
The Largest European Single-Center Experience: 300 Laparoscopic Pancreatic Resections



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- BACKGROUND:** Although laparoscopic pancreatic resection (LPR) has become routine, large single-center series are still lacking. Our aim was to analyze the results of a large European single-center series of LPR.
- STUDY DESIGN:** Between January 2008 and September 2015, 300 LPRs were performed and studied prospectively, including 165 (55%) distal pancreatectomies, 68 (23%) pancreaticoduodenectomies (PDs), 30 (10%) enucleations, 35 (11%) central pancreatectomies, and 2 (1%) total pancreatectomies.
- RESULTS:** Mean age was 54 ± 15.4 years old (range 17 to 87 years), and most patients were women (58%). Laparoscopic pancreatic resection was performed for malignancy (46%), low potential malignant (44%), or benign (10%) diseases. The mean operative durations were 211 ± 102 minutes (range 30 to 540 minutes) for the entire population and 351 ± 59 minutes (range 240 to 540 minutes) for PD, and decreased with the learning curve. Mean blood loss was 229 ± 269 mL (range 0 to 1,500 mL), and 13 patients (4%) received transfusions. Conversion to an open procedure was required in 12 patients (4%), and only 5 in the last 250 patients (14% vs 2%; $p < 0.001$). Mortality occurred in 4 (1.3%) patients and only after PD (5.8%). Common complications were pancreatic fistula ($n = 124$, 41%), bleeding ($n = 35$, 12%), and reoperation ($n = 28$, 9%). The postoperative outcomes were less favorable in procedures with a reconstruction phase ($n = 105$) than in those without ($n = 195$), with increased mortality (3.8% vs 0%; $p = 0.04$), overall morbidity (76% vs 52%; $p < 0.001$), and mean hospital stay (26 ± 15 days vs 16 ± 10 days; $p < 0.001$).
- CONCLUSIONS:** Laparoscopic pancreatic resection without a reconstruction phase has excellent outcomes; LPR with a reconstruction phase, especially PD, has less favorable outcomes, and further randomized studies are required to draw conclusions on the safety and benefits of this approach. (J Am Coll Surg 2017;225:226–234. © 2017 by the American College of Surgeons. Published by Elsevier Inc. All rights reserved.)
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Laparoscopic pancreatic resections (LPRs) without a reconstruction phase, such as distal pancreatectomy

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(DP) and enucleation, are frequently performed in low- and high-volume centers.¹⁻⁴ On the other hand, procedures with a reconstruction phase, such as pancreaticoduodenectomy (PD),⁵⁻⁹ central pancreatectomy (CP),^{10,11} and total pancreatectomy^{12,13} are still uncommon and are only performed in high volume centers and by experienced surgeons. Results of several retrospective comparative studies and meta-analyses have shown shorter hospital stays, fewer overall complications but no decrease in pancreatic fistula (PF) for DP,^{1,14-17} and safety of resection for adenocarcinomas.^{18,19} The benefits of the laparoscopic approach (LA) for PD were not as significant in retrospective studies for the feasibility and safety of this procedure; nonrandomized comparative studies showed reduced blood loss,^{20,21} a shorter hospital

Abbreviations and Acronyms

CP	= central pancreatectomy
DP	= distal pancreatectomy
IPMN	= intraductal papillary mucinous neoplasia
LA	= laparoscopic approach
LPR	= laparoscopic pancreatic resection
NET	= neuroendocrine tumor
PD	= pancreaticoduodenectomy
PF	= pancreatic fistula

stay,²⁰⁻²² and possible better oncologic results for adenocarcinoma.²³ Recently, increased mortality after laparoscopic PD was demonstrated.^{24,25} It is too early to reach firm conclusions about the benefits of laparoscopic CP compared with open surgery.^{26,27} Although many surgical series have now been published, there are very few large single-center studies providing an overview of the indications, outcomes, and limits of laparoscopic pancreatic surgery in specialized centers.^{8,28} The aim of this study was to analyze the results of the LA in a unit experienced in pancreatic surgery.

METHODS

Pancreatic resections were mainly performed by 3 senior pancreatic surgeons (AS, SD, and BA). The LA applied since January 2008 was decided according to each surgeon's experience and was mainly performed by SD and BA. All patients who underwent the LA were included in a prospective database. Contraindications to LA are summarized in Table 1. Laparoscopic pancreatic resections with a reconstruction phase were begun after performing approximately 50 DP. Demographic, surgical, and postoperative outcomes were recorded. Complications were recorded as pancreatic-specific, defined as PF and associated complications (bleeding and collections) and delayed gastric emptying. Certain patients developed more than 1 severe complication. Pancreatic fistulas were defined according to the International Study Group of Pancreatic Fistula (ISGPF).²⁹ Patients with any grade of PF were usually managed in the hospital until complete recovery. Mortality included all deaths occurring within 90 days after surgery. To facilitate analysis, the only 2 cases of total pancreatectomy were added to the group of PD.

Underlying pancreatic disease and surgical strategy

All cases were discussed in a multidisciplinary meeting, and the underlying pancreatic disease was classified as follows. Malignant diseases included adenocarcinomas, neuroendocrine tumors (NETs) >2 cm, malignant

Table 1. Relative Contraindications for the Laparoscopic Approach

Common contraindication
Vascular invasion
Radiochemotherapy
Adjacent organ invasion
Acute and chronic pancreatitis
Large tumors
Segmental portal hypertension
Need for multiple frozen section
Specific contraindication
Pancreaticoduodenectomy
Need for medial arcuate ligament division
Obese patients (BMI >30 kg/m ²)
Enucleation
Communicating lesions (IPMN)
Lesions close (<2 mm) to the main duct
Deep lesions located on the posterior aspect of the pancreatic head
Central pancreatectomy
Lesions situated to the right of the gastroduodenal artery but can be resected by central pancreatectomy

IPMN, intraductal papillary mucinous neoplasia.

ampullomas, degenerated intraductal papillary mucinous neoplasia (IPMN), solid pseudopapillary neoplasms, bile duct cancer, and other primary or secondary malignant pancreatic diseases. Low potential malignant diseases included noninvasive IPMN, NET <2 cm, noninvasive mucinous cystic neoplasm, pancreatic intraepithelial neoplasias in patients with familial pancreatic cancer and other rare diseases. Malignant diseases were treated by anatomic resection according to oncologic rules; low potential malignant, and benign diseases whenever possible, were treated by parenchyma-sparing pancreatectomy if they fulfilled anatomic criteria (location far from the main pancreatic duct for enucleation, and in the mid-pancreas for CP).

Surgical technique

The patient was placed in the supine position under general anaesthesia, with the legs spread apart and the monitor to the left. Open celioscopy was performed through the umbilicus and 5 to 6 trocars were inserted so that the surgeon and the first assistant did not cross hands. A 30-degree optic, a Harmonic shears (Ethicon), and recently, a Thunderbeat seal and cut (Olympus) and bipolar cautery coagulation device were used. Although the surgeon was positioned between the patient's legs for PD, he was to the right of the patient for DP and CP. An abdominal drain was routinely left in the surgical field. A hanging manoeuvre was performed

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