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Preoperative Evaluation of Lung Cancer in a Community Health Care Setting

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Background. **We examined the presurgical evaluation of suspected lung cancer patients in a community-based health care system to establish current benchmarks of care that will lay the groundwork for an evidence-based quality improvement project.**

Methods. **We retrospectively reviewed clinical records of all recipients of lung resection at two institutions, and classified all lung cancer relevant procedures into five "nodal points": lesion detection, diagnostic biopsy, radiologic staging, invasive staging, and treatment. We analyzed the frequency of passage through each nodal point, the time intervals between nodal points, and the use of staging modalities.**

Results. **Of 614 eligible patients, 92% had lung cancer, 5% had a non-lung primary tumor, 3% had a benign lesion. Six percent received preoperative therapy; 39% of resections were minimally invasive. Ninety-eight percent of patients had a preoperative computed tomography (CT) scan, 27% had no preoperative diagnostic procedure, 22% had no preoperative positron emission tomography (PET)/CT scans, and 88% had no invasive preoperative staging test. Only 10% had trimodality staging with CT, PET/CT, and invasive staging. Twenty-one percent of patients who had an invasive staging test had mediastinal nodal metastasis at resection. The median duration (interquartile range) from initial lesion identification to resection was 84 days (43 to 189) days; from lesion identification to diagnostic biopsy, 28 days (7 to 96); and from diagnostic biopsy to surgery, 40 days (26 to 69).**

Conclusions. **There is opportunity for improvement in the thoroughness, accuracy, and timeliness of preoperative evaluation of suspected lung cancer patients in this community cohort. Better coordination of care may significantly improve these benchmarks.**

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The 5-year relative survival of all patients diagnosed with lung cancer in the United States is still only approximately 17%, little changed in 30 years [1]. Surgical resection is the most important curative treatment modality for patients with non-small cell lung cancer. The vast majority of 5-year survivors of lung cancer have had surgery as part of their treatment. However, fewer than half of patients who undergo surgery for lung cancer survive as long as 5 years [2]. Most die of lung cancer. Inefficiencies in the process of care delivery may play a role in inhibiting progress in improving outcomes.

Optimal care for the lung cancer patient entails efficient passage from the point of initial identification of a radiologic lesion, through the steps of diagnosis, staging, and delivery of stage-appropriate treatment. The efficiency of passage through each of these steps may contribute to the timeliness, appropriateness, and cost of care. Numerous studies have shown significant delays in delivery of treatment, after initial detection of a potentially malignant pulmonary lesion [3, 4]. Furthermore, reviews of national databases reveal a low rate of use of staging tests in patients with lung cancer, with significant detriment to survival [5, 6].

Experts universally recommend an interdisciplinary approach to care delivery for lung cancer, the so-called multidisciplinary care model [3, 7–10]. Although much advocated, however, multidisciplinary lung cancer care is infrequently practiced. The gap between the frequency of recommendation and adoption of this care delivery model is especially pronounced in community-level institutions, where more than 70% of lung cancer care is delivered in the United States [11]. To help understand and address this gap, we are currently engaged in a cancer care delivery research project, which involves implementing a structured multidisciplinary lung cancer

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program within a large community-level health care institution in a high lung cancer mortality zone of the United States [12].

In preparation for the project, we examined the process of presurgical evaluation of recipients of surgical resection for lung cancer in the two metropolitan institutions within the health care system. Our aims were to describe the baseline practice of preoperative evaluation, and identify gaps in care delivery that might be targeted for improvement.

