



A Nationwide Comparison of Laparoscopic and Open Distal Pancreatectomy for Benign and Malignant Disease

Thijs de Rooij, BSc, Anneke P Jilesen, MD, Djamila Boerma, MD, PhD, Bert A Bonsing, MD, PhD, Koop Bosscha, MD, PhD, Ronald M van Dam, MD, PhD, Susan van Dieren, PhD, Marcel G Dijkgraaf, PhD, Casper H van Eijck, MD, PhD, Michael F Gerhards, MD, PhD, Harry van Goor, MD, PhD, Erwin van der Harst, MD, PhD, Ignace H de Hingh, MD, PhD, Geert Kazemier, MD, PhD, Joost M Klaase, MD, PhD, I Quintus Molenaar, MD, PhD, Els J Nieveen van Dijkum, MD, PhD, Gijs A Patijn, MD, PhD, Hjalmar C van Santvoort, MD, PhD, Joris J Scheepers, MD, PhD, George P van der Schelling, MD, PhD, Egbert Sieders, MD, PhD, Jantien A Vogel, MD, Olivier R Busch, MD, PhD, Marc G Besselink, MD, MSc, PhD, for the Dutch Pancreatic Cancer Group

BACKGROUND: Cohort studies from expert centers suggest that laparoscopic distal pancreatectomy (LDP) is superior to open distal pancreatectomy (ODP) regarding postoperative morbidity and length of hospital stay. But the generalizability of these findings is unknown because nationwide data on LDP are lacking.

STUDY DESIGN: Adults who had undergone distal pancreatectomy in 17 centers between 2005 and 2013 were analyzed retrospectively. First, all LDPs were compared with all ODPs. Second, groups were matched using a propensity score. Third, the attitudes of pancreatic surgeons toward LDP were surveyed. The primary outcome was major complications (Clavien-Dindo grade \geq III).

RESULTS: Among 633 included patients, 64 patients (10%) had undergone LDP and 569 patients (90%) had undergone ODP. Baseline characteristics were comparable, except for previous abdominal surgery and mean tumor size. In the full cohort, LDP was associated with fewer major complications (16% vs 29%; $p = 0.02$) and a shorter median [interquartile range, IQR] hospital stay (8 days [7–12 days] vs 10 days [8–14 days]; $p = 0.03$). Of all LDPs, 33% were converted to ODP. Matching succeeded for 63 LDP patients. After matching, the differences in major complications (9 patients [14%] vs 19 patients [30%]; $p = 0.06$) and median [IQR] length of hospital stay (8 days [7–12 days] vs 10 days [8–14 days]; $p = 0.48$) were not statistically significant. The survey demonstrated that 85% of surgeons welcomed LDP training.

CONCLUSIONS: Despite nationwide underuse and an impact of selection bias, outcomes of LDP seemed to be at least noninferior to ODP. Specific training is welcomed and could improve both the use and outcomes of LDP. (J Am Coll Surg 2015;220:263–270. © 2015 by the American College of Surgeons)

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From the Department of Surgery (De Rooij, Jilesen, Nieveen van Dijkum, Van Santvoort, Vogel, Busch, Besselink) and the Clinical Research Unit (Dieren, Dijkgraaf), Academic Medical Center; the Department of Surgery, Onze Lieve Vrouwe Gasthuis (Gerhards); and the Department of Surgery, VU Medical Center (Kazemier), Amsterdam; and the Department of Surgery, St Antonius Hospital, Nieuwegein (Boerma); the Department of Surgery, Leiden University Medical Center, Leiden (Bonsing); the Department of Surgery, Jeroen Bosch Hospital, Den Bosch (Bosscha); the Department of Surgery, Maastricht University Medical

Center, Maastricht (Van Dam); the Department of Surgery, Erasmus Medical Center (van Eijck); the Department of Surgery, Maasstad Hospital (Van der Harst), Rotterdam; the Department of Surgery, Radboud University Medical Center, Nijmegen (Van Goor); the Department of Surgery, Catharina Hospital, Eindhoven (De Hingh); the Department of Surgery, Medisch Spectrum Twente, Enschede (Klaase); the Department of Surgery, University Medical Center Utrecht, Utrecht (Molenaar); the Department of Surgery, Isala Clinics, Zwolle (Patijn); the Department of Surgery, Reinier de Graaf Gasthuis, Delft (Scheepers); the Department of Surgery, Amphia Hospital, Breda (Van der Schelling); and the Department of Surgery, University Medical Center Groningen, Groningen (Sieders), the Netherlands.

