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Pancreatic head resection for cancer of the pancreas Pattern of complications and choice of method in the 2000s

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In patients with resectable tumor of the head of the pancreas, pancreaticoduodenectomy has, for half a century, been the standard type of resection. However, this must still be regarded as a complex, potentially high-risk surgical procedure. The standard Whipple (PD) procedure and the pylorus-preserving modification (ppPD) are the most frequently used pancretoduodenectomies today.[1] The standard procedure – "Whipple" - includes removal of the head, neck and uncinate process of the pancreas, the duodenum, the distal stomach and the gallbladder, a small part of proximal jejunum, and the biliary tree distal to the junction of choledocus and cystic duct, all performed en-bloc to include loco-regional lymph nodes.[2] The standard method of reconstruction – often named standard or classical Whipple, though technically very different from what Whipple et al, first described in 1935,[3] and sometimes referred to as a "Kausch-Whipple" relating to the former's first successful pancreatoduodenectomy reported in 1912[4] - includes a pancreatojejunostomy, a hepaticojejunostomy and a gastrojejunostomy. When Traverso and Longmire in 1978[5] reintroduced the refined method earlier described by Watson in 1944,[6] which implied the preservation of the stomach and pylorus, a duodenojejunostomy must be made instead of the usually used Billroth II-gastrojejunostomy. All these procedures are today well standardized and documented, even though they can be performed in slightly different ways. In a recent consensus conference report from Padova, a standard pancreatoduodenectomy, a radical pancreatoduodenectomy and an extended radical pancreatoduodenectomy were defined.[2]

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The aim of the present review is to discuss the standards of pancreatoduodenectomy today with special regard to morbidity and mortality and to the possible different outcomes of standard pancreatoduodenectomy and its pylorus-preserving variant.

SURGERY-RELATED POSTOPERATIVE MORTALITY AND MORBIDITY

The postoperative mortality rate after pancreatoduodenectomy in multiinstitutional reports has most often varied from 8 to 14 percent.[7-10] In single-institution studies the postoperative mortality is generally lower than 5 percent.[9,11-14] Pancreatic fistula, intraabdominal sepsis, delayed gastric emptying, upper gastrointestinal bleeding, biliaryenteric anastomotic leak, and respiratory failure are the most frequent postoperative complications.[8,15-19] In a multivariate analysis and in randomized studies, closure of the pancreatic remnant without enteric drainage was a significant factor predisposing a patient to the development of postoperative pancreatic fistula.[16,20-22]

The quality standards attainable for pancreaticoduodenectomy in the 1990s were proposed by Yeo et al[23] from their view-point in a high-pancreatectomy-volume hospital. They reported a series of 650 pancreatoduodenectomies performed at Johns Hopkins Hospital between 1990 and 1996. The indication for the operation was a perimpullary adenocarcinoma in 68 percent of cases. The surgical mortality rate was 1.4 percent; 190 consecutive resections were performed without a death. The most common complications were delayed gastric emptying (19%), pancreatic fistula (14%), and wound infection (10%). The most dangerous complications seemed to be the anastomotic insufficiencies, but the technique of

how to perform the pancreaticoenteric reconstruction (pancreaticojejunostomy versus pancreaticogastrostomy) did not influence their leakage rate. The study highlighted the fact that the Whipple operation should be looked upon as a safe procedure when it is performed at high-volume centers by experienced surgeons. There are now many other surgeons who have reported that they can achieve these standards, and the surgical mortality for this procedure is, in recent reports, 2 percent or less.[12,13,16,24,26]

At the other end of the hospital spectrum, Chew and Attiyeh[27] investigated retrospectively a series of 29 Whipple operations performed over a 15-year period in a community hospital in the United States. The majority of patients (83%) were operated on for periampullary malignancy. The surgical mortality rate was 3 percent and the overall morbidity rate was 28 percent. These authors concluded that complicated procedures such as a pancreatoduodenectomy can be performed with favorable results in a low-volume community hospital. However, they state that it is necessay to concentrate such operations in the hands of a small number of highly trained surgeons. Indeed, in this study, all operations were performed by a single surgeon.

