoma showed a higher incidence of pancreatic leakage than those with pancreatic duct adenocarcinoma; however, neither univariate logistic regression analysis nor the chi-square test found any statistical differences on the basis of pathology of the tumor.

Although no preoperative parameters were significantly associated with pancreatic leakage, three intraoperative risk factors were found to be significant: anastomotic technique, pancreatic duct size, and texture of the remnant pancreas (Table 3). Type of resection, reconstruction arrangement, intraoperative radiation, number of patients per surgeon, operative time, and blood loss

Table 4. Logistic regression analysis for pancreatic leakage.

	Univariate analysis			Multivariate analysis		
Parameters	*p*-value	Odds ratio	CI	*p*-value	Odds ratio	CI
Anastomotic technique						
Duct-to-mucosa	—	1		—	1	
Total tube drainage	0.030	5.36	1.4–34.8	0.07	4.15	1.1–27.4
Pancreatic duct size (mm)						
≥ 3	—	1			1	
< 3	0.014	4.30	1.4–15.8	0.143	3.21	0.8–21.5
Pancreatic texture						
Hard	—	1		—	1	
Soft	0.087	3.75	1.1–24.4	0.893	1.15	0.1–10.1

CI: 95% confidence intervals.

Table 5. Pancreatic leakage and anastomotic technique in patients at high risk.

	Leakage	Nonleakage	*p*-value
Pancreas without duct dilatation ($n = 75$)			NS
Duct-to-mucosa anastomosis	1 (5)	19 (95)	
Total tube drainage	12 (22)	43 (78)	
Soft pancreas ($n = 111$)			0.035
Duct-to-mucosa anastomosis	1 (3)	33 (97)	
Total tube drainage	14 (18)	63 (82)	

Values in parentheses are percentages.

were similar for the two patient groups. The incidence of pancreatic leakage in patients with duct-to-mucosal anastomosis was 3%, and in those with total tube drainage it was 15%; in patients with a pancreatic duct size greater than 3 mm it was 5%, and in those with ducts smaller than 3 mm it was 17%. In patients with a hard pancreas pancreatic leakage was 4%, and in those with a soft pancreas it was 14%.

These three factors affecting leakage were further analyzed by univariate and multivariate logistic regression models for nominal response (Table 4). By univariate analysis, the respective odds ratios for patients with total tube drainage, without pancreatic duct dilatation, and with a soft pancreas were 5.36, 4.30, and 3.75 in comparison with their counterparts. These three factors were identified as significant predictors of pancreatic leakage. By multivariate analysis, anastomotic technique was the strongest and most independent risk factor (Odds ratio: 4.15, CI: 1.1–27.4).

To determine the effect of anastomotic technique on pancreatic leakage in patients at high risk, a sub-analysis was performed (Table 5). Among the 75 patients with a non-dilated pancreatic duct, the incidence of pancreatic leakage with duct-to-mucosa anastomosis was 5% and with total external tube drainage technique 22%. Among the 111 patients with a soft pancreas, the corresponding incidences were 3% and 18% ($p = 0.035$).

Treatment of Leakage

Of the 17 patients who developed pancreatic leakage, 11 were diagnosed on the basis of amylase concentration in the drainage exudate, and 6 were diagnosed on the basis of both amylase determination and radiography. Relaparotomy was necessary for 2 patients for the management of pancreatic leakage, and percutaneous drainage was added in the cases of 2 patients who peripancreatic drains were not effective; however, conservative treatment was successful in 13 patients. Octreotide was not used routinely before or after surgery, but it was administered to 2 patients who developed pancreatic fistulas. No deaths in this series were directly related to pancreatic leakage.

