ORIGINAL ARTICLE

Duodenal-Preserving Resection of the Head of the Pancreas and Pancreatic Head Resection With Second-Portion Duodenectomy for Benign Lesions, Low-Grade Malignancies, and Early Carcinoma Involving the Periampullary Region

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Hypothesis: Duodenal-preserving resection of the head of the pancreas (DPRHP) and pancreas head resection with segmental duodenectomy (PHRSD) can be alternatives to standard pancreaticoduodenectomy for benign periampullary lesions.

Design: Retrospective analysis of patients requiring surgery for benign and borderline malignant tumors of the periampullary region.

Setting: Tertiary care referral center.

Patients: Duodenal-preserving resection of the head of the pancreas (n=8) and PHRSD (n=7) were performed in 15 patients with a preoperative diagnosis of benign and borderline malignant tumors of the periampullary region (ie, 11 pancreas head lesions [2 intraductal papillary mucinous tumors, 4 serous cystadenomas, 2 insulinomas, 1 epidermal cyst, 1 metastatic renal cell carcinoma, 1 nonfunctioning islet cell tumor/parapaillary] and 4 duodenal lesions [3 adenomas and 1 adenocarcinoma]).

Main Outcome Measures: Surgical factors (operation time and blood loss), postoperative complication, postoperative pancreatic insufficiency (eg, development of diabetes mellitus and steatorrhea or elevated stool elastase values), weight change, and recurrence of disease.

Results: No differences were noted in the mean operation time and estimated blood loss between the 2 procedures. Major postoperative complication constituted the following: bile duct stricture (n=1) in DPRHP and delayed gastric emptying (n=1) and postoperative bleeding (n=1) in PHRSD. Newly developed diabetes mellitus occurred in 1 patient. Exocrine pancreatic insufficiency (steatorrhea) was observed in 1 patient after PHRSD. Patients with early duodenal carcinoma and intraductal papillary mucinous tumors with a borderline malignancy are still alive without evidence of recurrence. There was no hospital or long-term mortality.

Conclusions: Duodenal-preserving resection of the head of the pancreas is recommended first for a benign or low-grade, early malignant pancreatic head lesion; PHRSD can be an option for a lesion of the ampullary-parapapillary duodenal area as well as the pancreatic head. Duodenal-preserving resection of the head of the pancreas can be converted to PHRSD if ischemia of the second portion of the duodenum occurs. We found benign periampullary lesions could be conservatively treated with DPRHP and PHRSD, which could substitute for classic pancreaticoduodenectomy.

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A PANCREATICODUODENECTOMY, even if it is the pylorus-preserving type, appears to be an excessively invasive treatment for removing benign lesions of the head of the pancreas or periampullary region considering the extent of the resection and the resulting operative morbidity.[1] More conservative surgery such as a duodenal-preserving resection of the head of the pancreas (DPRHP) and a resection of a part of the head of the pancreas have been introduced as alternatives for the purpose of organ preservation and lowering the postoperative morbidity.[2]

The DPRHP was first introduced by Beger et al[2] for chronic pancreatitis. It constitutes a subtotal resection of the pancreatic head with a preservation of the duodenum, and a thin rim of the pancreas head close to the duodenum to maintain blood

See Invited Critique at end of article

supply to the duodenum.[3-5] Modified procedures have been invented to remove the pancreatic head completely with a different degree of preservation of the arcades of the pancreaticoduodenal arteries (PDAs).[6,7] We also previously reported the

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Table 1. Diagnosis, Preoperative Complaints, Location of Tumor According to Operation

Patient No./Sex/Age, y	Diagnosis	Location	Preoperative Complaint
	DPRHP		
1/M/56	Serous cystadenoma	Pancreatic head	None
2/F/50	Serous cystadenoma	Pancreatic head	None
3/F/33	Serous cystadenoma	Pancreatic head	None
4/M/52	IPMT	Pancreatic head	None
5/M/57	IPMT	Uncinate process	Epigastric pain
6/F/56	Insulinoma	Pancreatic head	LOC
7/M/26	Insulinoma	Pancreatic head	LOC
8/F/62	Epidermal cyst	Pancreatic head	None
	PHRSD		
1/F/47	Tubulovillous adenoma	2 cm Below the AOV	Epigastric pain
2/F/51	Tubulovillous adenoma	AOV	None
3/F/51	Villous adenoma	Just below the AOV	Epigastric pain
4/M/58	Serous cystadenoma	Pancreatic head	Abdominal pain
5/M/34	Nonfunctioning islet cell tumor	Pancreatic head	None
6/M/66	Adenocarcinoma	2 cm Anterosuperior to AOV	None
7/F/56	Metastatic renal cell carcinoma	Uncinate process	None

