Pancreatic Anastomotic Failure Rate after Pancreaticoduodenectomy Decreases with Microsurgery

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BACKGROUND: We have observed that leakage from pancreaticojejunostomy is reduced when a surgical microscope is used to construct the pancreaticojejunostomy during pancreaticoduodenectomy. To validate our hypothesis that better vision improves the technical performance of pancreaticojejunostomy, we limited inclusion criteria to those patients at high risk for leak, performed more cases, and used the grading system of the International Study Group of Pancreatic Surgery.

STUDY DESIGN: From 1988 through 2008, 507 consecutive pancreaticoduodenectomies were performed with pancreaticojejunostomy. A subset of 283 patients at risk for leak had a main pancreatic duct (MPD) ≤3 mm at the surgical margin. Pancreaticojejunostomy was completed with surgical loupes (n = 135) or surgical microscope (n = 148). Incidence of pancreaticojejunostomy leak and delayed gastric emptying was determined using a Web-based calculator for the severity grading scale of the International Study Group of Pancreatic Surgery.

RESULTS: Within the 507 pancreaticoduodenectomies, the clinically relevant pancreaticojejunostomy leak for those with an MPD >3 mm (n = 224) was 4%, and with an MPD ≤3 mm (n = 283) it was 16% ($p < 0.0001$). For these 283 high-risk patients, outcomes were worse in the loupes versus microscope group, ie, clinically relevant pancreaticojejunostomy leak (21% versus 11%; $p = 0.021$), pancreas-related complications (31% versus 19%; $p = 0.018$), clinically relevant delayed gastric emptying (19% versus 9%; $p = 0.016$), and hospital length of stay (12.9 versus 9.5 days; $p < 0.0001$).

CONCLUSIONS: In a subset of pancreaticoduodenectomy patients at high risk for pancreaticojejunostomy leak, the increased visual acuity of the surgical microscope reduced clinically relevant pancreatic anastomotic failure, delayed gastric emptying, and hospital length of stay. (J Am Coll Surg 2010;211:510–521. © 2010 by the American College of Surgeons)

Surgeons have attempted to find a reliable reconstruction technique during pancreaticoduodenectomy (PD) to lower pancreatic anastomotic failure (PAF) as detected by amylase-rich leakage and its associated complications.[1-9] However, a consensus has not been reached as to the best method of managing the pancreatic remnant. An explanation for this conundrum includes 2 observations. First, previous case studies of outcomes after PD included a large proportion of patients who were not at risk for leak after pancreaticojejunostomy (PJ), ie, a large pancreatic duct or a hard gland. These patients should be excluded when evaluating a promising anastomotic technique. A study group that has a high leak rate would not require numerous study subjects to detect an improvement. Second, and just as important, previous studies have used a wide variety of definitions for leak, encumbered by a lack of a severity grading system for the leak, particularly if it was clinically significant. Therefore, comparisons of leak rates between studies have been confusing. The goal of the literature studies has been to decrease PJ leak with clinical impact, not just a "chemical" leak without clinical significance. To address these pitfalls, subsequent studies to lower PAF rates would be improved if only those patients at high risk for leak were included and if the recently published PAF severity grading system of the International Study Group of Pancreatic Surgery (ISGPS)[10] was used.

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Abbreviations and Acronyms

DGE = delayed gastric emptying
IR = interventional radiology
ISGPS = International Study Group of Pancreatic Surgery
LOS = length of stay
MPD = main pancreatic duct
NG = nasogastric
PAF = pancreatic anastomotic failure
PD = pancreaticoduodenectomy
PJ = pancreaticojejunostomy
POD = postoperative day

