The Society of Thoracic Surgeons General Thoracic Surgery Database: Establishing Generalizability to National Lung Cancer Resection Outcomes

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Background. The Society of Thoracic Surgeons General Thoracic Surgery Database (GTDB) has demonstrated outstanding results for lung cancer resection. However, whether the GTDB results are generalizable nationwide is unknown. The purpose of this study was to establish the generalizability of the GTDB by comparing lung cancer resection results with those of the Nationwide Inpatient Sample (NIS), the largest all-payer inpatient database in the United States.

Methods. From 2002 to 2008, primary lung cancer resection outcomes were compared between the GTDB (n = 19,903) and the NIS (n = 246,469). Primary outcomes were the proportion of procedures performed nationally that were captured in the GTDB and differences in mortality rates and hospital length of stay. Observed differences in patient characteristics, operative procedures, and postoperative events were also analyzed.

Results. Annual GTDB lung cancer resection volume has increased over time but only captures an estimated 8% of resections performed nationally. The GTDB and

NIS databases had similar median patient age (67 vs 68 years) and female sex (50% vs 49%), lobectomy was the most common procedure (64.7% vs 79.7%; $p < 0.001$), and pneumonectomies were uncommon (6.3% vs 7.2%; $p < 0.001$). Compared with NIS, the GTDB had significantly lower unadjusted discharge mortality rates (1.8% vs 3.0%), median length of stay (5.0 vs 7.0 days; $p < 0.001$), and postoperative pulmonary complication rates (18.5% vs 23.6%, $p < 0.001$).

Conclusions. The GTDB represents a small percentage of the lung cancer resections performed nationally and reports significantly lower mortality rates and shorter hospital length of stay than national results. The GTDB is not broadly generalizable. These results establish a benchmark for future GTDB comparisons and highlight the importance of increasing participation in the database.

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L ung cancer remains the leading cause of cancer-related deaths in the United States, and surgical resection is the primary treatment for early-stage disease. Significant improvements in morbidity and survival have been achieved after lung cancer resections during the past several decades, with operative mortality and morbidity rates now approaching 2% and 8%, respectively [1, 2]. With advances in oncologic therapy and surgical technique, patient outcomes are expected to improve, and clinical documentation of patient-related details, cancer-specific data, operative features, and postoperative events will become increasingly emphasized to help guide treatment decisions and clinical research.

During the past 2 decades, significant progress has been achieved in documentation of patient characteristics and outcomes within administrative and clinical databases. Although the nature and intent of documen-

tation within each database may differ, substantial benefits have been derived by examining database content to advance patient care and facilitate clinical investigation. Among available databases, the Nationwide Inpatient Sample (NIS) exists as the largest, most representative, and publicly available administrative database [3]. The NIS uses inpatient discharge records to report patient-level and hospital-level details as well as disposition and mortality data. Using a coding system based on the International Classification of Diseases-Ninth Revision, Clinical Modifications (ICD-9-CM), the NIS provides an estimate of nationwide trends for inpatient diagnoses, procedure-related details, and postoperative outcomes.

Among clinical databases, The Society of Thoracic Surgeons (STS) General Thoracic Surgery Database (GTDB) represents the largest database specifically designed to capture and report general thoracic surgical outcomes. The GTDB was initiated in 2002 and has demonstrated outstanding outcomes for lung and esophageal cancer resection [2, 4].

We initiated this study to compare the current status of reported lung cancer resection outcomes between these administrative and clinical databases. Because the STS

GTDB has demonstrated outstanding results for lung cancer resections, the purpose of the present study was to establish the generalizability of the GTDB by comparing its lung cancer resection results with those of the NIS. We hypothesized that the GTDB would only capture a minority of procedures performed nationally and that it would report superior outcomes.

Material and Methods

Records for patients undergoing lung resections with a diagnosis of lung cancer were extracted from the NIS data sets and the STS GTDB for the years 2002 to 2008. The University of Virginia Institutional Review Board exempted this study from review because it was not human subjects research owing to the lack of discrete patient identifiers and because the analyzed data were not exclusively collected for research purposes.

