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Short-term outcomes after distal pancreatectomy: Laparotomy *vs.* laparoscopy – A single-center series

Gaëtan-Romain Joliat, Nicolas Demartines*, Nermin Halkic, David Petermann, Markus Schäfer

Department of Visceral Surgery, University Hospital CHUV, Lausanne, Switzerland

HIGHLIGHTS

- Laparoscopy has been recently used more frequently for distal pancreatectomy.
- Postoperative complications and oncologic outcomes were similar in this study.
- Length of stay was shorter for the patients operated by laparoscopy.
- Laparoscopy should be offered when technically feasible.

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ABSTRACT

Background: Laparoscopic distal pancreatectomy was introduced 15 years ago, but it is still not widely used. The aim of the study was to compare the postoperative complications and length of stay between open and laparoscopic distal pancreatectomy.

Materials and methods: A search of our institutional pancreas database was performed. All consecutive distal pancreatectomy patients from 2000 to 2015 were identified. Demographics, peri- and postoperative outcomes were reviewed. Postoperative complications were graded using Clavien classification. Standard statistical analyses were performed.

Results: One hundred and five patients underwent distal pancreatectomy (45 women, 60 men, median age of 63 years). Seventy-nine cases were performed open and 26 by laparoscopy (conversion rate from laparoscopy to laparotomy: 7/26). Characteristics of both groups were similar. The tumor proportion was similar in both groups (56/79 and 23/26, $p = 0.114$). Overall complication rate was 41/79 (52%) in the open group and 9/26 (36%) in the laparoscopy group ($p = 0.175$). Two patients died during hospital stay in the open group compared to 0 in the laparoscopy group ($p = 1$). The fistula rates were comparable (17/79 and 5/26, $p = 1$). Median length of stay was shorter for the laparoscopy group (8 *vs.* 12 days, $p < 0.001$), as well as the median intermediate care stay (1 *vs.* 3 days, $p = 0.004$).

Conclusion: Short-term outcomes after open and laparoscopic distal pancreatectomy regarding postoperative complications and mortality were similar, but length of stay was significantly shorter for the laparoscopic approach. Hence, laparoscopic distal pancreatectomy should be offered to all suitable patients.

1. Introduction

Pancreas surgery is mostly performed for oncologic reasons, and despite significant technical advances during recent decades, most surgeons still prefer open surgery as the operative procedures are complex. Nevertheless, minimally invasive surgery has been increasingly adopted, in particular for distal pancreatectomy (DP) as in majority of cases only a resection is performed compared to more complex pancreatic head resection where technically demanding reconstructions are needed [1]. The initial implementation of laparoscopic DP was rather reluctant, but increased since 2000 [2]. This might be explained by the need for both thorough skills in minimally invasive techniques and in pancreas

* Corresponding author. Department of Visceral Surgery, University Hospital CHUV, Rue du Bugnon 46, 1011, Lausanne, Switzerland.
E-mail address: demartines@chuv.ch (N. Demartines).

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surgery. Such combination is often best provided in specialized centers that have been recently developed due to the centralization of pancreas surgery in many countries.

Preliminary studies have shown that laparoscopy for DP was feasible and safe [2,3], whereby a learning curve of up to 15 cases is necessary [4–6]. More recently, several studies reported favorable short-term outcomes like shorter operative times, less postoperative complications, and decreased length of stay (LoS) [7–9]. A major concern for laparoscopic DP was to maintain oncologic standards for the resection of adenocarcinomas of the body and tail of the pancreas [10,11]. The current evidence comparing postoperative outcomes of open to laparoscopic DP for pancreatic adenocarcinoma is growing, but is still scarce until now [12].

The aim of the present study was to compare a single-center experience of laparoscopic DP to open surgery with a special emphasis on postoperative complications and LoS.

2. Materials and methods

2.1. Patients

The prospective pancreas database of the Department of Visceral Surgery of the University Hospital of Lausanne (CHUV, Switzerland) was searched for DP cases. All consecutive patients from 2000 to 2015 who underwent DP were potentially eligible to be included in the study. Patient demographics, perioperative data, and postoperative outcomes were retrieved.

2.2. Perioperative outcomes

Intraoperative blood loss was measured at the end of the operation by the surgeon and the anesthesiologist based on the soaked gauze weight and the aspirated fluids. Postoperative complications were measured using the Clavien classification [13]. They were separated into minor (I–II) and major complications (III–IV). Grade V was defined as death during hospital stay or during the 60 days after the operation. LoS was calculated from operation day to discharge date. Pancreatic fistulas and postoperative hemorrhages were defined using the International Study Group of Pancreatic Surgery (ISGPS) criteria [14,15].

