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A Comparison of Length of Stay, Readmission Rate, and Facility Reimbursement After Lobectomy of the Lung

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Background. Readmission to the hospital has become a focus for payers with the threat of nonpayment for preventable readmissions and a global penalty for excessive readmissions rates. This study compares readmission rates with lengths of stay (LOS) for patients undergoing lobectomy of the lung and the potential impact on reimbursement.

Methods. The Premier database for a single health system's hospitals was used to identify patients undergoing lobectomy for non-small cell lung cancer by cardiothoracic surgeons over a 5-year period. Charlson comorbidity scores were also calculated. Regression analysis was used to study the relationship between length of stay and readmission rates. A comparison of the effects of LOS and readmission on reimbursement was also performed.

Results. During the study period, 4,296 lobectomies were performed in 61 hospitals within the healthcare system that met the study's inclusion criteria. A readmission was recorded for 289 patients (7%). Factors associated with readmission were length of stay less than 5 days or more than 16 days and age more than 78 years ($p = 0.001$). An analysis of the effects of LOS and readmission on reimbursement found an extension of LOS was more cost effective than a readmission.

Conclusions. This review found that mean LOS after lobectomy is negatively associated with readmission rates, with the maximal effect being before postoperative day 5. Furthermore, facility reimbursement was optimized when LOS was extended to minimize the risk of readmission.

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Readmission to the hospital has become a focal point for health insurance providers and the Centers for Medicare and Medicaid Services (CMS). Preventable hospital readmissions are seen as a surrogate indicator of quality as well as an area of significant potential cost savings. The Affordable Care Act also specifically targets decreases in hospital readmission rates for specific diagnoses with financial penalties for hospitals [1].

Despite a long-standing focus on the quality of care within the thoracic surgery community, very few data exist related to potentially preventable readmissions and common pulmonary surgical procedures [2]. In a recent investigation, we found that indicators for quality of care and hospital charges for lobectomy of the lung were significantly influenced by surgeon specialty [3]. However, readmission rates did not differ significantly in spite of a significant difference in the mean length of stay and complication rates between the two cohorts of patients. These findings raised the question of whether an association exists between postoperative length of stay and readmission rates that had not been previously identified. This investigation compares length of stay and readmission rates after lobectomy of the lung performed for non-small cell lung cancer (NSCLC) performed by cardiothoracic surgeons within a diverse healthcare system.

Patients and Methods

Institutional Review Board approval was obtained at the authors' institution, and individual patient consent was not required with the condition of patient anonymity outside the initial data-gathering phase of the study. Using the Premier inpatient database (Premier Inc, Charlotte, NC), hospitals performing at least 50 lobectomies, cumulative (Current Procedural Terminology [CPT] code 32480) for NSCLC (diagnosis codes 162.2, 162.3, 162.4, 162.5, 162; International Classification of Diseases, Ninth Revision [ICD-9]) during the calendar years 2006 through 2010 within the Ascension Health System by cardiothoracic surgeons were identified. The Premier database is an administrative database that registers principle and secondary diagnoses as ICD-9 codes

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as well as CPT codes and demographic information for hospital admissions. Surgeons were identified as a cardiothoracic surgeon based on their national provider number and their board certification status. No attempt was made to differentiate thoracic surgeons who practiced cardiac and thoracic surgery from those that limited their practice to noncardiac thoracic surgery.

Patient demographic data, preoperative Zubrod performance score, postoperative length of stay, readmission to the same or a different hospital, operative morbidities, and mortality were abstracted for each patient from the Premier database and the local hospital's American College of Surgeons tumor registry data [4]. Also calculated were Charlson comorbidity scores for each patient based on secondary ICD-9 disease codes [5, 6]. Excluded from analysis were patients undergoing a bilobectomy (CPT 32482), lobectomy for a superior sulcus tumor or pulmonary metastasis (ICD-9; 197), lobectomy with a bronchoplastic procedure (CPT 32486), video-assisted thoracoscopic lobectomy or lobectomy in the setting of stage IV NSCLC such as a patient with an isolated brain metastasis. Also excluded were patients undergoing lobectomy with a primary ICD-9 code denoting an endobronchial (162.9) or tracheal (162) tumor component, NSCLC involving multiple lobes of the lung (162.8) or the chest wall (198.89, 171.4) or a pleural-based neoplasm (163).