Abbreviations: AOV, ampulla of Vater; DPRHP, duodenal-preserving resection of the head of the pancreas; IPMT, intraductal papillary mucinous tumor of the pancreas; LOC, loss of consciousness; PHRSD, pancreatic head resection with second-portion duodenectomy.

guidelines for vessel preservation during DPRHP.[8] However, preserving a PDA is a difficult and time-consuming procedure. To overcome the technical difficulties associated with a preserving vasculature during DPRHP, a pancreatic head resection with a second-portion duodenectomy (PHRSD) was introduced.[9-11] In this procedure, unlike DPRHP, the duodenum can be mobilized by the Kocher maneuver, which leads to easy handling and vessel identification. In addition, surgeons do not need to be stressed about preserving the PDAs. We applied these 2 surgical procedures to benign or low-grade malignant lesions of the pancreatic head and parapapillary area duodenum. In this article, we retrospectively analyzed clinical outcomes of patients to determine the feasibility of both surgical procedures and to establish the surgical indications of the procedures.

METHODS

PATIENTS

The DPRHP and PHRSD were performed in 15 patients (8 patients underwent DPRHP and 7 patients underwent PHRSD) for preoperatively diagnosed benign periampullary lesions between December 1, 1995, and September 30, 2001, at the Department of Surgery, Seoul National University Hospital, Seoul, South Korea. **Table 1** lists the patient's demographics, preoperative reports, location of the tumor, and final diagnosis classified by operations.

INDICATIONS

These procedures were considered for the benign lesions or tumors with low-grade malignant potential. In principle, these procedures were applied in consideration of the size, location(s), and the extent of disease.

Cystic Neoplasm of the Pancreatic Head

Duodenal-preserving resection of the head of the pancreas was considered unless there was any evidence of invasiveness or solid component or vessel preservation was precluded by their large size.

Intraductal Papillary Mucinous Tumor

Duodenal-preserving resection of the head of the pancreas was considered and attempted if the lesion was localized at the head and involved only the branches of the main duct. If the main duct was likely involved and dilated or if an invasive intraductal papillary mucinous tumor (IPMT) was suspected, the case was ineligible.

Endocrine Tumor or Nonfunctioning Islet Cell Tumor

An endocrine tumor (eg, insulinoma) with a relatively large size (>2 cm) located close to the main pancreatic duct was considered a candidate for DPRHP instead of enucleation. A nonfunctioning islet cell tumor was a candidate for this procedure also.

Ampullary or Nonpancreatic Periampullary Tumor

Pancreas head resection with segmental duodenectomy was attempted if gross endoscopic and biopsy findings revealed a benign adenoma.

Converting DPRHP to PHRSD

During the surgical procedure, DPRHP was converted to PHRSD if ischemia of the second portion of the duodenum was observed.

SURGICAL PROCEDURES

Duodenal-Preserving Resection of the Head of the Pancreas

Figure 1 shows the principal steps of the operative procedure. After abdominal exploration, the lesser sac was entered and the anterior aspect of the pancreatic head was fully exposed. The Kocher maneuver was not performed to preserve the integrity of the mesoduodenal vessels. The neck of the pancreas was transected along the midline of the superior mesenteric vein and portal vein. With preserving the right gastroepiploic artery, the anterosuperior pancreaticoduodenal artery was identified and divided. The origin of the posterior superior pan-

