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ORIGINAL ARTICLE

Perioperative complications and the cost of rescue or failure to rescue in hepato-pancreato-biliary surgery

Qinyu Chen[1,*], Eliza W. Beal[1,*], Charles W. Kimbrough[1], Fabio Bagante[1], Katiuscha Merath[1], Mary Dillhoff[1], Carl Schmidt[1], Susan White[2], Jordan Cloyd[1] & Timothy M. Pawlik[1]

[1]Department of Surgery, The Ohio State University Wexner Medical Center, and [2]Clinical, Health Information Management and Systems Division, The Ohio State University Wexner Medical Center, Columbus, OH, USA

Abstract

Background: It is unclear how either the successful or failed rescue of hepato-pancreato-biliary (HPB) patients from complications impacts costs.

Methods: A retrospective cohort study of HPB surgical patients was performed using claims data from 2013 to 2015 in the Medicare Provider Analysis and Review (MEDPAR) database. Patient demographics, characteristics, outcomes and risk-adjusted Medicare payments were compared.

Results: 11,596 patients were identified. Over half of the patients (n = 5,810, 50.1%) underwent liver surgery, while 42% (n = 4892) had pancreatic and 8% (n = 894) had biliary operations. The overall complication rate varied (liver: 19.6%; pancreas: 20.3%; biliary: 25.2%, p = 0.001). In general, both minor and serious complications resulted in higher Medicare payments. Failed rescue led to higher average Medicare payments during index hospitalization compared to successful rescue ($53,476 versus $44,636, p < 0.001). The reverse was true on readmission; successful rescue was associated with higher average Medicare payments ($25,746 versus $15,654, p < 0.001). Taken together (index plus readmission), total hospitalization payments were higher for failed compared to successful rescue ($66,604 versus $52,143, p < 0.001).

Conclusion: Following HPB surgery, there is a significant cost associated with both rescue and failure-to-rescue from perioperative complications. Total hospitalization cost was highest for patients who experienced failure-to-rescue.

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Correspondence

Timothy M. Pawlik, Department of Surgery, The Urban Meyer III and Shelley Meyer Chair for Cancer Research, Surgery, Oncology, Health Services Management and Policy, The Ohio State University, Wexner Medical Center, 395 W. 12th Ave., Suite 670, Columbus, OH, USA. E-mail: tim.pawlik@osumc.edu

Introduction

Surgical complications, in addition to causing harm to patients, are expensive and can result in dramatically increased healthcare expenditures for patients, hospitals and payers. Reducing complications can improve the quality of care, as well as enhance value by reducing overall costs. Minimizing complications has therefore become a common target for quality improvement initiatives. For instance, the Centers for Medicare and Medicaid Services (CMS) has made reducing healthcare-related harms a priority of the *CMS Quality Strategy*.[1] Payment reforms, such as bundled payments and non-payment for readmissions, are increasingly tied to performance in an attempt to drive down costs, improve quality, and reduce fraud and abuse.[1–3] Ultimately, these payment arrangements shift more of the cost burden to hospitals and create a real financial incentive for quality improvement.[4] In this setting, understanding the costs associated with complications is critical to guide policy and quality initiatives.

While surgical complications are a major driver of increased health care costs, the association between costs and quality is

* These authors contributed equally to this work.

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poorly understood. One recent study suggested that costs may vary according to how well a complication was managed and that successful rescue of surgical patients from post-operative complications led to higher expenditures compared with instances of failure to rescue.[5] Significant resources are often expended to rescue the patient, which may lead to increased use of diagnostic tests, therapeutic interventions, or a longer overall hospital stay. The ability of a hospital to rescue a patient from a severe complication is multifactorial, but may vary relative to the index operation.[5–8] Currently, data characterizing factors associated with cost-efficient rescue of patients from complications are scarce.