Reports from specialised centres indicate that the procedure can now be done routinely with a significantly decreased mortality rate,[25,26,28-45] of the order of 5 percent or less.[23.25,28,34,37] In two recent, large, multicentre studies investigating complications in elective pancreatic surgery the mortality was 3 and 5 percent, respectively.[20,46] A North American survey from the '90s, however, reported that mortality rates exceeding 10 percent were still common.[47] Given the relatively short survival time following resection, minimising surgery-related morbidity and mortality is particularly important.

Although surgery-related post-operative morbidity demanding treatment has also decreased in recent years, it still ranges between 20 and 45 percent.[12,23,25,26,28,31,32,34-45] In the two recent multicentre studies investigating complications in elective pancreatic surgery,[20,46] the morbidity was 23 and 44 percent, respectively. No other major elective intra-abdominal procedure is associated with such a high morbidity and mortality. It should then also be taken into account that the post-operative complications of pancreatoduodenectomy are alarmingly costly.[48,49]

Even though the high number of complications after pancreaticoduodenectomies have only recently decreased, these are now managed with greater expertise and are ususally not as life threatening as before. Therefore, a recent reports of complication rate donst have not exactly the same meaning as they had 20-20 years ago. On the other hand this has lead to a broaderning of the indications for the operation, again risking an increase in the complication rate. Consequently, major pancreatic resections are nowadays performed in octogenarians with morbidity and mortality rates approaching those seen in younger patients.[50,51] Moreover, if done with acceptably low perioperative morbidity and mortality pancreaticoduodenectomies may also have a place in the palliation of patients with seemingly unresectable disease.[52,53] In consecutive patients during the 1990s in a referal center in the US, Baltimore, 256 patients were operatively palliated whereas 512 patients underwent pancreaticoduodenectomy.[54] Those patients undergoing operative palliation had a significantly lower incidence of postoperative complications compared with those undergoing pancreaticoduodenectomy (22% versus 35%, p<0.0001) and had significantly shorter lengths of stay in hospital postoperatively (10 versus 15 days, p<0.0001). These complication figures should be further noted in the light of another study that, in an adjusted analysis with regard to age and systemic organ failure showed that postoperative mortality was lower after resection than after bypass but morbidity was higher after resection (27% and 35%, respectively).[52] In conclusion, even palliative resection may benefit well-selected patients and if this policy is widely adopted it may change the complication frequency and pattern considerably.[11,52,53]

After a Whipple resection, length of stay in uncomplicated cases is dictated, first, by the time it takes for recovery of hemodynamic stability, and then by bowel function and the ability to resume adequate diet and activities of daily living. In patients who develop complications, these indicators of recovery may be delayed, and patients generally remain hospitalized until the complications are controlled. In a study of a consecutive sample of patients undergoing pancreaticoduodenectomy 1986-1992 (n=104) and 1993-1998 (n=111) it was shown that the length of stay in hospital decreased from 26 to 15 days, with a decrease in preoperative stay from 4 to 2 days, and postoperative stay from 19 to 12 days. Major complications decreased from 49 percent to 25 percent, but the length of stay decreased both for patients with complications (25 to 20 days) and without complications (15 to 11 days). A multivariate analysis identified age, pancreatic fistula, delayed gastric emptying, biliary complications, operative time, extraabdominal infection and use of a percutaneous stent as independent predictors of total length of stay.[55] The progressive decrease of length of stay is also consistent with reports from many other institutions.[13,23,48,56,57] There are data[55] indicating that management of patients without complications has become more streamlined, leading to earlier discharge, and

for patients with complications the principles of care have made it possible to convert patients to out-patient management when medically appropriate.

However, the indication of the operation might be of importance not only for the long-term, but also for the short-term results of the operation. In a prospective series 1992-1998 the median survival after pancreaticoduodenectomy for carcinoma of the pancreatic head (n=108), distal bile duct (n=32), and ampulla (n=64) were respectively 16, 25, and 24 months. The postoperative morbidity and mortality were 52 and 2 percent, respectively, and the median hospital stay was 16 days.[58]

Hutter and co-workers[59] made a retrospective, population-based, risk-adjusted analysis of 5696 American patients who underwent major pancreatic resection and compared the outcomes of patients treated at hospitals with a general surgery residency program and those without. It was shown that the hospitals with a general surgery residency program had a slightly lower, but statistically significant, operative mortality rate (8 vs 11%, p<0.001), but a longer length of stay (22 versus 20 days). The observed difference in hospital mortality rates was not significant after an adjustment was made for patient mix and hospital volume. However, superior outcomes were found in the university teaching hospitals, as compared with the affiliated teaching and the non-teaching hospitals. There are also reports from UK showing that supervised surgical trainees can perform pancreatic resections safely.[60]

