



Complex distal pancreatectomy outcomes performed at a single institution

Benjamin L. Gough, Shoshana Levi, Arvind Sabesan, Raafat Abdel-Misih, Joseph J. Bennett*

Helen F. Graham Cancer Center & Research Institute at Christiana Care Health System, 4701 Ogletown-Stanton Road, Newark, DE, 19713, USA



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ABSTRACT

Objective: Discuss the outcomes of distal pancreatectomy in a high volume academic community cancer center. **Introduction:** Distal pancreatectomy can be done with minimal morbidity and mortality in high volume centers. However, there are limited reports of distal pancreatectomy being performed in the community. This study sought to define the experience with distal pancreatectomy at a high volume community cancer center with a dedicated surgical oncology team.

Methods: A retrospective chart review was performed for patients undergoing distal pancreatectomy performed over a twelve year period (2005–2017) at an academic community cancer center.

Results: 157 patients underwent distal pancreatectomy. The distribution of open, laparoscopic and robotic resections were 96 (61%), 42 (27%) and 19 (12%) respectively. Concomitant organ resection other than splenectomy was performed in 54 (34%) patients. Spleen sparing resections were performed in 6 (4%) patients. 84 (54%) out of the 157 resections had a malignant lesion on final pathology. Median length of stay was 6 days with 25 (16%) patients readmitted within 30 days. Grade 3 or 4 morbidity rate was 18% (28/157). The incidence of clinically significant pancreatic fistula (Grade B/C) was 8% (13/157). The reoperative rate was 3% (5/157). Overall 30 day mortality in all patients was 0.6% (1/157).

Conclusion: This is the largest series of distal pancreatic resections reported in a community cancer hospital. In a high volume academic community cancer center with a dedicated surgical oncology team, distal pancreatic resections can be performed with short hospital stays, minimal morbidity, and a mortality rate of less than 1%.

1. Introduction

Pancreatic resections are amongst the most complex abdominal operations, with high rates of post-operative morbidity and a small but well recognized rate of post-operative mortality [1–3]. An abundance of literature has suggested improved outcomes when these operations are performed in high-volume university centers or National Cancer Institute-Designated Cancer Centers, resulting in a controversial movement over the past several decades supporting a regionalization of such operations [2–4].

There is evidence to suggest regionalization of pancreatic resections has already begun, noting an increase in both the total number of pancreatic resections being performed and the proportion of these done in high-volume centers [4–6]. It is important to clarify that not all high volume centers have high volume surgeons, and there is significant variability of outcomes even when comparing high volume hospitals and providers [1,7].

Unfortunately, what is lacking within these studies is a uniform definition of high-volume, with many studies arbitrarily defining low-

and high-volume centers within their cohort. Furthermore, there is a scarcity of reports evaluating complex distal pancreatectomies being performed in a community setting.

Many studies evaluating pancreatic resections group distal pancreatectomies with more complex resections, such as total pancreatectomies and pancreaticoduodenectomies, despite evidence to suggest these resections are independently associated with increased post-operative complications [8]. While regression analysis has been used in limited reports, the impact of this grouping on post-operative outcomes for distal pancreatectomies is unclear when evaluating multiple studies.

As healthcare continues to move toward a more patient-centered, outcome-based reimbursement model, the pressure for not only surgeons but hospital systems as a whole to demonstrate cost containment and appropriate resource utilization continues to increase. While hospital volume is a simple metric to evaluate the appropriateness of procedures to be performed, it is likely shortsighted. Patient outcomes following distal pancreatectomy are multifactorial, needing to take variables such as surgeon training and experience, hospital resources, presence of surgical residents, and multiple other factors into account.

* Corresponding author.

E-mail addresses: Benjamin.L.Gough@christianacare.org (B.L. Gough), Shoshana.T.Levi@christianacare.org (S. Levi), arvindsabesan@gmail.com (A. Sabesan), RAbdel-Misih@Christianacare.org (R. Abdel-Misih), JoBennett@Christianacare.org (J.J. Bennett).

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The primary objective of this study is to define the experience with complex distal pancreatectomy at a high volume academic community cancer center with a dedicated experienced surgical oncology team.

2. Materials and methods

This study was designed as a twelve year retrospective review of a prospectively maintained database of pancreatic resections performed at a single, 1100-bed community hospital. The hospital performs greater than 39,000 surgical procedures annually, has been a National Cancer Institute selected Community Cancer Center, is a Level 1 Trauma Center, houses a 22-bed surgical critical care unit, and maintains an accredited general surgery residency program [9]. A weekly multidisciplinary Solid Tumor Conference, as well as a weekly multidisciplinary Hepato-pancreatico-biliary clinic are both held incorporating surgical oncology, medical oncology, radiation oncology, as well as additional specialties involved in patient care. Within the department of surgery, the division of surgical oncology is comprised of fellowship-trained surgical oncologists who participated in 100% of the procedures included in the study.

