Pancreaticoduodenectomies with a duct-to-mucosa pancreaticojejunostomy anastomosis with and without a stenting tube showed no differences in long-term follow-up

Shuji Suzuki · Satoshi Kaji · Nobusada Koike · Nobuhiko Harada · Tsuneo Hayashi · Mamoru Suzuki · Toshihide Imaizumi · Fujio Hanyu

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Abstract

Background/purpose The aim of this study was to evaluate the long-term complications of pancreaticoduodenectomy with a duct-to-mucosa pancreaticojejunostomy anastomosis without a stenting tube.

Methods Patients were followed for at least 3 years after pancreaticoduodenectomy. They were classified into two groups: duct-to-mucosa pancreaticojejunostomy anastomosis with a stenting tube (group A: 24) and without a stenting tube (group B: 21). Outcomes, including complications and dilatation of the pancreatic duct, were reported retrospectively.

Results The following complication rates were found for group A: morbidity 29.1%, cholangitis 12.5%, nonalcoholic steatohepatitis 4.2%, liver abscess 4.2%, intrahepatic stones 4.2%, abnormal glucose tolerance (progression of diabetes) 20.8%, and dilatation of the pancreatic duct 20.8%. In group B, the rates for morbidity (14.3%) and abnormal glucose tolerance (19%), and dilatation of the pancreatic duct (4.8%) were lower than those in group A, but all results lacked statistical significance.

Conclusions Pancreaticoduodenectomy with a duct-to-mucosa anastomosis of pancreaticojejunostomy with or without a stenting tube showed no difference in long-term follow-up.

Keywords Long-term complication · Pancreaticoduodenectomy · Nonstented pancreaticojejunostomy · Stented pancreaticojejunostomy · Dilatation of the pancreatic duct

Introduction

Although pancreaticoduodenectomy (PD) is a complex and high-risk procedure [1], PD has been increasingly accepted as a safe and appropriate procedure for neoplasms of the periampullary region [2]. Recently the surgical mortality rate associated with PD has decreased to less than 5%, but the morbidity rate remains high, between 30 and 50% [3–6]. The short-term complications after PD have been gradually decreasing, and recent improvements in operative techniques and perioperative management have resulted in an increase in the number of long-term survivors after PD [7–9]. With the increase of long-term survival, quality of life (QOL) after surgery is a great concern [10]. On long-term follow-up, the QOL was reflected by the treatment of complications and functional disturbances. Therefore, the successful treatment of long-term complications is important to maintain QOL after PD.

To avoid short-term complications after surgery, duct-to-mucosa pancreaticojejunostomy anastomoses were recently performed more safely without, rather than with, a stenting tube [11, 12]. However, no reports are available about non-stented pancreaticojejunostomy in regard to long-term complications. On long-term follow-up, it is also necessary to evaluate the patency of the pancreaticojejunostomy with or without a stenting tube and to investigate any functional disturbances.

The aim of this study was to evaluate long-term complications of pancreaticoduodenectomy with a duct-to-
mucosa pancreaticojejunostomy anastomosis without a stenting tube.

**Methods**

A retrospective study was conducted during a minimum of 3 postoperative years on a series of 45 patients with pancreatobiliary diseases who underwent PD with duct-to-mucosa pancreaticojejunostomies (not associated with hepatic resections) from 1990 to 2006. Neither recurrence nor disease-free survival was recorded. The study included 24 patients who underwent pancreaticojejunostomy with a stenting tube (group A) and 21 patients who underwent pancreaticojejunostomy without a stenting tube (group B) (Table 1). The decision on whether to perform the anastomosis with or without a stenting tube was based on the judgments of the surgeons. The two groups did not consist of consecutive patients. Long-term complications, dilatation of the pancreatic duct, and markers of diabetes were compared between the two groups. A “normal soft pancreas” was defined as a pancreas with normal exocrine and endocrine functions, with the diameter of the main pancreatic duct less than 3 mm and with no apparent fibrosis detected in postoperative pathological specimens [12]. Diabetes was evaluated by hemoglobin A1c [definition in this study: HbA1c: normal ≤5.8%, 5.8% < abnormal glucose tolerance (AGT)].

