Hospital Readmission Is Associated With Poor Survival After Esophagectomy for Esophageal Cancer

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Background. **Hospital readmissions are costly and associated with inferior patient outcomes. There is limited knowledge related to readmissions after esophagectomy for malignancy. Our aim was to determine the impact on survival of readmission after esophagectomy.**

Methods. **This cohort study utilizes Surveillance, Epidemiology, and End Results–Medicare data (2002 to 2009). Survival, length of stay, 30-day readmissions, and discharge disposition were determined. Multivariate logistic regression models were created to examine risk factors associated with readmission.**

Results. **In all, 1,744 patients with esophageal cancer underwent esophagectomy: 80% of patients (1,390) were male, and mean age was 73 years; 71.8% of tumors (1,251) were adenocarcinomas, and 72.5% (1,265) were distal esophageal tumors; 38% of patients (667) received induction therapy. Operative approach was transthoracic in 52.6% of patients (918) and transhiatal in 37.4% (653), and required complex reconstruction (intestinal interposition) in 9.9% (173). Stage distribution was as follows: stage I, 35.3% (616); stage II, 32.5% (566); stage III, 27.9% (487); and stage IV, 2.3% (40). Median length of stay was 13 days, hospital mortality was 9.3% (158 patients), and 30-day readmission rate was 18.6% (212 of 1,139 home discharges); 25.4% of patients (443) were discharged to institutional care facilities. Overall survival was significantly worse for patients who were readmitted ($p < 0.0001$, log rank test). Risk factors for readmission were comorbidity score of 3+, urgent admission, and urban residence.**

Conclusions. **Hospital readmissions after esophagectomy for cancer occur frequently and are associated with worse survival. Improved identification of patients at risk for readmission after esophagectomy can inform patient selection, discharge planning, and outpatient monitoring. Optimization of such practices may lead to improved outcomes at reduced cost.**

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Rehospitalizations place a significant burden on the healthcare system in our country. One report, by Jencks and colleagues [1], found that 19% of Medicare patients discharged from the hospital were readmitted within 30 days after discharge. That was associated with an estimated cost of $17 billion to our healthcare system in 2004. In addition, hospital readmissions have been associated with inferior long-term survival after colectomy for colorectal cancer [2]. With the recent passage of the Patient Protection and Affordable Care Act, the Centers for Medicare and Medicaid Services (CMS) have placed an emphasis on reducing hospital readmission rates to improve the quality of healthcare in the United States [3]. Postoperative readmission rates have been examined for a variety of operations, including coronary artery bypass, pancreatic resections, colorectal resections, hip replacements, and abdominal aortic aneurysm repair, and have been reported to be as high as 21% [2, 4–10].

An esophagectomy for esophageal cancer is a high-risk surgical procedure, with large administrative datasets demonstrating mortality rates ranging from 7% to 28% [11–13]. Hospital readmissions after an esophagectomy for esophageal cancer are also a common occurrence, ranging from 5% to 25% [10, 14, 15]. However, there is limited knowledge related to risk factors and mortality after readmission after esophagectomy, or to its impact on long-term survival. To establish care processes that are designed to minimize preventable rehospitalizations, one must first understand what variables place a patient at risk for readmission to the hospital. The objective of this study was to examine the impact on survival of hospital readmission after esophagectomy and to determine risk factors for readmission after esophagectomy using the

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Appendix 1 can be viewed in the online version of this article [http://doi.dx.org/10.1016/j.athoracsur.2014.07.052] on http://www.annalsthoracicsurgery.org

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Surveillance, Epidemiology, and End Results (SEER)–Medicare linked database. We hypothesized that readmission after esophagectomy would be associated with a higher mortality rate.

Patients and Methods

We performed a retrospective cohort study using the SEER-Medicare linked database to assess the impact of hospital readmissions in patients with esophageal cancer treated with an esophagectomy between 2002 and 2009. The SEER database is derived from 18 tumor registries, is maintained by the National Cancer Institute, and represents approximately 18% of the US population. Medicare beneficiaries within the registry have had their tumor records linked to all of their claims data. The quality, validity, and generalizability of the SEER-Medicare data have been described previously [16]. Approval for the study was obtained from the Institutional Review Board of Emory University. We utilized the Medicare denominator, inpatient, outpatient, and physician/supplier files for this study.