All distal pancreatectomies performed from May 2005 through March 2017 were reviewed, totaling 169 cases. Twelve cases were omitted because of incomplete data and surgeries not performed by fellowship-trained surgical oncologists, resulting in a final review of 157 cases. Pancreatic necrosectomy or debridement for acute pancreatitis were not the focus of this study and were excluded as well. Electronic medical records were individually queried to collect patient demographics, operative variables, and information pertaining to the post-operative course. Additionally, pathologic information was recorded after being verified by a board certified pathologist.

The primary outcomes were 30-day post-operative morbidity and mortality. Specific post-operative complications which were evaluated included pancreatic fistula, delayed gastric emptying, bleeding, infection, pleural effusion, sepsis, respiratory failure, renal failure, re-operation rate, and readmission rate. Intraoperative variables included operative approach (ie, open, laparoscopic, or robotic), operative time, blood loss, and additional organs resected.

The study was approved by the Christiana Care Health System Institutional Review Board.

3. Results

3.1. Demographics

From May 2005 to March 2017, 157 patients underwent distal pancreatectomy with a fellowship-trained surgical oncologist at our institution. The median age was 63, with a female predominance ($n = 98$, 62%). Many of the patients had associated comorbidities, with a median American Society of Anesthesiologists (ASA) Physical Status Classification of 3, indicating the presence of severe systemic disease [10]. Medical comorbidities of the patients included hypertension ($n = 103$, 66%), diabetes mellitus ($n = 37$, 24%), congestive heart failure and coronary artery disease ($n = 44$, 28%), chronic obstructive pulmonary disease ($n = 19$, 12%), and renal insufficiency ($n = 4$, 3%). Furthermore, the median body mass index (BMI) was 28, indicating a large portion of the patients were either overweight or obese.

3.2. Operative course

All resections were performed at a single community cancer center and involved a fellowship-trained surgical oncologist. The complexity of the surgeries varied greatly, influenced by factors such as patient disease, comorbidities, and additional organ resections. Median operative time was 191 min, with a median blood loss of 250 mL, and with 30 patients receiving blood transfusions. The vast majority of resections involved an associated splenectomy ($n = 151$, 96%), with additional

Table 1
Operative data including intraoperative metrics and additional organs resected.

Operative Data	No. (%)
Median Operative Time (min)	191
Median EBL (mL)	250
Additional Organs Resected (Total) ^a	37 (24)
Spleen	151 (96)
Stomach	12 (8)
Omentum	10 (6)
Adrenal	9 (6)
Spleen-sparing	6 (4)
Colon	6 (4)
Kidney	6 (4)
Small bowel	5 (3)
Liver	4 (3)
Diaphragm	4 (3)
Gallbladder	3 (2)
Mesentery	3 (2)
Esophagus	1 (< 1)
Abdominal wall	1 (< 1)

^a Does not include spleen.

organs being resected in 24% ($n = 37$) of cases. A single esophagus was resected in the setting of gastric adenocarcinoma. Twelve stomachs were resected, eleven of which were partial resections, nine for malignancy, and three for benign diagnoses. Four liver wedge resections were performed, two for malignancy and the others for a bile duct adenoma and a hepatic granuloma in the setting of pancreatic adenocarcinoma. The operative data and additional organs resected are shown in Table 1.

The distribution of open, laparoscopic and robotic resections were 96 (61%), 42 (27%) and 19 (12%) respectively, however, the operative approach was noted to change over the course of the study. Early in the study period (2005–2007), the vast majority of the operations were performed open (23/29, 79%). However, the percentage of open distal pancreatectomies consistently decreased over the subsequent time periods, with the most recent period (2014–2017) demonstrating 53% of resections being performed in the fashion. While the decrease in the percentage of open procedures was concurrently associated with an increase in minimally invasive approaches, it is worth noting the sharp increase in the percentage of robotic distal pancreatectomies between the latter two time periods (0%–33%).

3.3. Pathology

The final pathology of the resected specimens is shown in Table 2. The most common indication for distal pancreatectomy amongst the 157 resections was for pancreatic adenocarcinoma ($n = 33$, 21%), followed by neuroendocrine tumors ($n = 26$, 17%), mucinous cystadenomas ($n = 24$, 15%), intraductal papillary mucinous neoplasms ($n = 18$, 11%), and serous cystadenomas ($n = 12$, 8%). Malignant lesions were found in 84 (54%) of specimens. The remaining indications were largely comprised of benign localized disease processes as noted in Table 2.

3.4. Hospital course

All patients were admitted to the surgical oncology service post-operatively and received continuous care from a team of attending surgeons, general surgery residents, and physician assistants. The median length of hospital stay was 6 days. Twenty-five (16%) patients were readmitted to the hospital within 30 days of surgery.

3.5. Morbidity

The 30-day morbidity rates and re-operative indications are shown

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