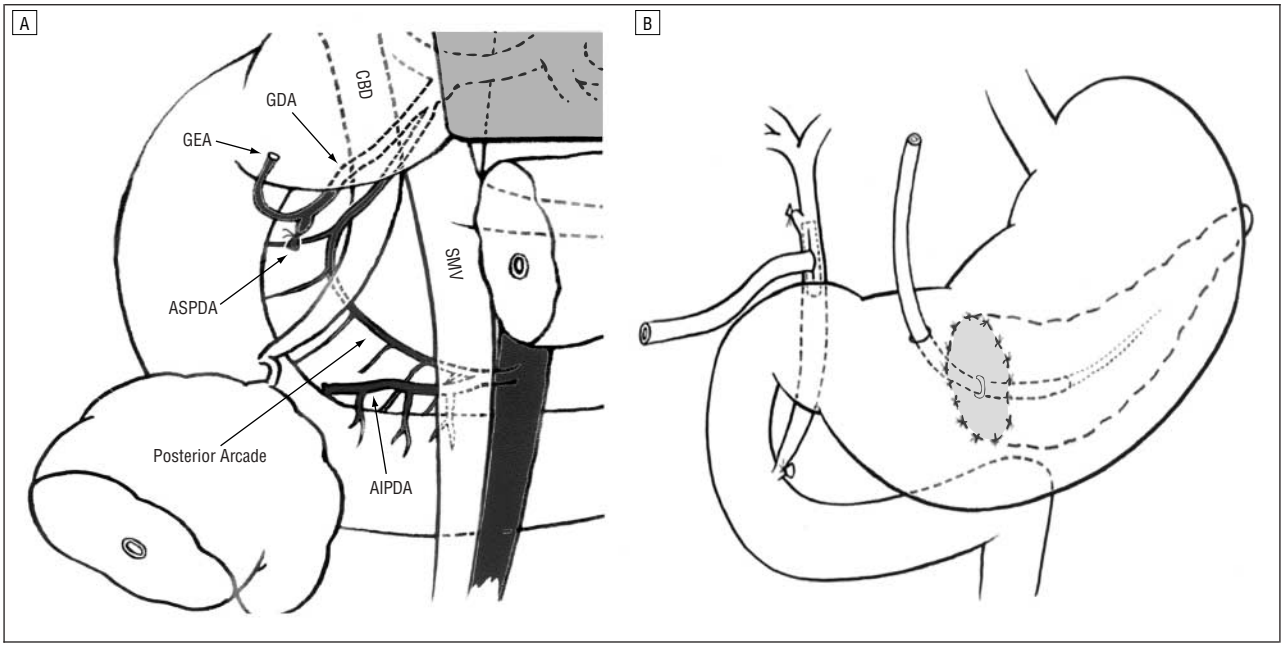

Figure 1. Schematic diagram of a duodenal-preserving resection of the head of the pancreas. A, The anterosuperior pancreaticoduodenal artery (ASPDA) is the only sacrificed pancreaticoduodenal artery. AIPDA indicates anterior inferior pancreaticoduodenal artery; CBD, common bile duct; GDA, gastroduodenal artery; GEA, gastroepiploic artery; and SMV, superior mesenteric vein. B, View after the total resection of the head of the pancreas, pancreatogastrostomy, T tube insertion, and pancreatic diversion were performed.

creaticoduodenal artery (PSPDA) was identified and the attached pancreatic tissues were separated downward, preserving the vessels. Leaving both the PSPDA and common bile duct (CBD) intact, the pancreatic tissues surrounding the CBD and intervening between the PSPDA and the CBD were carefully dissected. The pancreatic head facing the third portion of the duodenum was retracted upward and the pancreatic branches of the anterior inferior pancreaticoduodenal artery were ligated while the duodenal branches were preserved. The terminal portions of the CBD and the pancreatic duct were exposed as dissection approached the papilla. Then the pancreatic duct was divided at its confluence with the CBD. Finally, the pancreatic head was completely removed from the tightly attached parapapillary area of the second portion of the duodenum. The thinned wall of the medial part of the suprapapillary duodenal wall was reinforced with a 3-0 polyglactin (Vicryl) suture if needed. The distal pancreas was anastomosed to the posterior wall of the stomach and pancreatic tube was inserted and passed out through the anterior wall of the stomach for diversion. Cholecystectomy with T-tube choledochostomy was performed.