Among all esophageal cancer patients from 2002 through 2009 in the SEER-Medicare dataset, the following sequential exclusions were made: patients less than 66 years old, patients treated with therapy other than surgery, and patients with partial fee-for-service or concurrent health maintenance organization enrollment, or both, 1 year before esophageal cancer surgery. Only full fee-for-service beneficiaries not enrolled in other insurance programs would have complete claims records; therefore, all other patients were excluded. Patients who were 65 years old at the time of diagnosis were excluded because they do not have Medicare claims data in the year before esophagectomy, which would preclude the determination of receipt of neoadjuvant chemotherapy or radiation or both, and the calculation of comorbidity scores.

Patient, disease and treatment information were available through the SEER registry and Medicare database. Specifically, Current Procedural Terminology codes and International Classification of Diseases, Ninth Revision, codes were used to determine the surgical approach to esophagectomy (transthoracic versus transhiatal), patient comorbid medical conditions, and delivery of neoadjuvant chemotherapy and radiation (see Appendix 1 for specific Medicare billing codes, found at http://www.annalsthoracicsurgery.org/). Medicare claims within the physician/supplier and outpatient files in the year before diagnosis were used to calculate a Klabunde-modified Charlson Comorbidity Index (CCI), which was then used for risk adjustment [17]. Chemotherapy or radiation administered within 4 months of esophagectomy was considered neoadjuvant therapy, as classified in prior publications using SEER-Medicare data [18]. For analysis of patient characteristics, indicators of low income or education were based on the lowest quartiles of median income and proportion with a high school education within a given zip code from census tract data. Tumor size, stage, and histology were all based on information within 4 months of diagnosis in the SEER registry. All tumors were restaged to the American Joint Committee on Cancer, Seventh Edition, esophageal cancer staging system [19].

The primary outcome measure was hospital readmission with 30 days after discharge after esophagectomy. The denominator for analysis of hospital readmission was all patients discharged to home after esophageal resection for cancer. Patients discharged to an intermediate care facility were not included in the readmission analysis, because it is difficult to determine what constitutes a hospital discharge or readmission as patients are transferred from one inpatient care facility to another. Secondary outcomes were mortality and resource utilization after esophagectomy.

The software SAS version 9.3 (SAS Institute, Cary, NC) was used to perform all statistical analysis. Descriptive statistics are presented as counts with percentages, means with standard deviation, or median with interquartile range. Kaplan-Meier curves were generated that provide unadjusted survival estimates at postoperative points in time for patients who were and were not rehospitalized. Differences between strata were determined by log rank tests. Binary logistic regression models were used to examine the association between patient demographic, clinical, and treatment characteristics, and hospital readmission after esophagectomy. Variables were selected a priori for inclusion in the multivariable analysis. All statistical tests were two-sided and used an $\alpha = 0.05$ level of significance.

Results

In all, 1,744 patients in the SEER-Medicare dataset underwent esophageal resection for esophageal cancer between the years 2002 and 2009 and met inclusion criteria. The demographics and clinical details of patients at the time of hospital admission for esophagectomy are summarized in Table 1. These patients were predominantly elderly Caucasian men. The most common presentation of esophageal cancer was a distal esophageal adenocarcinoma, and 38% of patients (667 of 1,744) received neoadjuvant chemotherapy or radiation or both. More than 60% of patients had a modified CCI score of zero. A transthoracic approach to esophagectomy was more common than transhiatal approach (52.6% versus 37.4%). Complex reconstruction after esophagectomy (colonic or intestinal interposition, with or without microvascular anastomosis) was performed in 9.9%.

Postoperative outcomes in patients after esophagectomy for esophageal cancer are detailed in Table 2. Thirty-day and in-hospital mortality rates were substantial, at 8.8% and 9.3%, respectively. Because of outliers causing skewed distributions, the mean length of stay and intensive care unit days were larger than the median values (18.1 versus 13 and 10.6 versus 6, respectively). Approximately one quarter of patients were discharged to an intermediate care facility (ie, skilled nursing or rehabilitation facility). Of 1,139 patients discharged to home after esophagectomy, 18.6% were readmitted to the