**Operative techniques**

In both groups an end-to-side two-layer anastomosis was performed between the pancreas and jejunum. The pancreaticojejunostomy with a stenting tube was performed with a duct-to-mucosa anastomosis using a vinyl tube as a lost stent (Fig. 1). The pancreaticojejunostomy without a stenting tube was devised as follows (Fig. 2): anastomosis of the outer layer was performed between the pancreatic parenchyma and the jejunal seromuscularis, using 3-0 nonabsorbable sutures. Anastomosis between the pancreatic duct and jejunal mucosa was performed precisely using 5-0 or 6-0 monofilament absorbable sutures. With a suture placed on the anterior wall and sutures placed on the bilateral walls, the duct lumen was kept open. Interrupted sutures were placed on the anterior and posterior walls without a scope. Prophylactic octreotide was not used postoperatively.

**Statistical analysis**

Groups A and B were compared with the χ² test and the averages were compared using Student’s t-test.

**Table 1 Background characteristics and operative procedures after pancreatic resection**

<table>
<thead>
<tr>
<th></th>
<th>Group A (n = 24)</th>
<th>Group B (n = 21)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>61.2 ± 2.7</td>
<td>62.3 ± 3.4</td>
<td>NS</td>
</tr>
<tr>
<td>Gender (male/female)</td>
<td>14/10</td>
<td>11/10</td>
<td>NS</td>
</tr>
<tr>
<td>Normal pancreas</td>
<td>18/24 (75%)</td>
<td>12/21 (57.1%)</td>
<td>NS</td>
</tr>
<tr>
<td>Disease</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pancreatic cancer</td>
<td>3</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Bile duct cancer</td>
<td>5</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Cancer of the ampulla of Vater</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Gallbladder cancer</td>
<td>2</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Intraductal papillary mucinous neoplasm</td>
<td>1</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>11</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Operative procedures</td>
<td></td>
<td></td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>PD</td>
<td>18</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>PPPD</td>
<td>6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>DPPHR</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

**Fig. 1** Scheme of pancreaticojejunostomy with a stenting tube as a lost stent without external fistula (Fig. 1). The pancreaticojejunostomy without a stenting tube was devised as follows (Fig. 2): anastomosis of the outer layer was performed between the pancreatic parenchyma and the jejunal seromuscularis, using 3-0 nonabsorbable sutures. Anastomosis between the pancreatic duct and jejunal mucosa was performed precisely using 5-0 or 6-0 monofilament absorbable sutures. With a suture placed on the anterior wall and sutures placed on the bilateral walls, the duct lumen was kept open. Interrupted sutures were placed on the anterior and posterior walls without a scope. Prophylactic octreotide was not used postoperatively.
were considered significant at \( p < 0.05 \). Numeric data are expressed as means ± SD.

### Results

The patients’ backgrounds are shown in Table 1. There were no differences in age, sex, and disease distributions between groups A and B. However, operative procedures were different \( (p < 0.05) \) between the two groups. There were more patients undergoing PD in group A and more patients undergoing pylorus-preserving pancreatoduodenectomy (PPPD) in group B. However, there were no differences in the numbers of patients with minimally invasive surgical procedures such as duodenum-preserving pancreatic head resection (DPPHR) between the two groups. The average follow-up term was 6.86 years. The reason for PPPD being more frequently performed in group B than in group A is based on historical factors.

In long-term follow-up (Table 2), the overall morbidity rates showed no differences between the two groups. Rates of complications such as cholangitis, nonalcoholic steatohepatitis, liver abscess, and intrahepatic stones also displayed no differences. The differences in the proportions of patients showing dilatation of the pancreatic duct in group A (20.8%) and group B (4.8%) also lacked significance. AGT was found in 5 patients (20.8%) in group A and in 4 patients (19%) in group B, and the difference in these rates was also not significant (Table 2). In group A, 3 patients needed oral antidiabetic medication from years 1 to 3 after the operation, and 2 needed insulin from years 4 to 7 after the operation. In group B, 1 patient had to take oral antidiabetic medication within 1 year. Three patients became diabetic from years 1 to 2 although they had dietetic treatment.

### Discussion

Although PD is an aggressive surgical procedure with potential complications including pancreatic fistula, intra-abdominal hemorrhaging, and intraabdominal abscess in the short term, a number of recent reports have demonstrated that PD can be performed safely, and the mortality rate has been reported to be less than 5% \[13–15\]. Long-term survival has increased by improvements of mortality and multidisciplinary treatment. QOL assessment after PD has become an important issue, especially for long-term survivors \[16\], and the evaluation of long-term complications is an important determinant for QOL assessment after PD.