STANDARD WHIPPLE PROCEDURE

The first documented pancreatic resections were done by A Codivilla in 1898[59] and W Kausch in 1912,[4] and not by AO Whipple,[3] even though he – and not his co-workers and co-authors – has been given the eponyme of the procedure. However, already in 1942, Whipple wrote that pancreaticoduodenectomy with his new technique was the operation of choice for pancreatic cancer as well as for other periampullary neoplasms and some benign diseases.[60] Up to around 1980 the in-hospital mortality rate for the Whipple procedure commonly exceeded 20 percent and gave rise to a morbidity so formidable[9,61] that there were advocates for its abandonment altogether.[62-64] Pancreatoduodenectomy at that time was deemed as a success only if the patient survived, irrespective of the severe complications which were then regarded as an inevitable part of the procedure.[9,61] This must now be looked upon as surgical history, but according to Strasberg et al[65] some gastroenterologists may still be unaware of the improvements made over the years and may still associate the Whipple operation with unacceptably high morbidity and mortality rates.

Pancreaticoduodenectomy according to Whipple is, nowadays, gaining acceptance as an appropriate procedure for various malignant[18,66-72] and benign diseases[73] of the pancreas and periampullary region. In many tertial referral centers, the operation is now performed with complication rates of less than 40 percent and with death rates of 5 percent or lower.[12,23,65,74-77] The present status of the Whipple procedure was reviewed in 1997.[65] These authors discuss the remarkable evolution of the operation over the past 20 years. The forbidding mortality associated with pancreaticoduodenectomy just a generation ago has decreased in specialized centers to less than a few percent. Morbidity and length of hospital stay have also been markedly reduced. Although certain complications such as pancreatic fistula still occur, today they rarely result in the patient's death. Specialized centers have reported 5-year survival rates for adenocarcinomas of the pancreas of up to 20 percent (in node-negative patients and for well-differentiated tumors). More accurate preoperative techniques to identify unresectable cases, together with better peroperative surgical management, have reduced the incidence of operations in which resection turns out to be impossible.

As recently as the 1970s, the average mortality was 20 percent.[63] Since that time, improved understanding of the pathophysiological features of the disease process involved and improvements in surgical technique and perioperative care have contributed to a considerably decreased mortality rate. Several investigators[13,22,23,56,74,78-81] have described the ability of experienced surgeons and high-volume hospitals to perform this procedure with minimal mortality, less than 5 percent in many centers. Unfortunately, reported complication rates have remained relatively constant, ranging from 35 percent to more than 50 percent.[23,26,40,74,82,83]

Whipple's operation has also been used in patients suffering from chronic pancreatitis. Among 484 consecutive cases of chronic pancreatitis treated surgically between 1976-1997 at the Mayo clinic, 105 (22%) were operated on with a pancreaticoduodenectomy; suspicion of malignant neoplasm was a concern in 64 percent of these patients. Operative morbidity was 32 percent and mortality 3 percent and the mean hospital stay 16 days (range 12-82 days).[84] Whipple resection was also successfully done in patients with neuroendocrine tumors of the pancreas.[73]

PYLORUS-PRESERVING PANCREATICODUODENECTOMY (PPPD)

It is obvious that surgeons have to continued to modify the surgical procedures in efforts to further reduce

the mortality and morbidity and to cure more patients. One of the more important modification in recent years the pylorus-preserving pancreaticoduodenectomy, ppPD. Duodenum is has been usually cut at a point 3 cm distal from the pyloric ring, and the anastomosis is created 10cm apart from jejunal stump. The jejunum is positioned retrocolic.[85] The technique was first described by Watson in 1944[6] and reintroduced by Traverso and Longmire in 1978[5] to improve on the nutritional deficiencies associated with the standard Whipple resection and reduce likelihood of postgastrectomy syndromes, including dumping and bile reflux gastritis,[86] and enable possible faster nutritional recovery compared with PD.[87,88] Large published series on chronic pancreatitis report successful weight maintenance or gain in more than 80 percent of patients after either operations,[89,90] and both well-coordinated gastric and pyloric function in the long term[86,91] and emptying of liquids takes a significantly shorter time after ppPD than after a standard Whipple resection.[92,93]