2.3. Operative techniques and postoperative management

Open DP was performed using subcostal incision or midline laparotomy. No somatostatin analogues were given prophylactically. After opening the lesser sac, the pancreas was freed all around beginning laterally then progressing toward the pancreas neck (left to right approach). The spleen and its vessels were preserved if possible in patients with benign disease; otherwise the spleen was resected *en bloc* with the pancreatic tail and lymph nodes. The pancreas was transected using a linear stapler or by energy device upon the individual surgeon's choice. In all cases, the pancreatic stump was closed with a running suture, while targeted suture closure of the pancreatic duct was also upon the individual surgeon's choice. One drain was left in place near the pancreatic stump at the end of the operation. This drain was removed on postoperative day 3 if amylase in the drain fluid was not 3 times higher than serum amylase level. Epidural anesthesia was usually used.

For laparoscopic DP 4 trocars were used (one camera and three working ports) with the patient in supine position. The camera was placed in the peri-umbilical trocar. The same steps as open surgery were undertaken, except that pancreas mobilization was performed from right to left (medial to lateral). The pancreas was sectioned using an Endo-GIA© stapler or an energy device upon the individual surgeon's choice. The stump was closed with a running suture. Closure of the pancreatic duct depended on the individual surgeon's choice. A closed-suction drain was also left near the pancreas resection side.

The choice of performing open or laparoscopic surgery was decided by the surgeon in charge of the patient. Decision was based on the body-mass index (BMI), previous abdominal surgery, or tumor size.

Since 2012, enhanced recovery after surgery (ERAS) pathways have been implemented for DP. They are particularly focused on early mobilization and rapid postoperative nutrition [16].

2.4. Statistical analysis

Continuous variables were compared using a Mann-Whitney *U* test or a student *t*-test depending on the normality of the distribution and the homogeneity of the variances. Discrete variables were compared using a Chi-square test. Survivals were calculated using Kaplan-Meier method, and comparisons were made using the log-rank test. Graphpad Prism for Mac OS X was used for the statistical analyses.

This study has been approved by the local ethical committee of the University of Lausanne Hospital. The study was performed in accordance with the Helsinki Declaration as revised in 2013.

3. Results

3.1. Patient characteristics and operative indications

During the study period, 105 patients underwent DP, 45 women and 60 men with a median age of 63 years (IQR 49–71 years). Median BMI was 24.5 kg/m^2 (IQR 21.1-27.5 kg/m^2). A splenectomy was added to the DP in 86 patients (82%). Indications for DP were malignancies (64), benign tumors (15), pseudocysts (9), chronic pancreatitis (8), and other benign diseases (9).

3.2. Open vs. laparoscopic DP

Open surgery was performed in 79 cases (75%) and laparoscopy in 26 cases (25%). Laparoscopy was performed more frequently in the recent years (2000–2009: 9 cases, 2010–2015: 17 cases). In the laparoscopy group, 7 cases (27%) were converted to laparotomy due to adhesions (4x), lesion of the splenic vein (2x), and tumoral infiltration of the splenic vessels close to the celiac trunk (1x). Characteristics of both groups are presented in Table 1. Splenectomy was associated to the DP in 65 patients in the open group, 52 for oncologic reasons and 13 for technical reasons (5x resection of splenic vessels, 3x due to hilar anatomical position of the pseudocyst, 2x due to portal hypertension, 2x due to splenic vein/spleen lesions, and 1x due to splenic vein thrombosis) and in 21 patients (18x for oncologic reasons, 2x due to resection of splenic vessels, and 1x due to portal hypertension and splenic vein thrombosis) in the laparoscopy group ($p = 1$).

Table 2 summarizes the final diagnoses in both groups. Median operative times were similar in both groups (225 *vs.* 213 min, $p = 0.382$). For the operations with splenectomy ($n = 86$), median operative time was 237 min in the open group and 244 min in the laparoscopy group ($p = 0.436$), whereas for DP without splenic resection ($n = 19$) the median operative times were 213.5 min and 213 min ($p = 1$). Median intraoperative blood loss was 400 ml (IQR 200–900 ml) in the open group and 300 ml (IQR 75–750 ml, $p = 0.557$) in the laparoscopy group. Blood transfusion was required in 21 patients (19 in the open group, 2 in the laparoscopy group, $p = 0.125$).

Overall complication rate was 40/79 (51%) in the open group and 9/26 (36%) in the laparoscopy group ($p = 0.179$), respectively. No