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The effects of neoadjuvant chemoradiation on pancreaticoduodenectomy—the American College of Surgeon's National Surgical Quality Improvement Program analysis

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ARTICLE INFO

Article history:
Received 19 August 2014
Received in revised form
20 January 2015
Accepted 23 January 2015
Available online 30 January 2015

Keywords:
Pancreaticoduodenectomy
Chemotherapy
Radiation
Neoadjuvant therapy
Outcomes
Malignancy

ABSTRACT

Background: The purpose of this study was to investigate the effects of preoperative chemoradiation therapy on postoperative outcomes of pancreaticoduodenectomy (PD).

Materials and methods: The American College of Surgeon's National Surgical Quality Improvement Program Participant User File from 2005–2011 was used to analyze the outcomes of patients who underwent chemoradiation therapy before PD. Their outcomes were compared with those who underwent PD without neoadjuvant therapy.

Results: We identified 110 patients who received preoperative chemoradiation therapy before undergoing PD for pancreatic malignancies and compared them with 4915 patients who did not. The two groups were similar in their preoperative comorbidities and demographics. The neoadjuvant group experienced a significantly longer operative time with a higher rate of vascular reconstruction, transfusion requirement, and superficial wound infection compared with those who did not receive neoadjuvant therapy. However, mortality and the rate of major complications between the two groups were similar.

Conclusions: Preoperative chemoradiation therapy is associated with an increase in transfusion requirement and superficial surgical site infection. However, it is not associated with an increase in 30-d mortality or major complications.

1. Introduction

The overall prognosis and survival from pancreatic adenocarcinoma (PA) is dismal. It remains the fourth leading cause of cancer death in the United States in an era where the survival rate from other cancers is increasing secondary to improved screening, adjuvant therapies, and surgical techniques [1]. Although pancreaticoduodenectomy (PD) can result in the cure of PA localized to the head of the pancreas, there is evidence to suggest that surgical therapy may be underused because of its perceived morbidity [2,3].

Recent series have shown that because of improved surgical technique and perioperative care, the morbidity and the mortality of the operation have been lowered

The results of this article were presented in part at the meeting of the Society of Surgical Oncology in Phoenix, Arizona, March 12–15, 2014.

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http://dx.doi.org/10.1016/j.jss.2015.01.045

substantially [4–7]. Also, as adjuvant therapy options increase, there is a great interest in expanding the indication for PD [8,9]. A subset of patients with disease defined as borderline resectable because of its proximity to the major blood vessels is now often offered neoadjuvant chemoradiation therapy to treat micrometastases and to increase the potential for R0 resection. In selected cases, these patients can have good long-term results [10,11]. Additionally, there are data that show that preoperative chemoradiation may decrease the incidence of pancreaticojejunal anastomotic fistula [12].

Although there are data to suggest that long-term survival benefits with this approach, the data on short-term outcomes are lacking because of limitations of sample size and institution-specific protocols. In this study, we used the American College of Surgeon's National Surgical Quality Improvement Program (ACS-NSQIP) database to analyze the outcomes of patients with PA who underwent neoadjuvant chemoradiation before PD and compared the results with those who had a PD only.

2. Materials and methods

This review of the ACS-NSQIP Participant User File (PUF) database was performed with approval from our institutional review board and the data use agreement of the American College of Surgeons (ACS). The ACS-NSQIP is a risk-adjusted, outcomes-based program designed to measure and improve the quality of surgical care. The program collects data on 136 preoperative, intraoperative, and postoperative clinical variables. Additionally, 30-d postoperative mortality and morbidity data are collected in the database. Currently, there are over 200 hospitals that participate in this program [13].

The ACS-NSQIP PUF database was queried from 2005–2011 for PDs using Current Procedural Terminology codes: 48150, and 48152–48154 (Table 1). Elective cases performed for postoperative diagnosis of malignant neoplasm of the pancreas were then selected for using the International Classification of Diseases, Ninth Revision codes, 157.0, 157.1, 157.3–157.4, and 157.8–9. Patients that met the Current Procedural Terminology codes listed previously for PD procedures without a postoperative International Classification of Diseases, Ninth Revision code for "malignant neoplasm of the pancreas" were excluded from the analysis because only pancreatic malignancies were considered. Patients with disseminated cancer were also excluded from the study.

Clinically relevant preoperative, intraoperative, and postoperative events were noted and reviewed. All clinical factors in the ACS-NSQIP PUF database are defined in the user guide [14]. In addition to mortality, the occurrence of major complications was analyzed. The occurrence of any of the following events was considered a major complication: organ space infection, pneumonia, unplanned intubation, pulmonary embolism, ventilator requirement >48 h, progressive renal insufficiency, acute renal failure, cerebrovascular accident, coma, cardiac arrest, myocardial infarction (MI), deep venous thrombosis, sepsis, septic shock, and return to the operating room.

Our main study variable was preoperative receipt of both neoadjuvant chemotherapy and radiation therapy. The group that received both chemotherapy and radiation therapy preoperatively was designated as the neoadjuvant group and these patients were compared with the control group, those who received neither chemotherapy nor radiation therapy preoperatively.

Categorical variables were analyzed between the two groups by chi-square test, and continuous variables were analyzed with Student *t*-test and Mann–Whitney *U*-test where appropriate. Additionally, multivariate, step-wise logistic regression was used to evaluate preoperative receipt of chemotherapy and radiation therapy as an independent variable of occurrence of mortality, major postoperative complications, and wound complications. Other clinically relevant preoperative variables were also studied to generate odds ratios (ORs) for factors associated with mortality and occurrence of major complications. A P value <0.05 was considered statistically significant. All statistical analyses were performed on SPSS for Windows version 17 (SPSS Inc, Chicago, IL).

Table 1 – Procedures by CPT codes.

CPT codes and the procedure description	No preoperative chemoradiation/radiation ($n = 4915$)	Yes preoperative chemoradiation/radiation ($n = 110$)
48150 Pancreatectomy, proximal subtotal with total duodenectomy, partial gastrectomy, choledochoenterostomy, and gastrojejunostomy (Whipple-type procedure); with pancreatojejunostomy	2721	76
48152 Pancreatectomy, proximal subtotal with total duodenectomy, partial gastrectomy, choledochoenterostomy, and gastrojejunostomy (Whipple-type procedure); without pancreatojejunostomy	162	6
48153 Pancreatectomy, proximal subtotal with near-total duodenectomy, choledochoenterostomy, and duodenojejunostomy (pylorus-sparing, Whipple-type procedure); with pancreatojejunostomy	1937	25
48154 Pancreatectomy, proximal subtotal with near-total duodenectomy, choledochoenterostomy, and duodenojejunostomy (pylorus-sparing, Whipple-type procedure); without pancreatojejunostomy	95	3

CPT = current procedural terminology; all CPT codes are primary procedural codes; all cases were elective.