Hepato-pancreato-biliary (HPB) operations are associated with increased perioperative morbidity compared with other general surgical procedures and these complications can subsequently increase the length of stay, delay receipt of adjuvant therapy, and adversely impact patient quality of life.[9,10] In addition, HPB complications can be relatively resource intensive and generate costs greater than complications associated with general surgical cases.[11] The economic impact associated with the perioperative morbidity and mortality following HPB surgery remains, however, poorly defined.[12–15] No study to date has specifically evaluated Medicare payments associated with complications, rescue, or failure to rescue (FTR) among patients undergoing HPB operations. Therefore the objective of the current study was to define the relationship between perioperative complications and healthcare costs among Medicare patients undergoing HPB operations. In particular, we sought to assess the costs associated with rescue and FTR following complications after HPB surgery.

Methods

Data sources and study population

The Medicare Provider Analysis and Review (MEDPAR) files for the years 2013–2015 were utilized. The MEDPAR file contains records for all Medicare beneficiaries who use hospital inpatient services sponsored by CMS. MEDPAR includes information on diagnoses, procedures, payments, resource utilization and dates of hospital discharge for Medicare enrollees. Medicare patients aged 65–100 years who underwent surgical procedures of the pancreas, liver, or biliary tract were included.[16] The study cohort was restricted to patients who had been enrolled in both Medicare Part A and B plans, and who had no payments from a health maintenance organization during the study duration (7.8%, n = 1016). Medicare beneficiaries were excluded if the individual had no record of a Medicare claim payment or had payment made by a primary payer other than Medicare (1.5%, n = 192). This approach ensured that payments for a given episode of surgical care were captured entirely by Medicare. The study was approved by the Institutional Review Board of the Ohio State University.

Medicare payments

Actual Medicare payments (not submitted hospital charges) were assessed for each beneficiary. Payments related to the index hospitalizations were pooled from the MEDPAR inpatient dataset for all service types from the date of hospital admission for the index operation until discharge. Medicare payments for readmission episodes were also collected from the MEDPAR inpatient dataset. Readmissions included all beneficiaries who had been discharged from the hospital and were readmitted within 30 days of the index discharge. Total payments for each beneficiary consisted of the combined amount paid by CMS for the index hospitalization and any readmission.

Total Medicare payments were risk-adjusted for all analyses in this study. Payments for the index hospitalizations were adjusted for age, sex, race/ethnicity, Charlson comorbidity index,[17] procedure year, admission priority, and preoperative length of stay. Payments related to readmissions were adjusted for age, sex, race/ethnicity, Charlson comorbidity index,[17] and number of readmissions. Total payment (including both the index hospitalization and any subsequent readmission) were adjusted for age, sex, race/ethnicity, Charlson comorbidity index,[17] procedure year, admission priority, preoperative length of stay, and number of readmissions.

Perioperative outcomes

Perioperative complications were ascertained from all ICD-9-CM diagnostic and procedure codes from the index hospitalization. Codes were selected based on data from previous studies in order to achieve high specificity and sensitivity in identifying complications among patients undergoing surgery.[18–21] As previously reported, serious complications were defined as patients who had at least one complication associated with an extended length of stay (>75th percentile for each procedure).[16] Failure-to rescue was defined as the presence of at least one complication and death within 30 days of the index operation. Patients were included in the rescue group if the patient experienced a complication yet did not experience mortality within 30 days of surgery; 30-day mortality was defined as death within 30 days of the index operation. Information regarding patient death was found in the MEDPAR denominator file.

Statistical analysis

The average total Medicare payments for index hospitalizations, readmissions and total hospitalization were determined at the beneficiary level for each category of clinical outcome: no complication, complication and death (failure to rescue), or complication and survival (rescue). Complications were further stratified into minor versus serious complications. Differences in Medicare payments among patients in the rescue versus FTR groups were analyzed and reported. Total payments were risk-adjusted using generalized linear modeling with log link to account for the right-skewed distribution of actual Medicare payments. One-way analysis of variance with the Bonferroni

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