My colleagues and I have lowered our PAF rates by using microsurgery. In 2006, we reported that construction of the PJ during PD with the surgical microscope at 12.5 power was associated with a lower leak rate (3%, n = 70) than with surgical loupes at 2.5 power (15%, n = 196).[11] As discussed here, our study had similar limitations; we started the study with a low leak rate, as we included all patients regardless of their risk for leak and ISGPS definitions were not available at that time. In the 2006 study, we observed that a main pancreatic duct (MPD) ≤3 mm at the surgical margin was an independent predictor of leak (odds ratio = 7.75; p = 0.007). Just 55% (147 of 266) of PD patients had this small duct. Others have found MPD ≤3 mm to be associated with leak.[1,2,5,12-15]

Risk might be better assessed if the more objective small pancreatic duct size was used rather than the more subjective estimation of gland texture. In 2010, using 507 PD patients, we reported that an MPD ≤3 mm was the strongest predictor of PAF, but we did not analyze the effect of microsurgery within this subgroup at very high risk for leak (odds ratio = 4.8).[16] In that study, there was no comparison of outcomes using the microscope versus loupes for the group at risk to leak, ie, those with small ducts.

To address the pitfalls discussed here, the current study uses only patients with small ducts, which had increased from the 147 patients in the 2006 report to 283 in the current report, and used the ISGPS definition for PAF.[10] Also, we used a standardized Web-based calculator for leak, which has recently clarified the ISGPS system, making it more user-friendly and provided global access because it is Web-based.[16,17]

METHODS

Inclusion criteria for high-risk patients and clinical data collection

Cases of total pancreatectomy (without a PJ) were excluded. Using an IRB-approved prospective single-surgeon database for pancreatic operations, we found 507 consecutive patients undergoing PD with PJ from January 1988 to July 2008. There were no pancreaticogastrostomies. Fifty-five percent (283 of 507) of patients had a pancreatic duct ≤3 mm, as measured directly at the surgical margin, and were considered at higher risk to leak.[11,16] These 283 patients were the subjects of this study.

In this subset, ie, most likely to leak, we examined the impact of the surgical microscope on PAF and other outcomes after PD. The ISGPS PAF and delayed gastric emptying (DGE) rates were calculated for those reconstructed using surgical loupes at 2.5 power (loupes group) versus surgical microscope at 12.5 power (microscope group). The complete medical record of each patient was independently re-examined (by YH) for demographic, clinical, and pathological features.

Operative technique

Surgical technique and postoperative management are described in detail in previous reports[11,16,18] and have recently been described in a video/chapter.[19] Briefly, the technique of pancreatic anastomosis was generally the same in all patients, except for the magnification used for the duct to mucosa PJ anastomosis. Since April 2002, we have substituted the microscope for loupes in every case to reconstruct with PJ (n = 248).

The pancreatic remnant was mobilized just enough to allow the posterior outer sutures to be placed. This allowed minimal dead space behind the gland on top of the splenic vein and preserved blood supply inside the pancreatic parenchyma. The end to side, internally stented, 2-layered, duct to mucosa PJ used an inner layer of interrupted absorbable suture. For ducts ≤3 mm, 4 inner sutures were used, 1 at each quadrant. All knots were tied down on the outside of the new lumen. Because of the angles provided by the dual-head binocular microscope, half of the sutures were best placed from the senior surgeon's left side of the table and the other half of the sutures were placed from the resident's right side of the table. The internal stent was a 4-cm 3F pancreatic stent cut from a 10-cm commercially available endoscopic pancreatic stent (Geenen or Zimmon stent; Wilson-Cook Medical Inc.). The outer layer of the seromuscular envelope was completed with interrupted 3-0 silk Lembert sutures by the senior surgeon. When the visual aide was surgical loupes at 2.5 power, 5-0 monofilament absorbable sutures were used on a small needle (RB-2 size). When using the surgical microscope at 12.5 power (Leica Wild M680 with 30-cm focal length lens; Leica Microsystems), we were able to use a much smaller needle (RB-3; custom-made by Ethicon Inc.) on 6-0 braided absorbable suture.

A single closed-suction drain was routinely placed (n = 255, 90%) posterior to both the pancreatic and biliary anastomosis through a right subcostal site. Multiple drains