ORIGINAL ARTICLE

National trends in resection of cystic lesions of the pancreas

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Abstract

Background: Management of cystic lesions of the pancreas (CLP) is controversial. In this study, we sought to evaluate national changes in the resection of CLP over time, to better understand the impact of evolving guidelines on CLP management.

Methods: We used Medicare data to examine CLP resection among patients undergoing pancreatic resection between 2001 and 2012. Patients with a diagnosis of CLP were identified and compared to patients with non-CLP indications. We then examined changes over time in patient and hospital characteristics and outcomes among patients with a CLP diagnosis.

Results: We identified 56,419 Medicare patients undergoing pancreatic resection, of which 2129 had a CLP diagnosis. The annual number of CLP resections, and proportion of all resections performed for CLP increased significantly during the period, from 2.1% (65/3072) resections in 2001, to 4.5% (286/6348) in 2012 (p < 0.001). The proportion of CLP resections with a malignant diagnosis did not change (15.5% in 2001−2003 vs. 13.1% in 2010−2012, p = 0.4). Overall rates of 30-day mortality decreased significantly during the period (9.6% in 2001−2003 vs. 5.5% in 2010−2012, p < 0.001).

Discussion: CLP resections were performed with increasing frequency in Medicare patients between 2001 and 2012, but this did not correspond to increased diagnosis of malignancy. Additional research is needed to understand the influence of recent guidelines on management of CLP.

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Introduction

Cystic lesions of the pancreas (CLP) are being identified with increasing frequency, but the natural history of certain CLP lesions, such as intraductal papillary mucinous neoplasms (IPMN), remains poorly understood. Studies of abdominal imaging suggest as many as 44.7% of patients have an incidentally found CLP,[1,2] while 24.3% of patients were discovered to have a CLP at autopsy.[3] Though certain cyst features are widely recognized to be associated with increased malignancy risk,[4] studies of CLP meeting criteria for surveillance have reported varying rates of malignant progression.[4−6] As a result,

uncertainty exists regarding the optimal management strategy: efforts to halt progression to pancreatic cancer must be balanced with the morbidity of resection and the increasing incidence of diagnosis. The management of CLP has evolved over time: though routine resection was previous considered the standard by many,[7,8] advances in radiographic and endoscopic techniques have led to increased support for a more selective approach.[1,9,10] Consensus guidelines affirming this approach were released in 2006, and were recently updated in 2012.[11,12] Despite these guidelines, the optimal management of CLP remains controversial.[4,6,13−17]

Given this controversy, the influence of advancing technology and changing recommendations on management of CLP in the real world is unclear. Previous literature examining current practice is limited to the experiences of high volume, single-institution centers.[4,6,18,19] Because resection criteria likely vary

according to surgeon and institutional preferences,[20,21] it is unclear whether these experiences represent practice nationally. To date, no studies have evaluated national trends in resection for CLP. A better understanding of how recommendations for management of CLP are applied nationally could have important implications for the development and dissemination of future guidelines.

In this study we sought to examine trends in resection of CLP in the United States over a recent twelve-year period. To do this, we used national Medicare data to identify all patients undergoing pancreatic resection between the years 2001 and 2012. We examined resection rates among patients with and without a diagnosis of CLP, and we assessed changes over time in the patient and hospital characteristics, and outcomes, of patients with a CLP diagnosis.

Methods

Data source and study population
To complete this study, we used analytic files for the years 2001–2012 from the Center for Medicare and Medicaid Services. The Medicare Provider Analysis and Review (MEDPAR) file was used to create the primary study dataset, while the Medicare Denominator file was used to determine the vital status of all patients 30 days after surgery. The Institutional Review Board of the University of Michigan and the CMS approved this protocol and waived the requirement for informed consent.

Using appropriate procedure codes from the *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM), we identified Medicare patients between the ages of 65 and 99 years old who underwent a pancreatic resection (52.51, 52.52, 52.53, 52.59, 52.6, 52.7). Patients undergoing pancreaticogastrostomy or pancreaticoenterostomy (52.96) alone, and those undergoing transplant-related procedures (52.8) were excluded.

Indications for resection
The indication for pancreatic resection in Medicare data was identified by appropriate ICD-9-CM codes listed in any of the ten MEDPAR diagnosis fields. A patient was considered to have a CLP diagnosis if the ICD-9-CM code 577.2 was present in any of the diagnosis fields, regardless of other diagnoses present. Patients with pancreatic cancer were identified by the presence of diagnosis codes 157.0–157.9, while patients with duodenal, biliary, or ampullary cancer were identified by diagnosis codes 152.0 and 156.0–156.9, and patients with a neuroendocrine tumor were identified by diagnosis codes 209.0–209.39. To increase the homogeneity of our sample and minimize confounding, patients with an ICD-9-CM diagnosis code for pancreatitis (577.0 or 577.1) or transplant-related complications (996.59–996.89) in any field were excluded from the final analysis.

Patient and hospital characteristics
We evaluated patient characteristics including age, sex, race, and comorbidities. Comorbidities were identified by the appropriate ICD-9-CM diagnosis codes and defined using the Elixhauser method.[22] A patient was considered to have malignancy if diagnosis codes for pancreatic, duodenal, biliary, or ampullary cancers, or neuroendocrine tumor, were present.

We obtained characteristics of hospitals from the American Hospital Association (AHA) Annual Survey for the years 2008–2012. These data included bed size, teaching status, hospital ownership, urban or rural location, cancer center designation, critical access designation, availability of endoscopic ultrasound (EUS) and endoscopic retrograde cholangiopancreatography (ERCP), and level of technology. A hospital was considered to have "high technology" if it performed cardiac surgery and/or solid organ transplantation, in accordance with previous literature.[23,24] Medicare hospital volume was determined by calculating the total number of pancreatic resections in the final study cohort performed by each hospital. Hospitals were then ranked, and quintiles were created by defining whole number cutoffs that would separate all patients into five categories of equal size, similar to prior studies.[25,26]

Patient outcomes evaluated in this study included mortality, post-operative complications, and failure to rescue. Operative mortality was defined as death within 30 days of the index procedure or before hospital discharge. Post-operative complications were identified by ICD-9-CM codes using previously validated methods.[27,28] Failure to rescue was defined as a mortality among patients with one or more of the defined major complications.[29]

Statistical analysis
We calculated descriptive statistics and rates of unadjusted surgical outcomes for patients stratified by procedure type and indication for resection. Baseline patient and hospital characteristics were compared using student's t-test or Wilcoxon's rank sum test for normally or non-normally distributed continuous data, and chi-squared tests for categorical data. We used Cuzick's test for trend to assess differences over time in patient and hospital characteristics, surgical outcomes, and resection rates stratified by procedure type and indication for resection. All statistical analyses were performed using STATA version 12.1 (StataCorp, College Station, TX), with two-sided tests and alpha set at 0.05.

Results

The final cohort included 56,419 Medicare patients undergoing pancreatic resection during the 12-year period. Details regarding patient characteristics and type of resection, stratified by the indication for resection, are shown in Table 1. The median age of all patients was 74 years old, with a slight female majority