Pancreas Head Resection With Segmental Duodenectomy

Figure 2 shows the schema of PHRSD. Originally, PHRSD was introduced to overcome the technical difficulty of vascular preservation. For this reason, meticulous dissection for preservation of vasculature in DPRHP was unnecessary in this procedure. The preservation of only 2 vessels—the anterior inferior pancreaticoduodenal artery and the gastroduodenal artery—was needed for the blood supply to the remaining first and third portion of the duodenum, respectively.[8,11]

The pancreatic head was fully mobilized using the Kocher maneuver to examine the size and the extent of the tumor. The superior pancreaticoduodenal arteries were ligated and divided at their roots with preservation of the gastroduodenal and the gastroepiploic arteries. After tunneling of the pancreatic neck was performed, the exposure of the anterior inferior pancreaticoduodenal artery was performed with the dissection between the inferior portion of the pancreatic head and the third portion of the duodenum. At the point of transition to the anterosuperior pancreaticoduodenal artery (between the second and the third portion of the duodenum), the anterior inferior pancreaticoduodenal artery was ligated and divided. Then the pancreatic head including an intrapancreatic portion of the CBD and the second portion of the duodenum were resected en bloc. The distal end of the resected CBD was anastomosed to the first portion of the duodenum with an interrupted 4-0 polyglactin suture and a T tube was inserted for biliary diversion and stenting. The end-to-end duodenoduodenostomy was performed and finally the pancreaticogastrostomy was performed in the same manner as the DPRHP.

CLINICAL DATA ANALYSIS

Clinical data were obtained from the patients' medical records (surgical reports, pathologic reports, postoperative data, hospital course, and outpatient medical records) and telephone interviews. The surgical factors (including operation time, estimated blood loss, and transfusion), postoperative complications, and early outcomes were analyzed. The postoperative long-term outcomes (endocrine and exocrine function, recurrence, and weight change) were also evaluated. The median follow-up period was 13 months (range, 7-89 months) postoperatively.

RESULTS

The postoperative pathologic diagnosis of DPRHP comprised serous cystadenoma of the pancreas head (n=3), IPMT(n=2), insulinoma (n=2), and an epidermal cyst of the pancreas head (n=1). Except for epidermal cyst, preoperative diagnoses were well matched to the postoperative pathologic diagnoses.

In PHRSD, there were 4 duodenal lesions and 3 pancreatic head lesions. The PHRSD was applied to the duodenal lesions (tubulovillous adenoma of the ampulla of Vater [n=2], villous adenoma of the ampulla of Vater [n=1], and

