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An economic analysis of pancreaticoduodenectomy: should costs drive consumer decisions?

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Abstract

BACKGROUND: Consumer groups campaign for cost transparency believing that patients will select hospitals accordingly. We sought to determine whether the cost of pancreaticoduodenectomy (PD) should be considered in choosing a hospital.

METHODS: Using the Nationwide Inpatient Sample database, we analyzed charges for patients who underwent PD from 2000 to 2010. Outcomes were stratified by hospital volume.

RESULTS: A total of 15,599 PDs were performed in 1,186 hospitals. The median cost was $87,444 (interquartile range $16,015 to $144,869). High volume hospitals (HVH) had shorter hospital stay (11 vs 15 days, $P < .001$) and mortality (3% vs 7.6%, $P < .001$). PD performed at low volume hospitals had higher charges compared with HVH ($97,923 vs $81,581, $P < .001$). On multivariate analysis, HVH was associated with a lower risk of mortality, while extremes in hospital costs, cardiac comorbidity, and any complication were significant predictors of mortality.

CONCLUSION: Although PDs performed at HVH are associated with better outcomes and lower hospital charges, costs should not be the primary determinant when selecting a hospital.

Price transparency, as part of the growing consumerism movement in health care, is still in its infancy. In the era of hospital risk–based reimbursements and pay for performance, there has been an increasing interest in cost transparency. However, the impact of cost-transparency initiatives on patient outcomes remains limited. The notion of cost-conscious "shopping," while perhaps acceptable for basic medical goods such as prescription drugs, has not been investigated for complex procedures and services. Although proponents of cost transparency suggest that the wide variation in total hospital charges provide an opportunity for consumers to engage in more cost-conscious shopping, thereby selecting hospitals with lower prices for medical services, the relationship between quality of medical care (ie, outcomes) and hospital charges remains unknown.

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For complex procedures such as pancreaticoduodenectomy (PD), referral to high volume centers has been strongly recommended. This is based on the Leapfrog Group initiative in 2000 that defined an annual institutional resection volume for several complex surgical procedures.[1] For pancreatic resections, institutions performing a minimum of 11 pancreatic resections per year are classified as "high volume institutions."[2] However, the minimum number of pancreatic resections set by the Leapfrog initiative has not been universally accepted. In fact, the number of pancreatic resections that defines "high volume hospital (HVHs)" for pancreatic surgery remains variable, ranging from 11 to 25 pancreatic resections per year.[2–5] Despite the variable cut offs used to define high volume centers for pancreatic resection, the inverse relationship between hospital volume of complex surgical procedures and complications/mortality has been demonstrated in numerous retrospective studies.[2,6–13] Although it is well established that surgeries at HVH are associated with better quality of care and outcomes, what remains unclear is the relationship between hospital costs and outcomes. Therefore, the aim of this study is to evaluate the interaction between hospital charges and hospital volume on postoperative short-term outcomes following PD using a national, multi-institutional administrative database. We also sought to investigate whether the cost of a PD should be a potential determinant when selecting a hospital. We hypothesized that hospital charges should not be the primary determinant when selecting a hospital for PD.

Methods

A retrospective analysis was performed using patient data collected from the Nationwide Inpatient Sample (NIS) file between 2000 and 2010. NIS is maintained by the Agency for Healthcare Research and Quality as part of the Healthcare Cost and Utilization Project and comprised hospital discharge records from more than 1,000 hospitals in the United States. NIS database represents approximating 20% sample of all hospital discharges in the United States. Data available within the NIS database include patient demographics, hospital characteristics, insurance information, diagnoses, inpatient procedures, inpatient mortality, and unadjusted hospital charges.

Hospital volume was chosen based on prior studies investigating the volume–outcome relationship, including a recent NIS study that defined HVH as those that performed 19 and more PD per year while low volume hospitals (LVHs) performed fewer than 19 PD per year.[4] We defined HVH as those centers that performed 20 and more PD per year (choosing a round number that reflected a reasonable compromise within the spectrum of reported cut offs). Individual hospital procedure volume was determined using the NIS-assigned hospital identification number to calculate the annual number of PD performed. Inflation-adjusted hospital costs were calculated using the United States Department of Labor Consumer Price Index calculator in 2014 for each patient. To further understand the relationship between the presence of complications and hospital costs, hospitals were subdivided into 4 groups based on mean hospital charges: Quartile no. 1, <$85,600; Quartile no. 2, $85,600 to $103,000; Quartile no. 3, $103,001 to $140,600; and Quartile no. 4, >$140,600. Patients who underwent PD were identified using the International Classification of Disease, Ninth Revision, Clinical Modification (ICD-9-CM) procedure code 52.7 (radical PD). Elixhauser et al[14] previously identified and defined comorbidities using ICD-9-CM codes from administrative databases—these codes were used to classify important preoperative comorbidities. ICD-9 codes that are used to identify complications are shown in Supplemental Table 1. Subgroup analysis of complicated (defined as length of stay [LOS] > 14 days) vs uncomplicated PD (defined as LOS < 14 days) was performed to determine differences in hospital costs based on hospital type. We dichotomized PD into uncomplicated vs complicated based on LOS less than or greater than 14 days, respectively, because of the recent body of literature showing that the median LOS is generally less than 14 days in the hands of experienced pancreatic surgeons.[15,16] Although it may appear arbitrary to define a complicated course as greater than 14-day stay based on reports from experienced pancreatic surgeons, one would also expect a hospital stay longer than 14 days for complicated PD performed at an LVH without experienced pancreatic surgeons.

Categorical variables were presented as percentages and compared using Pearson chi-square test. Continuous variables were expressed as median and interquartile range and compared using Student *t* test for parametric variables or Wilcoxon rank-sum test for nonparametric variables. Multivariable logistic regression was performed to determine predictors of morbidity and in-hospital death. Statistical analyses were performed using SPSS version 22.0 (Chicago, IL). Statistical significance was set at *P* value less than .05.

Results

Patient demographics and hospital characteristics

During the study period from January 2000 to December 2010, a total of 15,614 patients who underwent PD were identified in the database. Charity cases (defined as PD that is less than $10,000 in a recent study using the same database)[17] were excluded from our analysis. After excluding charity cases, a total of 15,599 patients were analyzed. Stratifying by hospital volume, a total of 94 (8%) of 1,186 hospitals were categorized as HVH.

Clinical characteristics and outcomes are detailed in Table 1. The median age of diagnosis was 65 years. Patients were predominantly elderly men. Minimally invasive PDs were more commonly performed in HVH (5.3% vs 3.5%,