Delayed gastric emptying is a troublesome postoperative complication that can occur after various gastric procedures, including hemigastrectomy, gastrojejunostomy, pyloroplasty, or duodenojejunostomy as is performed after pylorus-preserving pancreaticoduodenectomy.[66] In an early series of eight patients with ppPD the mean time required to regain full and independent oral diet was more than six days longer than in eight patients who had a standard Whipple operation with vagotomy.[35] An early collected review[36] of 252 ppPDs reported the disquieting incidence of 30 percent for early delayed postoperative gastric emptying. In yet another group of 15 patients, DGE was seen in 61 percent after PPPD and was compared to 41 percent in 52 patients who underwent a standard Whipple operation.[37] Due to this and other reports, the incidence of early delayed gastric emptying was initially thought to be increased after pylorus-preserving resections.[94] Nowadays this statement is questioned and in most centers the incidence of delayed gastric emptying as well as other complications are recognized to be about equal after standard and pylorus-preserving pancreaticoduodenectomies:[25,26,95-99] whereas earlier it was most often was found in excess of 30 percent, it is now more often less than 15 percent.

Postoperative delayed gastric emptying remains an engima, although in many series it appears to be decreasing. This complication does not seem to be due to the extent of the retroperitoneal dissection, as it is identical in patients with or without retroperitoneal lymphadenectomy, who have either pylorus-preservation or a hemigastrectomy.[100] On the other hand, a clinical delayed gastric emptying is reported to occur in 25-30 percent of

patients after ppPD.[25,31,32,94,101-103] Warshaw et al[100] recommended placement of gastrostomy tubes in all patients at the time of ppPD to minimize the discomfort of prolonged nasogastric intubation and its attendant complications. Some investigators have also noted a correlation between the incidence of delayed gastric emptying and other complications such as abscesses, fistulas, cholangitis, and right upper quadrant inflammation.[103,104,105]

The etiology of delayed gastric emptying is, however, in most settings unclear. The addition of a vagotomy is a complicating feature that many feel plays a role. There are also suggestions that the loss of motilin plays a major role. Motilin is a gastrointestinal hormone, produced almost entirely in the duodenum, which stimulates gastric peristalsis. When a pancreaticoduodenectomy is performed, virtually the entire duodenum, and thus the source of mitilin, is removed, as in a ppDD. The antibiotic erythromycin is a motilin agonist and in a randomised study the postoperative administration of erythromycin as a motilin agonist stimulated gastric emptying.[96] This adds support to the concept that the loss of motilin has a role in the pathogenesis of delayed gastric emptying.

On the other hand, physiologic measurements of serum gastrin have been shown to be nearly normal after ppPD but markedly depressed after standard Whipple (in which antrectomy removes the source of gastrin).[106,107] Several studies have reported that the frequency of peptic ulcer disease is higher after ppPD than after Whipple, perhaps because of preserved antral gastrin.[103,104,108] However, although peptic ulcer disease historically was feared to be a common complication after pylorus preservation, that is not longer the case.

Preservation of the antrum and pylorus was proposed to avoid the postgastrectomy symptoms such as dumping, diarrhea, distention, and dyspepsia associated with the standard Whipple procedure without increasing the risk of marginal ulceration.[5,86,109] The reintroduction of pylorus-preserving procedure embodied an appealing concept also because processing and absorption of food appears to be more physiologic than if an antiulcer antectomy –or vagotomy- has to be added to the pancreaticoduodenectomy. Eliminating these parts of pancreaticoduodenectomy might also decrease the risk of postoperative diarrhea compounding the problems of possible pancreatic insufficiency.[94] However, ambitious studies in recent years have almost invariably failed to demonstrate nutritional advantages in terms of glucose homeostasis and iron absorption.[109] In general, most studies have used postoperative patient weights as parameters of nutritional status and have reported weight gain in 67

to 95 percent of patients after ppPD.[90,110,111] Also, no recent studies demonstrate differences between ppPD and Whipples concerning nutritional parameters,[100] also in randomized studies.[72] Because postoperative nuritional assessment by isolated weight measurements can be misleading, primarily because of variable preoperative nutritional status, standardization of weight measurements by determination of postoperative body mass index, BMI, has been advocated for nutritional assessment in patients after pancreaticoduodenectomy.[106]