Postoperative length of stay was calculated as the number of days from the day of surgery until death or discharge. Postoperative morbidities were attributed in a binary fashion by patient so that a patient having more than one event was only counted once. However, the tabulation of specific categories of complications include every occurrence. Operative mortality was defined as patient death after surgery before discharge from the hospital or within 30 days of surgery.

A readmission was defined as an unplanned admission to any hospital within 90 days of the date of discharge from the admission during which lobectomy had been performed. All readmissions were reviewed and categorized as either unrelated to the original admission or related. Unrelated admissions included planned admissions for medical issues or procedures not brought about or exacerbated by the admission for lobectomy. Admissions that were unrelated to the index lobectomy admission were recorded for subsequent review but were not counted as a readmission for the purposes of this analysis. Evaluation in an emergency department with discharge within 24 hours was not counted as a readmission. However, admission to the hospital in an observation status was considered a readmission. Transfer from the lobectomy admission to a facility for skilled nursing services or rehabilitation was not counted as a readmission.

Hospital reimbursement for the index admission of lobectomy was based on the national mean payments for CMS Diagnostic Related Groups (DRG) for major chest procedures without complication or comorbidity (165 [$10,054]) or with complication or comorbidity (164 [$16,657]) or major complication or comorbidity (163 [$28,668]) for 2011 [7]. These national average DRG payment rates were calculated using the national adjusted full update standardized labor, nonlabor and capital amounts, and to achieve a single surrogate value for reimbursement rate for this investigation, were averaged ($17,793). Indirect medical education payments, disproportionate share payment, and case mix adjustments were not included in the DRG payment approximation as such information was not available. Geographic factor adjustments were indirectly included as the mean values for these DRGs represent individual values from across the country.

Hospital expense per bed-day for 2010 ($1,910) is a national average value [8]. It is nonadjusted, meaning no costs have been added to include outpatient care. Parity of hospital charges was tested using each facility's charge per discharge index, a comparison of inpatient charges indexed to discharge diagnoses [9]. This is a method of determining whether different facilities have similar levels of charges used by the private insurers and the CMS [10]. This was performed to test the validity of using hospital expense per bed-day for the facilities involved in this investigation.

The unit of analysis for this study was a patient undergoing lobectomy for NSCLC. Readmission to a hospital within 90 days of discharge from the index admission was considered the outcome for analysis. The cohort of patients who experienced a readmission after lobectomy was compared to the group of patients who did not require readmission. Multiple logistic regression analysis was used to study relationships between patient variables and readmission. During this process, regression models were adjusted for clustering/nesting at the hospital level by the construction of two-level hierarchical analysis models with the assumption of normative distribution of variables [11, 12]. Group mean centering for each cohort was used within the analyses. Adjustments within the regression analysis were made for Charlson comorbidity score reported as adjusted odds ratios. Postoperative length of stay was represented as a continuous variable in the regression models.

Bivariate analysis of data was performed using GraphPad Prism software 4.02 (San Diego, CA) for Windows (Microsoft, Redmond, WA). Differences between categorical variables were evaluated by Fisher's exact test. Differences between continuous variables were measured by the two-tailed Student t test or the Mann-Whitney U test for non–normally distributed data. Multivariate analysis was performed using Stata version 11 (StataCorp, College Station, TX). A value of p less than 0.05 was considered significant.

Results

Over the 5-year study period, 4,411 lobectomies were performed by 69 cardiothoracic surgeons at 61 hospitals in 31 states that met the entrance criteria for this investigation. Operative mortality occurred in 114 of patients (2.6%) who subsequently had no risk of readmission. Therefore, 4,296 patients undergoing lobectomy were available for analysis.

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