ORIGINAL ARTICLE

Reduced morbidity with minimally invasive distal pancreatectomy for pancreatic adenocarcinoma

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Abstract

Background: Minimally invasive distal pancreatectomy (MISDP) has been shown to be safe relative to open distal pancreatectomy (ODP). However, MISDP has been slow to adopt for pancreatic adenocarcinoma (PDAC). This study sought to compare outcomes following MISDP vs. ODP for PDAC.

Methods: Data were prospectively collected from 2011 to 2014 for DP by the American College of Surgeons-National Surgical Quality Improvement Program. Patients without PDAC on surgical pathology were excluded. Impact of minimally invasive approach on morbidity and mortality was analyzed using two-way statistical analyses.

Results: Of 6198 patients undergoing DP, 501 (7.5%) had a pathologic diagnosis of PDAC. MISDP was undertaken in 166 (33.1%) patients, ODP was performed in 335 (66.9%). MISDP and ODP were not different in preoperative comorbidities or pathologic stage. Overall morbidity (MISDP 31%, ODP 42%; p = 0.024), transfusion (MISDP 6%, ODP 23%; p = 0.0001), pneumonia (MISDP 1%, ODP 7%; p = 0.004), surgical site infections (MISDP 8%, OPD 17%; p = 0.013), sepsis (MISDP 2%, ODP 8%; p = 0.007), and length of stay (MISDP 5.0 days, ODP 7.0 days; p = 0.009) were lower in the MIS group. Mortality (MISDP 0%, ODP 1%; p = 0.307), pancreatic fistula (MISDP 12%, ODP 19%; p = 0.073), and delayed gastric emptying (MISDP 3%, ODP 7%; p = 0.140) were similar.

Conclusions: This analysis of a large multi-institution North American experience of DP for treatment of pancreatic adenocarcinoma suggests that short-term postoperative outcomes are improved with MISDP.

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Introduction

With the evolution and refinement of operative technique, the development of minimally invasive surgery (MIS), including laparoscopic and robotic, has become an integral part of the management of surgical disease. Studies have demonstrated reduced morbidity, cost savings, and improved postoperative recovery when comparing MIS to open distal pancreatectomy.[1,2] With regards to oncologic outcomes, the utility and validity of applying MIS techniques to oncologic cases has been established. In 2004 the Clinical Outcomes of Surgical Therapy Study Group found no significant difference in MIS vs. open colectomy for colorectal cancer (COST 2004).[3] Improved laparoscopic training and perceived patient benefits have led to the application of minimally invasive techniques to most disciplines of surgery.

As a result, particularly challenging procedures such as pancreatectomy have witnessed a surge in MIS cases. Distal pancreatectomy (DP) does not always necessitate a traditional open approach (ODP). Rather, MISDP has become an important option for all indications including pancreatic adenocarcinoma (PDAC). Yet, underutilization of the MIS approach continues.[1] Several studies have shown that MISDP and ODP for PDAC

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have a similar harvest of lymph nodes, resection margin status, and mortality.[2,4–7] Some analyses also have indicated a decrease in length of stay with the MIS approach.[2,7,8] The viability of MISDP as an alternative to ODP is reliant on equivalent, if not improved, postsurgical outcomes as well as successful tumor resection.

Multiple studies have compared MISDP with ODP, but relatively few have examined MISDP for the treatment of PDAC. Studies that have focused on pancreatic cancer are limited due to a small sample size.[9,10] Therefore, this study was designed to compare MISDP vs. ODP for PDAC in a large multi-institutional database.[1,4,5] The aim of this study was to assess if minimally invasive distal pancreatectomy is equivalent to open distal pancreatectomy when comparing pathologic stage and postoperative outcomes for the treatment of pancreatic adenocarcinoma.

Methods

Patient population

Patient data were collected prospectively across multiple institutions which participated in the Pancreatectomy Demonstration Project in 2011–12 and Procedure Targeted Pancreatectomy in 2013–14. A total of 6698 DP operations were performed, 501 of which (7.5%) were patients who were identified histologically via surgical pathology as having PDAC. Patients with other diagnoses or incomplete surgical pathology were excluded. Study patients were grouped into either minimally invasive (which included laparoscopic and robotic operations) or open DP. The American College of Surgeons-National Surgical Quality Improvement Program (ACS-NSQIP) was used to monitor 30-day outcomes.