A potential problem with the ppPD technique is the possibility of infiltration of the duodenal margin and incomplete removal of regional nodes.[87,102] However, clinical experience has shown that the pyloric nodes close to the tumor can be removed even if the pylorus is preserved. If there is doubt, a frozen section examination of the duodenal section should be performed, and if positive, the procedure converted to a pyloroantrectomy.[87] Moreover, investigation of the lymphatic diffusion of pancreatic cancer found involvement of perigastric nodes in only 14 percent of cases.[113] This might explain why a retrospective comparison between pancreaticoduodenectomy with or without pylorus-preservation suggested standard PD was associated with a higher survival rate than ppPD in patients with obvious stage III carcinoma.[102] However, other studies suggest similar longterm survival.[114]

The operative results today are just as good for ppPD as for standard Whipple operations. In 283 ppPDs (243 for malignant disease and 40 for benign disease) the mortality was 1 percent, but 108 patients (39%) were readmitted (173 readmissions). However, most patients were readmitted due to recurrent disease (61%). Important indications were gastroinstestinal obstruction (n=13), biliary obstruction (n=14), and pain (n=21). Thirty-one (47%) patients were readmitted for end-stage palliation. Forty-seven (44%) of the patients were readmitted for surgical complications such as abscess (n=10), gastrointestinal obstruction (n=7) and fistula (n=7). The median hospital stay for surgical related complication was 7 days. The median hospital-free survival with a readmission was 16 months (recurrent disease 13 months, surgical related complication 30 months). After surgical intervention for recurrent disease median survival was 8 weeks.[115]

In a study of 72 consecutive, not-randomized patients with chronic pancreatitis, 39 patients were operated on with a ppPD and 33 with a classical Whipple. Short-term complications included (ppPD vs Whipple): pancreatic or biliary fistulas (5 vs 15%), delayed gastric emptying (33 vs 12%), cholangitis (3 vs 6%) and death (0 vs 3%). Delayed gastric emptying was not associated with other

complications and resulted in a longer hospital stay for ppPD than for Whipple patients (15 vs 12 days), but discharge on or before the 12th postoperative day was remarkably different between the groups (15% ppPD, 58% Whipple). The long term complications and effects were similar.[100]

There is also description of pancreato-gastrostomy in the reconstruction of a ppPD. In a three year period 47 pancreatogastrostomies were performed in an Indian hospital with 4 percent mortality, but there were no pancreatic leaks. Delayed gastric emptying (27%) and wound infection (15%) were the most common morbidity factors.[116]

COMPARISONS OF STANDARD WHIPPLE OPERATION AND PYLORUS-PRESERVING PANCREATICODUODENECTOMY

There have been several attempts to compare the standard Whipple and the pylorus-preserving variants both concerning the short- and long term results. One suggested advantage of pylorus-preserving pancreaticoduodenectomy (ppPD) is that operating time is shorter, as a gastric resection is not required.[87] However, retrospective comparisons, including both malignant and benign pancreatic diseases, between ppPD and standard PD found similar perioperative mortality and morbidity rates.[87,117,118] While some authors have reported a higher rate of postoperative delayed gastric emptying with ppPD in comparison with standard PD,[78] in other studies the rates between groups were similar.[87,88] The randomized study by Büchler et al[111] supports these results, but their study was done only on patients with chronic pancreatitis.

The long-term studies are even more important. In 1988 Fink and co-workers[92] compared six long-term survivors after classical Whipple operation with six patients who had undergone the pylorus preserving ectomy. Their postgrastectomy-type symptoms were identical; however, a delay in liquid-phase gastric emptying was seen in patients with an anterectomy compared to those with preserved pylorus and antrum. This report deserves attention even though the sample is very small.

In another, non-randomized study of a total of 156 eligible patients after pancreaticoduodenectomy, 61 were considered "survivors" and of them complete quality-of-life data were obtained from 45 patients; 24 who had undergone a pyloruspreserving pancreaticoduodenectomy and 21 who had undergone a classical Whipple operation. Quality-of-life parameters, as measured by the Short Form-36 health survey, demonstrated no significant differences between the subgroups and normal con-

trol subjects in six of the eight domains for physical and mental health. Patients who had undergone the classical operation were noted to have significantly lower scores for general health and vitality than either age-matched control subjects or those who had undergone the pylorus-preserving operation. No differences in nutritional parameters or indicators of pancreatic exocrine function between the two groups were identified. An elevated A_{1C} value was seen in only one patient who was not diabetic preoperatively. Therefore, it appears that nutritional status and pancreatic exocrine function are not improved in patients undergoing a pylorus-preserving procedure compared to the classic one.[118]