Discussion

Pancreaticojejunal anastomotic leakage after pancreaticojejunostomy was identified in 11% (17/161) of the patients in this study. The incidence of the leakage reported in the literature varies widely from 0 to 25% [2–4, 6, 7, 10, 11, 14, 15, 19, 20]. Pancreatoduodenectomy is a standard surgical procedure for periampullary malignancies, such as pancreatic ductal adenocarcinoma, endocrine tumor of the pancreas, cystic malignancy of the pancreas, ampullary carcinoma, and terminal bile duct carcinoma. Although their efficacy has not yet been proven, several procedures have been added in our institution to the standard pancreatic resection in an attempt to reduce post-resection recurrence in patients with advanced ductal adenocarcinoma. Extended dissection of the para-aortic lymph nodes and extra-pancreatic nerve plexus was routinely performed, and preoperative and/or intraopertive radiation therapy was employed for selected patients [18, 21]. Pancreatoduodenectomy was also applied to gallbladder carcinomas that had invaded the duodenum or metastasized to the lymph nodes around the pancreas, and simultaneous resection of the liver was performed in case of direct invasion of the carcinoma to the adjacent liver. These extended resections or additional radiation therapy might increase the incidence of pancreaticojejunal anastomotic leakage when compared to the incidence with standard PD or PpPD for low-grade malignancies.

In this study we have systematically analyzed 24 known or unknown parameters. Any preoperative factors were not significantly associated with the risk of pancreatic leakage, but three intraoperative parameters were significant: anastomotic technique, pancreatic duct size, and texture of the remnant pancreas. Duct-to-mucosa pancreaticojejunostomy was less likely to be associated with pancreatic leakage then pancreaticojejunostomy with total external tube drainage. A pancreas without duct dilatation or a soft pancreas was more likely to develop pancreatic leakage than one with duct dilatation or atrophy. Multivariate analysis revealed that only anastomotic technique turned out to be an independent risk factor. Sub-analysis of patients with soft

pancreas and non-dilated pancreatic duct further supported that the duct-to-mucosa pancreaticojejunostomy technique is safer for patients at high risk.

Relations of the incidence of pancreatic leakage to the type of anastomotic technique have been investigated by various authors. Several of these observed that the choice of either end-to-end pancreaticojejunostomy or end-to-side anastomosis did not influence the incidence of leakage [16]. Pancreaticogastrostomy was expected to be a safer form of anastomosis, but has been demonstrated to be equal to pancreaticojejunostomy [14]. We previously reported a technique involving end-to-side pancreaticojejunostomy with total external tube drainage, and other surgeons have described similar methods [17, 22–25]. The technique was expected to reduce the incidence of leakage because the pancreatic juice was completely drained out of the body; however, this hypothesis was statistically refuted in this study.

Mortality rates after pancreatic leakage are reported to be high [3, 7, 11–13, 15]. Fortunately, there was no death directly related to pancreaticojejunal anastomotic leakage in this series. One patient who had progressed to profound liver dysfunction and severe pulmonary infection died after PD with simultaneous resection of the liver. This patient also showed pancreatic leakage 7 days postoperatively, but the leak closed spontaneously. Most of the patients with pancreatic leakage in our series were treated conservatively: only maintenance of the drain, and suction and irrigation of the drain as necessary; nothing was administered orally and total parenteral nutrition was provided. Several randomized trials have shown that adjuvant perioperative use of octreotide reduces the incidence of complications after PD [26–29]. Although it has not yet been proven, this somatostatin analogue might well become the drug of choice to facilitate the closure of pancreatic fistula.

In conclusion, the status of the remnant pancreas and the pancreaticojejunostomy technique are the two major risk factors for pancreatic leakage after pancreaticoduodenectomy. Duct-to-mucosa pancreaticojejunostomy might well be the procedure of choice. A standardized technique and delicate handling of the pancreas minimize the incidence of leakage.