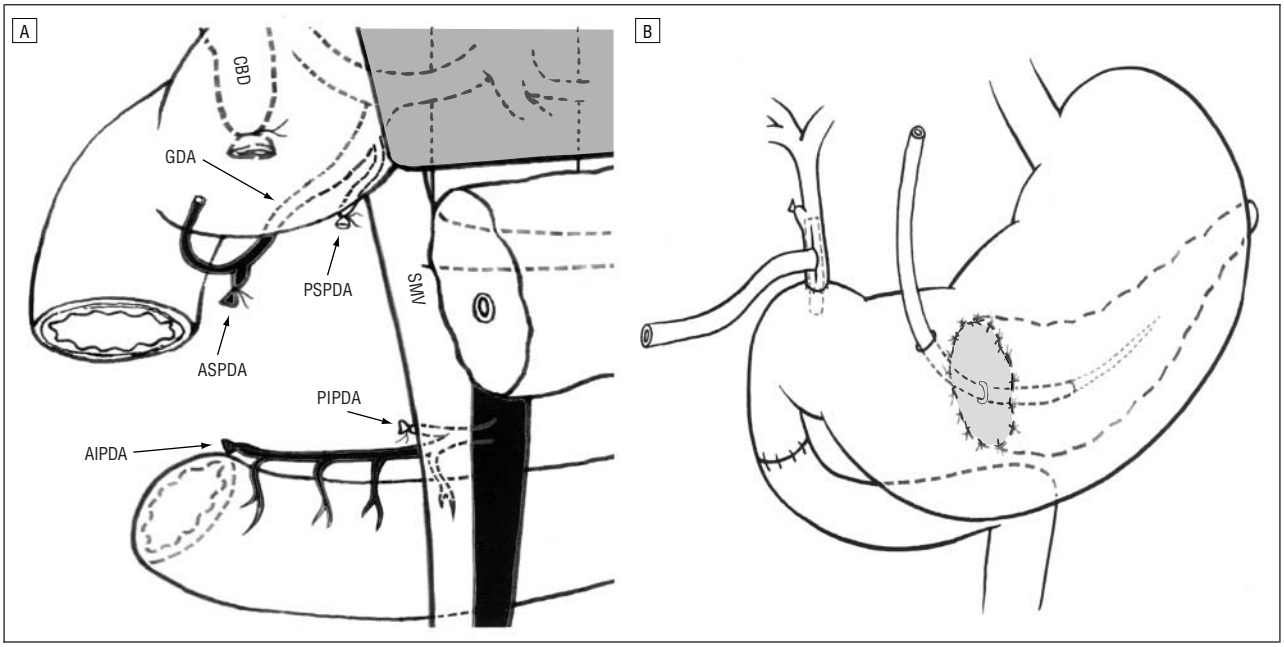

Figure 2. Schematic diagram of the pancreatic head resection with segmental duodenectomy. A, All pancreaticoduodenal arteries except the anterior inferior pancreaticoduodenal artery (AIPDA) were sacrificed with a resection of the second portion of the duodenum and the distal bile duct to prevent complications associated with ischemia of these organs. ASPDA indicates anterosuperior pancreaticoduodenal artery; CBD, common bile duct; GDA, gastroduodenal artery; PIPDA, posterior inferior pancreaticoduodenal artery; PSPDA, posterior superior pancreaticoduodenal artery; and SMV, superior mesenteric vein. B, View after the resection, a pancreatogastrostomy, an end-to-side choledochoduodenostomy with a T-tube stent, and an end-to-end duodenoduodenostomy were performed.

adenocarcinoma of the duodenum [n=1]) and performed successfully. The pancreatic head lesions were serous cystadenoma of the pancreatic head (n=1), nonfunctioning islet cell tumor of the pancreatic head (n=1), and metastatic renal cell carcinoma of the pancreatic head (n=1). Initially, the patients with serous cystadenoma and nonfunctioning islet cell tumor of the pancreatic head were candidates for DPRHP; however, they were converted to PHRSD because the ischemic sign of the duodenal second portion was observed during the surgical procedure.

The final diagnosis of a patient having early duodenal cancer was proved to be a "villous adenoma" on the preoperative endoscopic biopsy specimen. On the postoperative pathologic report, it was shown to be a "well-differentiated adenocarcinoma, confined to the mucosa." The patient with a "metastatic renal cell carcinoma" had a history of a radical nephrectomy for renal cell carcinoma 8 years prior to the operation. The preoperative radiological diagnosis was a "nonfunctioning islet cell tumor of the pancreas."

SURGICAL FACTORS

The mean surgical times for DPRHP and PHRSD were 366 minutes (range, 260-455 minute) and 392 minutes (range, 375-475), respectively. The mean estimated blood loss from the operation field was 450 mL for DPRHP and 557 mL for PHRSD. One unit of packed red blood cells was transfused during PHRSD to a patient with metastatic renal cell carcinoma.

POSTOPERATIVE COMPLICATIONS AND HOSPITAL COURSE

There were 6 cases (40%) of postoperative complications irrespective of the type of surgical procedure (**Table 2**). Minor pancreatic leakages were detected in 2 patients who recovered well with conservative management with percutaneous drainage and short-period fasting. In 1 patient with IPMT who underwent DPRHP, obstructive jaundice due to a focal bile duct stricture developed a few days after hospital discharge. A T tube was inserted in situ and the patient's condition was managed successfully by an interventional balloon dilatation through the T-tube tract. The patient has been healthy with normal liver function for 3 years.

Table 2. Postoperative Complications and Its Management

Type of Operation	Complication	No. of Patients	Treatment
DPRHP	Bile duct stricture	1	Balloon dilatation
	Fluid collection	1	PCD
PHRSD	DGE	1	NPO and L tube
	Pancreatic leakage	2	PCD
	Postoperative bleeding	1	Exploration

Abbreviations: DGE, delayed gastric emptying; DPRHP, duodenal-preserving resection of the head of the pancreas; NPO, nothing by mouth; PCD, percutaneous drainage; PHRSD, pancreatic head resection with second portion duodenectomy.

Delayed gastric emptying (DGE) was defined as nasogastric drainage for more than 10 days, or a reinsertion of a nasogastric tube because of vomiting, or a failure to tolerate a semisolid diet 14 days after surgery. In 1 patient who underwent PHRSD and who had a serous cystadenoma of the pancreatic head, DGE developed, and was managed conservatively for 20 days with a complete recovery. No DGE was observed in the DPRHP group.