Correspondence address: Marc G Besselink, MD, MSc, PhD, Department of Surgery, Academic Medical Center, PO Box 22660, 1100 DD, Amsterdam, the Netherlands. email: m.g.besselink@amc.nl

Abbreviations and Acronyms

ASA	= American Society of Anesthesiologists
CDC	= Centers for Disease Control and Prevention
IQR	= interquartile range
ISGPS	= International Study Group of Pancreatic Surgery
LDP	= laparoscopic distal pancreatectomy
ODP	= open distal pancreatectomy
OR	= odds ratio

Since the first reported laparoscopic distal pancreatectomy (LDP) in 1996,¹ its introduction into clinical practice has been relatively slow, especially when compared with other laparoscopic gastrointestinal procedures.²⁻⁴ This slow introduction may be related to the low volume and high-risk nature of pancreatic surgery, which hampers completion of the learning curve of approximately 10 to 17 LDPs.^{5,6} Considering an average of 3 to 6 distal pancreatectomies are performed per center per year in recent US⁷ and UK⁸ studies, completing the learning curve might take approximately 2 to 3 years. However, the ongoing centralization of pancreatic surgery^{9,10} may enhance completion of this learning curve within a reasonable time. An additional factor in the slow introduction of LDP may be the lack of specific LDP training.

In several recent systematic reviews, LDP was associated with less intraoperative blood loss (263 to 355 mL), more splenic preservation (odds ratio [OR] 2.98), lower postoperative morbidity (OR 0.7), and a shorter hospital stay (3 to 6 days).¹¹⁻¹⁶ Notably, 80% (24 of 30) of the studies included in these reviews originated from very high-volume expert pancreatic centers, and none of these studies was performed on a nationwide level. Therefore, it is unclear whether these promising results are generalizable to "real-world" clinical practice. Because most series were retrospective, selection bias might have played a relevant role in the perceived superiority of LDP. Propensity score matching could be used to reduce some of this bias in retrospective studies.^{17,18} Furthermore, it is unclear whether pancreatic surgeons consider nationwide introduction of LDP feasible and are willing to undergo specific training in LDP, if needed. We aimed to determine the use and outcomes of LDP vs ODP and surgeons' attitudes toward LDP, all on a nationwide level.

METHODS**Patients**

A nationwide retrospective study was performed on all consecutive adult patients who had undergone an elective distal pancreatectomy in 1 of 17 centers of the Dutch Pancreatic Cancer Group (DPCG)¹⁹ between January 1, 2005 and September 1, 2013. All 17 centers performed at

least 20 pancreatoduodenectomies annually. Patients were excluded if distal pancreatectomy was not the primary procedure or if essential data on the surgical procedure, such as the operative report or the postoperative course, were lacking. Patient categorization was done according to the applied method of surgery: laparoscopic or open. Analyses were performed according to intention-to-treat principles, meaning that the results of a converted LDP were analyzed in the LDP group. The Medical Ethics Review Committee of the Academic Medical Center (Amsterdam, the Netherlands) approved the study protocol.

Surgical technique

Laparoscopic distal pancreatectomy was performed using 3 to 4 trocars placed around an umbilical camera. The resected specimen was extracted by enlarging one of the trocar incisions or via a Pfannenstiel incision. During LDP, the patient was in a supine or right lateral decubitus position. Hand access ports were not used. Open distal pancreatectomy was performed using a bilateral subcostal incision or a midline laparotomy using standard techniques. In some cases, during either laparoscopic or open surgery, the pancreatic remnant was treated subsequently with additional sutures or with an absorbable fibrin sealant patch. In patients with benign disease, spleen preserving distal pancreatectomy with preservation of the splenic vessels (Kimura's technique²⁰) was attempted and if preservation of the splenic vessels was considered not feasible, a spleen preserving distal pancreatectomy with ligation of splenic vessels (Warshaw's technique²¹) or subsequent splenectomy was performed. In case of suspected or proven malignant disease, splenectomy and additional lymphadenectomy were performed. One or 2 drains were placed near the pancreatic remnant and left subphrenic space.

Definitions

Postoperative complications during hospital stay and 30 days thereafter were collected, dichotomously scored, and classified using the Clavien-Dindo classification of surgical complications.²² Major complications were defined as Clavien-Dindo grade III or higher. Postoperative pancreatic fistula, delayed gastric emptying and post-pancreatectomy hemorrhage were all scored using the recommended International Study Group of Pancreatic Surgery (ISGPS) definitions.²³⁻²⁵ Grade B/C complications were considered major, and only these grades were noted. Surgical site infection was defined using the Centers for Disease Control and Prevention (CDC) definition.²⁶ Resection margins, including transection and circumferential margins, were classified into R0 (distance margin to tumor ≥ 1 mm), R1 (distance margin to tumor < 1 mm) and R2 (macroscopically positive margin).²⁷

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