Short-term complications such as pancreatic fistula, hemorrhaging, abscess, and delayed gastric emptying tend to decrease regardless of the presence or absence of a stenting tube. This has been especially confirmed by reports in recent years of the effectiveness of non-stent pancreaticojejunostomy and pancreaticogastrostomy \[12, 17, 18\]. Short-term complications in non-stent pancreaticojejunostomy had reported an advantage of morbidity, delayed gastric emptying, and pancreatic fistula of the normal soft pancreas \[12\]. Non-stent pancreaticogastrostomy of pylorus-preserving pancreatoduodenostomy had shown a low incidence of pancreatic leakage and steatorrhea \[17\]. This raises the question of whether the decrease in short-term complications can be maintained in long-term follow-up. However, long-term complications of non-stent pancreaticojejunostomy after PD have not been reported. Our present study attempted to evaluate the long-term complications of pancreatoduodenectomy with a duct-to-mucosa anastomosis without a stenting tube.

PD with pancreatic duct invagination anastomosis prevented serious complications in the short term, but a dilatation of the pancreatic duct remnant was detected in 51% (37 of 73) of computed tomography evaluations, and

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**Table 2** Long-term complications after pancreatoduodenectomy

<table>
<thead>
<tr>
<th></th>
<th>Group A ((n = 24))</th>
<th>Group B ((n = 21))</th>
<th>( p ) value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morbidity rate (%)</td>
<td>7 (29.1%)</td>
<td>3 (14.3%)</td>
<td>NS</td>
</tr>
<tr>
<td>Complications</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cholangitis (%)</td>
<td>3 (12.5%)</td>
<td>2 (9.5%)</td>
<td>NS</td>
</tr>
<tr>
<td>Nonalcoholic steatohepatitis (%)</td>
<td>1 (4.2%)</td>
<td>0 (0%)</td>
<td>NS</td>
</tr>
<tr>
<td>Liver abscess (%)</td>
<td>1 (4.2%)</td>
<td>0 (0%)</td>
<td>NS</td>
</tr>
<tr>
<td>Intrahepatic stones (%)</td>
<td>1 (4.2%)</td>
<td>0 (0%)</td>
<td>NS</td>
</tr>
<tr>
<td>Abnormal glucose tolerance (%)</td>
<td>5 (20.8%)</td>
<td>4 (19%)</td>
<td>NS</td>
</tr>
<tr>
<td>Dilatation of the pancreatic duct</td>
<td>5 (20.8%)</td>
<td>1 (4.8%)</td>
<td>NS</td>
</tr>
</tbody>
</table>

NS non-significant
Pancreatic dysfunction was observed in a considerable number of patients on long-term assessments [19]. Fujino et al. [19] demonstrated a significant correlation between duct dilatation and endocrine dysfunction. On the other hand, patients with PD with duct-to-mucosa pancreaticojejunostomies in our study (group A or B) had decreased rates of severe complications in the short-term and revealed a greater reduction of dilatation of the pancreatic duct remnant than that seen in PD with pancreatic duct invagination anastomosis. Duct-to-mucosa pancreaticojejunostomies had decreased limited long-term complications for hospital admissions and had maintained QOL in long-term follow-up after PD [19]. Other complications showed no differences between groups A and B in our duct-to-mucosa pancreaticojejunostomies.

Until now, several groups have suggested that clinically overt diabetes was unlikely to develop after PD [20, 21], and the percentage of patients who became diabetic after PD ranged from 20 to 40% [22]. However, these conclusions were based on short-term follow-up data. Ishikawa et al. [20], in comparing the effects of pancreaticojejunostomy and pancreaticogastrostomy, suggested that glucose tolerance function was associated with pancreatic function reserve rather than with anastomotic procedures or their related complications. Most patients suffering from deterioration of diabetes had experienced the problem within 3 postoperative years. In our study, PD with duct-to-mucosa pancreaticojejunostomy with or without a stenting tube had no effect on AGT. Moreover, AGT had occurred within 3 postoperative years, as reported earlier by Ishikawa. Therefore AGT clearly needs to be monitored during follow-up.

We reported that pancreaticojejunostomy of duct-to-mucosa anastomosis could be performed more safely without, rather than with a stenting tube [12]. In this study, the long-term complications revealed the same results (Table 2) with no significant difference for PD with duct-to-mucosa pancreaticojejunostomies with or without a stenting tube. Therefore we submit that pancreaticojejunostomy of duct-to-mucosa anastomosis may be performed as well without a stenting tube.

Conclusion

Pancreaticoduodenectomies with a duct-to-mucosa pancreaticojejunostomy anastomosis performed with and without a stenting tube showed no differences in long-term follow-up. On the basis of the short-term and long-term complications, we suggest that duct-to-mucosa pancreaticojejunostomy anastomosis can be performed more safely without rather than with a stenting tube.

References


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