Major postoperative bleeding presenting gastrointestinal tract bleeding occurred in 1 patient after hos-

Table 3. Long-term Outcome After Surgery

Outcome	No. of Patients Who Underwent DPRHP	No. of Patients Who Underwent PHRSD
Diabetes mellitus		
Newly developed	0	1
Unchanged	1	1
Aggravated	0	0
Gastrointestinal syndrome		
Postoperative cholangitis	0	0
Steatorrhea	2 (0)*	3 (1)*
Weight loss†	0	2
Recurrence of disease, No. of patients/ total No. of patients		
IPMT	0/2	0
Early duodenal cancer	0	0/1

Abbreviations: DPRHP, duodenal-preserving resection of the head of the pancreas; IPMT, intraductal papillary mucinous tumor; PHRSD, pancreatic head resection with second portion duodenectomy.

*Immediate postoperative state (to 3 months) after the operation.

†More than 10% of the preoperative state at postoperative month 3.

pital discharge. This patient required an additional operation to control the bleeding from the inferior pancreaticoduodenal vessels caused by a leakage from the pancreatogastrostomy site. The pancreatogastrostomy site was revised and the pancreatic flow was diverted exteriorly with a percutaneous transgastric Silastic tube for 2 months and the patient survived. The mean hospitalization time was 22.9 days (range, 12-46 days) for DPRHP and 30.6 days (range, 18-50 days) for PHRSD. There was no hospital mortality associated with this study.

LONG-TERM OUTCOMES OF PATIENTS

The long-term outcomes of both surgical procedures were followed to keep track of disease recurrence, pancreatic endocrine and exocrine function, weight change, and gastrointestinal tract symptoms (**Table 3**). There was no evidence of recurrence of early duodenal cancer and there were 2 IPMTs with a borderline malignant nature at 23, 29, and 38 months after the operation, respectively. One patient with an IPMT of borderline malignancy had a positive pancreatic duct resection margin at the junction with the bile duct. Thirty-eight months after DPRHP, colon cancer developed in this 57-year-old man.

Regarding the endocrine function, 2 patients had diabetes mellitus and 2 patients had insulinoma with hypoglycemia preoperatively. The severity of the hyperglycemia was not aggravated and normoglycemia was obtained after removing the insulinoma. Among the 11 patients with preoperative normoglycemia, newly developed diabetes mellitus was noted in 1 patient after PHRSD, who had begun taking an oral hypoglycemic agent to control diabetes mellitus.

Five patients reported postoperative steatorrhea with intermittent abdominal cramping pain in the early posthospital days. One of the aforementioned patients is still suffering from postprandial diarrhea and severe steatorrhea. As an objective parameter for pancreatic exocrine function, the stool elastase level was measured. Among the15 patients, 5 patients had less than the lower limit for stool elastase level (reference range, 72-432 ng/dL). One patient with a serous cystadenoma of the pancreas and another patient with early duodenal cancer lost more than 10% of their preoperative body weight during the postoperative 3 months. Symptoms of cholangitis, which might occur due to choledochoduodenostomy, were not observed in any patients after PHRSD.

COMMENT

Beger et al[2] described DPRHP, which was developed and indicated for chronic pancreatitis. They removed the pancreatic head subtotally while leaving a small part of the head of the pancreas close to the duodenal wall. In contrast to this procedure, we performed a total pancreatic head resection while preserving the whole length of the CBD without the Kocher maneuver. The authors' procedure might be difficult for chronic pancreatitis.[8]

Isaji and Kawarada[9] and Nakao[10] described PHRSD as a simpler and safer method for a complete resection of the pancreatic head than DPRHP because in PHRSD, vessel preservation is not as stressful as in DPRHP. In addition, the duodenum can be mobilized by the Kocher maneuver, which facilitates the palpation of the lesion of the pancreatic head and vasculature and makes it simple to identify and dissect the peripancreatic structures.

However, in our experience, the operation time in the 2 procedures was similar. The gastroduodenal artery and the anterior inferior pancreaticoduodenal artery were preserved to prevent ischemia of the first and the third portion of the duodenum. It is worth spending additional time preserving the gastroduodenal artery so as to retain good viability of the first and proximal second portion of the duodenum. For reconstruction, DPRHP requires 1 anastomosis (pancreaticogastric), whereas PHRSD requires at least 3 anastomoses (pancreaticoenteric, choledochoduodenostomy, and duodenoduodenal anastomosis). It is believed that DPRHP requires a good deal of time to preserve the vessels whereas PHRSD takes time to complete a multiple anastomoses.