Source of data: ACS-NSQIP

The ACS-NSQIP is a validated, outcomes-based, risk-adjusted, peer-controlled program for the measurement and enhancement of the quality of surgical care. The sampling strategy, data abstraction procedures, variables collected and structure have been published.[11–16] One hundred and thirty-six preoperative (patient characteristics), intraoperative (processes of care) and postoperative (adverse outcomes) variables were prospectively collected by trained, certified Surgical Clinical Reviewers in the ACS-NSQIP. Patients younger than 18 years of age were excluded. Outcomes are assessed at 30 days after the index operation and highly standardized and validated definitions were employed. Quality is ensured by inter-rater reliability audits, as well as online clinical support so that the level of disagreement is currently only 1.53% for all variables. Surgical Clinical Reviewers also ensured the validity of their data by assessing physician documentation, and/or contacting patients directly.

Clinical endpoints

Preoperative variables collected included age, gender, race, height, weight, along with 31 comorbid conditions defined by ACS-NSQIP. In Procedure Targeted Pancreatectomy preoperative jaundice, presence of a biliary stent and neoadjuvant therapy also are measured. Operative variables recorded were approach, operative time, pancreatic duct size, pancreatic gland texture, pancreatic reconstruction, gastrojejunostomy or duodenojejunostomy, vascular resection, and transfusions given intraoperatively and in the subsequent 72 h of hospitalization. Each patient was identified as having PDAC on pathology. Postoperative variables examined were surgical site infections (including superficial, deep, and organ space), wound disruption, cerebrovascular accident or stroke, myocardial infarction, cardiac arrest, pneumonia, unplanned intubation, ventilator dependence longer than 48 h, acute renal failure, progressive renal insufficiency, bleeding complications, sepsis, septic shock, urinary tract infection, pulmonary embolism, deep vein thrombosis, delayed gastric emptying, percutaneous drain placement, and pancreatic fistula. Thirty-day morbidity and mortality outcomes were analyzed. Surgical pathology with tumor stage, tumor size/involvement (T), presence of lymph node metastasis (N), and presence of distant metastasis (M) was recorded.

Statistical analysis

All statistical analyses were performed initially using GraphPad QuickCalcs and Excel functions for basic statistical analysis; SAS 9.4 (SAS Institute Inc., Cary, NC) was used for complete statistical analysis including multi-group comparisons. Fishers tests were used for categorical data comparisons, and *t* test comparisons were used for continuous variables. Chi-square test and analysis of variance was employed when multiple subgroups were being analyzed. Results with a p value of less than 0.05 were considered statistically significant.

Results

The 2011–2014 ACS-NSQIP dataset yielded 501 patients with adenocarcinoma who underwent a DP. Of those, 166 (33.1%) had a laparoscopic or robotic procedure, and 335 (66.9%) had an open operation. Table 1 demonstrates preoperative variables. Patients in both groups were predominantly female (MISDP 54% vs. ODP 54%; p = 1.000) and Caucasian (MISDP 88% vs. ODP 80%; p = 0.025). Groups were similar in regards to ASA Score (MISDP 3 ± 0.04 vs. ODP 3 ± 0.03; p = 0.084), DM (MIS 33%, Open 34%; p = 0.920), and active tobacco consumption (MISDP 16% vs. ODP 21%; p = 0.185). The groups did differ with respect to mean age, (MISDP 69 years vs. ODP 65 years; p = 0.0001), race (MISDP 88% Caucasian vs. ODP 86%; p = 0.025), body weight loss in the previous 6 months (MISDP 9% vs. ODP 16%; p = 0.038) preoperative chemotherapy (MISDP 8% vs. ODP 26%; p = 0.001) and radiation therapy (MISDP 7% vs. ODP 13%; p = 0.001).

Table 2 depicts operative variables. Operative times were similar in the two groups (MISDP 239 ± 9.0 vs. ODP 250 ± 6.2; p = 0.311). MISDP consisted of 130 laparoscopic and 36 robotic procedures; unplanned conversion to open occurred in 39 (23%)