The fat absorption following pylorus-preserving pancreatoduodenectomy was studied using ^{13}C-triactanoin breath test in three groups: pancreatogastrostomy, pancreatojejunostomy retrograde to a duodenojejunostomy, or pancreatojejunostomy antegrade to a duodenojejunostomy. It was found that the ^{13}C excretion rates and the cumulative values of the pancreatogastrostomy group were better than those of the pancreaticojejunostomy group, whereas there were no differences between the two ways of performing the pancreaticojejunostomies. The ^{13}C excretion rates and the cumulative values in the patients with more than 30 percent pancreatic fibrosis were lower than those in the patients with less than 30 percent pancreatic fibrosis, regardless of the methods of reconstruction.[119]

In summary, the choice between a standard Whipple and a ppPD cannot, however, today be made on medically based evidence concerning long-term results.

DUODENUM-PRESERVING RESECTION OF THE HEAD OF THE PANCREAS

The duodenum-preserving resection of the head of the pancreas was first described by Beger[120,121] in the 1980s for the treatment of chronic pancreatitis. After laparotomy a Kocher's maneuver is performed. A bile duct drainage tube is placed from the extrahepatic bile duct to the ampulla of Vater. The pancreas is then divided by electrocautery above the portal vein. A drainage tube is placed into the main pancreatic duct of the pancreatic head up to ampulla of Vater from the pancreatic stump and the pulsation of the pancreatoduodenal artery is identified. The parenchyma of the pancreatic head is dissected preserving the artery. The posterior superior pancreatoduodenal artery is not routinely dissected, to prevent injury to it, because it provides arterial supply to the common bile duct. Palpating the drainage tube, only the pancreatic duct is dissected. After pancreatic head resection, pancreatic reconstruction was performed by

pancreaticojejunostomy. Today, a resection of the intrapancreatic portion of the common bile duct is seldom done as well, combined with a choledocojejunostomy distal to the pancreaticojejunostomy. This procedure depends on a precise knowledge of anatomy, especially of the pancreaticoduodenal arteries which provide blood to the duodenum. The most important part of the technique of this procedure is to keep the connective tissue membrane of the posterior surface of the pancreas intact so as to preserve pancreaticoduodenal arteries and veins.[122]

Since the first description some modifications of the method have been proposed.[123-125] The "Beger procedure" is based on the consideration that resection of the stomach, the extrahepatic bile duct, and the duodenum is neither anatomically nor functionally necessary for the removal of the enlarged head of the pancreas. After a median follow-up time of 14 years Beger et al found that 79 percent of their 504 patients were pain-free. They had a frequency of hospital deaths of 1 percent.[126]

To date, however, the procedure has not been proposed for malignant disease except in exceptional cases, due to the difficulties of lymph node dissection in the retropancreatic region. Not even in mucinous pancreatic cancer has it been widely adopted as a possible technique, as it is difficult to secure the local radicality of the disease.

The results of duodenum-preserving pancreatic head resection in patients with pancreas divisum has been shown to be good. In 36 patients there was no operative mortality and 50 percent of the patients became completely pain free.[127]

CONCLUSION

During the 65 years that have elapsed since Whipple and co-workers opened up the possibility of doing pancreatoduodenectomies, the pre-, per-, and postoperative management of the operation has changed considerably. There are now reports from so many different surgeons and groups of surgeons that the operation can be done with almost no mortality and a limited complication rate, that it is unacceplable for certain standards to be not reached. The first step towards this is to define the indications for the procedure in each surgical setting, and then to report the results: immediate postoperative mortality rate, complications, use of resources, and long-term follow-up including quality of life, etc.

However, there is, to date no important evidence favoring the standard instead of the pylorus-preserving pancreaticoduodenectomy for pancreatic cancer or vice

versa, and it is not probable that further randomized studies will give such evidence – the possible differences between the procedures are most probably too limited. Therefore, it can be recommended that each department of surgery dealing with pancreatic resections first become well familiar with one type of resection, and ensure that a high standard is reached with this method. If the number of patients is then big enough, the surgeons could also adopt the other technique.

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