All benign pancreatic head diseases can be treated with DPRHP. Other pancreatic lesions (such as IPMT) with a potential involvement of the main pancreatic duct or ampullary/parapapillary duodenal tumor with a benign or low-grade malignant potential are candidates for a PHRSD. For a benign lesion of the pancreatic head, DPRHP can be attempted first, after which it can be converted to PHRSD if the duodenal blood supply is precluded. In our series, 2 patients were converted to PHRSD from DPRHP during the operation owing to vascular compromise of the duodenum.

Büchler et al[12] demonstrated a significant difference between duodenal preservation and pylorus-preserving pancreaticoduodenectomy (PPPD) when glucose tolerance, insulin secretion, and resultant postoperative weight gain were looked at. In their report, though it was different in the volume of the resected pancreas(PPPD, 40%-60%; DPRHP, 30%-40%), the major difference between the surgical procedure was, in fact, the preservation of the duodenum, and this would appear to be the crucial factor for intact or unchanged glucose tolerance after DPRHP. Even though it was not the same as DPRHP, PHRSD could

preserve upper gastrointestinal tract including the third portion of duodenum and the proximal jejunum for a longer time than PPPD could. It is believed that the preserved relatively short segment may play a significant role in absorbing the iron, calcium, fat, folic acid, and so on. Therefore, both procedures are thought to be superior to PPPD with regard to postoperative nutritional support. Our result would appear to reveal that weight loss is a serious long-term problem after PHRSD. However, 3-month follow-up period would not appear to be long enough to permit a comparison between the procedures with regard to weight loss.

After a Whipple operation, the percentage of patients who become diabetic amounts to 20% to 40%.[13] Bittner et al[14] performed a prospective study to evaluate the endocrine pancreatic function following DPRHP. In most patients, DPRHP did not lead to an impairment of glucose tolerance. In this study, 2 patients with preoperative diabetes mellitus who had a serous cystadenoma of the pancreas and early duodenal cancer showed no change in their blood glucose levels after the operation. One patient who had a villotubular adenoma of the ampulla of Vater became diabetic after PHRSD; this patient's diabetes mellitus is under control because the patient is taking oral hypoglycemic drugs.

Only 1 biliary complication from DPRHP was experienced. This patient had a stricture of the distal CBD, which was successfully managed by dilatation and temporary stenting. A focal ischemia or a sealed-off microperforation might be the cause of the stricture, which appears to be a procedure (DPRHP)-related complication. A biliary stricture, as a late complication, is also a potential complication of PHRSD because the choledochoduodenostomy stoma is usually small (owing to the normal caliber of the CBD) and reflux of duodenal content is expected.[9,10]

Delayed gastric emptying has been described as one of the leading causes of postoperative morbidity after PPPD, and it causes a prolongation of nasogastric intubation and delays the beginning of oral intake and the patient's recovery. Many factors have been implicated in the pathogenesis of pancreaticoduodenectomy, including gastric dysmotility secondary to an anastomotic leak or perianastomotic abscess, gastric atony after resection of the duodenal pacemaker and disruption of gastroduodenal neuroconnections, ischemic injury to the antropyloric muscle mechanism, and gastric dysmotility in response to a reduction of circulating levels of motilin.[15,16] Muller et al[15] compared DGE after PPPD and DPRHP. In contrast to the PPPD, they found no DGE after DPRHP. Even though no meaningful conclusion can be made owing to too few instances (8 cases) of these surgical procedures in our series, we also found no DGE after DPRHP. One case of DGE that occurred in the PHRSD group was probably caused by an intra-abdominal complication (anastomotic leak or perianastomotic abscess) that gave rise to gastric dysmotility, because the duodenal pacemaker, located 0.5 to 1 cm distally from the pylorus, could be preserved and antropyloric muscular ischemia could not occur in PHRSD. In addition, reduction of the circulating level of motilin after duodenal resection is not thought to be a major cause of gastric dysmotility in PHRSD. Murakami et al[17] reported that pancreatic fibrosis enhances DGE in PPPD with a pancreatogastrostomy, probably due to the effect of pancreatitis and increased gastric fluid production. We performed pancreaticogastrostomy, and we think it can be an attributable cause of DGE in this study.