Material and Methods

Identification of Patients

With the approval of the Institutional Review Board, we conducted a comprehensive retrospective review of hospital and clinic records of all patients who underwent resection for presumed lung cancer at the Baptist Memorial Hospital in Memphis, Tennessee, and Baptist Memorial Hospital in Southaven, Mississippi, from January 1, 2009, to June 30, 2013. Patients were identified from the combination of a search for lung resection International Classification of Diseases, 9th Revision (ICD-9), codes by the institutions' health information management department, augmented by pathology department and tumor registry records. We used the following ICD-9 procedure codes to identify resection patients: 32.20 (thoracoscopic excision of lesion or tissue of lung), 32.29 (other local excision or destruction of lesion or tissue of lung [wedge]), 32.30 (thoracoscopic segmental resection of lung), 32.39 (other and unspecified segmental resection of lung), 32.41 (thoracoscopic lobectomy of lung), 32.49 (other lobectomy of lung), 32.50 (thoracoscopic pneumonectomy), 32.59 (other and unspecified pneumonectomy), 32.60 (radical dissection of thoracic structures), and 32.90 (other excision of lung). All operations were performed by board-certified cardiothoracic surgeons.

Data Abstraction

Trained data abstractors reviewed hospital and outpatient clinic records of eligible patients. These records included the history and physical examination, surgical operation notes, consultants' reports, progress notes, and discharge summaries from all hospital admissions, as well as all outpatient clinic notes and pathology and radiology reports. For each patient, abstractors manually reviewed the final radiologist's report from all available chest radiologic studies going back to the earliest study in which the resected lesion was identified. This study, which defined the start point, could be a chest radiograph, computed tomography (CT) scan, or other radiologic study. From that time forward, all radiologic, and invasive procedures performed were reviewed for relevance to lung cancer, including pathology reports of all invasive biopsies. Tests and procedures for which reports were found included the dates of performance. Tests and procedures mentioned in clinical records but for which reports were not directly retrieved were noted without dates. These were treated as missing values in the time-based analyses.

Classification of Procedures

Using process of care logic, we separated the steps from initial lesion identification to surgical intervention into five "nodal points": initial lesion identification, diagnostic biopsy, noninvasive (or radiologic) staging, invasive staging, and treatment. These five nodal points were selected as key clinical landmarks in the management of lung cancer. The activities leading to, and from, each will provide data input for mathematical simulation modeling of pathways of care in a future process efficiency engineering analysis [13]. We classified all relevant tests and procedures into one of the five nodal point categories. Diagnostic biopsy tests could be either CT-guided biopsy or bronchoscopy. Noninvasive staging tests were CT scans of the brain, chest or spine, positron emission tomography (PET)/CT scans, magnetic resonance imaging (MRI) scans of the brain, spine, or liver, and bone scans. Invasive staging tests were thoracentesis, bronchoscopy with transbronchial needle aspiration of a lymph node, endobronchial ultrasound- or endoscopic ultrasound-guided biopsies, mediastinoscopy, or mediastinotomy. Surgical resection was defined as an open thoracotomy, video-assisted thoracotomy, or robotic-assisted thoracotomy in which part or all of a lung was removed. Primary surgical resection entailed surgery as the first treatment modality, whereas neoadjuvant therapy refers to surgery performed after prior administration of chemotherapy or radiation therapy, or both, including patients who received radiation therapy to nonthoracic structures (such as brain radiation for oligometastatic disease). We classified invasive staging tests done without a prior tissue diagnosis of cancer as both diagnostic and staging tests.

Definition of Cumulative Use of Staging Modalities

Given the necessity of classifying CT scans as both initial lesion-identifying and staging tests, we further examined the thoroughness of preoperative staging by using the method of Farjah and colleagues [5]. We identified monomodality staging as use of a chest CT scan only, bimodality staging as use of a CT scan and another radiologic staging test (eg, PET scan, brain imaging, bone scan) or use of a CT scan and an invasive staging procedure, and trimodality staging as use of a CT scan in combination with both another radiologic staging test and an invasive staging procedure. Patients with non-CT staging modalities were assumed to have had a CT scan that could not be located, and were assigned to multimodality staging cohorts.

Statistical Methods

We measured the interval of care from the date of lesion detection to surgical resection, and also internodal intervals, such as lesion identification to diagnostic test, diagnostic test to staging test, diagnostic test to surgery, and staging test to surgery. When the records clearly indicated the month when a test was performed, but not the actual date, we assigned the date of performance, for