Patient Selection

Within the NIS, appropriate discharge records were identified by querying the first five diagnosis and procedure categories using the ICD-9-CM diagnosis code 162.X for primary lung cancer and procedure codes 32.9, 32.3X, 32.4X, and 32.5X for lung resection. The STS GTDB was queried for all patient records for those undergoing primary lung cancer resections during the study period. Within both databases, lung cancer resections were characterized by the extent of anatomic resection to include pneumonectomy, lobectomy, and sublobar resections. Data were excluded for patients with benign pulmonary disease. During data extraction from the NIS data sets, less than 5% of patient records with missing data for patient age, sex, resection type, and mortality underwent case-wise deletion to obtain a complete data set for analysis.

Variable and Outcome Definitions

All variable definitions conformed to those used within the NIS and GTDB [3, 5]. All measured outcomes were established a priori before data analysis. The primary outcomes of this study included differences in reported frequency of lung cancer resections within both the NIS and GTDB as well as observed differences in discharge mortality rates and hospital length of stay (LOS). Reported mortality rates represent those deaths occurring during hospitalization for the NIS and within 30 days of lung cancer resection for the GTDB. The incidence of postoperative death and morbidity within the NIS data sets was determined using previously described methodology [6].

Statistical Analysis

All statistical methodology was designed to test the null hypothesis that outcomes after performance of lung cancer resection wound not be significantly different as reported within the GTDB and NIS. Standard statistical significance was set to an α = 0.05. Descriptive statistics for all variable comparisons were calculated using appropriate univariate hypothesis tests. Categoric variables are expressed as within-group percentages and were compared for independent samples using either the Pearson

Table 1. Patient Demographics and Risk Factors for Primary Lung Cancer Resections as Reported in The Society of Thoracic Surgeons General Thoracic Surgery Database and the Nationwide Inpatient Sample

Factor[a]	GTDB (n = 19,903)	NIS (n = 246,469)	p Value
Age	67 (60, 74)	68 (60, 74)	0.24
Sex			0.001
Male	9,754 (49.0)	123,686 (50.2)	
Female	10,149 (51.0)	122,620 (49.8)	
Year of operation			<0.0001
2002	513 (2.6)	34,050 (13.8)	
2003	1,308 (6.6)	32,675 (13.3)	
2004	2,014 (10.1)	32,590 (13.2)	
2005	2,635 (13.2)	37,682 (15.3)	
2006	4,418 (22.2)	34,450 (14.0)	
2007	5,786 (29.1)	37,422 (15.2)	
2008	6,458 (32.4)	37,600 (15.3)	
Comorbid disease			
Hypertension	10,724 (53.9)	119,629 (48.5)	<0.0001
Heart Failure	715 (3.6)	11,290 (4.6)	<0.0001
Peripheral vascular disease	1,794 (9.0)	15,065 (6.1)	<0.0001
Renal Failure	415 (2.1)	6,262 (2.5)	<0.0001
Operation			
Sublobar resection	5,764 (29.0)	28,390 (11.5)	<0.0001
Lobectomy	12,886 (64.7)	196,469 (79.7)	<0.0001
Pneumonectomy	1,253 (6.3)	17,694 (7.2)	<0.0001

[a] Continuous variables are reported as median (interquartile range) and categoric variables as number (%).

GTDB = general thoracic database;   NIS = Nationwide Inpatient Sample.

χ^2 or Fisher exact test. Continuous variables are expressed as mean ± standard deviation (SD) or median (interquartile range), depending on overall variable distribution. Independent sample, single-factor analysis of variance was used for parametric data comparisons, and the Mann Whitney *U* test was used for all nonparametric data comparisons. Calculated test statistics were used to derive all reported two-tailed *p* values. All statistical analyses were performed using PASW 18 software (IBM Corp, Somers, NY).

Results

A total of 19,903 patients were identified within the GTDB, and 246,469 patient records were extracted from the NIS (Table 1). Median patient age was similar in both databases (GTDB, 67 years; NIS, 68 years). Each database included a nearly equal number of men and women undergoing lung cancer resection. Among major comorbid disease states, nearly half of all patients presented with a preoperative history of hypertension, with a slightly higher prevalence among patients represented in the GTDB (53.9% vs 48.5%, *p* < 0.0001). GTDB patients also had a higher prevalence of preoperative peripheral