Among the 5 patients who had postoperative steatorrhea, 1 patient with PHRSD had steatorrhea at this time; the others recovered within 3 months postoperatively. Although we were unable prove the statistical significance of the study because of the small number of cases, it appears that there was no difference in the outcome between the 2 operations.

Intraductal papillary mucinous tumor of the pancreas shows (1) a tendency toward intraductal spread, (2) dysplasia varying in severity and epithelial atypia within the same tumor, and (3) slower development, which means (4) a better prognosis.[18] Histologically, the tumor includes a spectrum of changes ranging from low- to high-grade dysplasia and from adenoma to infiltrating carcinoma. Intraductal papillary mucinous tumor of the pancreas has a high rate of malignant degeneration; however, the respectability rate and survival after resection are almost 90%, which suggest early surgical resection is warranted. The oncologically correct approach to treatment should be to proceed with a pancreatic resection until a resection margin free of epithelial atypia is achieved. In some of the literature, even total pancreatectomy is recommended when a resection margin cannot be achieved.[18-22] However, it is proposed that carcinoma occurs frequently in the main pancreatic duct type than in the branch type[23] and the extent of resection of the IPMT with mild to moderate dysplasia at the resection margin remains uncertain.[21] We agree that standard Whipple operation or PPPD is too invasive for patients with IPMT of borderline malignancy in pancreas head and DPRHP can completely eradicate the lesions.[24] Two IPMTs in our series that were side branch duct type on preoperative computed tomographic scan, had a free resection margin on intraoperative frozen section but turned out to be IPMT with moderate dysplasia on the postoperative pathologic report. Although there is the possibility of recurrence in remnant pancreas, both patients are under observation and show no sign of developing symptoms and recurrence in the median follow-up period of 34 months.

Theoretically, because DPRHP and PHRSD are less extensive surgery than standard pancreaticoduodenectomy, operation time should be shorter and blood loss should be less, there should be fewer complications and the hospital stay should be shorter. Although our results did not satisfy these conditions, more cases and experience would improve our surgical skills and thus produce better clinical outcomes.

CONCLUSIONS

Duodenal-preserving resection of the head of the pancrease is technically difficult owing to the high level of vascular preservation; PHRSD is complicated because of the multiple anastomoses. The 2 operations had a similar aspect of early and late complications. Indications for doing DPRHP should be limited to benign pancreatic le-

sions and those for PHRSD should include benign or low-grade malignant ampullary and parapapillary duodenal lesions as well as benign pancreatic head lesions. Duodenal-preserving resection of the head of the pancreas can be converted to PHRSD if ischemia of the second portion duodenum occurs. We concluded that both DPRHP and PHRSD can be alternatives to a conventional pancreaticoduodenectomy in the aspect of organ preservation, postoperative morbidity, and nutritional support.

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Invited Critique

Are we making this unnecessarily complicated? A standard operation—pylorus-preserving pancreaticoduodenectomy—has evolved in the past decade to a high level of applicability in many centers, with a low morbidity and mortality. Is there a role for other operations for pathology in the head of the pancreas? The authors of the current article present their experience with 15 patients having more conservative resections of the pancreatic head with 2 other operative techniques. Are there specific reasons we should perform these procedures based on pathology or factors of operative technique?

The initial pathologic indication for duodenal-preserving head of pancreas resections was chronic pancreatitis. In the current article 50% of the patients had malignant or potentially malignant lesions that were resected. Small numbers and short follow-up without recurrence do not justify this more conservative approach for these pathologic features.

The operative techniques used in this article do not simplify resection in comparison to a standard pancreaticoduodenectomy. Certainly, they "can" be done, but that does not mean they "should" be done. Two of their 10 patients undergoing resection with duodenal preservation required conversion to segmental duodenal resection because of ischemia of the duodenum. While the operative times and postoperative complication rates are no higher than for pancreaticoduodenectomy, the authors failed to demonstrate any advantage for the standard procedure. Indeed, their hospital stay was over twice as long as most centers publish for pancreaticoduodenectomy.

So, where does this leave us for eligibility for conservative pancreatic head resection? The authors have expressed their opinion as to disease and/or pathologic indications and demonstrated feasibility. From my own perspective, I shall continue to do pancreaticoduodenectomy for patients with these diseases and/or pathologic conditions, rather than an occasional more complex procedure. For the rest of our readers, their decision should be based on their interpretation of these data and on their experience.

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