Résumé. Le but de cette étude rétrospective a été d'analyser les facteurs de risque de fistule anastomotique après duodénopancréatectomie céphalique (DPC) et de déterminer si l'anastomose pancréaticojejunale par anastomose entre le canal de Wirsung et la muqueuse jéjunale était supérieure à l'intubation avec drainage externe total. Entre 1990 et 1999, 161 patients ont eu une DPC avec anastomose pancréaticojéjunale termino-latérale dans notre institution. Quatorze facteurs de risque préopératoires et dix facteurs peropératoires pour fistule pancréaticojéjunale ont été analysés. On a mis en évidence une fistule pancréaticojéjunale chez 11% (17/161) des patients. Aucun des paramètres préopératoires était significativement corrélés au risque de fistule pancréatique. Trois variables peropératoires ont été identifiées en analyse univariée: la technique d'anastomose, la taille du Wirsung et la consistance du parenchyme du moignon de pancréas restant. Le taux de fistule d'une anastomose pancréaticojéjunale prenant les bords du canal de Wirsung et la muqueuse jéjunale était moindre qu'en cas d'anastomose pancréaticojéjunale avec intubation et drainage externe total (3% vs. 15%, $p = 0.018$). Il y avait plus de fistules en cas de non-dilatation du Wirsung ou de pancréas mou que lorsque le Wirsung était dilaté ou que le parenchyme était atrophique. En analyse multivariée, seule la technique d'anastomose était un facteur indépendant de risque de fistule (rapport de côte: 4.15, IC: 1.1–27.4). L'analyse de sous-groupes des patients ayant un pancréas mou sans dilatation du Wirsung sont en faveur de la technique d'anastomose entre le Wirsung et la muqueuse jéjunale chez le patients à haut risque. Les résultats de cette étude indiquent que l'état du moignon pancréatique et la technique d'anastomose sont les facteurs de risque essentiels de fistule aprés DPC. L'anastomose entre le canal de Wirsung et la muqueuse lors d'une anastomose pancréaticojéjunale pourrait être le procédé de choix.

Resumen. En este trabajo se analiza la frecuencia de fístula prancreática anastomótica tras duodenopancreatectomía (PD) y sí ésta es mayor tras anastomosis latero-terminal (mucosa-ductal), en la pancreático-yeyunostomía, que con las técnicas de drenaje total mediante una intubación exteriorizada. Entre 1990 y 1999, 161 pacientes fueron intervenidos, en nuestro Hospital, realizándoseles tras una duodenopancreatectomía, una pancreatoyeyunostomía termino-lateral. Se analizaron 14 factores preoperatorios y 10 intraoperatorios que podrían propiciar la fuga o dehiscencia de la anastomosis pancreatoyeyunal. En 17/161 pacientes (11%) se produjo una fuga anastomótica pancreatoyeyunal. Los parámetros preoperatorios considerados no guardaron relación alguna con dicha complicación y el análisis univariante sólo demostró ser significativo para tres hechos intraoperatorios: la técnica de la anastomosis, el calibre del conducto pancreático y la consistencia del remanente pancreático. La anastomosis muco-ductal yeyuno-pancreática fue significativamente más segura, por lo que a la aparición de fistulas o fugas anastomóticas se refiere, que el drenaje total mediante una intubación exteriorizada (3% frente al 15%, $p = 0.0018$). Un Wirsung no dilatado y un páncreas poco consistente facilitan la instauración de una fuga anastomótica, mientras que ésta es menos frecuente cuando el conducto pancreático está dilatado y el remanente pancreático atrófico. Un análisis multivariante demuestra que sólo la técnica anastomótica constituye un factor de riesgo independiente (coeficiente de odds: 4.15, CI: 1.7–27.4). Un subanálisis de los pacientes con Wirsung no dilatado y con escasa consistencia pancreática demostró que, para estos pacientes con elevado riesgo, la técnica más segura es la anastomosis latero-terminal mucosa-ductal yeyuno-pancreática. Conclusión: Nuestros resultados demuestran que los factores más importantes en la aparición de una fistula pancreática, tras duodenopancreatectomía son: la calidad textural del remanente pancreático y la técnica de la pancreatico-yeyunostomía. La técnica anastomótica de elección debe ser la yeyunostomía pancreática mucosa-ductal.

Acknowledgment

This work was supported in part by a grant from the Japan Ministry of Education.

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